The experience of using prompting technology from the perspective of people with dementia and their primary carers

Evans N[1], Boyd H[1], Harris N[2], Noonan K[3], Ingram T[2], Jarvis A[4] and Ridgers J[1] and Cheston R[5]

[1] Designability, Wolfson Centre, Royal United Hospital, Bath

[2] Department for Health, University of Bath, Claverton Down, Bath

[3] School of Social and Community Medicine, University of Bristol, Tyndall Avenue, Bristol.

[4] Research Institute for the Care of Older People, The RICE Centre, Royal United Hospital, Bath

[5] Health and Social Sciences, University of the West of England, Coldharbour Lane, Bristol.

Pre-submission *Aging and Mental Health*

* Correspondence to: Nina Evans, Research Occupational Therapist, Designability, Wolfson Centre, Royal United Hospital, Bath, BA1 3NG; Email: ninaevans@designability.org.uk.

Funding. This work was supported by The Dunhill Medical Trust [grant number R399/0215].

Acknowledgements. We would like to thank everyone who participated in our studies.

MESH Key words: Alzheimer's Disease, Dementia, Reminder systems, Activities of Daily Living, Technology

Word count: 4,950/5,000 excluding references

The experience of using prompting technology from the perspective of people with dementia and their primary carers

Abstract (227/250 words)

Objectives: People who are living with dementia typically experience difficulties in completing multi-step, everyday tasks. However, digital technology such as touchscreen tablets provide a means of delivering concise personalised prompts that combine audio, text and pictures. This study was one component of a broader, mixed methods study that tested how an application (app) –based prompter running on a touchscreen tablet computer could support everyday activities in individuals with mild to moderate dementia. In this study we set out to understand the experiences of people living with dementia and their primary carer in using the prompter over a four-week period.

Method: We collected qualitative data using semi-structured interviews from 26 dyads, composed of a person living with dementia and their carer. Dyads were interviewed at the start and end of this period. Transcripts were then analysed using thematic analysis.

Results: The study identified three overarching themes related to: participants' attitudes towards the technology; their judgements about how useful the prompter would be; and the emotional impact of using it.

Conclusion: Consistent with the Technology Acceptance Model, carers and participants were influenced by their approaches to technology and determined the usefulness of the prompter according to whether it worked for them and fitted into their routines. In addition, participants' decisions about using the prompter were also determined by the extent to which doing so would impact on their self-identity.

The experience of using prompting technology from the perspective of people with dementia and their primary carers

Introduction:

Dementia is characterised by a pattern of short-term memory loss, impaired communication, difficulty thinking, and problem solving. As a person's cognitive impairment increases, so multi-step tasks requiring episodic memory and executive brain functioning become increasingly problematic (Orpwood *et al.*, 2007; Wherton and Monk 2010) and he or she becomes increasingly dependent on other people for support (World Health Organisation, 2014). In a European survey of over 1,000 carers, 87% of participants reported that the person they cared for had difficulties with memory and confusion while 97% also reported problems with the management of activities of daily living or ADLs (Georges *et al.*, 2008).

There is evidence that structured interventions can both improve a person's ability to complete ADLs and also enhance their quality of life (Graff *et al.*, 2006, NICE 2008). Typically within these interventions, carers first deconstruct tasks into a series of steps for the person with dementia, and then prompt people to complete these steps (Small *et al.*, 2003; Wilson *et al.*, 2013). These prompts are often written on paper or "post-it" notes. However, increasingly, prompts can also be provided using electronic and digital technology, which offer advantages over paper notes - for instance information can be presented in concise, discrete steps rather than as a list. Additionally audio, text, picture and video prompts (Boyd *et al.*, 2015; Jamieson *et al.*, 2014) can all be incorporated into the prompting package providing greater flexibility.

One example of just such a digital prompter was supplied by Boyd *et al.* (2015), who explored combining text, audio and pictures to aid people living with dementia through step-by-step tasks. They found that tailoring the prompts so that they were familiar to the individual and closely fitted the task increased their effectiveness. However, the medium used needs to be appropriate for the task: for example, signing a card and putting it into an envelope may be best prompted using audio and text instructions, whereas the process of completing a task with multiple potential options, such as using a CD player, may be better conveyed using a series of pictures to indicate which sequence of buttons to press. Therefore, any prompting device should offer multiple-modes to offer the best means of supporting a range of tasks.

