

Solent University

SCHOOL OF MEDIA ARTS and Technology

**Web Design and Development
Year 3 2019-2020
Alexander Zietara Nicholls**

Supervisor : Martin Reid

Date of submission : May 2020

1. Acknowledgements

Grateful thanks to Southampton Solent University for supporting this study, especially Martin Reid, MA, Course Leader, School of Media Arts and Technology who supervised this project.

This project would not have been possible without the expertise and insights provided by the following clinicians and senior academics in the field of dementia:

Dr Michele Board, Principal Academic Nursing Older People, Deputy Lead Ageing and Dementia Research Centre (ADRC), Bournemouth University

Mr Chris O'Connor, Consultant Admiral Nurse, Nursing Directorate, East Surrey Hospital

Dr Stephanie Daley, Senior Lecturer in Old People's Mental Health and Education, Brighton and Sussex Medical School

Professor Murna Downs, Professor of Dementia Studies, Faculty of Health Studies, University of Bradford

Dr Sarah Smith, Reader in Dementia Research, Centre for Dementia Research, School of Health and Community Studies, Leeds Beckett University

Professor Claire Surr, Professor of Dementia Studies, National Teaching Fellow, PFHEA, Director of the Centre of Dementia Research, School of Health and Community Studies, Leeds Beckett University

Sarah Waller CBE. Associate Specialist, Association for Dementia Studies, University of Worcester

Their support with 1-1 interviews and participation in the usability testing was much appreciated especially during the Covid-19 crisis.

2. Abstract

Dementia is a general term for a decline in mental ability with symptoms that can include memory loss, difficulties with thinking, problem-solving, language and visual perception. Around 850,000 people are currently living with dementia in the UK with around 42,000 people affected by 'young onset dementia' (Prince *et al.* 2014; Alzheimer's Society 2018b; Young onset dementia 2019). The prevalence of dementia is projected to rise significantly in the future and as many of those diagnosed with dementia will be users of technology, this study explored what was being done to make websites and applications more accessible for those living with dementia and what emerging good practice could be used by User Experience (UX) designers and developers to promote accessibility and independence when using web technology.

In addition to an extensive literature review, senior clinicians and academics were engaged to determine what were the key design challenges that may impact those living with dementia when using websites. Using David Kelly's Design Theory Model (Dam and Teo, 2020), a Minimum Viable Product (MVP) was developed based on the research and tested with the senior clinicians and academics to further develop the design concept. Key design principles to emerge include simplification and clarity whilst at the same time avoiding being patronising. The outputs from the study is a set of practical design principles/framework based on the evidence base to help guide those developing and designing websites and an MVP developed using these key principles.

3. Acronyms

MVP – Minimal Viable Product

W3C – World Wide Web Consortium

IT – Information Technology

AT – Assistive Technology

1 to 1 – One to One Interviews

HMW – How Might We

PCA – Posterior Cortical Atrophy

DEEP – Dementia Engagement and Empowerment Project

RNIB – Royal National Institute for the Blind

Contents

1.	Acknowledgements.....	1
2.	Abstract	3
3.	Acronyms.....	4
4.	List of Figures	8
5.	Introduction/Background	9
6.	Literature Review	11
6.1	Understanding Dementia.....	11
6.2	Web Accessibility	11
6.3	Web Design and Development Challenges	12
6.4	Web Design and Development Opportunities	14
6.5	Navigation and Information Architecture	15
6.6	Assistive Technologies	16
7.	Methodologies	18
7.1	User Research	18
7.2	User/Usability Testing of the Prototype	20
7.2a	Test Plan	20
7.2b	Testing Metrics	20
7.2c	Subject User Base.....	21
7.2d	Consent Forms	21
7.2e	Pilot Testing.....	21
7.2f	Usability Tests	22
7.3	Professional, Ethnical and Legal reasons	22
7.4	Project Management	23

8.	Design and Implementation	27
8.1	Design Process	27
8.2	Empathise Phase	28
8.3	Define Phase	29
8.4	Ideation Phase.....	30
8.5	Prototype Phase.....	32
8.6	Testing Phase	33
9.	Results	35
9.1	Dementia Expert Interviews	35
9.2	Usability Testing wireframe	38
10.	Conclusions	41
11.	Recommendations	44
12.	References.....	46
13.	Bibliography	50
14.	Appendix	52
	Appendix 1 – 1 to 1 Interviews Consent Forms.....	52
	Appendix 2 – 1 to 1 Interviews Questionnaire	53
	Applicant’s Interview Notes Form	53
	Interview Details	53
	Questions to Ask Interviewer.....	53
	Additional Notes.....	55
	Appendix 3 – Results Summary Table.....	56
	Appendix 4 – High Level Summary Table	57
	Appendix 5 – Test Plan.....	66

Appendix 6 – Usability Test Consent Forms	67
Appendix 7 – Unmoderated Survey.....	69
Link to Blank Unmoderated Testing Survey	69
Screenshots	69
Appendix 8 – Usability Testing Script.....	72
Appendix 9 – Privacy Impact Assessment	74
Appendix 10 – Literature Review Process Document	75
Appendix 11 – User Personas	76
User Persona A.....	76
User Persona B	77
Appendix 12 - MockingBot Prototype Link.....	78
Screenshots	78
Appendix 13 – Framework.....	82
Web Design Check List/Guidelines with comparative analysis	82
Google Drive Link	89

4. List of Figures

Figure 1 - The Design Thinking Model was the chosen methodology for gathering user research, to understand user needs and to problem solve. This is a human centred methodology, created by David Kelly that solves problems efficiently and aims the product to the right target audience (IDEO, 2019). It is broken down into 5 stages: Empathise, Define, Ideate, Prototype and Test (Dam and Teo, Jan 2020).

Figure 2 – Defining users and problems were used with sticky notes to help brainstorm and ideation. Pink sticky notes used to show problems found in the literature review. White notes were problems and issues from the user research.

Figure 3 – HMWs and Brainstorming are all found within Figure 3. Blue sticky notes represent all How Might We's and green sticky notes represent all ideas created during the brainstorming.

Figure 4 – Storyboard, rough sketches and tasks are all found within Figure 4. Blue sticky notes represent the relevant tasks and a user scenario. Rough sketches then are represented below all tasks.

Figure 5 – Clickable prototype created through using Mockingbot. This is a screenshot of the homepage. See **[Appendix 12]** to view all screenshots and link for the clickable wireframe prototype.

5. Introduction/Background

Dementia is a general term for a decline in mental ability which over time can become severe enough to affect daily life. Around 850,000 people are currently living with dementia in the UK. Although dementia normally affects those over 65, around 42,000 people are affected by ‘young onset dementia’ or ‘working age’ dementia (aged between 30 and 65) (Prince *et al.* 2014; Alzheimer's Society 2018; Young onset dementia 2019). The prevalence of dementia is projected to rise significantly in the future, rising to over 1 million by 2025 and 2 million by 2051. As many of those diagnosed with dementia, particularly those with young onset, will be users of technology, this study explored what was being done to make websites and applications more accessible for those living with dementia and what emerging good practice could be used by User Experience (UX) designers and developers to promote accessibility and independence when using web technology. The outputs from the study is a set of practical design principles/framework that builds on existing research to help guide those developing and designing websites and a Minimal Viable Product (MVP) developed using these key principles alongside a robust design methodology.

Dementia is caused when the brain is damaged by diseases such as Alzheimer’s disease or a series of strokes. The specific symptoms that someone with dementia experiences will depend on the parts of the brain that are damaged and the disease that is causing the dementia but symptoms may include memory loss, difficulties with thinking, problem-solving or language and visual perception (Alzheimer's Society 2020). These symptoms suggest that the ability of those living with dementia to navigate websites may be impaired. There is currently no cure for dementia, although the Government, together with the key charities (including Alzheimer’s Research UK, and the Alzheimer’s Society) are investing in strategies to tackle dementia including the UK Dementia Research Institute (UK Dementia Research Institute, 2020) and in the Prime Minister’s 2020 Challenge against Dementia (Gov 2015).

The initial literature review revealed that the World-Wide Web Consortium is encouraging companies to ensure their website design supports those with impairments and disabilities such as dementia (Caldwell *et al.* 2008). Although some research exists in this field, these were not necessarily contemporary. The Alzheimer's Society 2017 blog (Williams 2017) provides a comprehensive suite of guidelines. This was used as a reference point against which to identify and test any new and emerging principles from other sources. Although this provides a check list for designers, it did not include any framework illustrations. Given the pace with which technology moves, this study set out to determine whether there are any new issues to be considered to update the guidance. Several companies were located on the internet whose business it is to review and make recommendations on a website's accessibility, but this expertise comes at a cost and therefore may not be accessible to all those designing and building websites (Monsido 2020; Dig Inclusion 2020).

The initial concept was to produce a website, but the perceived value to industry and therefore those living with dementia is really in the design process and principles, so the focus shifted accordingly. This study explains the journey of producing a MVP with the Design Thinking design model to rapidly design and test ideas through wireframe prototypes. This inspires innovation through generating new ideas and methods to help design websites. Senior clinicians and academics, based on their subject matter expertise, were used as a proxy for those with lived experience to test out design concepts, understand key problems and expand ideation and innovation. This provided an insight into how those living with dementia might interact with prototypes.

The resulting output is an MVP and an evidence-based set of guidelines and principles based on good practice and a detailed understanding of user needs.

6. Literature Review

This literature review explores a range of research sources related to websites, accessibility, and dementia with a view of understanding how websites and assistive technologies can be designed for those living with early stage dementia and improve their quality of life. A total of 67 references were sourced with 55 of these considered more directly relevant to the study.

6.1 Understanding Dementia

Dementia is a generic term for a decline in cognitive functions, affecting people's daily lives. Around 850,000 currently live with dementia in the UK (Alzheimer's Society 2018) and 5.4 million Americans are affected by Alzheimer's (Alzheimer's Association 2012). The literature review shows a common trend of a global increase in dementia with figures expected to rise to 2 million in the UK (Alzheimer's Society 2018) and 44 million globally by 2051 (Gallagher 2013). In the UK 42,000 people are affected by young onset dementia (people under 65). (Alzheimer's Society 2018a). Many of those diagnosed with dementia, particularly those with young onset, will be users of technology. Many older adults might have dementia but may also develop mild cognitive impairments or subjective memory loss (Arch and Abou-Zhara 2004; University of California). Given that in the future the majority of the world's population will lean towards having an older demographic (Yamagata *et al.* 2013), creating more accessible sites for those living with dementia may also help with accessibility for those with other cognitive disabilities and the older age group. The indications are that more people with dementia and other cognitive disabilities will be accessing websites now and in the future.

6.2 Web Accessibility

W3C (World Wide Web Consortium) has adapted their Web Content Accessibility Guidelines and User Agent Guidelines to improve accessibility for those with disabilities (W3C 1999). Six high

level guidelines are set out within W3Cs cognitive accessibility section. These include: Guideline 1.3 Adaptability using a variety of different ways to simplify content; Guideline 2.2 Enough Time - providing time for users to read and use content; Guideline 2.4 Navigation through allowing users to navigate and find content; Guideline 3.1 Readability must be achieved to make content and information readable and understandable; Guideline 3.2 Predictability is making sure pages appear and operate in predictable ways and Guideline 3.3 Input Assistance is assisting users to avoid task error and correct mistakes previously made (World Wide Web Consortium 2019). The drawback is that many Information Technology (IT) systems and websites fail to follow these recommendations (Loiacono 2004; Zajicek 2007) and websites are mainly designed for the younger generations that are adapted to the digital world (Zajicek 2007). Rapid Advancements in technology make it difficult for designers and developers to take in consideration adapting a product that can help those with disabilities (Dobransky and Hargittai 2006). Cost is another problem with designing for digital accessibility, specifically due to the fact that technologies designed for those with disabilities are expensive to manufacture and create (or adapt) which is difficult for those who have limited incomes (Dobransky and Hargittai 2006; Stienstra 2007). Some of these sources make a huge assumption that the older generation are not technologically savvy, however, as these are older references, it may be that was accepted thinking at that point in time. Technology is advancing considerably and what was new in 2007 will be considered out of date by now.

6.3 Web Design and Development Challenges

Generalised guidance such as that provided by the UK government provide some key principles that are core to all websites (Government Digital Service, 2016). A very contemporary blog can be found at (tbhcreative 2020) that encourages the use of testing tools and general guidance. Publications and sources reflect on website usability and Assisted Technology (AT) for those with dementia providing numerous different methodologies. Most of the articles promote the need to improve accessibility of technology for those with dementia, especially websites, mobile and tablet applications. Although solutions have been created to improve web accessibility this is mainly targeting those with perceptual and physical disabilities, designing for cognitive

impairments has been shown to be more difficult (Kelly 2010; Lazar, Goldstein and Taylor 2015). Some sources suggesting that adapting websites to suit those with dementia or who have mild cognitive impairments is not feasible. Kelly refers to 'just-in-time accessibility: that accessibility may be appropriate for widely accessed informational resources but may be inappropriate if resources are expected to be little used. Kelly 2010 also refers to various authors including Lisa Seeman (Seeman 2006) who criticised the W3C as not covering cognitive disabilities well.

