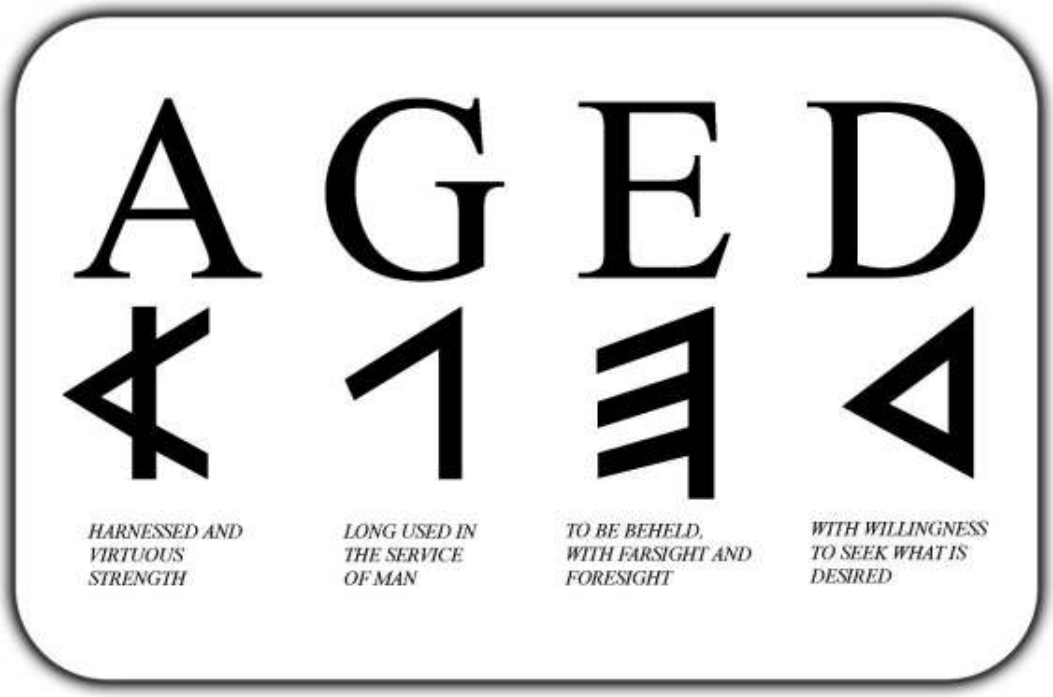
Aging Futures

Towards cognitively inclusive computational products



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ABSTRACT

This paper describes a research project exploring the idea that designers can gain some insight into the design of email and digital photography products inclusive of older users by understanding the way in which this group of people interacted with technology when they were aged between 10 and 25 years.

The research focuses upon the difficulties those aged 70 and over face when learning to interact with the computer. Despite perceived benefits of being computer literate and a noted desire by older adults to use the technology, there are considerable hurdles to be navigated and mental strategies to be developed when learning to use a computer; whilst the abilities with which to accomplish these diminish as the brain ages. These difficulties are explored through examining the implications of the normal aging process in the context of the cognitive demands put upon older users by the personal computer. The paper calls into question tangible computing, claimed to create a more natural, less abstract interface. The research suggests that designers may be able to expand upon tangibility, working towards the design of computational products that provide an aging group of people with the foundations with which to apply the knowledge they have acquired through a lifetime's experience. The paper explains how a model might be developed that could aid designers in the development of computational products inclusive of those aged 70 and over. The paper describes how the study begins to take tentative steps to exploring how this model may be applied to the design of an email and digital photography based product. Intended to provoke thought and ask further questions, this paper and its supporting study hopes to add to the ever growing fields of gerontology, inclusive design and older adult studies.

1

RESEARCH FOCUS

The United Kingdom is in a period of significant population change; lower birth rates and longer life expectancies are creating a population that is notably getting older (National Statistics, 2004:1). This change presents the opportunity for older adults to demand a greater focus from the design community, in the form of creating products and services that are more finely tuned for their wants, needs and abilities (Coleman, 2004). This has led to the development of an inclusive[1] ideology that takes up the *'challenge of understanding and quantifying the numbers of people adversely affected by decisions made during the specification and design process'* (Coleman, 2004, pp.1). Research preceding this study suggests that the Inclusive Design movement, in regards to designing for older adults, has concentrated on the physical effects of aging (e.g. arthritis, vision, dexterity and hearing) yet rarely considered the cognitive inabilities that become more apparent as a person ages (Vines, 2005:1).

The study this paper describes takes this further by attempting to understand some of the cognitive alterations of normal aging that an older adult faces and how these may affect the way in which they relate with certain product interfaces. This is coupled with a claim that being computer literate[2] is healthy for older adults and may improve their well-being (Nova Scotia Centre on Aging, 2001); it enables them to participate with younger age groups through media such as email and digital photography. Despite this claim, further research has demonstrated that those over the age of 50 incur more problems with the interaction of a personal computer than younger adults, such problems increasing in regularity into old age

[1] Not solely concerned with the aging population, although it is this aspect that is of interest to this project, Inclusive Design attempts to bridge the gap for all minorities that may have previously been sidelined by design and manufacturing. Inclusive Design may also be referred to as Design-for-All and Universal Design (Coleman, 2004).

[2] For the purposes of this study computer literacy may be defined as *'the degree to which individuals are familiar with computer operating systems and applications'* (Harvard University, 2004, pp.1).

(Goodman et al, 2003). Goodman et al (2003) and Adler (1996) explain that despite the numerous problems encountered when interacting with computers, many older adults attempt to work through them due to the perceived benefits of computational media; such as internet access, word-processing and in particular relevance to this study, email and digital photography.

The research described in this paper focuses on some of the cognitive changes that occur into old age rather than just physical inabilities. The research suggests that the issues older users encounter when learning to use a computer can be addressed by simply improving the design of computational products for older adults, taking into account their differing cognitive models. In the following chapter the paper will survey some of these changes that occur to a persons cognitive profile during the normal aging process. It evaluates what some of these changes are, at what age they occur, whether certain cognitive functions are unaffected by aging and how these changes affect an older adults ability to learn to use a computer.

2

RESEARCH CONTEXT

2.1 Aged cognition

Cattell (1987) defines two forms of intelligence within the mind that perform very different roles:

1. Crystallized intelligence – fixed, pre-learned knowledge and skills.
2. Fluid intelligence – problem solving for 'unknown', previously un-experienced artefacts.

Zajicek (2001) claims that it is fluid intelligence that is required when learning to use a personal computer as it allows the user to build a strategy with which to manage a new, previously unknown, interaction. However, mental fluidity is known to decrease in effectiveness as the brain ages, hindering such a learning process (Stuart-Hamilton, 1999). Essentially, *'older people using computers for the first time are faced with new ways of thinking and have little experience with which to draw upon. The faculties that decrease with age such as memory, sight and strategy building are precisely those that are required for successful computer use'*(Zajicek, 2001, pp.1). Alongside this loss of mental fluidity, certain memory functions are known to diminish with age, outlined below.

Human memory can be split into two groups; short term and long term. Short term memory is comprised of:

- Primary memory; accounting for the static representation of data around us (Schieber, 2003).

- Working memory; the utilisation information from Primary memory and manipulation of it for a desired task in hand (Baddeley, 1989).

Long term memory consists of three sections:

- Semantic memory; the *'storage and utilisation of knowledge about words and concepts, their properties and interrelations'* (Tulving and Thompson, 1973, pp.354).
- Episodic memory; the coding of events, and *'storage and retrieval of temporally dated, spatially located and personally experienced events or episodes'* (Tulving and Thompson, 1973, pp.354).
- Procedural memory; stores the *'implicit (i.e., unconscious) representation of the rules for various domains of skilled performance'* (Schieber, 2003, pp.65).

As the brain ages, certain attributes of this model decrease in ability. Most notably, working memory ability begins to reduce significantly between the ages of 67 and 70[3], continuing gradually as a person ages (Park et al, 1996, Schieber, 2003). This cognitive change, combined with the above discussed reduction in fluid intelligence, further hinders the manipulation of data in a given task or situation. Put simply, it is harder for those over the age of 70 to learn an abstract technology they may be inexperienced with, such as a personal computer.