This type of technology shows distinct promise as potential ways to prompt people living with dementia to complete ADLs: touchscreen computers, for example, can be utilised by people living with dementia (Boyd *et al*., 2015; Jodderell and Astell, 2016; Lim *et al.,* 2013; Smith *et al*., 2018). Moreover, studies involving participants with mild cognitive impairment confirm that using technology for prompting has assistive potential (Hedman *et al*., 2017; Lanciono *et al*., 2017; Robertson *et al.,* 2015; Steelye *et al*., 2013; Thomas and Marsiske, 2014). What is less clear, however, is whether touchscreen devices could be used effectively by carers to guide people who are living with dementia through a sequence of actions to complete a task and whether this technology is likely to be acceptable to people who may be unfamiliar with it.

The Technology Acceptability Model (TAM) provides a simple framework to explain the use or non-use of technology (Davis, 1989; Davis, Bagozzi and Warshaw, 1989; King and He, 2006). The TAM holds that a person's actual use of technology depends on the balance between how much they perceive it as being useful for them and how easy or difficult the expect it to be to use. The interplay between these two factors is anticipated to determine the person's attitude towards using the technology, their intention to use and their actual use of a new device. The TAM model has since been extended to accommodate research suggesting that factors such as social influences and facilitating conditions are also important (e.g. Venkatesh and Bala, 2003). Within dementia care research, the TAM has been used to predict whether carers will make use of specific technologies (O'Neil *et al.*, 2013; Kramer, 2013; Zhang *et al.*, 2013). As carers play an influential and often vital role in the selection and use of compensatory assistive technology for people living with dementia (Lindquist, Nygard and Borrell, 2013; Rosenburg and Nygard, 2012), understanding how these wider, social, factors influence the person's intention to act is likely to be especially important when considering how people living with dementia make decisions around using technology.

In summary, assistive technology has the potential to play an important role in enabling people living with dementia to participate in day-to-day activities. However, as the sophistication of such technology advances and the practical obstacles that impede carers from setting up and deploying such prompting systems are gradually overcome, it may well be that attitudes to the technology continue to present a significant barrier to their uptake. Consequently, in order to develop an effective and inclusive cognitive prosthesis we need to have a fuller understanding of the carer and user experience of using the technology.

This study set out to gather qualitative data using semi-structured interviews about the experience people living with dementia and their carers in using a prompter. This study was one component of a broader, mixed methods study that tested how a prompter could support everyday activities in individuals with mild to moderate dementia. The prompter used in this study is an application (app) –based solution running on a touchscreen tablet computer. The tablet was set up to only run the prompting software, with all other, potentially distracting, applications on the tablet being disabled. Using the app, carers can set up a series of step-by-step prompts using any combination of text, audio and pictures through which the person living with dementia can be prompted to complete a task of their choosing. The aim of this study was to understand the experience of using this prototype electronic prompter at home from the perspective of people living with mild- to-moderate dementia and their family carer.

Methodology

Ethical considerations. Approval for the study was granted[1], and all elements of the study adhered to the principles of the Mental Capacity Act (Code of Practice, 2005).

Recruitment. Members of the study team (TI and AJ) working at a dementia assessment, treatment and research centre advertised the study and independently screened potential participants. Participants were recruited as dyads composed of a person with mild dementia (participant) and their primary carer (carer). The inclusion criteria for participants were:

i) A confirmed clinical diagnosis of Alzheimer's disease, vascular dementia or mixed Alzheimer's disease with vascular dementia;

ii) A mild or moderate level of cognitive impairment as indicated by a score of at least 50 on the Addenbrooke's Cognitive Examination III or ACE-III (Hsieh *et al.*, 2013);

---

[1] The study received ethics permission on 16/04/16 from the South-West Central Bristol Research Ethics Committee (ref: 16/SW/0038), IRAS Project ID: 1885151, and was reviewed and approved by the Health Research Authority in England. Amendment number 01/11/2017, was approved on the 8th January 2018

iii) Reduced ability to perform ADLs as indicated, for instance, by a score of 5 or more on the Bristol Activities of Daily Living Scale (BADL) (Bucks *et al.,* 1996);

iv) Capacity to give consent; and

v) A primary carer who is willing and able to take part in the study and who has contact with the individual with dementia on at least three separate occasions per week.