Savitch and Zaphris (Savitch and Zaphris 2006) analysed design needs specifically relating to information architecture. From their findings there were many design challenges to creating/adapting a website to be accessible for those with dementia including difficulties in grouping concepts together and the use of terminology. It is suggested that the older age group suffer from the lack of technical knowledge (Zajicek 2007) and there is a digital divide in technology for older adults and those with dementia (Peterson *et al.* 2009). Some generalizations are made in some of the sources. For example, the majority of older or disabled people live with low budgets and struggle to have access to some technologies (Zajicek, 2007). Even though designing websites is a challenge, finding the right and appropriate content for those with dementia is also challenging. Bouchier and Bath evaluate websites accessibility of information for those with Alzheimer's disease. Within their article, it states there will be some time before users will be able to access health-related information with confidence (Bouchier and Bath 2003). With developments and access to information by charities such as the Alzheimer's Society this no longer feels the case.

Those living with dementia also experience memory difficulties, this has in the past led to the controversial suggestion as to whether designing websites for people with dementia is feasible (Morris 1999). Those with brain injuries or other cognitive impairments as well as those with dementia can easily be prone to experience frustration and poor concentration. Muzio and Serra suggested disabled patients experienced lowered threshold of indignation, thus if they do not enjoy using a website, they are more likely to quit early (Muzio and Serra 2001). Designing applications for mobile may potentially be a major problem for users with dementia. Tablets and mobiles use a touchscreen panel and those with dementia struggle to identify the difference

between understanding this panel to a traditional resistive panel which can result in them being easily frustrated and avoid using the mobile app (Savitch and Zaphris 2006).

6.4 Web Design and Development Opportunities

However, if the right learning measures are implemented within the designs, it may be possible to help those with dementia learn and retain new information (Clare, Linda & Wilson, Barbara & Breen, Kristin 1999; Clare *et al.* 2000). Those with cognitive impairments have shown to still be able to learn and retain information over a period of time and the knowledge and skills necessary to use a computer (Glisky and Schacter 1988). Freeman, Clare, Savitch, Royan, Litherland & Lindsa suggest that reducing the amount of design elements and information will help improve cognitive load. They proposed lowering the amount of options available at one time; using navigation buttons with links at the bottom of each screen and a fixed page with no scrolling (Freeman *et al.* 2005). Woods and Bird also suggest avoiding using too many tasks, reducing distraction, and keeping information and content simple (Woods and Bird 1999).

Muzio and Serra suggest a range of design principles for those users living with dementia. These include using bigger graphic elements, reducing the number of elements within the screen, fewer colours, reducing the amount of information within one screen, and using familiarity and imagery. They also suggest directing user's attention through structuring and grouping elements and avoid (Freeman *et al.* 2005) having multiple tasks occupied at the same time. Reference is made to not presenting new information quickly, in a complex manner or in competition with other information. Keeping the design simple is key when designing websites for dementia (Muzio and Serra 2001). Furthermore, Arch and Abou-Zhara explain within their comparative analysis that designers should improve downloading speeds; present small amounts of information clearly and easy to read; keeping colours simple and avoiding fluorescent colours. In addition, not including double mouse clicks and using static menus over popups or pulldowns. Similar to Ed Freeman they also suggest having a previous or next page links to keep navigation simple and easy to access (Arch and Abou-Zhara 2004)

Marijke Span designs a responsive web tool called DecideGuide to support shared decision making for dementia. The article suggests that two sets of requirements are intended to improve usability. First set of requirements targets care and well-being topics to address decision making and second set of requirements reflects on core user needs and preferences. The research highlights that it is essential to include the perspective of the person living with dementia to develop useful and user-friendly tools. It also highlights that participating in research activities may contribute to social inclusion, empowerment, and quality of life of people with dementia (Span *et al.* 2018). Recent research has also shown that types of games e.g. brain training can help improve memory and support problem solving by stimulating the brain and reduce Alzheimer's Disease symptoms (Yamagata *et al.* 2013).

6.5 Navigation and Information Architecture

Many websites today contain hierarchical navigation structures which are less suitable for those with dementia, moreover more tasks implemented within these sites makes it complex for people to understand and learn information. Holsapple, Pakath and Sasidharan demonstrate a proof of concept which is a Web Framework aimed to help designers and developers adapt websites for those with disabilities and to meet the necessary requirements set out by W3C guidelines. They propose implementing a network structure to help those with Alzheimer's navigate around the site as well as improving other areas of web design through using three other design elements: Content Compatibility, Knowledge Acquisition Task and Accessibility (Holsapple, Pakath and Sasidharan 2005) . Savitch and Zaphris used user research methodologies to understand the correlation between information architecture and those with dementia. 40 participants were involved within focus groups and interviews, through the use of card sorting they identified that the majority of those with the disease were able to organise the information correctly however they suggested that traditional website designs based on menus hierarchies are not suitable for people with dementia, suggesting a flat navigation structure would be the appropriate solution to allow those with dementia to access information and manoeuvre around a website. They did however warn about making too many generalizations

about web design and support an alternative navigation structure to be considered and investigated by comparing other websites to help accessibility. (Savitch and Zaphris 2006).

6.6 Assistive Technologies

Assistive Technologies (AT) have shown significant advancement and support for those with dementia. AT can also help reduce government costs on staff roles for those caring for people with dementia. AT can improve care of a person living with dementia and improve their quality of life through enhancing their independence and improve relationships between carers and those diagnosed with dementia (Green 2013). Some AT have also shown to reduce anxiety for both carers and those living with dementia (Gilliard *et al.* 2004).

CIRCA was an AT designed to facilitate communication between people with dementia and caregivers. Its aim is to reduce working memory problems and improve long term memory (Gowans, Dye and Alm 2007) . Gowans also stated that AT can have a profound impact on those with dementia if systems are designed carefully and correctly (Alm *et al.* 2003) A similar communication tool was designed by Czaja and Rubert which was a computer integrated telephone system allowing conference calls between family members, caregivers and therapists. Its purpose was to provide access to information on caregiving resources and improve the relationship between carers and professionals (Czaja and Rubert 2002). Some AT has proven to have a positive impact on memory and cognitive impairment. An electronic calendar called Forget-Me-Not device was designed for users that struggled with day and night cycles (Holte, Hagen and Björneby 1998). Similarly, wearable device called PiTaSu was targeted for those with early onset dementia. It displays information on flat surfaces and allows the user to interact with the device when necessary. The idea of this is to improve quality life of those with dementia by assisting them in day-to-day activities and tasks (Pulli, Yamamoto and Hyry 2010).

The Alzheimer's Society 2017 blog (Williams 2017) provides a comprehensive suite of guidelines that identifies many of the recommended design features identified by Arch, Abou-Zhara and

(Muzio and Serra 2001) and is probably the most comprehensive, contemporary and readable source available that provides practical advice.

Most of the sources use mixed method approaches to examine the correlation between a dementia user and technology. Common data collection methods include surveys and focus groups involving those living with dementia. The findings identify some good practice to support those with dementia, however some of these were only theories or only in early stages of development. It was interesting to see that many of the resources were over 5 years old, with assumptions about use of technology and this could be significant given the pace at which technology is developing. Originally, sources over 5 years old had been excluded from the literature review, but the research brief was revised when it became apparent that many of the resources were not recent. It suggests that whilst there is some good practice identified by this research, current research in this area is limited. Also, of note is the fact that many of those involved in the research were 60 plus. There is some debate about the IT literacy of those living with dementia and existing research seems to be focused on the older person with dementia rather than those with early onset. There is also an underlying assumption that older people are not tech savvy, and this is a generalisation that should be avoided.

The lack of contemporary literature in this field suggests there is potential benefit to be gained from reviewing and applying the emerging principles to design practice to see how easy they are to apply and if there are any significant gaps.

7. Methodologies

7.1 User Research

The original plan was to seek consent to speak to those living with dementia, however, for ethical reasons (these are potentially vulnerable individuals), it was suggested that the study use dementia subject matter experts as a proxy for those living with dementia. This approach had been identified as a mitigating factor in the project risk register. The investigations focussed on 5 1-1 interviews with experts in dementia. The communication tools used were telephone calls (2) and video-calls using Zoom (3). This qualitative approach was based on the theory of Nielsen who suggests including more participants is not necessary as common patterns or information tend to be raised from the first 5 interviews (Nielsen 2000); the more interviews that are conducted, the less learning is involved, and more topics are repeated.

Before the study was conducted 3 user research artefacts were created to approve, collect, and analyse research findings.

- (1) ***Consent Forms [Appendix 1]*** were issued via email to each of the five participants to gain approval on allowing calls to be noted during the interview. Due to the Covid-19 pandemic, methods of consent approval were altered, and consent was accepted either through electronic signature; email message or verbally before the interview was started.
- (2) The 1-1 interviews were conducted using a ***10-point questionnaire [Appendix 2]*** designed to reflect on four key aspects of dementia specifically the correlation between web design, accessibility, assistive technologies and the future of dementia and technology. The interviewees were asked to put themselves into the shoes of someone living with dementia to help identify some of the challenges that individuals might face in order to test and further inform the development of the guidance/principles for web developers/designers. The first two interviews were captured in summary note form. However, given the high quality of the information shared, it was decided to record and transcribe the remaining three interviews

to provide a fuller record of the conversations. The consent forms were amended accordingly. Interview duration ranged from approximately 30 to 60 minutes. There was some repetition in the answers to the questions, which emphasised the importance of questionnaire design. However, this did not present any particular issues for this study.

(3) **Results Summary.** Results were captured by individual interviewee, then summarised [Appendix 3]. A further iteration (High Level Summary) [Appendix 4] was produced to capture common themes across each of the 10 questions.

The original plan was for these interviews to be face-to-face, but the approach had to be adapted due to Covid-19. Access to dementia experts was a challenge because of Covid-19; these are busy senior academics and/or clinicians dealing with the day to day issues arising from the current crisis across the health and education sectors. An advantage was a saving in the time it would have taken to travel nationally to meet with these individuals and this compensated to some degree for the delays associated with obtaining ethics approval.

Initial plans to conduct focus groups with those with lived experience (and subsequently the dementia experts) and to undertake card sorting could not be achieved due to the ethical situation and the pandemic. Therefore, secondary (literature review) and primary (dementia experts) qualitative research were the data collection methods used within this study.

The website prototype was developed based on the emerging good practice principles identified in the literature research and from the results from the 1-1 interviews. The prototype was tested to determine usability. The results were analysed to identify next stage improvements and to determine if any new design considerations had emerged.

7.2 User/Usability Testing of the Prototype

An inductive testing approach (Trochim 2020) was used to analyse the feasibility of the prototype. This involves setting the project aims before testing, evaluating to provide a summary of project progress against the project objectives, current achievements, impact, sustainability, and efficiency. The testing metrics were then created within the testing plan to underline key problems with the prototype. The usability test was conducted with 5 dementia experts to identify key areas for improvements. Analysis and evaluations were concluded from the testing metrics to help re-iterate and improve any identified weaknesses. This inductive testing approach was the better choice in comparison to a deductive approach (Trochim 2020) as it links well with the Design Thinking Model and is the best way to quickly gather results and generate quick solutions.

7.2a Test Plan

A test plan was created to reflect on all the testing materials needed to test the prototype. A testing plan document *[Appendix 5]* was created for the interviewees and included tasks that were to be completed, testing metrics were to be analysed, success rate and the subject base that will be targeted within the usability testing.

7.2b Testing Metrics

Three testing metrics were analysed to identify design weaknesses in three key areas:

Navigation, Layout and Feedback.

Navigation was the first main metric to be tested. Testing navigation is vital when designing for those with dementia, as it is highlighted in the research as an important consideration for those with dementia. ***Navigation*** was measured to make sure that users can fluctuate between pages, access content easily and test core usability.

The second testing metric within the prototype was **Layout**, to evaluate the design layout, content, and visual design elements (e.g. colour, typography, and sizes).

Feedback was the last testing metric designed to identify any specific user needs and frustrations experienced during testing.

7.2c Subject User Base

Five dementia experts were invited to use the prototype and based on their knowledge, experience and understanding of dementia was asked to identify any potential frustrations to emerge from the usability testing. Five participants were selected based on research by (Nielsen 2000) that suggests this is the right number of users to collect information and produce accurate feedback before the prototype was re-iterated and designed.

7.2d Consent Forms

Prior to usability testing, consent forms were issued to those participating in the test [Appendix 6]. Each participant was provided an explanation of the test, the rationale behind the activities and tasks involved within the test and all non-disclosure agreements and consent. All participants agreed to consent through either: email verification; verbal consent or electronic signature.

7.2e Pilot Testing

Pilot testing was carried out 10 to 15 minutes prior to the usability testing. This involved testing /checking the consent and instruction documents were available and accessible to participants and that the wireframes were functioning. Pilot testing provides rehearsal before the actual test is executed and is the pre-planning to help ensure that the research runs smoothly to maximize

the opportunity to obtain good results. Pilot testing resulted in some tweaks in the scenario to better guide interviewees.

7.2f Usability Tests

Five usability tests were collected from dementia experts to gather key areas of improvements for the prototype. Remote usability testing method enabled the prototype to be tested through online services and tools that assisted in recording and gathering data provided from the users. The original idea was to conduct usability lab testing, but this could not be performed due to the Covid-19 restrictions. This method was a feasible, alternative approach in the circumstances.