There are also features – in the form of the primary, procedural and semantic functions – that do not reduce in ability (Craik, 1977; Smith & Earles, 1996); these functions being connected to the stability within crystalline memory. Quite simply, these functions would all be formed by previous experiences, and provide information to retrieve in similar experiences in the future. This study claims that in order to allow older users to participate in the benefits of digital photography and email, product designers should consider ways in which these healthy aspects of the older adult cognitive profile may be exploited. In 2.2, the paper will briefly discuss how aspects tangible computing may be of interest to this claim, and bring the research context together to form a claim to be acted upon.

[3] As of 2004 there are approximately 8 million people aged 70 or above (National Statistics, 2004:2) and it is reasonable to claim the vast majority of these people are affected by the outlined cognitive changes

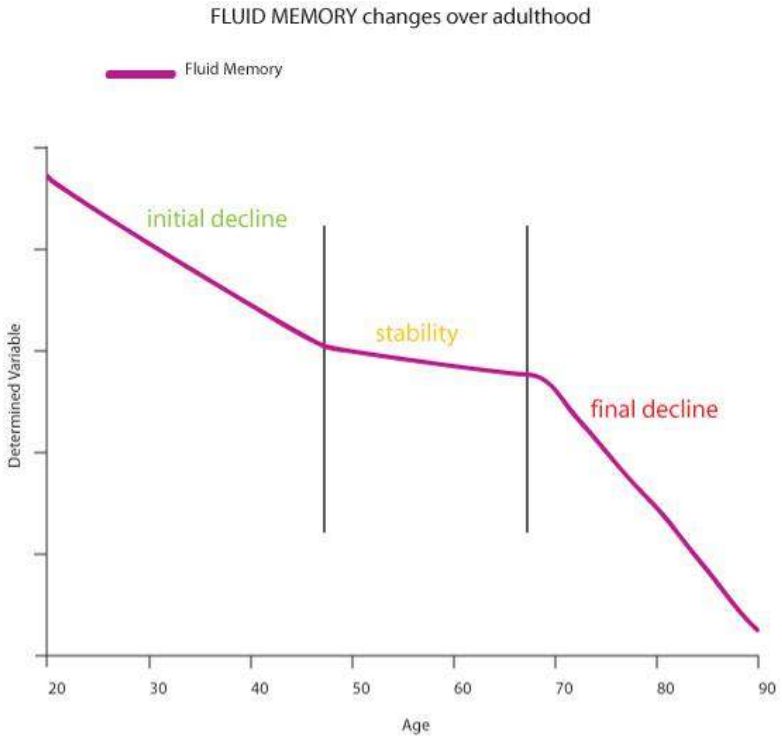


Fig. 1 Fluid memory decline over age. Adapted from Park et al, 1996. *John Vines, 2006*

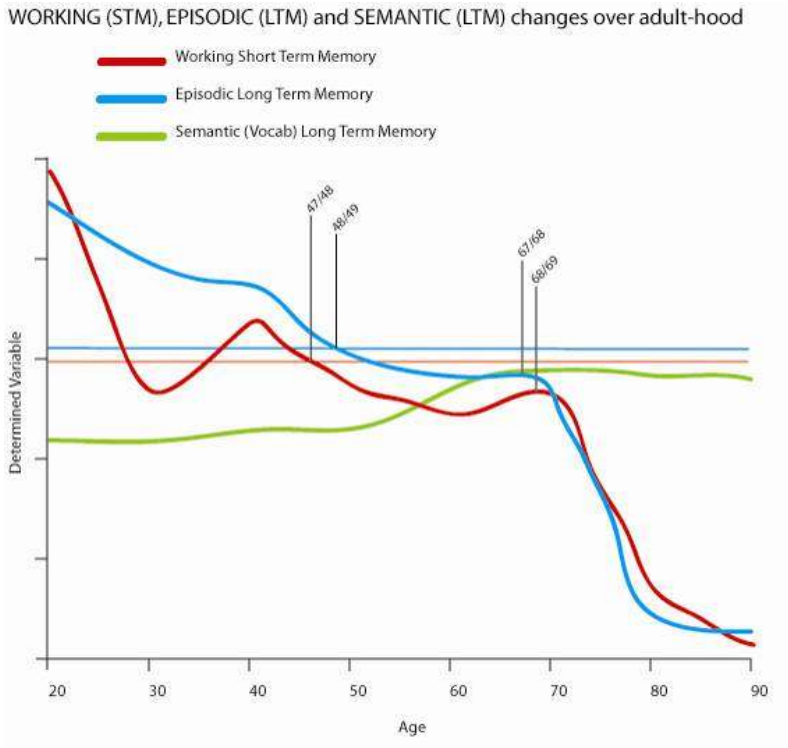


Fig. 2 Working, episodic and semantic memory changes over adult-hood. Adapted from Park et al, 1996. *John Vines, 2006*

2.2 From tangible computing to formative experience

'...it is widely agreed that by moving human–computer interaction from the virtuality of the screen into the physicality of the real world, the design space is significantly extended, enabling new and richer forms of interaction' (Holmquist, Schmidt and Ullmer, 2004, pp.291)

Tangible computing provides an opportunity to create more natural interactions which exploit an unconscious recollection of procedural and semantic knowledge – presenting a user with an interaction that they may be familiar with. Tangible artefacts also have the ability to convey more to the senses in comparison to typical computing and graphic user interfaces; *'what appeals to us in the direct* [tangible] *approach is the sensory richness and action-potential of physical objects as carriers of meaning in interaction. Because they address all the senses, physical objects offer more room for expressiveness than screen-based elements'* (Djajadiningrat et al, 2002, pp.4). Nygren (Nygren et al, 1992) uses the example of medical record cards used in hospital wards to track and display a patients history, which were subsequently replaced by a screen-based computerised system. The former allowed for observation of who completed previous work (in the handwriting), which data was tentative (pencil) and permanent (pen) and what errors and changes have been made (scribbles and erased marks). The latter computer system lost all these properties, with developers and users encountering problems as a result.

Tangibility points the designer onto a reasoned path with which to develop computational products for older adults but the study needs to expand upon this. Although tangible interaction can claim to produce physical familiarity, the vast majority of accessible examples still require a distinct learning process with which to put them to an intended or required use. This is portrayed by the Interactive Desk tangibility concept (a design exploration from the early stages of this study, Fig. 3) which does not afford the application of procedural and semantic knowledge without a certain amount of fluid thought. Although the research can consider that whilst greater tangibility can aid the appropriation of certain aspects of computer-based applications over the typical desktop computer and its graphic user interface, it still did not provide the older user with a suitable platform with which to apply their past-experience.

Fig. 3 The Interactive Desk gave physical form to computational media. However, interactionally it still acted as a computer and thus required similar levels of abstract thought and strategy building. *John Vines, 2005*

Lakoff and Johnson's (1999) view of the neural model (that it is formed in the body and shapes our reasoning) suggests a model of reasoning whereby objects and phenomena are experienced and categorised to produce mental concepts. If this model is useful to the study, it suggests that experiences stored over a lifetime's learning may have an affect on the way in which a person approaches familiar environments and objects. Although Lakoff and Johnson do not state how age affects such mental conceptualisations, it is suggested that the acquisition of concepts and categorisations from experience are of most significance in adolescence and young adulthood, between the ages of 10 and 25 (Sroufe and Cooper, 1988), the period during which fluid intelligence and working memory ability peak (as discussed in 2.1). These concepts are stored as long term memories for later procedural and semantic unconscious retrieval. As fluid and working memory ability decreases, a person relies more and more on these already stored concepts of experience as the capability to create new concepts diminishes. Exploration of the interactions a prospective user over 70 may have experienced in this adolescent period may reveal opportunities to create new computational products that exploit such stored procedural knowledge – creating 'new' interactions that combine conscious action and unconscious thought. By understanding something of the composition of these memories, the designer might begin to understand how an older user may appropriate[4] their product, object or artefact into an activity. Of course, appropriation of an item is personal and subjective upon their experience through life (Dourish, 2001). However, a designer that understands an older user's prior experience may also understand how they might approach the product they design: in understanding this, the designer can develop their product to aid its appropriation.

[4] Dourish defines appropriation as the '*way in which practices and technologies evolve around each other.'* (Dourish, 2001, pp.204)

By taking the position laid out above, it is possible to begin tentatively developing a model the study could use as an aid with which to investigate the formative experiences and interactions an older user may have stored in procedural and semantic memory. By taking the suggestion that the experiences gained between 10 and 25 years of age form the strongest embodied concepts, it is possible to conceive a time span to investigate for the current population above the age of 70. For clarity, let us take a reasonable cap on the target demographic of 95 years old. Somebody currently aged 95 (2006) would have been aged 10 in 1921 and a 70 year old would have been 25 in 1961 – indicating a period between 1921 and 1961 with which to study for a user's formative experience profile (Fig. 4). Such a model may be of particular use to designers in the future as it is somewhat dynamic – it moves along with time (e.g. for 70-95 year olds in 2050 the formative years would be 1965-2005).

