Technology for Older People: A Critical Review

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Abstract. We will present the results of a critical review of research published in a range of peer-reviewed conferences in the period 2005 - 2012 on the use of technology to support older people. We explore what problems faced by older people are being addressed by the research; whether the research is motivated by user needs; the methodologies used; the levels of target user involvement in the research; and the outcomes achieved. Eight major topics of research have been identified: mobility and wayfinding; communication and social interaction; interaction with technology; using the web; access to and exploration of information; education; support for daily living; and games and play. In addition, we have categorized the research into four main types: research that proposes technologies for older people; research to understand the use of technology by older people and their attitudes to technology; research on guidelines, standards or other information to support developers and researchers; and research that on methodologies for working with older people in the development of new technological solutions. Important gaps and weaknesses in the current research portfolio are explored. The review will provide an overview of the state of the art of technologies for promoting independent living and wellbeing of older people, which should be useful for researchers, developers and practitioners in the field.

Keywords: Older people, Assistive technologies, User needs, Evaluation, Methodologies for working with older people.

1 Introduction

It is well known that many societies around that world are currently experiencing an aging of their population. The United Nations [7] estimates that in 2012, there were 841 million older people (they use a definition of people aged 60 years or older) worldwide and estimates that by 2050 the proportion of older people will increase to 21 per cent of total population or more than 2 billion people [6, 7]. If this prediction is born out, it will be the first time in history that the proportion of the population aged 60 years and over will be larger than the proportion of young people (aged under 15) [6]. The ratio of people of working age to older people, often known as the "aged

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dependency" ratio, is also very relevant. For example, in the European Union, for every person of 65 year or over, there are currently four people of working age (15 – 64 years); by the year 2060, it is estimated that there will be on two people of working age for each person of 65 for over [3].

These changes in the population have many implications, but of particular interest here is the consequences for the care of older people. In the coming years there will be far fewer younger people to help care for the older population. Technology has a vital role to play in filling this growing personnel gap. More technological support will be needed to enable more older people live independently in the community for older, and also to support their care in residential homes, hospitals and hospices.

For these reasons, we believe a critical review of current technology research and developments for older people is particularly timely. If technological support is likely to be used by older people, it needs to be useful and usable. To ensure this, it needs to be developed in a user-centred manner, taking into consideration the needs of users throughout the design process. Our review is investigating what problems faced by older people are being addressed by current research; whether the research is motivated by user needs; the methodologies used; the levels of target user involvement in the research; and the outcomes achieved.

2 Aims of the Current Review

The critical review covers relevant research published between 2005 to 2012. The review has been inspired by work carried out by Rogers Strong and Fisk [4] as they published a major survey of research on technology in relation to older people in 2005 which built on an earlier review by Czaja in 1990 [2]. They reported that very often the abilities and constraints of older users and were not taken into account in the development of technology.

3 Method

Research published in a selection of peer-reviewed conferences and journals was selected for inclusion in our review. The areas we focused on included "mainstream" outlets in human-computer interaction and human factors, as well as "specialist" outlets in gerontology, geronotechnology and rehabilitation technology. Journals and conferences were selected for inclusion based on their Impact Factor [5] and rankings by the Australian Research Council's ranking of journals and conferences [1]. From a list of possible conferences and journals, a random selection was made to reach a managable number. Table 1 lists the conferences and journals in the final selection.

Papers were included in the review if they included words relevant to older people and technology in the title, abstract or keywords. Terms included "older people", "older adults" and "elders" in mainstream conference or journal papers (which were by definition about technology) and in addition "computer/s", "assistive technology" and "online" in the specialist journals. A full set of the terms and how they were used is available at www.yorkhci.org/criticalreview/.

To ensure accuracy of selection of papers, either two researchers reviewed each conference proceedings or journal or the same researcher reviewed the proceedings or journal at least three months apart. Inter-coder reliability on the selection of papers was calculated on several sets and averaged over 90%.

Table 1. Conferences Proceedings and Journals included in the Review

Mainstream journals and conferences	
Journals	ACM Transactions on Computer Human Interaction Behaviour and Information Technology Human Computer Interaction Human Factors International Journal of Human-Computer Studies
Conferences	ACM Conference on Human Factors in Computing Systems (CHI) British Computer Society Interaction Specialist Group Conference (BCS HCI) IFIP TC 13 Conference on Human-Computer Interaction (INTERACT)
Specialist journals and conferences	
	ACM Transactions on Accessible Computing (ToACCESS) Educational Gerontology Gerontechnology Technology and Disability Universal Access to the Information Society
	ACM Conference on Computers and Accessibility (ASSETS) International Conference on Computers Helping People with Special Needs (ICCHP)

4 Results

A total of 5143 papers have been reviewed so far, 3823 in mainstream outlets and 1830 in specialist outlets. The number of papers relevant to technology for older people is 187, made up of 170 relevant solely to older people and 17 relevant to older people and people with disabilities. So far we have conducted detailed analysis of 131 of these papers.