All experts were asked for consent to their involvement with the usability testing. Emails were sent to gather diary availability and to secure dates and times convenient to them and consent forms were sent. Unmoderated testing using a Survey Monkey questionnaire was used for this test **[Appendix 7]** and a testing script **[Appendix 8]**. Although, this is a less sensitive approach than the planned moderated testing where observations are used, it was a pragmatic solution in the circumstances. Had the test been carried out with those living with dementia, then the observational approach would have been critical. However, it was less so given that the experts are not living with dementia themselves.

7.3 Professional, Ethnical and Legal reasons

From the majority of sources found there are many concerns about the legal, ethical and social issues with accessibility especially for those with dementia. One source quite controversially questioned whether designing websites for people with dementia was feasible and practical (Freeman, Clare, Savitch, Royan, Literland & Lindsay, 2005). Several of the dementia experts supported a 'human rights based' approach suggesting those with dementia and other

disabilities have the right to be able to use websites and should have the appropriate accessibility and support to help them.

Had the research project involved access to those living with dementia, formal ethics approval would have been required to seek their involvement. University ethics approval was consented on the basis that dementia experts be used as a proxy for those living with dementia. Nevertheless, it was necessary to observe the laws surrounding consent, data handling, confidentiality, and storage to ensure compliance with the Data Protection Act 2018 (UK Government 2018) which includes General Data Protection Regulation (GDPR). GDPR regulations with Solent University is a major concern for usability testing and user research. A data privacy impact self-assessment was undertaken [*Appendix 9*] which suggested this project to be low risk. From the project perspective, all individuals provided consent to be involved and indicated their willingness to be identified in this research. No personally identifiable data, not already in the public domain for these individuals has been collected. No direct quotes are attributed to the experts.

7.4 Project Management

A project management approach has been adopted for this research based on some of the principles of the PRINCE2 Process relevant to individual research projects (clarity of brief, establishing project scope, direction, time management and review of tasks and presentation of results) (Malsam 2018). Risk management and time management between October 2019 and May 2020 are key aspects of this approach. Weekly review meetings (every Friday) ensured risks were reviewed and that the project remains on track. This ensures that any outstanding or emergent issues must be considered and addressed in a timely way.

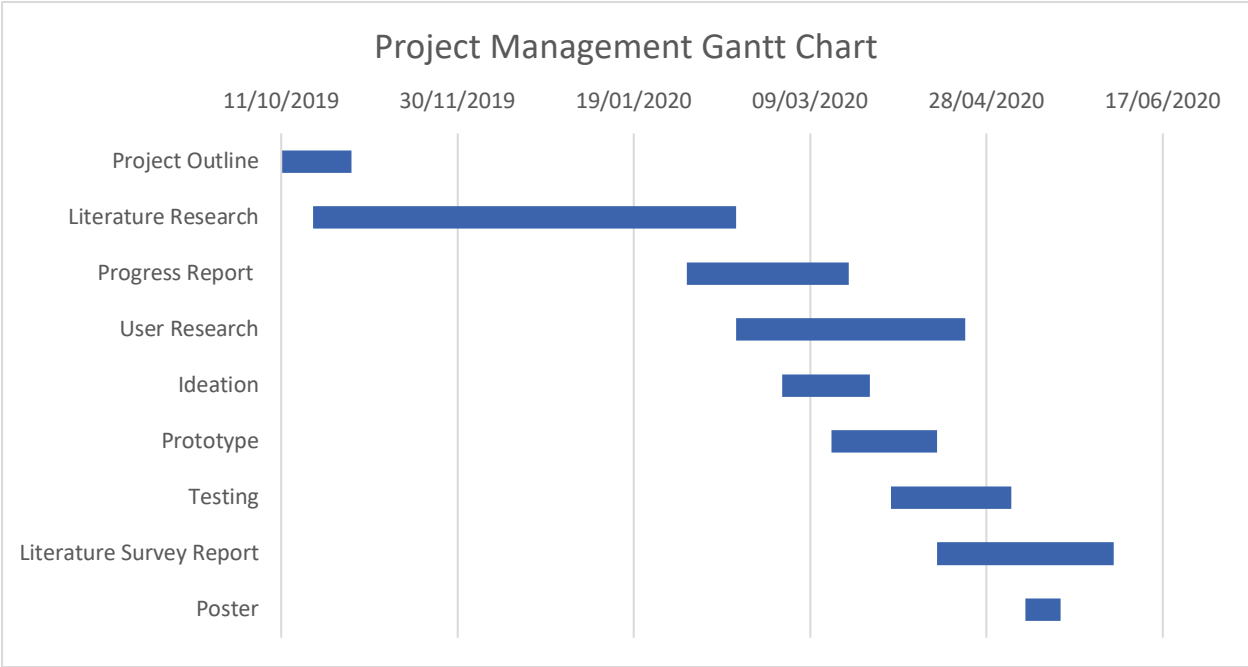
The risk assessment (*Table 1*) highlights the project potential risks.

Potential Risk/Challenge Description	Probability Rating (1 - 5)	Impact Rating (1-5)	Overall Risk Rating (Red, Amber, Green)	Risk management action
User Research. Data collected did not provide the best and appropriate user needs	3	3		Use 7 deadly sins (David Travis,) to monitor user research and to provide the most efficient, precise and accurate user feedback
Ideation. Ideas that are produced may not work or have minimal effect on improving accessibility	3	4		Create multiple different designs (e.g. using a parallel design approach) and conduct wireframe-based designs to reduce time and be financially efficient
Usability Testing. Limited or no access to target audience (those with lived experience of dementia) due to ethical reasons	3	4		Consideration given to alternative proxy measures including subject matter experts in the field of dementia
Usability Testing. Avoid providing participants with testing environments that they are unfamiliar	2	2		Make sure that the environment which you are testing or conducting research within are suitable and appropriate
Behaviour. Causing confusion, frustration and feeling uncomfortable	3	3		Careful choice of participants, assisting them when they need help. Chaperones, caregivers, support and

				clear consent documentation and guidance to participants.
--	--	--	--	---

The Gantt chart (**Table 2**) sets out the key project deliverables and key milestones and provides a high-level demonstration as to how the indicative 400 hours of expected study was profiled. Some slippage occurred as a result of delays with ethics approval, identification of subject matter experts and Covid-19.

Tasks/Milestones/Outputs	Date Started	Hours	Notes
Project Outline	11/10/2019	20	
Literature Research	20/10/2019	120	
Progress Report	03/02/2020	46	
User Research	17/02/2020	65	Includes preparation and key meetings with academics in the field
Ideation/Designs	01/03/2020	25	
Prototype	15/03/2020	30	
Testing	01/04/2020	34	
Literature Survey Report	14/04/2020	50	
Poster/Dissemination Strategy	09/05/2020	10	Include presentation pack to support dissemination of results and explain poster



8. Design and Implementation

This section documents the implementation, testing and conduct of the investigations including a discussion on issues that arose and how these were resolved.

8.1 Design Process

David Kelly's Design Thinking Model was the implemented design process to identify key problems and areas of improvement for designing a website for those with dementia. This design process was split in to five stages ***Empathise, Define, Ideate, Prototype*** and ***Test*** (DAM and TEO 2020). ***Empathise*** and ***define*** were used to analyse the types of problems those with dementia face with design and assistive technologies. ***Ideation*** phase outlined some potential ideas and solutions that could be implemented within the prototype. ***Prototype and testing*** were the final phases which allowed designs to be tested and validated before being implemented. This design process was vital to identify key design problems faced by those with dementia and promotes the use of rapid prototyping and innovation. Another strong benefit of using this design process is that it enables designers to repeat and redefine phases (Stevens 2019); its non-linear approach helps in terms of flexibility in identifying key problems and finding quick solutions through being able to use different stages of the design thinking process. Two other design processes considered were the Design Sprint (Knapp, Zeratsky and Kowitz 2016) and Double Diamond (4D) Design Process (Costa 2016). Although these could have been suitable, the Design Thinking Model helps inspire iteration, discover, and solve problems through re-iteration and thorough usability testing. This considered approach would also be suitable when engaging directly with those living with dementia.

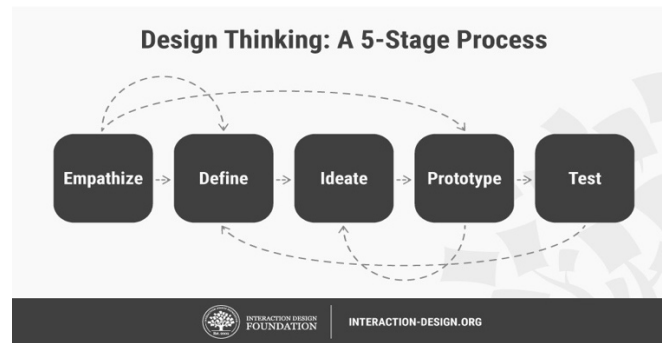


Figure 1 - Design Thinking Process (Dam and Teo, 2020)

8.2 Empathise Phase

Empathising phase is broken into two sections, (1) gathering research from literature review and (2) 1 to 1 interviews. These methods provided an understanding of the types of problems and solutions that need to be addressed when designing an interface for those with dementia. The literature review was planned through a literature review process. The aim of this review process [Appendix 10] was to identify appropriate resources and provide a guideline on source management. Gathering research was a major challenge at first. Sources were difficult to find from the set Exclusive and Inclusive criteria plan [included in Appendix 10]. Many sources ranged from 2000 to 2010 rather than in the last 5 years this ran the risk that papers were irrelevant to current practices and technologies. To overcome this issue, search engine filters were altered to find sources within the last five years. This identified some new information on the correlation of technology and design and those with dementia. Sources were generally difficult to find from search engines. To overcome this obstacle, sources were used within the found papers to provide additional research information, although this still did involve considering older references. After collecting all the research, individual interviews were conducted with dementia experts to gain contemporary insight into the problems faced by those living with dementia when interacting with technologies and website applications. The 7 deadly sins (Travis 2014) was used to underpin the research approach when conducting interviews. This included consideration of bias to ensure fair results (Travis 2014) .

At the start of the interviews, the plan was to compile summary notes during the course of each interview. However, capturing detailed and comprehensive notes while listening and engaging in the interview was challenging. There was a significant risk of missing key points. From the third interview, all interviews were recorded and then transcribed verbatim to the best of the researcher's ability to provide a detailed record of the discussions and responses. This helped retain more accurate responses to each question and ensure key points were not missed.

8.3 Define Phase

Defining explored the types of user requirements needed to design a proof of concept to help those with dementia. It considers the problems that may occur, user needs, goals, motivations, and frustrations. Although the information could not be obtained first-hand from those living with dementia, the research provided from the literature review and the insight provided by the dementia experts provided the foundation for this stage. All user needs and goals were identified based on the research conducted. Two user personas were developed (one for the over 65's) and (one for those under 65 to represent someone with young onset dementia) **[Appendix 11]** to provide a better understanding of the user demographic. Each user persona included a virtual profile, interests, frustrations and needs. Implementing these elements and artefacts, helps identify any potential ideas, features or solutions that maybe effective to help with navigation, usability, and design layouts within the ideation phase.



Figure 2 - Define phase

8.4 Ideation Phase

Ideation phase consisted of numerous different UX design methodologies and creativity to inspire a range of ideas that could provide new solutions for the prototype. During the ideation phase the primary design factor was to focus on novelty instead of relevance. This encourages new ideas to be inspired which are collected and evaluated at the end of the session. Four methods used within the ideation phase included *“How might we questions”*, **brainstorming** and **storyboarding** implemented with *rough ideas*. **Game storming** and the **worst possible ideas method** were alternative methods that were considered for the ideation phase. However, game storming was not considered as it is generally a team-based technique and opportunity to enlist additional support in the current Covid-19 crisis was limited. Worst Possible ideas was another ideation exploration method considered but brainstorming appeared more conducive to generating a greater volume of ideas designed to provide solutions for complex problems.

“How might we questions” (HMWs) (Figure 3) were identified using sticky notes and were based on the user needs from the **define** phase. These notes were prioritised before conducting any ideation. HMWs provide an insight into some problem statement and help launch brainstorming by providing a wide range of different ideas. **Brainstorming** (Figure 3) was conducted using the HMWs to provide a large range of different ideas which potentially could be implemented in the prototype. To come up with the best ideas, the main goal was to work on adding as many ideas as possible then evaluate at the end of each session to provide an insight into the most appropriate ideas for a potential solution. Before adding storyboards, all the best ideas were collected and evaluated.