Participants were excluded from taking part in the study if they had significant a sensory or physical disability which meant that they were unable to utilise a prompter.

Design. The study had two phases (1 and 2), which were identical except for the level of support given to participating dyads. In phase 1, dyads received a training session, instruction manual and the prompter. During phase 2, in contrast, dyads did not receive any support or training from the study team and were instead provided with only the prompter and accompanying instruction manual to represent an *"out of the box"* experience. In both phases couples had the opportunity to use the prompter at home for four weeks. Interviews were conducted and audio-recorded before and after the intervention with field notes also being taken by two researchers (NE and HB). The interviews were semi structured with questions focussing on the ease with which participants used the prompter and its usefulness for them (see table 1).

Insert table 1 here

Sample. Twenty-six dyads composed of a person living with dementia and their carer were recruited across the two phases of the study. All participants were independently assessed (by TI and AJ) as having capacity to consent to participate and provided written consent to the inclusion of their data in dissemination of the results.

Details of participant dyads are given in table 2. The average age of the participants was 80 years, with the youngest participant being 67 years and the oldest 94 years of age. The majority of dyad relationships were spouses, although mothers, daughters and sisters were also represented. There were 14 male participants and 12 female participants with most of the carers being female. All participants had been diagnosed with mild to moderate levels of cognitive impairment resulting from dementia and were experiencing difficulties with ADLs. Across the two phases, ACE-III scores for participants living with dementia ranged from 50 to 83 and Bristol Activities of Daily Living Scale scores from 1 to 22. Using an independent samples t-test, there was no difference between participants in the two phases for ACE III scores ($t(24) = 0.57$, $p = 0.58$) or BADLS scores ($t(24) = 0.85$, $p = 0.41$).

Insert table 2 here.

Analysis. Interview data was analysed using thematic analysis, a method for identifying, analysing and reporting on themes related to the research question (e.g. Braun and Clarke, 2006). Thematic analysis enabled the analysis to capture those elements of using the prompter that were meaningful to participants and carers. Using a continuous process of reflection the first researcher (NE) familiarised herself with the data by listening to the audio recordings and created verbatim transcripts. Initial codes reflecting provisional or emerging themes or ideas were generated from the text. These codes were reviewed separately by the second researcher (HB) to check consistency and validity. The researchers clarified any questions or disagreements about the codes that arose by discussion. Once there was a consensus, these codes were then categorised into candidate themes. The themes and the codes and data pertaining to these themes were then independently reflected on and refined by researchers (RC and

TI) who were not connected with the data collection. A recursive process of review by both researchers (NE and HB) then added further definition and naming of the themes and subthemes. In order to allow for any differences in participant experiences between phase 1 (which had an additional training session on how to set up and use the prompter) and phase 2 (which was "*out of the box*"), two separate thematic analysis processes were conducted. These two analyses showed a very similar set of themes occurred in each of them (see table 3). All these themes were subsequently revisited and reviewed, as part of a further recursive exercise to produce a comprehensive report of overarching themes, candidate themes and subthemes on the experience of using the prompter across both phases of the research.

Insert table 3 here.

Tasks. Participants (P) and carer participants (C) chose a wide range of multi-step tasks to try out using the electronic prompter. These are itemised in table 2 and covered daily living tasks from making a cup of coffee, a salad or a sandwich to using household appliances like microwaves and vacuum cleaners. Using the telephone, and leisure activities were also common.

Data Collection. In both phases, interviews were carried out in week one, when the dyads first received the prompter, and at week four, when the intervention was concluded. Over the course of the study three dyads withdrew (due to: a change in personal circumstances; concerns that the participant would find being asked to use the prompter demeaning; and deciding that using the prompter would just not work for them). Consequently, while a total of 26 interviews were carried out in week one only 23 post intervention interviews were possible. Participant dyads were interviewed together and the average length of the interview was 30 (range 15 to 60) minutes.