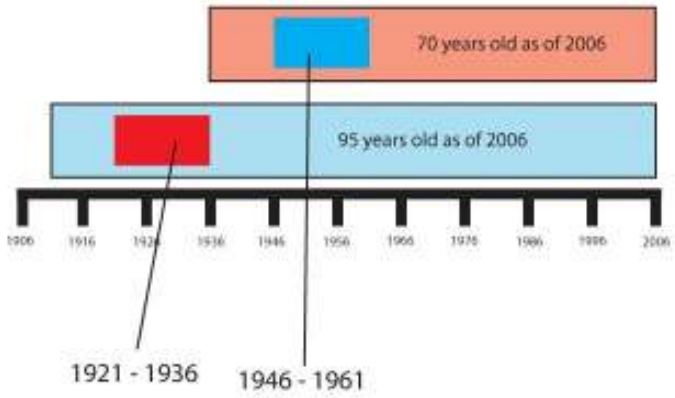


Fig. 4 The study claims designers can gain some insight into the design of email and digital photography computational products inclusive of those aged 70 and over by understanding the technology experienced between 1921 and 1961. *John Vines, 2006*

Such 40 year periods would provide a vast amount of experiential change. Inside the proposed period of time to explore (1921-1961) it is possible to observe numerous technological and social adjustment – wars, new materials, increasingly affordable and available wireless and communicative technologies – all of which have effect on the experiences of people existing throughout these periods. A most fascinating facet of embodiment – yet somewhat infuriating from a design perspective – is that any one persons experience through life is totally subjective; it is different to any others (Lakoff and Johnson, 1999). In the context of this study, it would be the researcher's role to devise the best-fit based upon the target user base, their

formative experiences and the context(s) within which the planned product is to be used. Taking the claims laid out throughout this chapter, the study suggests that designers can gain some insight into the design of email and digital photography products inclusive of those aged 70 and above by understanding the way in which this group interacted with technology between 10 and 25 years of age.

3

ACTING ON RESEARCH

Armed with the knowledge outlined in the previous chapter, the study is able to take tentative steps towards designing an email/digital photography product that may be more suitable to those in the 70 to 95 age group. By exploring some of the technology and products in common use between 1921 and 1961, the study devised a number of ideas that attempt to translate some of the concepts from the past into new computational products (Fig. 5). These semi-developed concepts are then taken forward to the next stage of research involving collaboration with a group of potential users, providing the study with an opportunity to appreciate what features may be worthy for development. In chapters 4 and 5, the paper will discuss in greater detail how collaboration falls within the research methodology and the problems this can provide for a researcher. In the remainder of this chapter, the paper will provide an overview of what user collaboration achieved in allowing the study to act upon the previously learnt knowledge.

Fig. 5 Work in progress concepts from initial exploration of the 1921-1961 period. *John Vines, 2006*

One design in particular stood out for development during collaboration: Memories. The underpinning concept of Memories was a film-canister like device that rotates via a crank handle allowing a user to view digital images stored internally (Fig. 6). It was this reel like mechanism that stood out in collaboration critique as something easily graspable, concept wise. A number of collaborators commented on its

similarities to some early slide projectors used during their past employment or socially at home, whilst others recognised the similarities between the crank-handle device and early home-movie projectors and video cameras. Despite these initial positive comments, there a number of areas of the concept that needed improvement and refinement, which will be discussed in the following subchapter.

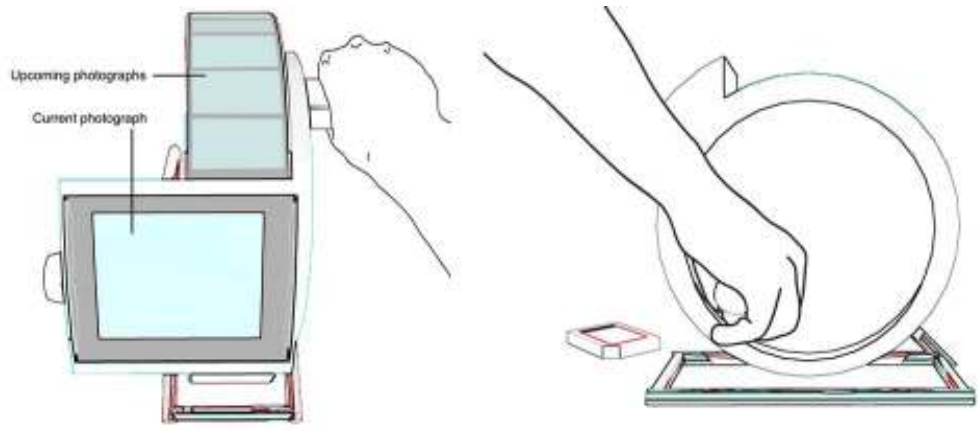


Fig. 6 Early imagery of the reel device that formed the centre of the Memories concept. This was later developed into Photo Reel. *John Vines, 2006*

3.1 Refinement of 'Memories' into Photo Reel

The focal of Memories was a reel-like device that acted as a library of digital photographs that could be rotated through and viewed on a magnifying screen at the front of the device. The underpinning concept of utilising a rotating mechanism as a way to traverse the images that would be stored within the internal memory and this aspect of the device could be considered successful upon critique from potential users. The reel mechanism was taken forward to form the basis of the eventual product stemming from collaboration, Photo Reel.

Certain aspects of Memories were considered unsuccessful, based upon the reasoning that they did not achieve the central aim of the study – utilising formative experiences – and were also felt unnecessary from certain collaborators. These failures centred on the considerations Memories gave for transferring images from the reel to compatible products that may inhabit a certain environment, such as picture frames, mobile phones and projection devices. The transferral system used a small device named Framer (Fig. 7), which

could be used to touch the surface of an image to pick it up, and then touched again onto a compatible surface to drop the image back down again.

Fig. 7 The Framer device – part of the initial Memories concept - was a small device used to transfer images between compatible surfaces. *John Vines, 2006*

Upon collaboration it was noted that this process was unsuitable based upon the cognitive needs of the target user. The very point of this research is to provide products and systems that enable an older adult to utilise past experience and negate the necessity to apply fluid intelligence and abstract thought. Although a seemingly simplistic way of interacting with digital images and devices in an environment, use of the Framer device would still require a certain amount of working memory and fluid intelligence and does not relate to any formative experiences for the older user to rely upon. The fact this was brought up during collaboration with intended end users goes someway to validate some of the claims of the research explored in chapter 2 of this paper.

Fig. 8 A slide-based system replaced Framer as the method to transfer images, as it afforded an interaction based upon a formative experience and thus less fluid though. *John Vines, 2006*

The Framer device was replaced with a system formed around a photographical concept that could be deemed more fitting with the overall context of the product - slides (Fig. 8). A slide replaced the screen at the front of the reel (which in itself caused issues, see next page) and acted as a gateway to the selected

image. Once an image the user is looking for is displayed, the slide can be removed and placed into other compatible devices. The slide also acts as a simplistic way to rotate the currently displayed photograph, by simply removing the slide, turning around to suit, and replacing it back into its slot. The use of slides – mimicking transparencies used in slide projection – was felt to afford a more formative experience by the collaborators as it was a concept they recognised from previous experiences. Rather than being used with a multitude of compatible products, the slides would be limited to just a small number of devices that expand the application of the digital images. An example of such devices is the viewer accessory (Fig. 9), which would be a relatively simplistic screen device which a slide could be slid into.

Fig. 9 This slide viewer allows for enlargement of the image to 10 by 15 cm. Various size options could be produced, mimicking the sizes of photographical prints available. *John Vines, 2006*

A number of other flaws were picked up on during collaboration and development of Photo Reel. Not so much noteworthy because of the way they shape the end product, but more for the validity of using the target user-base in the design process.

- Ensuring all display screens were not curved and allowed for more comfortable viewing.
- Consideration for left-handed as well as right-handed users (Fig.10).
- Alteration to the process used to rotate displayed photographs.
- Increasing overall stability of the reel when in use.