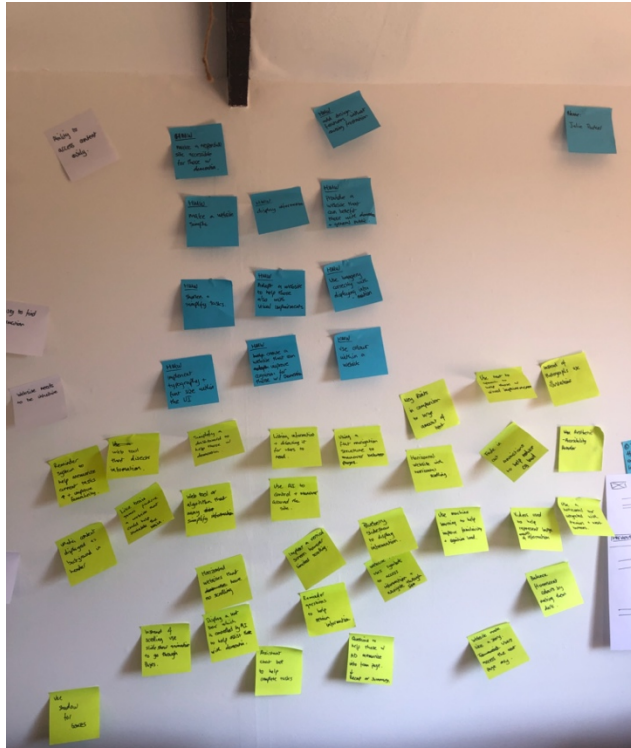


Figure 3 - HMWs and Brainstorming

Storyboarding (Figure 4) was used by collecting user journeys and structuring set tasks for a potential solution from a given idea. Six tasks were added based on the user journey, starting from the users starting point (Being on the Homepage) to the end point (Being provided with support to help for dementia). A series of rough sketches were then created and implemented for each task. After a series of rough sketches were implemented on to the storyboard, they were evaluated, and the best sketches were chosen for each task and used within the prototype.

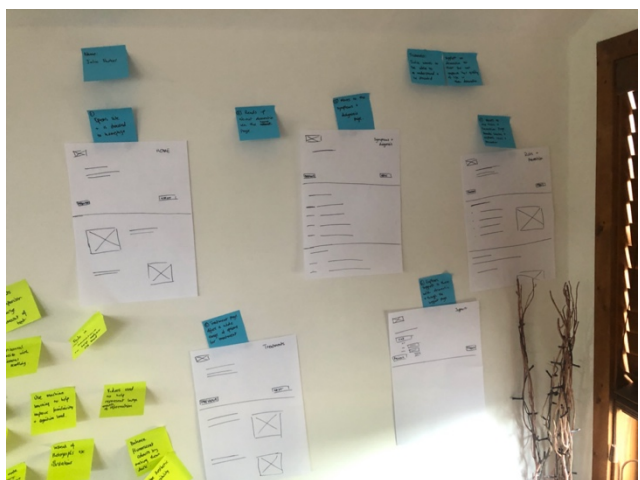


Figure 4 - Storyboarding, rough sketches and tasks

8.5 Prototype Phase

A clickable wireframe prototype was created [Appendix 12] using design software MockingBot. A wireframe design in comparison to a full high-fidelity prototype was used as the aim of the project is identify new problems and provide an insight into some new design features. These design features can then be used to help provide recommendations for designers and developers, so they consider the needs of those living with dementia. The prototype was based on a dementia website which was aimed to demonstrate a real life, website with content, design features and navigation to help analyse the websites usability during testing.

The idea of this prototype was to test the following design elements: *navigation* and *design layout*. The wireframe incorporated some key good practice principles from the 1-1 discussions and literature research. The websites navigational system used a linear navigational structure (flat navigational structure). All pages were linked together and did not include any subpages. Navigation consisted of two methods, horizontal navigation bar and two buttons for next and previous page links. The main navigational system that was implanted first was the 'next' and 'previous page' buttons which was displayed at the bottom of each header of each page. The idea of having two buttons on the bottom of the header is to allow users to access the next page or previous page without using a traditional horizontal navigation system. However, from prior testing it found to be a complication by just using this on its own. Finding pages were difficult and could potentially cause confusion to users. Therefore, to improve familiarity and simplicity a horizontal navigation bar was integrated at the top of the header including five links to all the other screens. This was beneficial design decision as it still allows users to access pages using the current web navigation design methods.

Design layout consisted of implementing a mixture of videos, images, text, input forms and headings into the layout of each page on the prototype. For designing the layout of the prototype, the main goal was to keep information short, accessible, and simple for users to read. This was achieved by using short sentences, dissecting large amounts of information into key points. Lorem ipsum was used as a text generator which was implemented into all the information design elements. Images and videos were then combined with text to help users understand the research provided within each page.

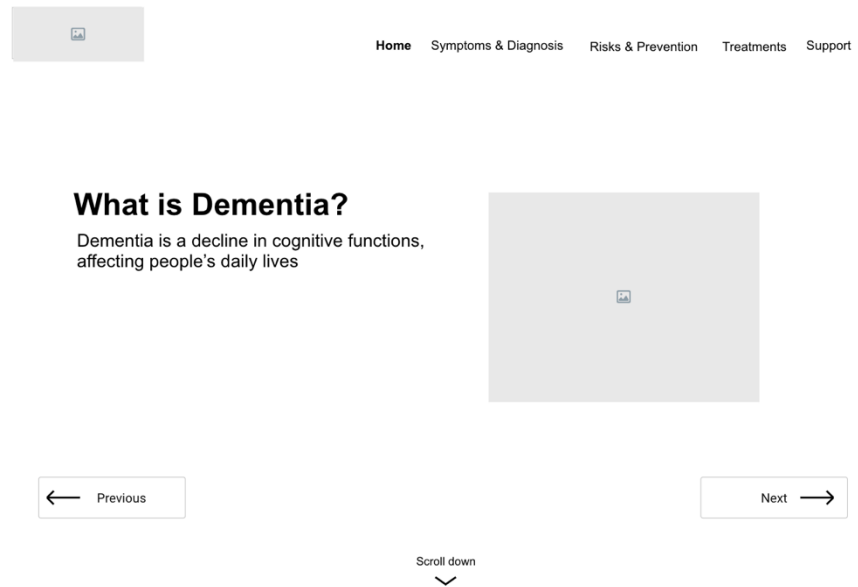


Figure 5 - Screenshot of Clickable Prototype

8.6 Testing Phase

The testing phase consisted of using remote testing with dementia experts using the prototype made from MockingBot. Unfortunately, due to social distancing the testing approach was altered. Original idea was to use on-site testing to gather feedback and observe the use of the prototype. Remote testing was the alternative testing method adopted. Unmoderated remote testing meant that users can be given tasks and questionnaires to fill out after completing the prototype through a direct link to MockingBot. The only drawback was that observations could not be measured - the only reliable feedback to analyse was from the questionnaire. Some options considered for helping analyse observations would have been to integrate a moderating tool like User Zoom. This software allows designers to setup the whole usability testing and then

send a link to users via communication tools (e.g. Social Media, Mobile or Email). However, this approach was dismissed on the grounds of financial and time constraints.

A questionnaire, test instructions and link to the prototype was the more appropriate method for the unmoderated remote test. A questionnaire was created using Survey Monkey **[Appendix 7]**, containing the user scenarios, tasks and set of five questions for respondents to answer after using the prototype. Survey Monkey is a great survey tool which can help identify patterns and trends in data from feedback. The usability testing script **[Appendix 8]** included what the project and usability test was about and how it was going to be conducted. Test instructions in the script plan included a set of guidelines for the user when conducting the test. Consent forms were created to provide consent before testing the prototype. All data from the feedback was collected, evaluated ready to re-iterate and design the next version of the prototype.

9. Results

9.1 Dementia Expert Interviews

[Appendix 4] provides a high-level summary of the key themes to emerge from these interviews, a more detailed breakdown is provided in *[Appendix 3]* and the responses from the 1-1 interviews are captured in *[Appendix 2]*.

One of the clear messages from the study is that just as in society generally, there are some people who will have more technical know-how than others. This may be preference or lack of opportunity (no internet, no training, no technology, complicated technology, cost) rather than a direct result of their diagnosis. Similarly, the correlation of someone's prior knowledge and experience with using technology is a key factor. This could be either preference of using technology or lacking prior knowledge with using technologies and not just a direct result from their diagnosis. Those with dementia are heavily underestimated with being able to use such technologies and are more than capable of engaging well with these technologies. This reinforced the evidence found in the literature review by Glisky and Schacter (Glisky and Schacter 1988). There was substantial agreement that good design principles should be implemented within all websites, but more specific technical design principles should be addressed for those living with dementia. None of the participants were familiar with W3C guidelines, however acknowledged that in principle these should be implemented. This is perhaps not surprising as their expertise is in relation to dementia rather than web-design.

Many forms of dementia were highlighted within the interviews and provided important context for how different types of dementia can impact people differently especially the ability to process information. Different forms of dementia can play a key role in the user experience of engaging with a website. Some forms of dementia mean people cannot verbalise information, have visual impairments (e.g. such as the Posterior Cortical Atrophy (PCA) diagnosis of author Terry Pratchett) or Lewy Bodies where people struggle with fine motor movements which can be

a major issue when using touch screens. Terry Pratchett found it difficult to reading words but not with his speech. Older people are more likely have other impairments and symptoms of old age, such as reduced vision. Furthermore, those with dementia may also have problems with perception, colour contrast, depth, and tone. Items that are the same or similar colours may cause problems for a person with dementia, an example was given that it may be difficult to distinguish between chicken and mash potato.

Dementia can also have a negative effect on the ability to read, process and retain information and maintain orientation particularly on ‘fast moving’ websites.

Key issues faced by those living with dementia include:

How to use tech is not always obvious/Challenges setting up technology	Buttons being too small/generally confusing
Size of the font is often too small	Complicated navigation/hierarchy and lack of prompts to aid orientation – menus within menus
Remembering passwords	Understanding cookies
Too many pages	Too much content, information, words on a page, too many pieces of information at once including peripheral information
Too many clicks to get to key information (individuals can get lost)	Familiarity of language
Lack of clear imagery/pictures	Too much jargon, negativity
Patterns in general/depth/perceived depth	Patronising tone
Losing interest when faced with difficulty	Sequencing – people with dementia may find it hard to retain something from one screen to the next.

The dementia experts pin-pointed some key areas of improvement for designing for those with dementia. These supported issues raised in the desk top research.

Some of the **design solutions** suggested included:

Simplifying language/messaging, shorter sentences and use person centred and dementia friendly language. E.g. The DEEP guidelines	Good use of clear/familiar/straightforward pictures/imagery/symbols particularly for those who have difficulty reading
Focus on menus, buttons, different layouts	Minimise number of clicks
Provide bitesize chunks of information	Reduce pace of information flow
Quality (sans serif family) and size of font (not too small)	Reduce amount of peripheral material to reduce distraction
Avoid jargon and negativity	Straightforward navigation
Make contrasting clear	Consider voice commands VOIP and subtitling to accommodate both visual and hearing impairments
Evenly spread text	Flatter hierarchy
Repetition to help navigation	Present the same information in different ways so people can use the abilities they have retained if they lack processing capability or have problems with language
Clear menu descriptors	Limited content/text on a page
Avoid flashing imagery	Static, clear and large buttons
Must not be patronising or paternalistic	Use logic
Accessibility rather than changing content - Do not dumb down content	Using the DEMTECH principles of communication

The simplification message is one that features in several literature sources included WC3 guidelines, (Muzio and Serra 2001) and (Williams 2017). The suggestion of a flat navigational structure reinforces the recommendations provided by (Savitch and Panayiotis Zaphris 2006). The call for bigger graphic elements, reducing the number of elements within the screen all echo the recommendations put forward by (Muzio and Serra 2001), as does the guidance regarding familiarity and imagery. (Muzio and Serra 2001) does not directly relate to contrast but does suggest using fewer colours. Points raised by Arch and Abou-Zhara about avoiding double mouse clicks and static menus over pop ups or pulldowns were also identified during the study. The key message is simplification but avoid patronising at all costs. The (Williams 2017) blog proved to be the most relatable and practical set of guidance for web-designers with most of the earlier research captured within it and reinforced by the dementia experts. There is some concern, however, that this guidance will only be accessed by those designing websites specifically for those living with dementia rather than recognised as important principles that need to be considered in all website design. Those without knowledge of dementia may require some training to better understand the consequences of design decisions.

9.2 Usability Testing wireframe

Feedback gathered from the prototype was overall positive and achieved the testing objectives in the test plan [Appendix 5]. It was suggested that the quantity of information presented was suitable with some respondents stating the good use of ‘bitesize chunks’ and that information did not ‘overload’ the page. Navigation was another positive outcome, start and previous buttons worked well together and overall navigation was considered, easy and simple for users to flow through the website. For designing for those with dementia, the experts mentioned the need for designers to have a better knowledge and understanding of dementia.

Some setbacks found within the usability testing included some layout and navigation testing metrics and typography. The font family could be more friendly for those with dementia, font size could be larger and text alignment could be centre aligned to allow users to read

information more easily. The DEEP guidance (DEEP 2020) was identified as a resource to ensure content uses appropriate language. The experts reinforced the need for information structure, hierarchy, size and keeping information simple. The lack of UI elements was identified as an issue by some, for example the lack colour and imagery within the prototype meant it was considered less engaging. This was a problem that was anticipated prior to the usability testing as the aim of the prototype is to identify solutions for the key design principles of layout and navigation initially.

Table B shows a summary of the data collected from the usability testing from the dementia experts. These identify several issues and opportunities prompted by the five questions within the usability testing survey.