Research reflexivity. In this study, HB and NE acted in a joint capacity: as both analysts, looking to establish patterns across the data, and also integrating this emerging analysis into the project as a whole, so that it contributed to the design of the prompting package. In order to avoid their dual role compromising the confirmability of the research (Shenton, 2004), they consulted regularly with RC who, while a member of the project team, was an experienced qualitative researcher who was not involved in either the day-to-day running of the project or the design process.

Results

Participants and carers found the experience of using the prompter elicited responses that were *attitudinal, judgemental and emotional* (Figure 1: Thematic map).

These overarching themes, themes and subthemes are presented in Table 4.

Insert Table 4 here

Insert Figure 1 here

1. Attitudes to technology.

Participants who were living with dementia and those who were carers made assumptions about the viability of using an electronic prompter based on their attitudes towards technology and their previous experiences. Before using the prompter, many participants were concerned about whether they would be able to use it successfully and this anxiety acted, to some extent, as a brake on their willingness to take part. Those participants, who were familiar with technology, seemed to be more willing to engage with the prompter. All of the carers who participated succeeded in setting up the prompter, although some attributed difficulties with the prompter to their lack of familiarity and skill in using technology. This concern about a lack of familiarity with technology, while much diminished, continued after the intervention.

1.1 'Technology is trouble'. Where participants were more familiar with technology, then they were more confident in using the prompter. Conversely, a lack of interest or engagement with technology in general held back some participants and carers from engaging with it and thus created a barrier. One carer described technology as "*trouble*".

> [1] "*Technology I am in trouble with*" [Carer 11, phase one]

For some participants (both carer and the person living with dementia), the technology was perceived to be just too problematical to use. This was attributed to the impairment of cognitive functioning caused by both ageing and dementia.

> [2] *"Memory is a problem. I am not happy with these things (modern technology) now"* [Person with dementia 17, phase two]

For others, their lack of interest in technology reflected a personal lifestyle choice

> [3] "No*, I am not interested in. Not at all, definitely a people person not a machine. No disrespect"* [Person with dementia 21, phase two]

> [4] *"I am afraid I don't have a computer, I am too old… I know if I had been really interested in it I would have taken them up no matter how old I was when they started at the beginning but I am not"* [Person with dementia, phase two, 24]

1.2. 'I'm not a computer genius'. Some participants, especially carers, were willing to engage with the prompter, but anticipated that they would struggle to do so. This stemmed from an assumption that setting up and using a technological device such as the prompter would need a high level of skill. Even though all of the carers were able to set up and use the prompter during the trial, they freely expressed their perception that using technology would be challenging for them:

> [5] *"I am not a computer genius"* [Carer 21, phase two]

These concerns extended to carers who were clearly competent at using a range of other everyday technology including computers, iPads and smart phones:

> [6] *"I am alright with computers, I am not as good at programming obviously but I can use them. I use Facebook and twitter, I have had some experience of an iPad. I am not very good at it (smart phone)"* [Carer 18, phase two]

1.3 Family and friends. Some carers described using a network of family and friends as informal sources of help and support whenever they had to use any form of technology. Having others able to set up the technology for them ensured that they could overcome any barrier to using technology and boosted their confidence that they would be able to succeed:

> [7] *"My granddaughter did help me do the photographs on there, she was here at the time so she was handy. Whether I would have worked it out myself, possibly"* [Carer 15, phase two]

2. Is it useful?

In order for the electronic prompter to be a useful intervention it needed to be seen as workable for the carer to set up, as well as necessary and acceptable to the participant who was being prompted. Consequently, participants made a judgement about the how useful the prompting technology would be for them, weighing up the probability that it would work and improve their life, whilst also fitting into their routines and lifestyles.

