How do people living with dementia use technology?

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1. Introduction and Context
Over 46.8 million people live with dementia worldwide, and this number is set to increase to 131.5 million by 2050; the need to support these people is of paramount importance (Alzheimer’s Disease International, 2015). While research continues to work towards effective treatments, there is need for research to improve the lives of people living with the symptoms (Alzheimer’s Society, 2014); ergonomics and design research has a key role in this challenge.
As technology-rich environments are becoming increasingly commonplace, and society becomes increasingly automated, people with dementia (PWD) will be exposed to technological interfaces through necessity as technology becomes impossible to avoid (Wallace, Mulvenna, Martin, et al., 2010). Yet as technologies are developed in a ‘hyper-cognitive society’, where assumptions about cognitive ability are implicit (Brittain, Corner, Robinson, et al., 2010), there becomes an increasing risk of PWD being excluded from society as the demands of technologies are beyond their capabilities. It is therefore important to ensure that technologies are usable by PWD, by identifying and addressing the barriers to technology use. This could lead to a range of future accessible and usable technologies (e.g. everyday ICT, assistive technologies, or telemedicine) for PWD, to support increased independence.

2. State of the art
Literature discusses the interaction of PWD with a variety of technologies such as washing machines, laptop computers and telephones, to assistive technologies (Nygård & Starkhammar, 2007; Blaschke, Freddolino & Mullen, 2009; Gell. Rosenberg, Demiris et al., 2013; Cash, 2003). Whilst PWD use many technologies, a range of barriers that may be faced when using them. Potential barriers include inappropriate physical design, unusable graphical interface design, the demands that technologies make on the user, lack of training, cost, and rejection of technology (Gell, Rosenberg, Demiris, et al., 2013; Arning & Ziefle, 2009; Wallace, Mulvenna, Martin, et al., 2010; Astell, Ellis, Bernardi, et al., 2010; Rosenberg, Kottorp & Nygård, 2012; Agree, 2014). However, the method of identification, and the extended range of potential barriers to technology uptake and use remain under-explored.

3. Objectives & Methods
This systematic literature review addresses how PWD use technology. It explores barriers faced when using technology and identifies where technology does not meet the needs of PWD due to a lack of human factors design consideration.
Searches to identify relevant studies were conducted within the following online databases: Medline, PubMed, Ergonomics Abstracts, Scopus, Web of Science, Science Direct and ASSIA, using a search strategy based on terms from initial scoping. 1297 retrieved articles were screened for relevant content that met the inclusion criteria. The 40 included papers were critically appraised for methodological quality using the Mixed Methods Appraisal Tool (Pluye, Gagnon, Griffiths, et al., 2009). All studies were of medium to high methodological quality. Included studies were analysed using thematic coding.
4. Results & Discussion

4.1 Technologies
Assistive technologies (ATs), everyday technologies, and therapy-provision technologies were evaluated. ATs were the focus of the majority of the included studies, in terms of their incorporation into the lives of PWD (Arntzen, Holthe & Jentoft, 2014; Lindqvist, Nygård & Borell, 2013; Boger, Quraishi, Turcotte, et al., 2014) and their usability. Everyday technologies, such as commercial devices including telephones and computers were evaluated for their intended use, and when being utilised as AT. Technologies for rehabilitation and therapies, assistive ambient living systems and eHealth were also evaluated within the reviewed literature.

These results demonstrate the diverse range of applications where technologies have been developed for use by PWD, in different settings, and for different stages of progression of dementia, from PWD living independently at home, to those living in residential care settings.

4.2 Barriers
A range of barriers were identified within both the uptake and use of technology by PWD. These barriers were mostly identified by caregivers, rather than PWD themselves. Lack of awareness and high cost of available technologies are two key barriers to the uptake of AT (Boger, Quraishi, Turcotte et al., 2014; Rikonen, Mäkelä & Perälä, 2010; Gibson, Dickinson, Brittain, et al., 2015). Negative attitudes of both PWD and their caregivers are another barrier (Arntzen, Holthe & Jentoft, 2014; Boger, Quraishi, Turcotte, et al., 2014). PWD were sometimes found to be sceptical of the usefulness of a technology, and carers felt that technology could not be a solution to the challenges that they faced. It is therefore vital that all stakeholders perceive a need for the technology if it is to be successfully incorporated.

The design of technologies is core to the usability and acceptability of devices, with ergonomic and aesthetic considerations required (Abbate Avvenuti & Light, 2014). Technologies can be problematic due to their physical complexity and the excessive demands they place on the user due to extensive operation procedures (Arntzen, Holthe & Jentoft, 2014; Boger, Quraishi, Turcotte, et al., 2014; Chen & Leung, 2012; Faucounau, Riguet, Orvoen, et al., 2009; Gibson, Dickinson, Brittain, et al., 2015; Jentoft, Holthe & Arntzen, 2014). This makes technologies incompatible with the capabilities of users. Technologies need to support learning, and to fit within users’ habitual practice (Arntzen, Holthe & Jentoft, 2014). PWD are more at ease with familiar objects, and unfamiliar design can be a deterrent for using technology (Cahill, Begley, Faulkner, et al., 2007). If technologies are not accessible and usable, they can evoke negative emotional reactions, including anxiety, frustration and incompetency, as well as the feeling of being stigmatised (Arntzen, Holthe & Jentoft, 2014; Gibson, Dickinson, Brittain, et al., 2015; Rikonen, Mäkelä & Perälä, 2010). These emotional reactions can result in non-use of devices.

5. Conclusions & Perspectives
A range of barriers were identified across the use of a variety of technologies by PWD. Many of these barriers exist due to poor compatibility between the technology design and the users’ capabilities. It is believed that better accessibility and usability of technology could be achieved by implementing a human-factors approach to the design process, in which PWD and caregivers are fully integrated into the process.

Keywords
Dementia, Technology, Human Factors Design
References