<i>Issues</i>	<i>Opportunities</i>
<ul style="list-style-type: none"> • <i>Small font size</i> • <i>Font is not friendly</i> • <i>Alignment of information</i> • <i>Scroll down button does not scroll down</i> • <i>Buttons could be larger</i> 	<ul style="list-style-type: none"> • <i>DEEP guidelines should be considered for design language</i> • <i>Review Thomas Pocklington Trust and RNIB considerations as some of the key principles may apply</i> • <i>Use 'friendlier' fonts</i> • <i>Implement colour and images</i>

The next stages of the design process will need to address and modify the prototype to take into consideration the issues and exploit the opportunities identified to improve user experience and perception. Immediate changes include using font size of 14 (as considered an appropriate size) and sans serif as considered clearer fonts. This next stage would need to involve those with lived experience and following necessary consent should involve an observational testing phase to refine the website requirements.

10. Conclusions

Dementia is an umbrella term and there are many different types. The type of dementia and the stages of dementia will affect the ability of those living with dementia to engage with websites in different ways. Generally, those living with dementia need extra help with processing information, navigation, and orientation.

It would be wrong to assume that older people and those living with dementia cannot use technology. The dementia experts provided several examples where older people living with dementia were engaging very effectively with technology such as Alexa, particularly during the Covid-19 crisis. Understanding the challenges that people living with dementia might face has the potential to make websites that are more accessible for most people. This study suggests a consensus that websites should be designed to make them as accessible as possible to most people.

However, developing website design principles for people living with dementia is complex as there are several aspects to take into consideration. It depends on the person living with dementia including how tech savvy they were before the diagnosis and whether they are living with other conditions, including sight or motor movement issues. Dementia is also a progressive illness, so the needs of the users will change over time as the disease progresses. Giving thought to the needs of those living with dementia has the potential to give greater accessibility to others such as those with learning disabilities, brain injury, strokes and older people who may not be so computer savvy and may be easily overwhelmed by large quantities of information.

There was a very clear steer from all the dementia experts that designers should wherever possible routinely engage with those living with dementia and/or carers to get a true insight into their needs and challenges. Several examples were shared where too often designers assume, they know what is best and get caught up with the technological challenge of developing a new idea. Consequently, they produce something that is not what the person living with dementia

needs or wants. Although the examples were focussed on assistive technology, e.g. tracking device, the fundamental principle remains that those living with dementia must have a say in matters that affect them. This study demonstrated that it is not necessarily easy to engage with those living with dementia because of the ethical issues, but in normal circumstances, organisations that represent those living with dementia could be approached for guidance, e.g. DEEP (DEEP 2020) , TIDE (Tide 2020) and Young Onset Dementia (Young Dementia 2020).

The research informed the design of the questionnaire and aimed to tease out the issues most likely to affect those living with dementia and to identify any new and emerging principles.

Despite having the benefit of the various good practice principles from the research, it was evident that translating these into practice is complex and reinforced the importance of reiteration in the design process. The prototype initially provided an insight into some key aspects and opportunities for improvement. The MVP approach helps to identify new problems and helps add more features within the design concepts overtime. This improves the quality of the design, produces a better user experience for those with dementia and vitally identifies new areas and ideas that could be used to make websites more suitable for other disabilities. Overall understanding from the project research and the prototypes show that simplicity and readability are key design principles for designing for those with dementia.

Considerations on some important design principles would need to be addressed to help those with dementia. Navigation will need to be clear and easy for the user to flow through the application. This study will build on the research in this field which suggests navigation buttons need to be bold and easily accessible. Failure to achieve this may mean those with dementia will get confused or frustrated and disengage with the website. Content must be easy to find and obvious. Keeping the design simple and easy to use will be key to provide the best UX for people with early stage dementia. Some examples of things that will be considered would be keeping the site static. Some of the findings are challenges to modern website design, for instance avoiding animations and patterns as these can cause distractions and confusion. Typography

should be kept simple and good use of large fonts. Information would need to be short and simple, reducing the amounts of jargon with each paragraph or sentence. The Alzheimer's Society within their own website model good practice including the use of video clips together with text translation, therefore offering different means of accessing the same information. This is particularly helpful to those who may retain some abilities but not others.

During the study various good practice principles were identified and are summarised in **[Appendix 13]**. These are presented alongside the W3C guidelines, The Alzheimer's Society Design principles and significant principles that emerged from other studies. Following comparison, there do not appear to be any significant gaps between this study and the guidance produced by Williams 2017, however, it is suggested when the different guidance are read together they provide a more comprehensive suite of good practice principles. It is suggested that using wireframe diagrams (such as those used in this study) could help illustrate some of the design principles to make it clearer for designers. Furthermore, it is suggested that the good practice principles could be presented in a way that provides the clinical reasoning for the design accommodations. This is evident to some extent in Williams 2017, but further rationale might be beneficial for those who have no prior knowledge of dementia and how it can affect people so differently.

Finally, discussions with the experts around AT acknowledged that technology can considerably help those living with dementia, e.g. Alexa. This is likely to increase as technology develops further, but there is a need always to check back with those with lived experience to see if the technological advancements are the ones that those with lived experience want.

11. Recommendations

The recommendations from this study are as follows:

1. The important message from this study is the need to involve people who have dementia in the design from the outset, this will enable the designer to fully understand their needs by involving them in practical sessions, observing them navigating through the application and informing the reiteration process. This will maximise the opportunity to produce a higher quality website design. The same applies to developments with assistive technology. The MVP needs to be further iterated and designed with those living with dementia.
2. This study focussed on dementia, but on several occasions the issue of accessibility to other groups of individuals was cited. This suggests that web designers should ensure they engage regularly with a group of both subject matter experts and service users with disabilities to test the accessibility of their design ideas and concepts. It is possible that conflicting design challenges may arise, but a panel or group of experts could enable these issues to be discussed and resolved in a pragmatic and systematic way. Given that dementia impacts on individuals very differently, a panel of those with lived experience would help to bring their different experiences to the design process.
3. Designers should enable users to easily customise the look of webpages e.g. one click to change font size, background colour (rather than having to go to settings) as this could expand accessibility to a number of groups of individuals with particular needs.
4. In modern design trends there is a huge focus on patterns. This is identified as a potential issue for those living with dementia. The research surrounding patterns is generally taken from experiences within the physical environment. It is suggested that

further research in this field may be helpful to understand what may or may not work for those with dementia in the web environment.

5. Talk to the key dementia organisations to see if they would consider
 - a. Reviewing existing guidelines to include some of the additional detail to emerge from this study.
 - b. Adding wireframe illustrations (such as those used in this study) to existing guidelines to provide more targeted help to generalist web designers.
 - c. Providing more rationale behind the reasons for the design principles to help those who do not have broad understanding of dementia to better understand why adjustments to the design principles are necessary, perhaps via an on-line learning tool/video.
 - d. Exploring if there is an opportunity to promote the guidelines/check list to the web-industry to raise awareness, perhaps using a video clip of people with lived experience sharing the challenges they face when using websites that do not adhere to the basic guidance.
 - e. Exploring a kite mark to identify a dementia friendly website.
6. Consider a paper/article to promote the issue of involving users with disabilities in the routine design and delivery of websites.

12. References

ALM *et al.*, 2003. *Designing an Interface Usable by People with Dementia*.

ALZHEIMER'S ASSOCIATION, 2012. 2012 Alzheimer's disease facts and figures.

ALZHEIMER'S SOCIETY, 2018a. *Alzheimer's disease* Available from:
<https://www.alzheimers.org.uk/about-dementia/types-dementia/alzheimers-disease>

ALZHEIMER'S SOCIETY, 2018b. *Facts for the media* [viewed 02/01/ 2019]. Available from:
<https://www.alzheimers.org.uk/about-us/news-and-media/facts-media>

ALZHEIMER'S SOCIETY, 2020. *Alzheimers Society Website* Available from:
<https://www.alzheimers.org.uk/>

ARCH and ABOU-ZHARA, 2004. *How Web Accessibility Guidelines Apply to Design for the Ageing Population*. France: W3C [viewed 04/01/2019]. Available from: https://www.w3.org/WAI/WAI-AGE/Papers/York_ADDW_waiage_paper.doc

BOUCHIER and BATH, 2003. Evaluation of websites that provide information on Alzheimer's disease. 9, 17–31

CALDWELL, COOPER, GUARINO REID and VANDERHEIDEN, 2008. *Web Content Accessibility Guidelines*. W3C [viewed 18/12/2018]. Available from:
<https://www.w3.org/WAI/WCAG20/versions/guidelines/wcag20-guidelines-20081211-letter.pdf>

CLARE, LINDA & WILSON, BARBARA & BREEN, KRISTIN, 1999. Errorless Learning of Face–Name Associations in Early Alzheimer's Disease. 5, 37-46

CLARE *et al.*, 2000. Intervening with Everyday Memory Problems in Dementia of Alzheimer Type: An Errorless Learning Approach.

COSTA, 2016. *The Double Diamond model: what is it and should you use it?* Available from:
<https://www.justinmind.com/blog/double-diamond-model-what-is-should-you-use/>

CZAJA and RUBERT, 2002. Telecommunications Technology as an Aid to Family Caregivers of Persons With Dementia.

DAM and TEO, 2020. *5 Stages in the Design Thinking Process* Available from:
<https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>

DEEP, 2020. *DEEP - The UK Network of Dementia Voices* Available from:
<https://www.dementiavoices.org.uk/>

DIG INCLUSION, 2020. *Dig Inclusion Website* Available from: <https://diginclusion.com/>

DOBRANSKY and HARGITTAI, 2006. The Disability Divide in Internet Access and Use.

FREEMAN *et al.*, 2005. Improving website accessibility for people with early-stage dementia: A preliminary investigation. *Aging & Mental Health*, 9(5), 442-448

GALLAGHER, 2013. *Uneven dementia care 'disgraceful'* Available from:
<https://www.bbc.co.uk/news/health-21009458>

GILLIARD *et al.*, 2004. Development of a Protocol for the Assessment of Assistive Aids for People with Dementia. 3, 281-296

GLISKY and SCHACTER, 1988. Long-term retention of computer learning by patients with memory disorders.

GOV, 2015. *Prime Minister's challenge on dementia 2020*. Available from:
<https://www.gov.uk/government/publications/prime-ministers-challenge-on-dementia-2020>

GOWANS, DYE and ALM, 2007. Designing The Interface Between Dementia Patients , Caregivers And Computer-Based Intervention. 10(1), 12-23

GREEN, 2013. *Alzheimer's Society's view on assistive technology* Available from:
<https://www.alzheimers.org.uk/about-us/policy-and-influencing/what-we-think/assistive-technology>

HOLSAPPLE, PAKATH and SASIDHARAN, 2005. A WEBSITE INTERFACE DESIGN FRAMEWORK FOR THE COGNITIVELY IMPAIRED: A STUDY IN THE CONTEXT OF ALZHEIMER'S DISEASE . *Journal of Electronic Commerce Research*, 6(4),

HOLTE, HAGEN and BJÖRNEBY, 1998. Evaluation of an electronic calendar as helping aid for persons suffering from memory problems or cognitive impairment.

KELLY, 2010. Developing countries; developing experiences: approaches to accessibility for the real world.

KNAPP, ZERATSKY and KOWITZ, 2016. *Sprint how to Solve Big Problems and test new ideas in just five days*. a ed. Great Britain: Transworld Publishers

LAZAR, GOLDSTEIN and TAYLOR, 2015. *Ensuring Digital Accessibility through Process and Policy* Available from:

https://books.google.co.uk/books?hl=en&lr=&id=YepDBAAAQBAJ&oi=fnd&pg=PP1&ots=vSkK6qwrfp&sig=JDlSJy0b0dcBJMpAZhA4iOH4dHk&redir_esc=y#v=onepage&q&f=false

LOIACONO, 2004. *Cyberaccess: Web Accessibility and Corporate America*.

MALSAM, 2018. *PRINCE2: An Introduction to the Project Management Methodology* Available from: <https://www.projectmanager.com/blog/prince2-methodology>

MONSIDO, 2020. *Web Accessibility for Cognitive and Neurological Impairments* Available from: <https://monsido.com/web-accessibility-cognitive-impairments>

MORRIS, 1999. *The neuropsychology of Alzheimer's disease and related dementias* .

MUZIO and SERRA, 2001. *HCI Challenges In Designing for Users with Disabilities*. 1, 1-5

NIELSEN, 2000. *Why You Only Need to Test with 5 Users* Available from: <https://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/>

PETERSON *et al.*, 2009. *The phenomenological experience of dementia and user interface development*. , 1-6

PRINCE *et al.*, 2014. *Dementia UK: Second edition – Overview*.

PULLI, YAMAMOTO and HYRY, 2010. *Requirements guideline of assistive technology for people suffering from dementia*. , 1-5

SAVITCH and ZAPHRIS, 2006. *Accessible Websites for People with Dementia: A Preliminary Investigation into Information Architecture*. , 144-151

SEEMAN, 2006. *Formal objection explained*. In: *W3C*. Available from: <https://lists.w3.org/Archives/Public/public-comments-wcag20/2006Jun/0119>

SPAN *et al.*, 2018. *Involving people with dementia in developing an interactive web tool for shared decision-making: experiences with a participatory design approach*. *Disability and rehabilitation*, 40(12), 1410-1420

STEVENS, 2019. *What Is Design Thinking? A Comprehensive Beginner's Guide* Available from: <https://careerfoundry.com/en/blog/ux-design/what-is-design-thinking-everything-you-need-to-know-to-get-started/>

STIENSTRA, 2007. *A Three-Way Dance: The Global Public Good and Accessibility in Information Technologies*.