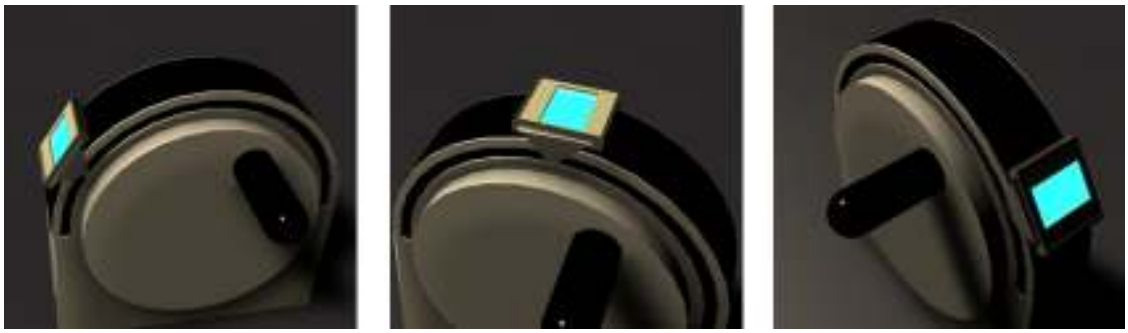


Fig. 10 A refinement of Photo Reel through collaboration with users was consideration for left handed, as well as right handed users. By adjusting the slide, it is possible to alter the devices state from left to right handed to suit its user. *John Vines, 2006*

3.2 Continued development of Photo Reel

An insight made through collaboration was how a device such as Photo Reel allows people aged above 70 to participate with a currently established technology, but on their own terms. It was noted how Photo Reel would allow for photographs to be sent to its owner (through a standard modem and internet connection) from other compatible platforms. This allows younger generations to continue to use digital photography technology as they see fit, whilst not overlooking the older user. The Photo Reel acts as an email account, allowing for the sending and receiving of photographs through an internet connection. Friends, children and grandchildren of the user would be able to send images to the reel through such a connection via email or text/picture messaging. The device begins to allow all age groups to communicate electronically at their own level of skill and interactional knowledge, whilst not to the detriment of what could be termed inter-age communications.

Fig. 11 Photo Reel should integrate with current technological infrastructures, such as email. *John Vines, 2006*

Photo Reel, in its current form, is far from a complete product - there are a number of limitations to the concept in its current form. There isn't any consideration thus far for how images may be sent via email from the device, or how it signals that a new photograph has been received. The slide format used to share pictures to compatible devices around the home would not integrate with any current products; it would require the development of its own compatible devices (such as the viewer) to do so. It is hoped some of these issues will be addressed prior to the presentation of this study and attached to this paper within its appendices. What Photo Reel does provide is a step towards creating computational products that are more suited to the cognitive abilities of those aged above 70. Through refinement from initial 'Memories' conceptualisation, it provides an older user with a product system based upon concepts they may be able to recognise from their formative period and previous experience. In doing this, the designer (through Photo Reel) is able to exploit the healthy procedural, semantic and crystallised functions of the aged cognitive profile. It has flaws which need further examination, but the product provides a foundation for future study to build upon.

4

RESEARCH METHOD

In this chapter, the paper will outline the strategies and tools utilised to perform the research. For purposes of clarity, the chapter will be split up into subsections detailing various aspects of the research methodology. Each section is ordered in a manner representative of the order of research in the study; starting from initial exploration in October 2005 through to the final stages of research in December 2006.

4.1 Identifying a research question

To aid early exploration of the research context, the study was broken down into three parts:

1. *Theory.*[5]
2. *Practice.*[6]
3. *Research.*[7]

Despite acting as differing individual aspects of the study, all three routes were intended to link directly into one another and form together over the first 8 months to create one research question by May 2006 (visualized in two differing manners in Fig. 13 and 14, p.22). Theory explored what literature and research is already completed or in-progress and what is missing, practice would explore the theory and develop a creative outcome to what is missing and research would help bind this together to form a cohesive proposal for future study. At various points, a period of time would be spent bringing all work together and

[5] Reviewing and understanding the context the study fits within and where it fits in the wider design world.
[6] Exploration of the research context (as determined through Theory) via the researcher's own practice of product design and conceptualisation
[7] Consideration of future research, how it may be performed, what may be its limitations and practicalities, and what responsibilities the designer/researcher holds.

reflecting upon what has been performed thus far. The researcher could then clarify the route forward, understanding what is to be done next and proceed accordingly.

Fig. 12 Categorised reference list. *John Vines, 2006*

It was necessary to stop researching the context and reading literature on occasions, allowing the researcher to gather everything together and understand where the study actually sits. By reflecting upon the research performed up until that point, it was possible to see what is and is not relevant to where the researcher intends the study to progress. This was aided by continuously making note of any significant literature and publications (Fig. 12), documenting relevant page numbers, references and quotes for future retrieval.

Fig. 15 and 16 (p.23) display two variations of activities used to overview the research landscape. As may be visible, many of the fields and authors referenced at this point have not made it into the completed study. This could be attributed to decisions made by the researcher upon reflection on the reading and research performed until that point, and making critical decisions as to what does and does not fit into the planned future of the project.

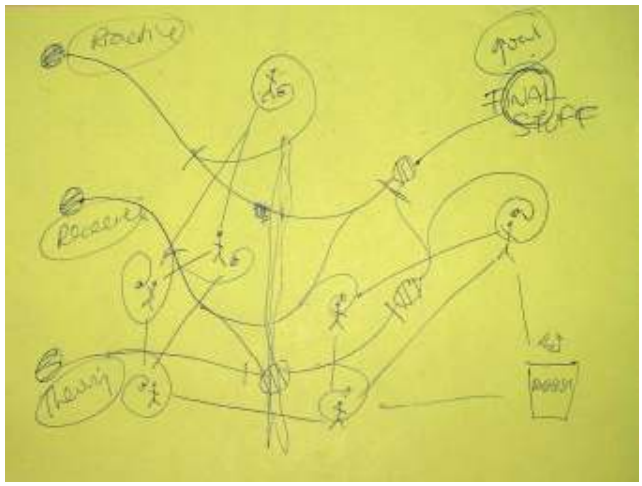


Fig. 13 Sketch diagram illustrating an early perception of the research process; practice, research and theory working inter-independently, but after many twists and turns resulting in the single goal of a research claim, termed here 'final stuff'. *John Vines, Dec 2005*

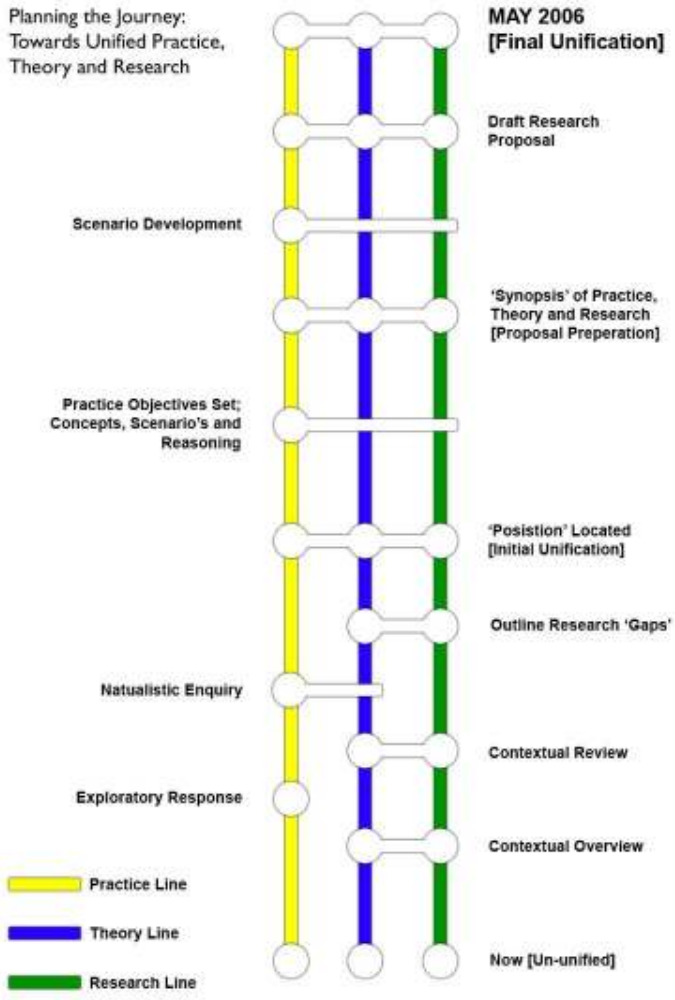


Fig. 14 'Planning the journey' towards unified practice, theory and research. *John Vines, Jan 2006*