2.1 'An extra help if you're not quite sure'. In order for the prompter to be seen as potentially useful, it was crucial that participants could identify a clear purpose for it that would enhance or facilitate their existing routines and lifestyle. This calculation was pragmatic and based on the carer's knowledge of the preferences and habits of the person living with dementia. In some cases, carers could see how they would tailor the prompter to support specific behaviours. For instance, one carer commented:

> [8] *"At the moment I have everything typed up, instructions for washing machine, microwave and cooker etc. I think all those things would work on there (the prompter)"* [Carer 10, phase one]

In instances such as these, where the prompter was clearly accepted as a potential source of help, which fitted into existing patterns of need, then both carers and participants were more likely to report positive outcomes:

> [9] *"Today you made my coffee twice; you came through to me for confirmation of what was going on. If he hadn't been using the tablet he wouldn't have made it full stop"* [Carer 2, phase one]

> [10] *"Yes I can use it (the prompter to manage the central heating controls). I won't be cold if I am on my own especially if you are not around any time. I think it is brilliant what I have achieved on it."* [Person with dementia 6, phase one]

2.2 'Domesticity did not really attract him'. Some participants and carers struggled to identify a clear purpose for the prompter that would be relevant to their lifestyle and routines. Consequently, they expressed a lack of conviction about using it:

[11] *"I've given this a lot of thought and I find it difficult to think of who really would make use of this"* [Carer 20, phase two]

For some participants who had never shown a great deal of interest within the home, and who were now being cared for by their close family, there was little need to complete tasks independently. Consequently, the intervention lacked relevance for their situation:

[12] *"He does not need to do it. Domesticity did not really attract him."* [Carer 11, phase one]

3. Emotional impact

For many participants living with dementia and their carers, a determining factor in whether or not the prompter was used was how it made them feel: where participants framed the prompter as a way in which they could continue to complete tasks independently, then their response to it was likely to be positive. In contrast, if the prompter was interpreted as a reminder to the person of what they couldn't do, then this precipitated anxious or negative responses.

3.1. Needing help carries a stigma. Many participants were aware that the need to be prompted reflected a lack of competency in everyday living tasks - something that was socially stigmatised and which some participants were clearly embarrassed about.

One participant mitigated their embarrassment using humour.

[13] *"I could probably tell you how to cook the tea (laughs)"* [Participant with dementia 25, phase two]

A number of carers described being sensitive to the potential for embarrassment occasioned by the need to use a prompter and tried to provide support in a way that did not compromise the person's dignity. For these carers, use of the prompter had to be weighed against their concern not to undermine their partner's self-esteem:

> [14] *"If you are a relative to somebody perhaps one is in the danger zone again making this almost like a commander of how to do something"* [Carer 23, phase two]

Perhaps for this reason, for some participants, more familiar forms of prompting, using pen and paper were more acceptable:

> [15] *"I am a notes person. So much of it is really beyond me and not worth the while for me to change habits. I would have to write a note to remember to look at it. A pencil and paper serves me the purpose."* [Participant with dementia 4, phase one]

3.2 'It was just another task for me'. Some carers were concerned about the effect that using the prompter might have on their relationship, especially when the participant lacked motivation or was affronted or embarrassed about needing to be prompted. For a few carers, using the prompter was very hard work and they did not feel that the benefits that accrued from it merited the energy that they had to invest in the prompter.

> [16] *"It was just another thing to do. If I needed to do it every day it would be a chore. It is quicker for me to do it (remind him/her rather than use tablet). It was just another task for me to get him to do these things. I can't honestly say it is going to save me any time at all."* [Carer 7, phase one]

Some carers reported that they had to use a lot of persuasion to get the person with dementia to try the prompter: this was often problematic and could cause tensions in their relationships.

[17] *"If it becomes a bone of contention there is no point."* [Carer 9, phase one]

Discussion

Elsewhere we have described how both people living with dementia and their carers were able to use a multimodal electronic prompter successfully (*reference removed to preserve anonymity*). Thus all the carers were able to master the process of deconstructing a task, then loading this on a step-by-step basis onto the tablet regardless of whether they participated in phase one (where training and support were available) or phase two, where they worked with the prompter '*out of the box*'. Similarly, all but one of the participants who were living with dementia were able to use the prompter to achieve at least some or all of the goals they had set themselves at the start of the intervention. The complementary, qualitative analysis presented in this paper suggests that participants' experiences of using the prompter is shaped by three core themes: their attitudes to technology, their judgements about its utility and the emotional impact of needing help. These three themes were present for participants in both phases of the study, and thus appear to be relevant regardless of the level of support that participating dyads received from the study team.