TBHCREATIVE, 2020. *Circle* Available from: <https://blog.tbhcreative.com/>

TIDE, 2020. *Tide* Available from: <https://www.tide.uk.net/>

TRAVIS, 2014. *The 7 Deadly Sins of User Research* Available from: <https://www.userfocus.co.uk/articles/7-sins-of-user-research.html>

TROCHIM, 2020. *Research Methods Knowledge Base* Available from: <https://conjointly.com/kb/deduction-and-induction/>

UK GOVERNMENT, 2018. *Data Protection Act 2018*. Available from: <http://www.legislation.gov.uk/ukpga/2018/12/contents/enacted>

UNIVERSITY OF CALIFORNIA, Memory & Ageing Center .

W3C, 1999. *W3C Guidelines 1999*.

WILLIAMS, 2017. *How to design websites for older people* Available from: <https://www.alzheimers.org.uk/blog/how-design-websites-older-people>

WOODS and BIRD, 1999. *Non-pharmacological approaches to treatment*.

WORLD WIDE WEB CONSORTIUM, 2019. *Cognitive Accessibility at W3C* Available from: <https://www.w3.org/WAI/cognitive/>

YAMAGATA *et al.*, 2013. *Mobile app development and usability research to help dementia and Alzheimer patients*.

YOUNG DEMENTIA, 2020. *Young Dementia UK* Available from: <https://www.youngdementiauk.org/>

YOUNG ONSET DEMENTIA, 2019. *Young onset dementia facts & figures* Available from: <https://www.youngdementiauk.org/young-onset-dementia-facts-figures>

ZAJICEK, 2007. *Web 2.0: Hype or Happiness?* , 1-5

13. Bibliography

ARLENE J. ASTELL, REAFF - A framework for developing technology to address the needs of people with dementia. 1-7

ASGHAR, I., S. CANG and H. YU, 2015. A Systematic Mapping Study on Assitive Technologies for People with Dementia. 1-9

BEN CALDWELL, MICHAEL COOPER, LORETTA GUARINO REID and GREGG VANDERHEIDEN, 2008. Web Content Accessibility Guidelines. W3C [viewed 18/12/2018]. Available from: <https://www.w3.org/WAI/WCAG20/versions/guidelines/wcag20-guidelines-20081211-letter.pdf>

GOVERNMENT EQUALITIES OFFICE and EQUALITY AND HUMAN RIGHTS COMMISSION, 2013. Equality Act 2010. Available from: <https://www.gov.uk/guidance/equality-act-2010-guidance>

LAUREN TAN and DEBORAH SZEBEKO, 2009. Co-designing for dementia: The Alzheimer 100 project. 12, 185-198

M.D. MULVENNA and C.D. NUGENT, 2010. Review of ICT-Based Services for Identified Unmet Needs in People with Dementia. 38-63

MARIJE DE HAAS, SUE HIGNETT and GYUCHAN THOMAS JUN, 2019. Provoking the debate on euthanasia in dementia with design.

MASTER PRINCE et al., 2019. Alzheimer patients, Human-Computer Interaction, Usability, Intuitive interfaces, User-friendly. 5(2), 48-53

MUKTA KULKARNIA, 2018. Digital Accessibility: Challenges And Opportunities. IIMB Management Review, 1-16

PHILLIP VAUGHAN et al., 2009. Involving older people with dementia and their carers in designing computer-based support systems – some methodological considerations. 8, 49-58

SOUTHAMPTON SOLENT, 2020. Ethics projects Available from: <https://portal.solent.ac.uk/portal-apps/ethics/ethics.aspx>

UK GOVERNMENT, Data Protection Act 2018. Available from: <https://www.gov.uk/data-protection>

USABILITY.GOV, 2019. User Research Basics Available from: <https://www.usability.gov/what-and-why/user-research.html#>

VIRGINIA MATTHEWS, 2018. 10 things you didn't know about dementia [viewed 3rd January 2019]. Available from: <https://www.telegraph.co.uk/wellbeing/alzheimers-research/10-things-you-didnt-know-about-dementia/>

WALLACE, J. et al., 2010. ICT Interface Design for Ageing People and People with Dementia. pp.165-188

XANTHIDIS, D., M. YOUSOF and O. XANTHIDOU, 2016. ICT and the people with Dementia.

YA-HUEI WU et al., 2013. Designing an assistive robot for older adults: The ROBADMOM project.

14. Appendix

Appendix 1 – 1 to 1 Interviews Consent Forms



Consent Form

I agree to participate in this dementia 1 to 1 interview study conducted by Alex Zietara Nicholls a undergraduate student at Southampton Solent University.

I understand that participation in this study is voluntary and I agree to immediately raise any concerns or areas of discomfort I might have with the study administrator.

I am going to record our interview via notes and audio, responses will be anonymised. Please advise if you wish to be acknowledged within the study.

Please sign below to indicate that you have read, and you understood the information on this form and that any questions you might have about the session have been answered.

We would appreciate it if the information you see could be kept confidential. *Date:* _____

Name: _____

Please sign your name: _____

Thank you!

We appreciate your participation.

Here is all consent forms for 1 to 1 interviews

<https://drive.google.com/drive/folders/1PQUVbsrflmJDkpJUPyVD12Tz85jqgMSd>

Applicant's Interview Notes Form

Interview Details

Date: Enter date Time: Enter time

Interviewee Name: Enter Interviewee Name

Question What do you consider to be the common problems faced by those living with dementia when
#1: using assisted technology and information technology generally?

Notes: Enter notes

Question The research is mixed. Do you think that websites should take into consideration the needs of
#2: those living with dementia when setting out their design principles or should these be reserved
 for specialized websites only?

Notes: Enter notes

Question What do you consider are the common problems faced by those living with dementia when
#3: using websites/web applications?

Notes: Enter notes

Question Have you heard of the World Wide Web Consortium accessibility guidelines? From your
#4: knowledge do you think these are widely used in industry?

Notes: Enter notes

Question How do you think designers can improve the usability (e.g clicking and scrolling) of a web-site
#5: to meet the needs of those living with dementia?

Notes: Enter notes

Question How do you think designers can improve the information architecture (navigation/typography
#6: and lay out of the information)?

Notes: Enter notes

Question What different considerations need to be given to content for those living with dementia
#7: compared to those without a dementia diagnosis?

Notes: Enter notes

Question Does an individual's perception of colour change in those living with dementia that might
#8: have a bearing on design?

Notes: Enter notes

Question #9: Are you aware of any design features or patterns that might be confusing for those living with dementia and should be avoided?

Notes: Enter notes

Question #10: How do think web applications in the future may support those living with dementia, in particular do you think there are aspects of care that might be successfully substituted or enhanced by the use of technology.

Notes: Enter notes

Enter Additional Notes.

Here is all consent forms for 1 to 1 interviews

<https://drive.google.com/drive/folders/1PQUVbsrflmJDkpJUPyVD12Tz85jqgMSd>

Appendix 3 – Results Summary Table

Here is the interview results summary table

https://drive.google.com/file/d/1biepE1A8Q6qwj-9GdsS3V9pupx-Jici_/view?usp=sharing

Appendix 4 – High Level Summary Table

High Level Summary Table

<p>1. What do you consider to be the common problems faced by those living with dementia when using assisted technology and information technology generally?</p>	<p>Some people will be tech savvy and others not regardless of diagnosis</p> <p>Difficulties of accessing technology</p> <p>Technological solution does not meet their needs</p> <p>Exclusion from the design process</p> <p>How to use technology is not always obvious</p> <p>Current Covid-19 crisis is promoting greater use of technology</p> <p>Depends on the person living with dementia and how their dementia has affected their ability to process information</p> <p>Older people may have other sensory impairments linked to old age</p> <p>Issues with certain types of dementia. E.g. Parkinson's disease and Lewy's Bodies creates problems with fine motor movements and touchscreens</p>
<p>2. The research is mixed. Do you think that websites should take into consideration the needs of those living with dementia when setting out their design principles or should these be reserved for specialized websites only?</p>	<p>Navigation can be an issue for users regardless if there is a dementia diagnosis or not</p> <p>Good accessible design principles should be applied to all websites</p> <p>More specific technical needs maybe required for websites aimed at those living w/dementia.</p> <p>Clicking buttons, auto-read content, audio format, pictorial versions</p> <p>Greater accessibility for those living w/ dementia.</p> <p>Generic websites enable users to enlarge the font size – need for accommodations for people w dementia from a disability's human rights perspective</p>

	<p>Consider people with dementia find it hard to retain something from one screen to the next</p> <p>Users need prompts</p> <p>Generic websites should be accessible for those with cognitive impairments to make the website applicable for those with learning disabilities and stroke</p> <p>Tabs are confusing</p> <p>All websites should be intuitive not complicated</p> <p>Recognise that older people may live with other difficulties with old age. Such as visual impairment</p> <p>Needs of those with young onset dementia may be different</p> <p>Websites should be accessible for everyone who has the potential E.g. needs to be dementia friendly</p> <p>Would then be helpful to other disadvantage groups. Older people living with disabilities.</p>
3. What do you consider are the common problems faced by those living with dementia when using websites/web applications?	<p>Access to the internet</p> <p>Different types and stages of dementia will influence ability to read and process information</p> <p>Remembering passwords</p> <p>Over complication/overwhelming/over stimulation/cognitive load</p> <p>Too fast paced</p> <p>Too much information on one page</p> <p>Too many pages</p> <p>Too many words on the page</p> <p>Font is too small</p> <p>Too many menus to click through</p> <p>People w/ dementia may not be able to process lots of information</p>

	<p>Screen speed</p> <p>Cookies</p> <p>Familiarity of language</p> <p>Depends on how involved they have been with technology within their lives</p> <p>Technology solutions have not been developed with people living with dementia</p>
<p>4. Have you heard of the World Wide Web Consortium accessibility guidelines? From your knowledge do you think these are widely used in industry?</p>	<p>None of the respondents had heard of these guidelines</p>
<p>5. How do you think designers can improve the usability (e.g. clicking and scrolling) of a website to meet the needs of those living with dementia?</p>	<p>Create simple messaging, attractive websites with good use of pictures/imagery</p> <p>Involve people who have dementia in the design from the outset</p> <p>Observe them navigating through an application</p> <p>Focus on Menus, buttons, different layouts and numbers of 'clicks'</p> <p>Providing bitesize/piecemeal of information</p> <p>Reduce pace of information</p> <p>Quality of font</p> <p>Make contrasting clear</p> <p>Straightforward back and forth navigation</p> <p>Reduce peripheral material</p> <p>Straightforward, intuitive and less information/words, no jargon and good use of symbols</p>

	<p>Take into consideration voice commands</p> <p>Peoples difficulty with perception</p> <p>Dementia is an umbrella term and there are many types</p> <p>Type of dementia will affect their ability to engage with websites in different ways</p> <p>Understanding the challenges that patients might face to make something that is mostly accessible for most people.</p> <p>Principles for those w learning disabilities and dyslexia might be valuable principles</p>
<p>6. How do you think designers can improve the information architecture (navigation/typography and lay out of the information)?</p>	<p>Simplification</p> <p>Focus on the most important information that some w/ dementia might want to access on a regular basis rather than lots of options</p> <p>Cf common phone numbers on quick dial</p> <p>Could a website be tailored to the user personally?</p> <p>Three clicks to your most common used menus</p> <p>Bear in mind, dementia affects people differently.</p> <p>There are many types of dementia: Some cannot verbalise, some have site issues. E.g. PCA Posterior Cortical Atrophy.</p> <p>Type of dementia will influence what needs to be adapted</p> <p>It depends on the stage of dementia</p> <p>Speed of processing information, navigation/ orientation all needs extra help</p> <p>Evenly spread text</p> <p>Not too much text</p> <p>Use of clear imagery</p> <p>Familiar straightforward images</p> <p>Symbols and pictures</p> <p>Flat structure could be better</p>

	<p>Reduce number of clicks</p> <p>Things need to be straightforward</p> <p>Imagery in conjunction with simplified language</p> <p>Presenting the same information in many ways so people can use the abilities they've retained</p>
<p>7. How do you think designers can improve the information architecture (navigation/typography and lay out of the information)?</p>	<p>Focusing on the most important information that some w/ dementia might want to access on a regular basis rather than lots of options</p> <p>Cf common phone numbers on quick dial</p> <p>Could a website be tailored to the user personally?</p> <p>Three clicks to your most common used menus</p> <p>Logic not menu driven, avoid menus within menus</p> <p>Clear menu descriptors</p> <p>Agree with flat based structure</p> <p>Accessible content careful use of design</p> <p>Limited content on page at a time</p> <p>Avoid flashing imagery</p> <p>Static, clear and large buttons</p> <p>Bear in mind, dementia affects people differently.</p> <p>There are many types of dementia: Some cannot verbalise, some have site issues. E.g. PCA Posterior Cortical Atrophy.</p> <p>Type of dementia will influence what needs to be adapted</p> <p>It depends on the stage of dementia</p> <p>Speed of processing information, navigation/ orientation all needs extra help</p> <p>Evenly spread text</p> <p>Not too much text</p> <p>Familiar straightforward images/clear imagery</p> <p>Symbols and pictures</p>