Fig. 15 Overviewing the research context at a very early stage. *John Vines, Oct 2005.*

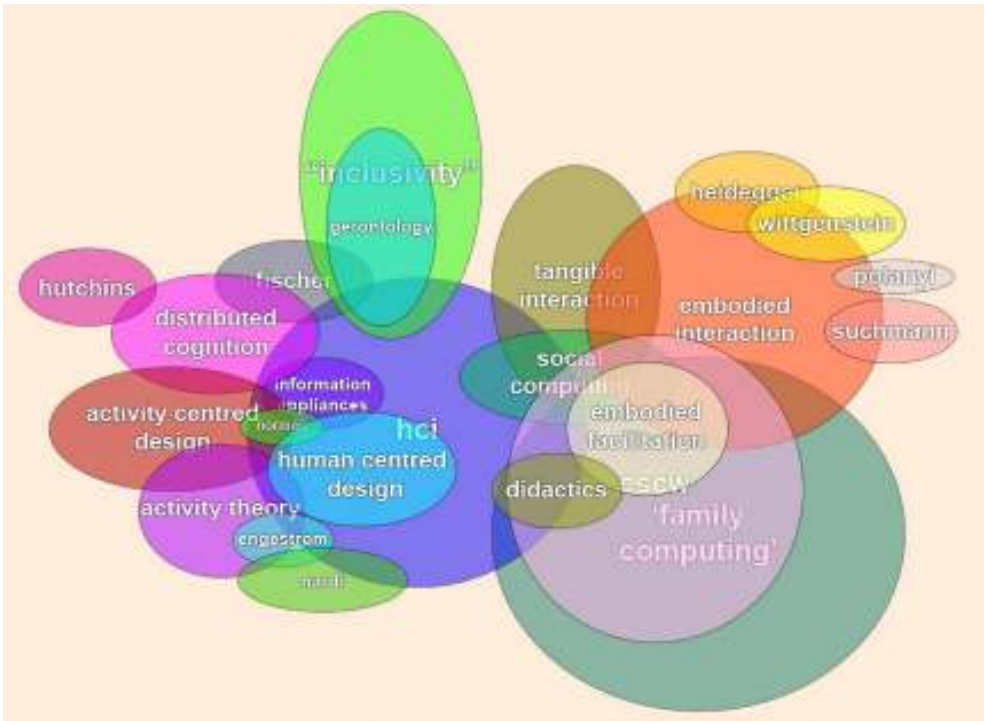
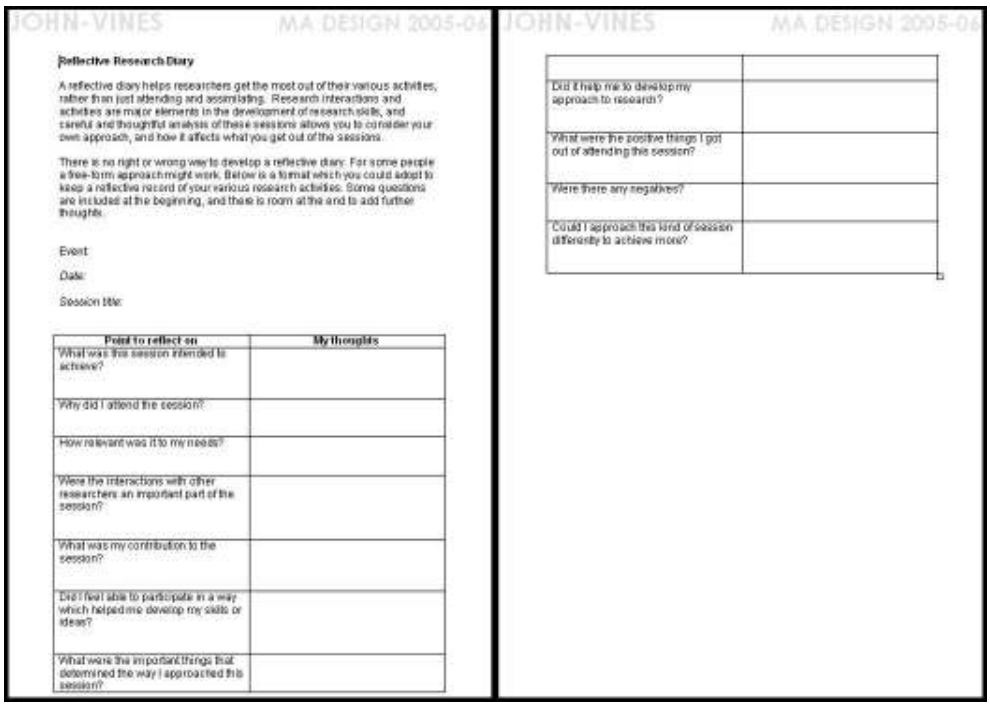


Fig. 16 Visualising the research context. Adapted from Gray and Marlins, 2004. *John Vines, Feb 2006*

4.2 Reflective study

Notably from the previous subchapter, reflecting upon performed research is an integral aspect of the study; aiding and ensuring it progressed in a correct manner. Initially, reflection was performed after each group or individual research session at university, using a reflection questionnaire (adapted from University of Manchester, 2005). The questionnaire (Fig. 17) comprised of a number of questions that intended to get the researcher to understand and assess the way in which they have approached research sessions - whether certain things were successful, what went wrong and what could be learnt for future sessions.



Reflective Research Diary

A reflective diary helps researchers get the most out of their various activities, rather than just attending and assimilating. Research interactions and activities are major elements in the development of research skills, and careful and thoughtful analysis of these sessions allows you to consider your own approach, and how it affects what you get out of the sessions.

There is no right or wrong way to develop a reflective diary. For some people a free-form approach might work. Below is a format which you could adopt to keep a reflective record of your various research activities. Some questions are included at the beginning, and there is room at the end to add further thoughts.

Event:

Date:

Session title:

Point to reflect on	My thoughts
What was the session intended to achieve?	
Why did I attend the session?	
How relevant was it to my needs?	
Were the interactions with other researchers an important part of the session?	
What was my contribution to the session?	
Did I feel able to participate in a way which helped me develop my skills or ideas?	
What were the important things that determined the way I approached this session?	

Did it help me to develop my approach to research?	
What were the positive things I got out of attending this session?	
Were there any negatives?	
Could I approach this kind of session differently to achieve more?	

Fig. 17 A reflective questionnaire, adapted from University of Manchester, 2005. *John Vines, 2005*

As the study moved on, a less formal approach of reflective diaries was used. The diary acted as an aid to look back on and document all aspects of the study and what influences the research. Rather than just documenting research activity, it was important to document what went wrong, what was successful and what could be learnt or taken forward from it. Reflection was not just limited to university sessions (as that would somewhat reduce the effectiveness of the research diary) it was a constant throughout the day to day activities of the researcher. Conversations, presentations, discussions with peers and colleagues, browsing the internet for publications and library visits were all noted and analysed. Reflection allowed the

researcher to understand the various factors that can affect the way in which research is approached, and improve upon in the future. It allows for the digestion of any notable issues arising from the research, for the unearthing of previously unknown issues, and provides a basis to improve future study.