Our findings are largely consistent with the Technology Acceptance Model (TAM), where expectations about performance and ease of use are key factors that determine use. Thus, many participants in our study were not confident in their ability to use technology, both when using the prompter and more generally. This reflected not simply an unfamiliarity with the mechanics of twenty-first century living: while some participants such as carer 21 (extract 5) were unfamiliar with technology in general, others such as carer 18 (extract 6) used mobile phones and laptops on a daily basis and were familiar with apps, including twitter and Facebook. Nevertheless almost all of the participants expressed concerns about using the prompter not just before doing so, but also after the trial, even if they had completed the tasks successfully.

Additionally, some dyads struggled (at least initially) to identify a ready use for the prompter, even if they all ultimately managed to set themselves a goal. This suggests that if the prompter is to be used, then it has to fit into the daily routine of the person living with dementia and be seen to enhance their life: dyads were unlikely to experiment with the prompter, and therefore needed to grasp its relevance to their lives relatively quickly. This is consistent with research elsewhere into how older adults use technology (Peek *et al.,* 2016; Ryd *et al*., 2018), which suggests both that their thoughts on technology in general influence usage, and that this is also dependent on whether it has a highly relevant occupational purpose. Interestingly, one study reported that when carers were asked to rate prompters they did not rate them highly and categorised them as having a low perceived usefulness (Mao *et al.*, 2015).

While these findings are consistent with TAM, we also identified another important theme in the experiences of both the person living with dementia and their carer - namely the emotional impact of the prompter. Thus participants framed their use of the prompter in terms of its potential threat to self-functioning. Deciding to use the prompter entailed making a decision that, in effect, the cognitive level of the person living with dementia had deteriorated to a point where they now needed to draw on what for many seemed to be an artificial aid. Both the person living with dementia and their carer were highly sensitive to the way in which the implications of using the prompter might be, for some people at least, emotionally deregulating (Cheston and Christopher, 2019).

Using a prompter, then, to help with everyday tasks potentially constituted a threat to self-functioning in a qualitatively different way to other forms of prompting such as being reminded by a carer. Whereas the latter might be shrugged off as a simple absent-mindedness, using the prompter implied an enduring deficit. Unsurprisingly, therefore, participants and carers compared using the prompter to other strategies such as being guided by a carer or using paper and pen instructions (e.g. extract 15): these strategies seemed more acceptable to some dyads as they did not threaten the person's emotional stability and their relationships in the same way that the prompter may have done. Where participants living with dementia used the prompter, then they often used different strategies to lessen the emotional impact that this might have. Thus participant 25 joked that while she might need to use the prompter, nevertheless she "*could probably tell you how to cook the tea*" (extract 13). Similarly, a number of carers were sensitive to the threat to identity that using the prompter implied, and balanced the benefits that might accrue from using it against concerns that to do so might be experienced as diminishing the person's identity (Baghirathan *et al*., 2018). This finding is consistent with research elsewhere suggesting that the stigma associated with being reminded of lowered cognitive functioning is likely to be a barrier to adoption for many (Herrmann *et al*., 2018). For instance, in a consumer study of older people, poor design and associated stigma influenced people's purchasing decisions of assistive technology (Ward *et al*., 2017).

Study limitations. The participants living with dementia and their carers who took part in this study came from a relatively narrow socio-economic and cultural group and were aware that the researchers were also the designers of the intervention. Consequently some participants might have felt inhibited in offering criticism of the product design. Additionally, the two researchers who led the analysis (HB and NE) also led the development of the prompter, and their investment in this may have unconsciously influenced their interpretation of the data. Consequently, a process of wider consultation and review within the research team took place to monitor the credibility of the analytical process (Shenton, 2004).

Conclusion:

In recent years, a range of relatively low cost and widely available devices have been used to support people with dementia and their carers to manage their daily activities and to enhance their safety. However, to date the potential utility of technology to support memory function in people diagnosed with dementia has not been accompanied by an understanding of the psychological processes underlying its adoption (Van der Roest *et al.*, 2017). It is important, then, to explore whether devices such as the prompter app described here can not only be used successfully, but also whether they are acceptable. Elsewhere we have reported how many of the carers and people living with dementia in this study were able to successfully set up and to use the prompter to support multi-stage everyday tasks, thus prolonging the person's engagement and independence in daily activities (*reference removed to preserve anonymity*). The aim of this study was to understand more about the experience of using the intervention.