We found that the papers divided into three types of research and development. These are:

Development of new technologies/systems: research and development that proposes emerging technologies or new uses of technologies for older people;

Understanding users: This is research that seeks to understand the use of technology by older people and their attitudes to technology;

Methods for working with older people: This research proposes methodologies for working with older people in the development of new technological solutions, or reflects on this area of research and development.

Table 2 shows the breakdown of the papers analysed so far into the three types of research. Just over three-quarters (75.6%) of the papers were about understanding older people, their use of technologies, experiences with technologies and attitudes to technology. The remaining papers were split evenly between proposals for new technologies and systems (11.5%) and methods for working with older people (12.9).

Table 2. Breakdown of papers by type of research and development

Research and development type	Mainstream outlets % (N)	Specialist outlets %(N)	Total % (N)
New Technologies/systems	15.4 (12)	5.7 (3)	11.5 (15)
Understanding older people	71.8 (56)	81.1 (43)	75.6 (99)
Methods for working with older people	12.8 (10)	13.2 (7)	12.9 (17)
Total	100.0 (78)	100.0 (53)	100.0 (131)

In addition, we found that the research could be categorized into 11 major topics, as listed in Table 3. So research on "mobility and wayfinding" might be proposing a new system to help older people with their mobility (so would fall in the "New technologies/systems" type of research) or it might be about understanding the issues that older people have with mobility (so would fall in the "Understanding older people" type of research). The "Methods for working with older people" we left as a topic in itself, as well as a type of paper.

Table 3. Breakdown of papers by topics addressed

Topic	Mainstream outlets % (N)	Specialist outlets % (N)	Total % (N)
Mobility and wayfinding (e.g. indoor, outdoor navigation)	6.4 (5)	1.9 (1)	4.6 (6)
Access to and use of information (e.g. search, health information)	3.8 (3)	9.4 (5)	6.1 (8)
Communication and social interaction (e.g. encouraging socializing, supporting communication, collaboration)	10.3 (8)	7.6 (4)	9.2 (12)

Table 3. (*continued*)

Interacting with/using technology (e.g. input/output, interaction techniques)	24.4 (19)	5.7 (3)	16.8 (22)
Attitudes to / experience with technology	7.7 (6)	24.5 (13)	14.5 (19)
Specific technology issues (e.g. security)	1.3 (1)	1.9 (1)	1.6 (2)
Education	0.0 (0)	20.8 (11)	8.4 (11)
The web (e.g. use, assessing accessibility, teaching developers about web accessibility)	2.6 (2)	3.8 (2)	3.1 (4)
Tasks of daily life (e.g. memory support, home monitoring, cooking, banking, exercise)	25.6 (20)	9.4 (5)	19.1 (25)
Games and gaming	5.1 (4)	1.9 (1)	3.8 (5)
Methods for working with disabled/older people	12.8 (10)	13.2 (7)	12.9 (17)
Total	100.0 (78)	100.0 (53)	100.0 (131)

Further analyses of the papers are underway and will be presented at the conference.

5 Discussion and Conclusions

The analysis of papers thus far has shown that there is a wide range of research on technology for older people. It is encouraging that so much of the research is about understanding older people's use and attitudes towards technology – this shows that researchers and developers are taking user-centred approaches, investigating older people issues around technology. The fact that this work is being published in such large numbers means there is a growing body of knowledge for researchers and developers entering the area to draw on.

The analysis of topics also shows that there is research on a wide range of different issues. Some of the common topics are to be expected: the most common area of research (19.1% of papers) is "Tasks of daily life", which is a very broad topic, but also reflects the interest in supporting older people in living independently but supporting them in a wide variety of tasks of daily life. However, at the other extreme, it is surprising that there is so little research on web accessibility for older people (only 3.1% of papers), as the web is such an important source of information, commerce and leisure. Researchers may not be aware that the Web Content Accessibility Guidelines (WCAG) [8] do not cover the needs of older web suers, and this is definitely an area that needs further research.

Further analyses are being undertaken to explore further gaps in the research, the actual level of involvement of older people and the outcomes achieved in the research. These will be reported at the conference and in subsequent publications.

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