	<p>Flat structure could be better</p> <p>Getting to things after a couple of clicks</p> <p>Things need to be straightforward</p> <p>Imagery in conjunction simplified language</p> <p>Presenting the same information in many different ways so people can use the abilities they've retained</p> <p>Simplified way of organising limited information</p> <p>Simpler interface provides accessibility to other people including those with learning disabilities, brain injury, strokes and older people who may not be so computer savvy – more easily overwhelmed by large qty of information</p> <p>The pace of which material is provided</p> <p>The amount of information offered</p> <p>Orientation cues of the material</p> <p>Peoples ability to read and understand is still there</p> <p>Length easy read guidance</p> <p>Depends on what the website is saying, avoid jargon, negativity, not to patronizing or paternalistic.</p> <p>Simplification but not dumbing down</p> <p>Accessibility rather than changing content</p> <p>Simplifying language, shorter sentences and use person centred and dementia friendly language. E.g. The deep guidelines</p> <p>DEMTEch Principles</p>
8. Does an individual's perception of colour change in those living with dementia that might have a bearing on design?	<p>Colour perception and depth is difficult for some.</p> <p>Ability to change the interface colour without going into settings</p> <p>Different for different people</p> <p>Not aware of any change in perception of colour</p>

	<p>No specific dementia colour, but yellow is one of the last colours to go - for some people w/ dementia it is easier to have a yellow background with black writing (Used frequently within signs)</p> <p>Salient points must stand out</p> <p>Colour and enhancing contrast are important to make text more legible</p> <p>Web designers should have an awareness of these issues</p>
9. Are you aware of any design features or patterns that might be confusing for those living with dementia and should be avoided?	<p>General design principles include flecks on carpets can be mistaken for a puddle</p> <p>Challenge of sequencing may need repetition within a website</p> <p>Depends from person 2 person</p> <p>In building design, we avoid pattern carpets and marks that can disorientating and confusing i.e. be mistaken For holes</p> <p>Avoid busy designs/strip designs impact perception and disorientating and difficult</p> <p>Avoid shiny surfaces, use clear signage</p> <p>Take cues from examples of real-world objects</p> <p>Strong link with visual impairment and dementia. Professor Crutch General design principles and swirly patterns must be avoided as they are very confusing his work at UCL</p> <p>Less animations can be</p> <p>Nothing to fancy or decorative</p> <p>Make things prominent not complicated</p> <p>Simplification and keeping things simple but not boring.</p>
10. How do think web applications in the future may support those living with dementia, in particular	<p>Inevitable with technological advances</p> <p>Alexa is widely used for flexibility in meeting owner's individual needs</p> <p>Importance of technology working for people rather than telling them what to do</p>

do you think there are aspects of care that might be successfully substituted or enhanced by the use of technology.	<p>Must address the actual needs of people w /dementia rather than assumptions - Should be developed with close collaboration or led by people living w dementia</p> <p>Design what the user wants, involve the user from the start</p> <p>Technology has a place to support people to live well with dementia</p> <p>Dementia Research Institute</p> <p>Technology itself is nor good or bad however it's the use to which its put - technology can be used for good or ill.</p> <p>Must address their priorities and wellbeing for quality of life</p> <p>Importance of technology for social inclusion not driven by cost saving measures</p> <p>People get used to technology, many people already using it who live with dementia</p> <p>Alexa often cited for making an impact but there are cons</p> <p>I.e. Dismembered voices can be difficult to understand and stressful for some</p> <p>Technology has real potential especially as the population changes and becomes more tech savvy</p> <p>Lots of consent and privacy, ethical and legal issues associated with wearable technologies and tracking</p> <p>VR might be suitable for some living with dementia as part of reminiscence but used with caution for others it may upsetting or disorientating</p> <p>Lots of potential in the future. Lot of work has already been done around person centred care like reminiscence</p> <p>Brain training</p> <p>Really important as part of social connection and avoiding loneliness</p>
---	--

	Internet of things Wearable technology
--	---

Appendix 5 – Test Plan

Link to testing plan document

<https://drive.google.com/file/d/1d1mz515ehgf9tmz0L7oyo7wK6GXRQVqd/view?usp=sharing>

Appendix 6 – Usability Test Consent Forms



Consent Form

I agree to participate in a usability study which is a prototype made to provide a solution for a given problem and will be conducted by Southampton Solent University.

I understand that participation in this usability study is voluntary and I agree to immediately raise any concerns or areas of discomfort I might have with the study administrator.

The administrator will be taking down notes on my experience with this paper prototype and have conversations and brief discussion after the testing has been completed. All findings will be used to help us to improve the concept.

Please sign below to indicate that you have read and you understand the information on this form and that any questions you might have about the session have been answered.

We would appreciate it if the information you see could be kept confidential. *Date:* _____

***Name:* _____**

***Please sign your name:* _____**

Thank you!

We appreciate your participation.

Here are all consent forms for Usability Tests

<https://drive.google.com/drive/folders/19e5mAy7VSZG2KsLswZvapDh9x6yFm1lo>

Appendix 7 – Unmoderated Survey

Link to Blank Unmoderated Testing Survey

<https://www.surveymonkey.co.uk/r/5QRPRDM>

Screenshots

Q1

What is your first impression of the overall design layout of the wireframe?

acceptable - but not overall engaging
font is very small - too small

Q2

What are your thoughts on how the content is structured (e.g. headings, spacing and layout of the blocks of 'information', amount of information, typography, etc)?

blocks of information are ok - not 100% clear how much information is planned - spacing ok - but font is too small - some evidence that colour eg black on yellow is helpful for people with dementia

also would centre information in the middle of the page

Q3

How easy was it to navigate through the website using the navigational tools, ie buttons and scroll facility?

Easy - could navigate quickly and easily

Q4

What issues/problems have you experienced whilst using the prototype?

found the instructions re using the ctrl button not to be very clear

Q5

Are there any other improvements that need to be addressed?

none

Q1

What is your first impression of the overall design layout of the wireframe?

There isn't information overload, which is good.
Obviously colour and images would help.

I think the next, previous arrows, sign could stand out some more, larger, or colour?. I thought the scroll down arrows could be pressed to scroll down but it didn't, so I had to scroll using the mouse and cursor. Could the scroll down arrows help move the page down??

Q2

What are your thoughts on how the content is structured (e.g. headings, spacing and layout of the blocks of 'information', amount of information, typography, etc)?

Layout good, not too much information
Font sizes could be larger of headings on the top of the page

Q3

How easy was it to navigate through the website using the navigational tools, ie buttons and scroll facility?

Moderate - some hesitation

Q4

What issues/problems have you experienced whilst using the prototype?

As indicated above, could the scroll down arrows move you on like the next and previous arrows move you on?

Q5

Are there any other improvements that need to be addressed?

Its good to have the blank spaces and not information overload.
It would be interesting to know where you see this being stored. For example could a library have this as a resource for people to access, that way they could have the support of a librarian if they need help navigating??

Q1

What is your first impression of the overall design layout of the wireframe?

clear and uncluttered

Q2

What are your thoughts on how the content is structured (e.g. headings, spacing and layout of the blocks of 'information', amount of information, typography, etc)?

think one piece of info per page is sufficient - eg symptoms being separate to diagnosis and risks separate to prevention - even though I know they are closely related - the less information per page the better -

Like the simplicity of the forward and back buttons
less clear what the scroll down button was about as was unable to scroll down

Q3

How easy was it to navigate through the website using the navigational tools, ie buttons and scroll facility?

Moderate - some hesitation

Q4

What issues/problems have you experienced whilst using the prototype?

the scroll down - perhaps it was operator error..

Q5

Are there any other improvements that need to be addressed?

Not that I can think of - the pages were free from clutter and the information in bite size chunks (apart from my comment re there being 2 bites on some slides)
well done...

Q1

What is your first impression of the overall design layout of the wireframe?

I think the font is very small and that there could be better contrast to ensure things stand out more although the bold headings are easy to see. The arrow to suggest where to scroll down is helpful.

Q2

What are your thoughts on how the content is structured (e.g. headings, spacing and layout of the blocks of 'information', amount of information, typography, etc)?

I like that the information is in 'bitsize chunks'. The font could be of a 'friendlier' nature, arial 14 is seen as a dementia friendly font and black on yellow is considered easy to see.

Q3

How easy was it to navigate through the website using the navigational tools, ie buttons and scroll facility?

Moderate - some hesitation

Q4

What issues/problems have you experienced whilst using the prototype?

I think the tiny font and lack of contrast meant I had to look hard to read/find things. My navigation was made easier by my own knowledge of using the internet but a person with dementia may not always have prior knowledge. Buttons etc will need to be really obvious, language very simple and friendly.

Q5

Are there any other improvements that need to be addressed?

I would look at the DEEP guidance on writing/design and language.

Q1
What is your first impression of the overall design layout of the wireframe?
The text is small and needs to be easier to differentiate from the background e.g. by using a bold colour contrast . The use of the word previous may be difficult for some.
Q2
What are your thoughts on how the content is structured (e.g. headings, spacing and layout of the blocks of 'information', amount of information, typography, etc)?
See above. This needs to be checked against work by the Thomas Pocklington Trust and RNIB as many people living with dementia are older people
Q3
How easy was it to navigate through the website using the navigational tools, ie buttons and scroll facility?
Moderate - some hesitation
Q4
What issues/problems have you experienced whilst using the prototype?
It would have been helpful to have some text under the scroll down button as I was unclear if it was working.
Q5
Are there any other improvements that need to be addressed?
It was easy to go forward and back through the screens. Care needs to be taken in insuring best practice regarding size of text, colour contrast etc are taken into account



Usability Testing Script

Before testing session begins, participants will be giving an overview of the activities from the prototype. This includes:

1. What is this project?

This project is using a minimal viable product (MVP) approach (based on innovation and reiteration) to develop a ***basic wireframe prototype*** of a website (as opposed to a high-fidelity version). This proof of concept incorporates design principles, that have emerged from the literature review and interviews with subject matter experts. Those incorporated are intended to help those with living with dementia have a better ***user experience*** when using websites. The design principles in this wireframe are focussed around navigation: -

- Simplicity of navigation – forward and reverse buttons in addition to more formal tab structures – therefore offering choice)
- Flat navigational page structure – using scroll buttons to reduce the density of text on each page to minimise the risk of users getting ‘lost’ within the structure
- Images – to provide clarity for those with greater cognitive impairment

2. What is the usability test about?

The study is focussed on User Experience (UE) and how users inform the decision process. This test is about finding out any problems from this wireframe clickable prototype that dementia users may face from your overall experience and knowledge of being a dementia researcher.

Please note, that as this is a proof of concept and is a wireframe not a fully developed website. No images and information will not be displayed. The aim is to test the layout and navigation of this prototype

3. How will this test be conducted?

You will be given a scenario and a set of tasks to complete which are provided within the questionnaire. After completing each task, you will be invited to fill out 5 questions on your overall experience and thoughts of the prototype and provide an insight into some potential problems or opportunities for this proof of concept (prototype).

I appreciate your participation within this remote test and be looking forward to seeing your feedback!

Thank you!

Name of tester: Alex Zietara Nicholls

Appendix 9 – Privacy Impact Assessment

Appendix 9

Data Protection/Privacy Impact Assessment

Project Title: Web Design and Development, Year 3 2019-2020 Final Year Dissertation

Name: Alexander Zietara Nicholls

Personal Data to be collected:

Personal data to be collected is limited to names and email addresses of the dementia subject matter expert contributors.

There is no special category data to be collected as part of this study.

All participants have consented to be part of this study and to be identified as a contributor.

There are no quotations directly attributable to the subject matter experts within the final report.

Data Destruction: Audio recordings will be destroyed once the marking of the assignment is complete.

Risk assessment: This is a low risk project from a DP/PIA perspective.

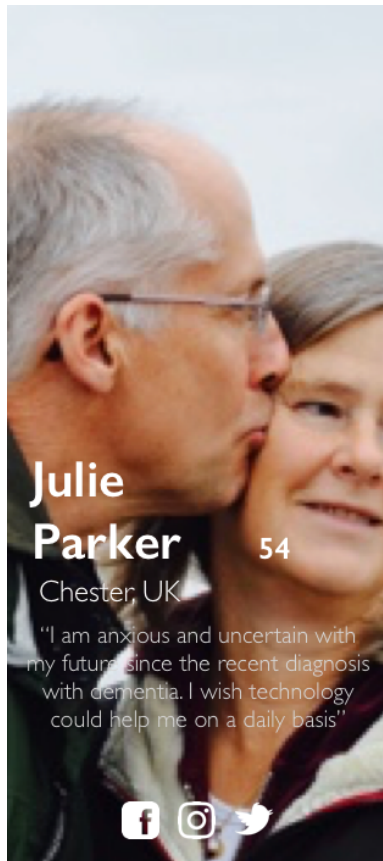
Appendix 10 – Literature Review Process Document

Click here to see the Literature Review Process Document

https://drive.google.com/file/d/1nyrV2WtrOhl87fm0zIlCJI8_iIJwy4kB/view?usp=sharing

Appendix 11 – User Personas

User Persona A



ABOUT

Julie lives in a bungalow with her husband Adam 10 miles away from Chester in Cheshire, England. Julie was recently diagnosed with Alzheimers two months ago. She is feeling a little anxious and uncertain for her future. She loves when her grandchildren visits her. She has a computer in her office to keep up to date with social media.