For all participants, successful use of the prompting package did not primarily rely on them mastering the operation of the prompter, but on their attitudes to using technology, their judgements about how useful the prompter would be and the emotional impact of using it. Consequently, continued use of the promoter depends on understanding and managing the psychological impact of this technology. In order to produce a viable tablet based app, we need first to overcome misconceptions about technology, ensure that this fits into the person’s lifestyle fit and minimise the impact of stigma.

References:

Baghirathan S, Cheston R, Hui R, Chacon A, Shears P and Currie K (2018) A grounded theory analysis of the dementia experiences of people from three BME communities: balancing the need for support against fears of being diminished, *Dementia: the International Journal of Social Research and Policy,* published on-line 15th October 2018*,* doi: 10.1177/1471301218804714.

Boyd, H., Evans, N., Orpwood, R., Harris, N. (2015). Using simple technology to prompt multistep tasks in the home for people with dementia: an exploratory study comparing prompting formats. *Dementia The International Journal of Social Research and Practice*. 0 (0) 1-19.

Braun, V. and Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 2, 77-101.

Bucks, R., Ashworth, L., Wilcock, K., Siegfried, K. (1996). Assessment of Daily Living in Dementia: Development of the Bristol Activities of Daily Living Scale. *Age and Aging* 25,113-120.

Cheston R and Christopher G (2019) *Confronting the Existential Threat of Dementia: an Exploration into Emotion Regulation*, London: Palgrave-MacMillan. ISBN: 978-3-030-12349-9.

Davis, F (1989) Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13, 3, 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35, 982–1003. doi:10.1287/mnsc.35.8.982

Georges, J., Jansen S., Jackson, J., Meyrieux, A., Sadowska, A., Selmes, M. (2008) Alzheimer's disease in real life- the dementia carer's survey. *International Journal of Geriatric Psychiatry*, 23 (5) 546-51.

Graff, M., Vernooij-Dassen, M., Thijssen, M., Dekker, J., Hoefnagels, W., Olde Rikkert, M. (2006) Community based occupational therapy for patients with dementia and their caregivers: randomized control trial. *British Medical Journal*, 333 (7580) 1196-1201.

Hedman, A., Nygard, L., Kottorp, A. (2017) Everyday technology use related to activity involvement among people in cognitive decline. *The American Journal of Occupational Therapy*,71(5).

Herrman, L., Welter, E., Leverenz. J., Lerner, A., Udelson, N., Kanetsky, L., Sajatovic, M. (2018) A systematic review of dementia-related stigma research; Can we move the stigma dial? *The American Journal of Geriatric Psychiatry* 26 (3) 332-333

Hsieh, S., Schubert, S., Hoon, C., Mioshie, E., Hodges, J. (2013) Validation of the Addenbrooke's Cognitive Examination in Frontotemporal Dementia and Alzheimer's Disease. *Dementia and Geriatric Cognitive Disorders,* 36, 242-250

Jamieson, M., Cullen, B., McGee-Lennon, M., Brewster, S., Evans, J. (2014). The efficacy of cognitive prosthetic technology for people with memory impairments: A systematic review and meta-analysis. *Neuropsychological Rehabilitation*, 24 (3–4) 419–444.

Jodderell, P. and Astell, A. (2016) Studies involving people with dementia and touchscreen technology: A literature review. *JMIR Rehabilitation AssistiveTechnology* (3) 2.

King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information and Management*, *43*(6), 740-755.

Kramer, B. (2013). Dementia caregivers in Germany and their acceptance of new technologies for care: the information gap. *Public Policy and Aging Report*, *24*(1), 32-34.

Lanciono, G., Nirbhay, S., O'Reilly, M., Sigafoos, J., D'Amico, F., Pinto, K., De Vanna, F., Caffo, A. (2017). A technology-aided programme for helping persons with Alzheimer's disease perform daily activities. *Journal of Enabling Technologies* 11 (3) 85-91.

Lim, F., Wallace, T., Luszcz, M., Reynolds, K. (2013). Usability of tablet computers by people with early stage dementia. *Gerontology* 59 (2), 174-82.