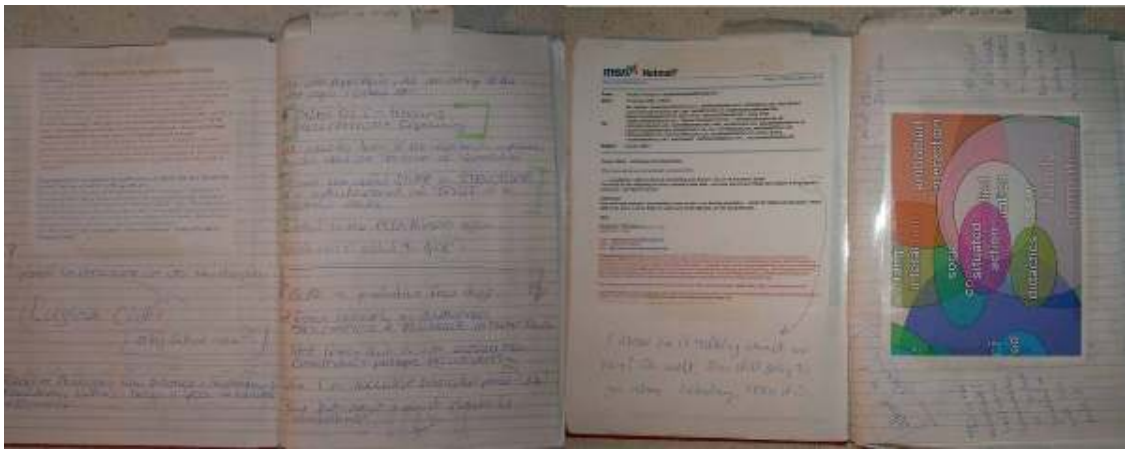


Fig. 18 Reflective diary. *John Vines, 2006.*

4.3 Design practice

Throughout the study, the practice of product design was used as a way to explore the ideas underpinning the research claim. The direction of the design practice very much worked alongside the thesis it fed off as a result. For example, at an early stage the study was interested in the possibility of using tangible computing as a basis for designing computational products for older adults (as described in 2.2); the design practice emanating from the study at this time – such as the interactive desk (Fig. 3, p.11) – visualises that. The continuous nature of thesis development meant that for a considerable amount of time, practice exploration was very much a naturalistic enquiry based upon early research findings. Much early practice-based work could be considered sketchy and very much work-in-progress (Fig. 19), attempting to understand how the findings of the literature and contextual study could be translated into design practice and actual products.

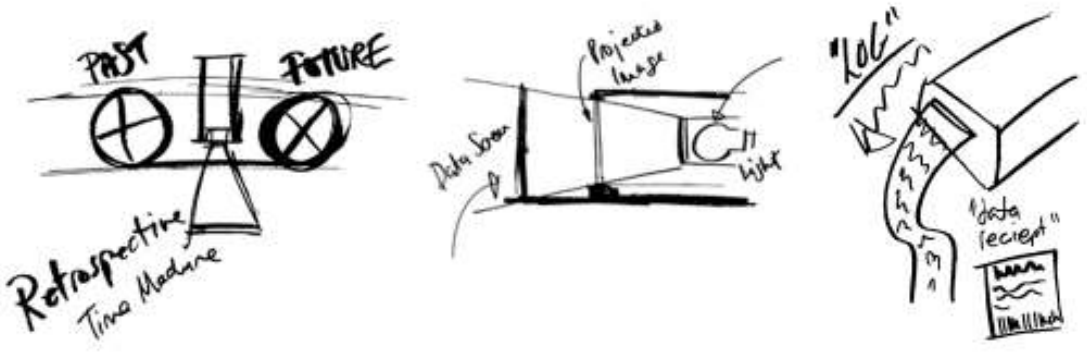


Fig. 19 Very early design exploration of research context, based upon physical data representation and image projection. *John Vines, 2005*

In the later stages of developing a research claim, the design practice began exploring the interactions a person aged between 70 and 95 may have experienced in their formative years; determined as the period between 1921 and 1961 in chapter 2.3. This lead to the creation of a number of more derailed product concepts (Fig, 5, p.14) based upon the technology, products and infrastructures this age group may have interacted with during this time period. From here, the study could take these concepts forward into the collaboration process for further development and refinement. Design practice is an important function within the study as it provides the creative output of the overall research, in the form of a developed concept and product. It presented an opportunity for the researcher to give some sort of real-world application to the review of the literature within the context, and provides real-world legitimacy to the project.

4.4 Proposing research

The initial stages of study could very much be seen as time the researcher spends getting their head around the context. Once this is complete, it is possible to propose future research based upon a question that begins to act upon the review of literature and research context. Eight months spent exploring the research context lead to the formation of a research question to be explored in the final stages of the study. At this point, the researcher evaluated how the forthcoming final stages of the research project may be completed. This culminated in the development of a plan of work for the final 8 months of the research project (Fig. 20). Although differing slightly, the research has kept somewhat accurately to the above plan of work.

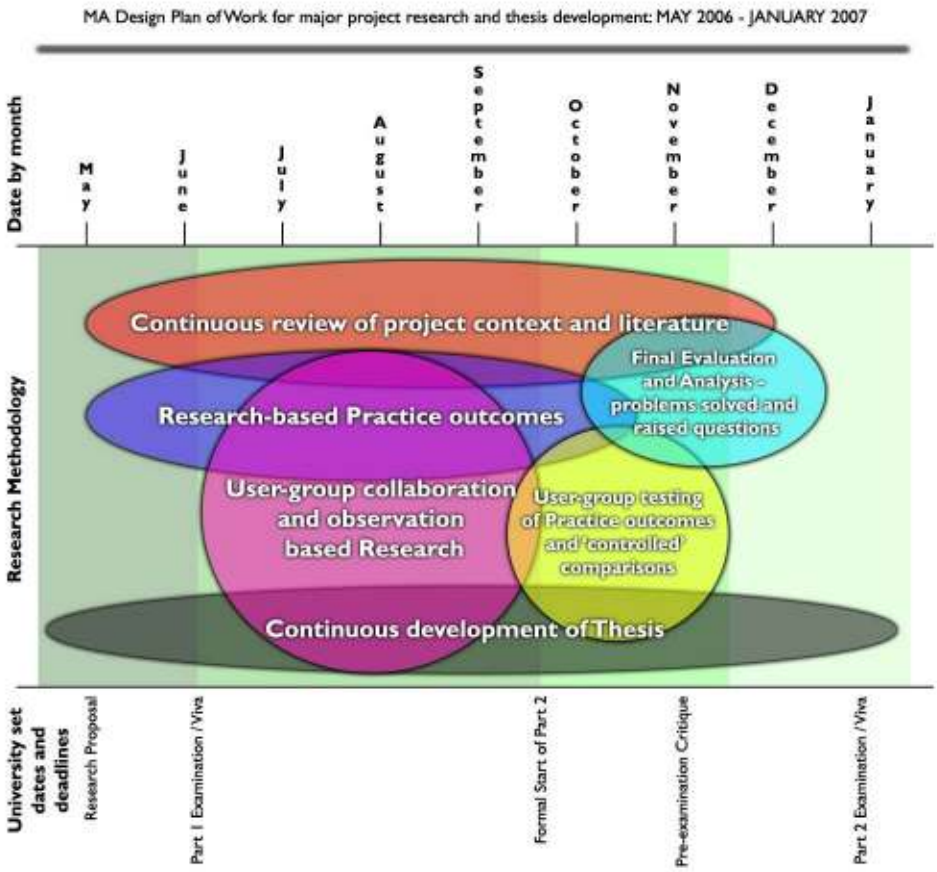


Fig. 20 Proposed plan-of-work for MA Design Part 2 research and practice project. *John Vines, 2006*

4.6 User collaboration

Collaboration was the final stage of research, enabling the study to evaluate with a group of potential users as to how to develop and refine the concepts that were created through research-based practice.

Collaboration was intended to be used to gather two types of information:

- A greater understanding of what may be considered formative experiences for the 70 to 95 year old age group and how these may be incorporated into email/digital photography based products.
- Refinement of developed product through collaboration with users based upon their critique and evaluation of product (Fig. 21).