GOALS

- Loves having her own indepenance
- Stay in contact with her family on a regular basis
- Be able to access use technology to help support her with daily life
- Manage her daily routine without forgetting

FRUSTRATIONS

- Fears she of the rapid deterioration of her memory
- Struggles to read information and using a computer is a challenge
- Does not want to be a burden on others or her family
- Patterns are disorienting and confusing
- Uncertain for her future

EMPLOYER

JOB STATUS Retired
RELATIONSHIP Married
CHILDREN 2 Children and 4 grand children

INTERESTS

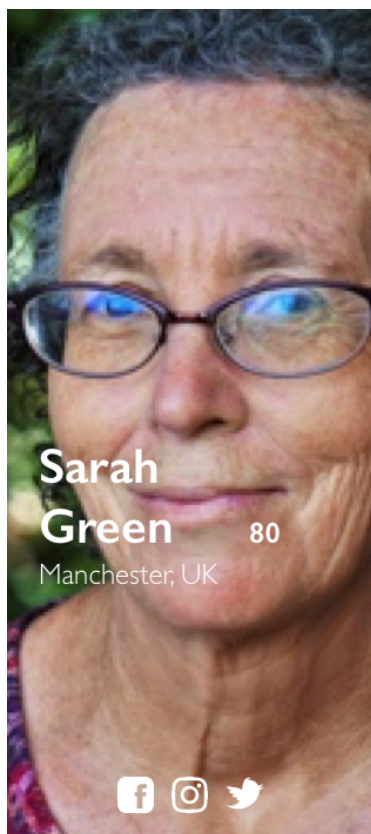
Music

Baking

Gardening

Knitting

User Persona B



ABOUT

Sarah lives in a residential home in Manchester, England. Sarah has had dementia for four years and her condition is deteriorating. She has two daughters, a son and six grandchildren. She loves when her grandchildren visits her. She has no access to computers and struggles to read newspapers, books and information in general.

GOALS

- Loves having her own indepenance
- Stay in contact with her family on a regular basis
- Manage her daily routine without forgetting

FRUSTRATIONS

- Struggles to read information
- Patterns are disorienting and confusing

EMPLOYER

JOB STATUS Retired

RELATIONSHIP Single

CHILDREN 3 Children and 6 grand children

INTERESTS

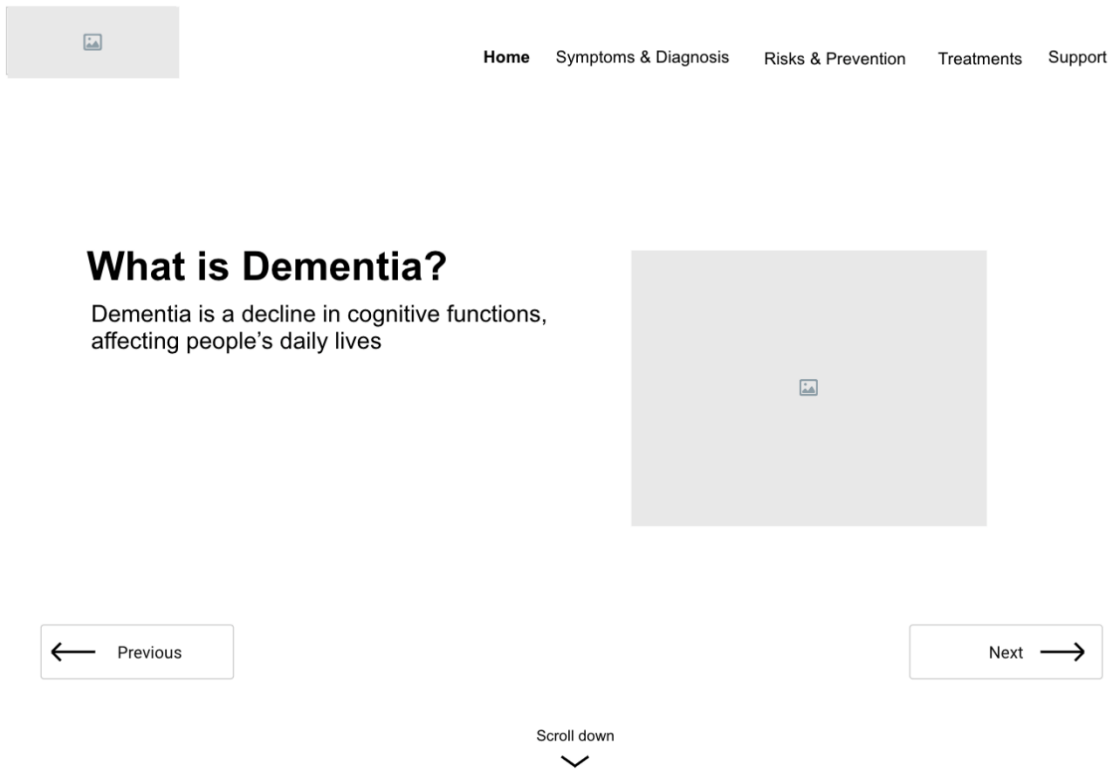
Knitting

Baking

Gardening

Appendix 12 - MockingBot Prototype Link

Screenshots





Symptoms & Diagnosis

Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium

← Previous

Next →

Scroll down



Risks & Prevention

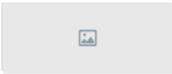
Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium

← Previous

Next →

Scroll down






Treatments

Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium

[← Previous](#)

[Next →](#)

Scroll down
▼



[Home](#) [Symptoms & Diagnosis](#) [Risks & Prevention](#) [Treatments](#) **[Support](#)**

Support

Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam.

Call our service number

Call

Contact us via Email

Name

Name

Email

Email

Comment

Comments

Send

← Previous

Next →

MockingBot Link: <https://mockingbot.com/app/wgy7sl3bdfhka74bei7mwygyoeiwdve>

Appendix 13 – Framework

Web Design Check List/Guidelines with comparative analysis

Features Identified within this Study	Links to WC3	Links to Alzheimer's Society Dementia Digital Design Guidelines	Other Sources
1. Utilise the general principles of good practice in web design e.g. UK Government guidelines https://www.gov.uk/guidance/content-design/writing-for-gov-uk https://blog.tbhcreative.com/2020/03/website-accessibility-review-beginners-guide.html		✓ Reference to UK Government guidelines	
Consider other design principles e.g. for Learning Disabilities, visual impairment and Dyslexia to determine common issues https://www.nationalelfservice.net/learning-disabilities/communication/websites-for-adults-with-learning-disabilities-accessible/ https://www.pocklington-trust.org.uk/ https://www.rnib.org.uk/			
2. Engage with those living with dementia in the design process to meet the real needs of those with lived experience Young Onset Dementia/ DEEP and TIDE		✓ Dementia Talking Point/Reddit/Dementia Cafes/Social Media/Specialist recruiters	
3. Use a Design Methodology to reiterate and develop design concepts		✓ Get feedback from people living with dementia during beta.	
		Refine rather than redesign	
4. Usability (motion and scrolling)			
Static, clear, and large buttons	V3.2.3 ; 2.4.5	✓ providing a clear link to 'Home', or the start,	✓ Freeman et al 2005

			Muzio and Serra 2001 Use bigger graphic elements i.e. fonts, buttons, icons etc
Consider voice commands VOIP and subtitling to accommodate both visual and hearing impairments	√ Guideline 3.3 Input Assistance		√ Muzio and Serra 2001 Sound is used to reinforce the visual information, but used very sparingly
Minimise number of clicks			√ Muzio and Serra 2001 Account for patients who cannot use the mouse or part of the keyboard due to motor impairments. Minimize the number of transitions between gross and fine motor movements Minimize the number of gross motor movements e.g. back and forth between

			mouse and keyboard
5. Content (including Language)			✓ Bouchier and Bath (2023)
Simplify language/messaging	✓ Guideline 1.3 3.1.5 ; 2.4.6 ; 2.4.2 ; 2.4.4 ; 2.4.10	✓ clear, specific and explicit language. headings and labels, explicit and arresting content	Woods and Bird 1999
Shorter sentences		✓ simple, clear, direct and precise prose,	
Use person centred and dementia positive and friendly language. E.g. The DEEP guidelines, using the DEMTECH principles of communication		✓ use dementia positive language, like 'living with', rather than 'suffering from', dementia, DEEP: Writing dementia-friendly information DEEP: Dementia words matter: Guidelines on language about dementia	
Avoid jargon and negativity	✓3.1.3 ; 3.1.4	✓ avoiding using abbreviations and acronyms avoiding generic calls to action, complex wordplay, jargon,	
Evenly spread text			
Good use of clear/familiar/straightforward pictures/imagery/symbols particularly for those who have difficulty reading		✓Keep images relevant and closely related to the content. To reduce the chance that the interface and content is confusing. Make images simple, engaging, and meaningful."	✓ Muzio and Serra 2001 Use familiarity and imagery for things that must be remembered
Must not be patronising or paternalistic			
Limited content/text on a page – evenly spread out			✓ Freeman, Clare, Savitch, Royan,

			Litherland and Lindsa √ Muzio and Serra 2001 Minimize the quantity of information that must be remembered from one screen to the next
Use logic	divide long forms into multiple smaller forms that constitute a series of logical steps	√ During longer tasks, give clear feedback on goal & progress. People living with dementia may have problems with attention AND working memory.	
Present the same information in different ways so people can use the abilities they have retained if they lack processing capability or have problems with language (film, audio, sub-titles)	1.4.2 ; 2.2.2	√ Provide subtitles or transcripts for video and audio content.	
Reduce amount of peripheral material to reduce distraction			
6. Colour			
Make contrasting clear	√1.4.3:1.4.6	√ using high contrast colour schemes to improve readability,	√ Arch, Abou-Zhara 2004
Avoid fluorescent colours Yellow backgrounds provide a good contrast with black text		√ avoiding the use of blue, green and purples, especially for important interface components.	√ Arch, Abou-Zhara 2004 √ Muzio and Serra 2001 Very few colours, clearly distinct from one another.

7. Information Architecture/Navigation/Typography			✓ Savitch and Zaphris
Provide bitesize chunks of information	✓ Guideline 3.1 Readability		✓ Arch, Abou-Zhara 2004 ✓ Muzio and Serra 2001 Avoid lengthy written information ✓ Direct users' attention by structuring and grouping elements ✓ Reduce the normally suggested number of maximum elements on a screen from 7 + 2 to 4 + 2;
Repetition to help navigation	✓ Guideline 3.2 Predictability is making sure pages appear and operate in predictable ways		
Focus on menus, buttons, different layouts	2		✓ Muzio and Serra 2001 Arch, Abou-Zhara 2004

Straightforward navigation	<p>✓ Guideline 2.4 allow users to navigate and find content.</p> <p>3.2.3 ; 2.4.5 ;</p> <p>2.4.6 ; 2.4.10</p>	<p>✓ using clear section breaks to make splits and stages obvious, making hyperlink styles, and states, like 'visited link', clear, avoiding splitting tasks across multiple screens, avoiding hiding navigation off-screen.</p> <p>✓ Use clear breadcrumb navigation <i>so that it is easy to understand location in the site structure.</i> <i>Disorientation when trying recall relative location in a system.</i></p>	<p>✓ Woods and Bird (1999) reduce distraction/ Simplification</p> <p>✓ Muzio and Serra 2001 Avoid situations in which the user feels 'trapped' in a screen which can trigger severe frustration.</p> <p>✓ Avoid simultaneous tasks.</p> <p>✓ Offer a narrow and shallow decision structure with few choices for options</p>
Accessibility rather than changing content - Do not dumb down content			
Clear menu descriptors			
Reduce pace of information flow	<p>2.2 Provide enough time for users to read and use content</p>		Arch, Abou-Zhara 2004
Quality and size of font - San serif text preferable as it is less decorative		<p>✓ using sans-serif fonts because the letter shapes are generally</p>	

		more readable on digital screens, √ avoid using multiple fonts, unnecessarily. This may make the interface and content confusing	
Use larger texts 14 and above		√ using larger text sizes (and higher contrasts) to provide more information to the eye. This is especially important for older people whose visual system declines with age,	
Flatter hierarchy			√ Offer a narrow and shallow decision structure with few choices for options
8. Design Features/Patterns			
Avoid flashing imagery			
Avoid complex Patterns		√ using plain backgrounds, rather than patterns or images, for textual content,	

(Muzio and Serra 2001)(Arch and Abou-Zhara 2004) (Williams 2017) (Woods and Bird 1999)
(Freeman *et al.* 2005) (Bouchier and Bath 2003)

Google Drive Link

To access any files that are not included (e.g. Log Book or Project Library) within the report or the appendix click the link below:

https://drive.google.com/drive/folders/1FRaY3nxFfy5QUNQAAmTGTxz_6zz7n_y