Lindquist, E., Nygard, L., & Borrell, L. (2013). Significant Junctures on the way to becoming a user of assistive technology in Alzheimer's disease. *Scandinavian Journal of Occupational Therapy,* 20, 386-396

Mao, H., Chang, L., Yao, G., Chen, W., Huang, W. (2015) Indicators of perceived useful dementia care assistive technology: Caregivers' perspectives (2015) *Geriatric Gerontology International* 15 (8) 1049-57.

National Institute for Health and Clinical Excellence (NICE 2008) Occupational therapy interventions and physical activity interventions to promote the mental wellbeing of older people in primary care and residential care. London: Retrieved from: http://www.nice.org.uk/nicemedia/pdf/PH16Guidance.pdf

O'Neill, S. A., McClean, S. I., Donnelly, M. D., Nugent, C. D., Galway, L., Cleland, I., Zhang S, Young T, Scotney BW, Mason SC, & Craig, D. (2013). Development of a technology adoption and usage prediction tool for assistive technology for people with dementia. *Interacting with Computers*, *26*(2), 169-176.

Orpwood, R., Sixsmith, A., Torrington, J., Chadd, J., Gibson, G., Chalfont, G. (2007) Designing technology to support quality of life of people with dementia. *Technology and Disability,* 19, 103–112.

Peek, S., Luijkx, K., Rijnaard, M., Nieboer, M., van der Voort, C., Aarts, S., van Hoof, J., Vrijhoef, H., Wouters, E. (2016) Older Adults' reasons for using technology while Aging in Place. *Gerontology* 62 226-237

Robertson, K., Rosasco, C., Feuz, K., Schmitter-Edgecombe, M., Cook, D. (2015) Prompting technologies: A comparison of time-based and context-aware transition based prompting. *Technology Health Care* 23 (6) 745-56.

Rosenberg, L., & Nygard, L. (2012). Persons with dementia become users of assistive technology a study of the process. *Dementia the international Journal of Social Research and Pr*actice 11(2) 135-154

Ryd, C., Malinowsky, C.,Ohman, A., Kottorp, A., Nygard, L. (2018) Older adults' experiences of daily life occupations as everyday technology changes. *British Journal of Occupational Therapy.* 81 (10) 601-608

Shenton, A. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22, 63-75.

Small, J., Gutman, G., Makela, S., Hillhouse, B. (2003). Effectiveness of communication strategies used by caregivers of persons with Alzheimer's disease during activities of daily living. *Journal Speech Language Hearing Research* 46 (2) 353-67.

Smith, K., Mountain, G., Hawkins, R. (2018) Qualitatively exploring the suitability of tablet computers to encourage participation with activities by people with moderate stage dementia. *Dementia: the International Journal of Social Research and Practice* 0 (0) 1-18.

Thomas, K. and Marsiske, M. (2014). Verbal prompting to improve everyday cognition in MCI and unimpaired older adults. *Neuropsychology* 28 (1) 123-134.

Van der Roest, H., Wenborn, J., Pastink, C., Droes, R., Orrell, M. (2017). Assistive technology for memory support in dementia. *Cochrane Database of Systematic Reviews*, Issue 6.

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273-315.

Ward, G., Fielden, S., Muir, H., Holliday,N., Urwin, G. (2017). Developing the assistive technology consumer market for people aged 50-70. *Ageing and Society* 37, 1050-1067.

Wherton, J. and Monk, A. (2010). Problems people with dementia have with kitchen tasks: The challenge for pervasive computing. *Interacting with Computers* 22 (4) 253-66.

Wilson, R., Rochon, E., Mihailidis, A., Leonard, C. (2013). Quantitative analysis of formal caregivers' use of communication strategies while assisting individuals with moderate and severe Alzheimer's disease during oral care. *Journal Communication Disorders* 46 (3) 249-63.

World Health Organisation (2014). International Statistical Classification of Diseases and Related Health Problems. Retrieved from http://apps.who.int/classifications/icd10/browse/2015/en#/F00-F09

Zhang, S., McClean, S. I., Nugent, C. D., Donnelly, M. P., Galway, L., Scotney, B. W., & Cleland, I. (2013). A predictive model for assistive technology adoption for people with dementia. *IEEE journal of biomedical and health informatics*, *18*(1), 375-383.