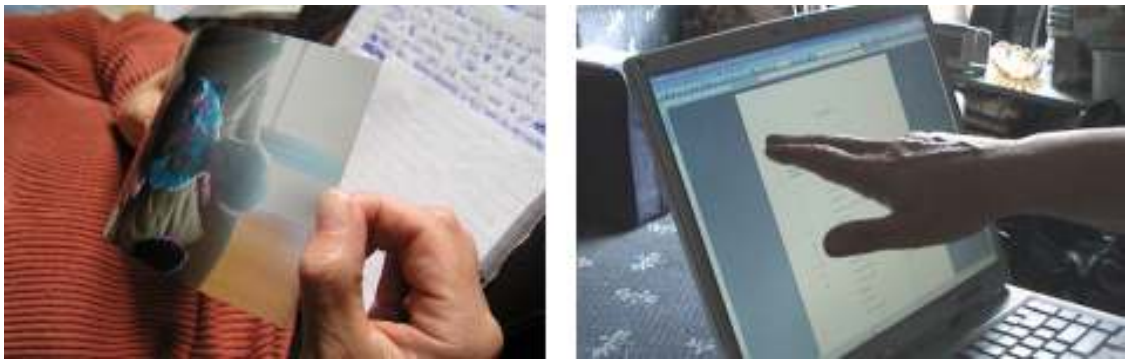


Fig. 21 Stills from a user collaboration study video. *John Vines, 2006*

Limited by time constraints, the study intended to utilise this section of research as a purely qualitative piece of research – based on understanding and utilising the experiences of a small number of potential users of the email/digital photography product. Seven prospective users were collaborated with and those who were selected for collaborating with were done so based upon a number of factors:

- Availability for meeting the researcher
- Aged 70-95 years old
- Relatively accessible (distance to travel)
- Considered prospective users of the potential end product

Collaborators were presented with a number of work-in-progress concepts that were produced just previous to the research proposal. These concepts were formed from investigations into some of the potential technology and products people now aged between 70 and 95 may have experienced when in their formative age period, between 10 and 25, and were presented to the users in four ways: as conceptual imagery, scenarios and story boards, computerised 3D modelling and simple development models. Collaborators were asked for their opinion on each concept, with a focus on whether they felt each one achieved the aim of utilising prior experiences from a younger age and if any particular concept stood out from the others as being something they would be interested in owning and/or using.

One concept did stand out from the others. Memories, later developed in the Photo Reel, became the concept that the study took forward for further development. From this point, collaboration was used to

refine this concept, as detailed in chapter 3. Collaboration proved valuable to the research as it begins to create validity to the suggestion that people between the ages of 70 and 95 could have their experience of certain computational products improved by designers understanding the technology and interactions that occurred at a far younger age. It also enables the actual end user to participate in the research and development process, providing the researcher with valuable insight and criticism into certain oversights in the design of the product. Collaboration presented the researcher with a number of obstacles, which will be detailed in the following chapter.

4.7 Continuous development of researcher's thesis.

An aim for the research was to create a good foundation for future research to be completed at the next level following from the completion of the Masters degree. The development of the thesis never really stops aside from to gather up all materials to see what is and what is not of use. This often leads to further questions to be asked and insights to be made - it only serves to push the thesis ever forward. The project would be successful if it allows for a good foundation for future stages of study, and provides insight into potential future claims emanating from the study.

5

RESEARCH OBSTACLES

In this chapter, the paper will briefly reflect upon certain obstacles from the research process, describing certain problems that occurred, how this affected the study and the way in which they were overcome.

5.1 Collaboration logistics

Logistical issues during collaboration became apparent as a result of an initial inability on the researcher's part to find suited and willing collaborators within the local vicinity of where the researcher lived. This (1) limited the opportunities to organise research critiques with the participants and (2) also restricted the ability to organise all collaboration participants to meet in one place as a group. The study somewhat overcame the first issue of restricted sessions by understanding in advance what should be achieved from each meeting. By focusing upon what was to be gained from a certain collaborator meeting, the study was able to maximise the participants input from a limited number of visits. The second issue has inhibited an opportunity to generate inter-collaborator research discussion, rather than just between a single collaborator and the researcher. Future study should consider the organisation of a research group at an earlier stage, whilst understanding the benefits of collaboration participants being located within a certain vicinity of each other.

5.2 Collaboration ethics

The researcher has a responsibility for ensuring the safety of all participants in the research process (researcher themselves included) and must consider the rights of collaborators. There are also the wider implications of the responsibility of design ethics, based upon the research and creations disseminated into

the public domain. It would be possible to write a further paper on the latter (see Vines, 2005:2 for more information), so just for now the paper will briefly consider its responsibilities to research participants.

At all times during this study, the University of Wales ethics committee guidelines (University of Wales Newport, 2005) were adhered to, with consideration given to the following (determined answer in brackets):

- Does the project involve primary data collection from human subjects? *(Yes)*
- Are research subjects able to provide full and informed consent? *(Yes)*
- Does it cover a sensitive subject? *(No)*
- Does it involve convert data-gathering or deception? *(No)*
- Is there any risk of harm to participants? *(No)*
- May publication of the results pose risk of harm to anyone? *(No)*

Despite the research using human participants, gaining ethic approval was not an issue as all collaborators provided full and informed consent. At no point were collaborators put at risk and they were always informed of the intended purpose of the research, with the agreement that any future change of use would be made aware for their approval beforehand. All collaborators were promised identity concealment if desired and had the opportunity to pull out of the research at any time.

5.3 Collaboration disclosure

Overlooked initially by the researcher, it is important to consider the intellectual rights of the research and the product(s) it produces. All collaborators were asked to sign non-disclosure forms in order to limit the discussion of the research outside of set meetings, on the basis that gathered information is for intellectual generosity. If Photo Reel (or any directly resulting product) is developed for future commercial application, the researcher would have to attain approval from research collaborators. This would also be true of any others who have provided valuable input to the development of the research and end product, such as research supervisors, peers and fellow researchers.

5.4 Hodderdodder

At a late stage of the study, it was made aware to the researcher of the similarities between the Photo Reel product outcome, and Hodderdodder (3eyes, 2001), an interaction design concept conceived by Theo Humphries. Although there were distinct differences in the underpinning ideas of the two concepts, there were very noticeable similarities in the manner in which both were interacted with by a user. As a result of this being made aware to the researcher, efforts had to be made to communicate with the creator in order to gain permission to continue using the developed concept. This was achieved and research was able to continue as before. As with all collaborators, this was based upon intellectual generosity; any future research that continues to develop Photo Reel for commercial application of the device would have to include further discussion and agreement with Hodderdodder's creator.

5.5 Prototyping

Prototyping became an obstacle due to time and financial constraints put upon the study. Time constraints were amplified by continuous development and exploration of product ideas, resulting in numerous alterations to planned prototyping. Financially, the researcher couldn't afford to be purchasing materials for prototyping, only for the prototype to change. The research addressed this by developing the prototype in two ways. Firstly, sketch and developmental models were used throughout, made out of inexpensive and occasionally reusable materials. This allowed for rapid development of models that reasonably visualised and simulated what the product concepts wanted to achieve, allowing for collaborators to interact with them and critique accordingly. Secondly, artwork was used to visualise how the perceived product would actually look and inhabit an environment. These were produced through CAD renderings, user scenarios, story boards and exploded drawings. Combined, the two very different approaches work well, as it provided the researcher and collaborators an idea of both how the product may work from an interactional and experiential point of view, as well as understanding how it may fit into their day to day lives and activities.

5.6 Lack of comparison

In the research proposal, it was planned to spend some time making comparison tests between the resulting product from the study and a computer based alternative. In doing this, it was hoped to prove or disprove whether the end product (which would be based upon the research findings) would be successful in improving an older adult's appropriation of computational media. Time constraints stopped this coming to fruition, as it became clear that if such tests were performed at this stage they may be rushed and not be a long term benefit to the research. It could be portrayed as a limitation of the research that this was not performed, but it very much depends on how the project is viewed. The research was intended to provide a piece of insight that could be developed in a future study with grander claims; it suggests certain claims, instead of outright stating them as a truth. However, such controlled comparison tests may be useful in future research as a way of testing a hypothesis, depending upon the content of the research at that time and what it is intending to achieve.

6

RESEARCH EVALUATION

Although providing a valid product outcome to the project in the form of the Photo Reel, the research discussed within this paper is still a work in progress towards something larger in the future. From an early stage of study, the researcher planned for the project to become a stepping stone to the next level of research. This leads to a focus on the theoretical aspects of the project, to the detriment to the practical and creative aspects of study. Though this may benefit the next level of research at MPhil or PhD, providing the researcher with many critical insights to proceed forward, it has made creating a valid outcome to the Masters study rather awkward.

This may have been amplified by early over-ambition. Throughout the majority of the study, it was planned to investigate and develop rather vaguely titled 'computational media and products'. It was intended from an early stage to create a collection of various computational devices that all aimed to explore the model suggested in 2.3. Given the various constraints a research project such as this falls within however, it was felt necessary to reduce focus towards just one aspect of computational media. It wasn't until collaboration with users that this was narrowed down further to an eventual single concept based upon digital photography (and a little later in collaboration, incorporating email) media. It was perhaps far too ambitious to study the broader category until a relatively late period of study.

The research also has certain limitations. Firstly, the study only subscribes to one line of thought. Currently, a core suggestion from the research revolves around the idea of the embodied mind. It may be in the interest of validity for future research to focus upon aging cognition research (as in 2.1) without the

necessity to bring in the claims of an embodied mind (as in 2.2). This may also aid in removing any tautological undertones currently residing in the thesis' current form. It may also be a reasonable suggestion for future study to examine opposite views and opinions, as this may alert the researcher to points of conjecture in the research.

Secondly, the collaboration period was used as a piece of purely qualitative research. This provides a subjectivity issue for the research to overcome in the future. Photo Reel was developed based upon the experiences recalled from a small group of people; what is there to say a product that may meet these users' formative experiences, may suit others? A future study would not only have to consider expanding the breadth of user collaboration for qualitative research (beyond the 7 participants of this study), but also devise some way to quantify the technology and products used by a significant proportion of the 70-95 age group when they were aged between 10 and 25.

Using this study as a stepping stone for future research has presented a problem in producing a desirable outcome to the project - as stated a few paragraphs ago - but does provide the researcher a good foundation to develop their thesis for the next level of study. Two significant suggestions arising from the research are:

1. Designers may be able to improve an older adult's use of email and digital photography based products by understanding the technologies and products this group of people interacted with in their formative period between the ages of 10 and 25 years.
2. This could allow older adults to participate with technologies in common use now on their own terms, whilst not affecting how other age groups interact with such technologies.

The first suggestion was shaped through the study of aging cognition (2.1) and claimed that as a person ages, their ability to learn to use a personal computer and thus participate in computational media such as email and digital photography is limited.

The research suggested that by expanding upon tangible computing and understanding the formative experiences from when older adults were aged between 10 and 25, designers can gain some insight into

designing such products for this age group (2.2). Based upon these findings, a model was developed that could be used as an aid in designing such product (2.3). This model has then been tentatively investigated through user collaboration and the development of Photo Reel (3). Future study would need to go on to further hypothesise and test said model, further developing it in doing so. This may present a need for user collaboration and testing on a much larger scale than this study was able to provide. As briefly discussed above, future study would also need to consider quantifying the amount of people who may find a particular formative experience useful.

The second research suggestion becomes apparent through the user collaboration performed to investigate the former. It begins to propose that those aged above 70 are enabled through the utilisation of their formative experiences to use the same technologies as those in younger age and ability groups, but on their own terms. All age groups would be able to participate within the same technological infrastructure and do so in a manner fitting of their understanding of how that technology should work. The paper touched on this in chapter 3, citing the example of various generations of the same family who could communicate through the same infrastructure (email/digital photography) on their own level of knowledge and ability. This begins to view groups of certain ability and skill (toddlers, teenagers, middle aged, over 70's etc), with particular products developed for them, but all groups participating among the same infrastructure. This can only be considered as a brief insight of the research at this moment, but is certainly something considered when developing the researcher's thesis in the future.

Taken as how the researcher intended it to be, the research this paper describes could be considered successful, as it has provided the researcher with a good basis for the next stage of research. The research doesn't claim to provide any answers, only further questions, and begins to take tentative steps towards making grander claims in the future. Through demonstration of research into the aging mind and the development of the Photo Reel product, this study believes designers can gain some insight into the design of email and digital photography computational products aimed at those aged 70 and above by understanding the way in which they experienced technology and products between the ages of 10 and 25.

BIBLIOGRAPHY

3EYES. 2001. *Hodderdodder*. [WWW] http://3eyes.co.uk/views/public/?doc=Hodderdodder (20 October 2006)

ADLER, R. 1996. *Older Adults and Computers: Report of a National Survey*. [WWW] http://www.seniornet.org/php/default.php?PageID=5476&Version=0&Font=0 (15 April 2006)

BADDELEY, A. 1989. The psychology of remembering and forgetting. *Memory: History, culture and mind,* pp. 36-60. Oxford: Basil Blackwell

CATTELL, R. 1987. *Intelligence: Its Structure, Growth, and Action*. New York: Elsevier Science.

COLEMAN, R. 2004. *About: Inclusive Design.* [WWW] http://www.designcouncil.org.uk/webdav/harmonise?Page/@id=6004&Section/@id=1354 (01 February 1006)

CRAIK, F. 1977. Age differences in human memory. *Handbook of the psychology of aging*, pp.384-420. New York: VanNostrand-Reinhold.

DJAJADININGRAT, T., OVERBEEKE, K. WENSVEEN, S. 2002. *But how, Donald, tell us how?* [WWW] http://www.itproducts.sdu.dk/djajadiningrat/publications/02DjajDISButH.pdf

DOURISH, P. 2001. *Where the Action Is: The Foundations of Embodied Interaction.* Cambridge: MIT Press

GOODMAN, J., SYME, A., EISMA, R. 2003. *Older Adults' Use of Computers: A Survey* [WWW] http://www.dcs.gla.ac.uk/~joy/research/2003_bcs_hci/paper.pdf (16 March 2006)

GRAY, C., MARLINS, J. 2003. *Visualising Research: A guide to the research process in art and design*. Aldershot: Ashgate Publishing

HARVARD UNIVERSITY. 2004. *Glossary of terms*. [WWW]
http://cyber.law.harvard.edu/readinessguide/glossary.html
(28 April 2006)

HOLMQUIST, L., SCHMIDT, A. ULLMER, B. 2004. Tangible interfaces in perspective: Guest editors' introduction. *Personal and Ubiquitous Computing.* 8 (5), pp. 291-293.

LAKOFF, G. JOHNSON, M. 1999. *Philosophy In the Flesh: The Embodied Mind and Its Challenge to Western Thought.* New York: Basic Books

NATIONAL STATISTICS, 2001:1. *Use of the Internet: by age and gender, July 2001: Social Trends 32*. [WWW]
http://www.statistics.gov.uk/StatBase/ssdataset.asp?vlnk=5200&More=Y
(09 February 2006)

NOVA SCOTIA CENTRE ON AGING, 2001. *Using Technology? Positively! Computers: Getting Online Using the Internet*. [WWW]
http://www.phac-aspc.gc.ca/seniors-aines/pubs/tech_fact_sheets/pdf/computers_e.pdf
(09 February 2006)

NYGREN, E., JOHNSON, P., HENRIKSSON, P. 1992. *Reading the medical record I: Analysis of physicians' ways of reading the medical record.* Computer Methods and Programs in Biomedicine. 39. pp. 1-12.

PARK, D., SMITH, A., LAUTENSCHLAGER, G., EARLES, J. 1996. *Mediators of long-term memory performance across the life span.* Psychology and Aging, 11, pp. 621–637.

SCHIEBER, F. 2003. Human factors and ageing: Identifying and compensating for age-related deficits in sensory and cognitive function. In: CHARNESS, N., WARNER SCHAIE, K., *Impact of technology on successful ageing*, pp. 42-84.

SMITH, A., EARLES, J. 1996. Memory changes in normal aging. *Perspectives on cognitive change in adulthood and old age*, pp.192-220. New York: McGraw-Hill.

SROUFE, L., COOPER, R. 1988. *Child Development: Its nature and course*. New York: Alfred A. Knopf, Inc.

STUART-HAMILTON, I. 1999. Intellectual changes in late life. In WOODS, R. *Psychological Problems of Ageing*. Chichester: Wiley.

TULVING, E. THOMPSON, D. 1973. *Encoding specificity and retrieval processes in episodic memory.* Psychological Review, 80, pp.352-373.

UNIVERSITY OF MANCHESTER, 2005. Independent language learning: Reflective questionnaire. [WWW]
http://www.langcent.manchester.ac.uk/learningresources/languagesupport/learningguide/independentlanguagelearning/thefile,20024,en.pdf
(20 October 2005)

UNIVERSITY OF WALES NEWPORT. 2005. Algorithm for research ethics approval process. [WWW]
http://www3.newport.ac.uk/displayPage.aspx?object_id=1414&type=msw
(15 April 2006)

VINES, J. 2005:1. *Aging Futures: Are the ageing population's of developed countries a design opportunity in the waiting?* [Unpublished] University of Wales, Newport, Caerleon Library.

VINES, J. 2005:2. *A perspective: design and ethics*. [Unpublished]. Available upon request of the author.

ZAJICEK, M. 2001. *Special Interface Requirements for Older Adults.* 2001 EC/NSF
Workshop on Universal Accessibility of Ubiquitous Computing: Providing for the Elderly, pp. 60-65.
ACM Press.
Available Online at: http://virtual.inesc.pt/wuauc01/procs/pdfs/zajicek_final.pdf

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