OLDER TRAVELLERS

AND TECHNOLOGY ENGAGEMENT

CATAPULT
Transport Systems

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The findings and recommendations are those of the authors and do not necessarily represent the views of TSC or DfT.

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Acknowledgements

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Older Travellers and Technology Engagement

Technology is increasingly being used to plan, book, pay for and manage journeys. Whilst such innovations are on the increase, so too are the number of older people living in Great Britain. For transport in our society to be accessible to as many people as possible, it is therefore important that older people are able and willing to engage with such technologies. This report was commissioned to both encourage and enable developers and commissioners of customer-facing transport technologies to better consider the needs of older travellers.

Newcastle University was commissioned by the Transport Systems Catapult to undertake a literature review and interviews with both older people (thirty-two, ranging in age from 63 to 96[1]) and recognised experts in the field, with the aim of answering the following research questions:

- What is the scale of the problem?
- What are the key barriers to engaging with new and emerging technologies for older people, and how do these barriers differ by type of older person? Where older people have generally engaged with some forms of new technology, why have other older people not done so?
- Where do well-designed examples of new and emerging technology already exist (in transport and other sectors) that meet the needs of older people? Why have these technologies been used successfully by older people?
- What specifically needs to change to enable greater numbers of older travellers to access technology to help people to plan and make journeys?
- Where is further research needed?

[1] Of those interviewed, 10 were aged 63-69, 12 were aged 70-79 and 10 were aged 80 and over. The gender ratio was 1:1 and the average age was 74.2 for male participants and 74.0 for female.

1. What is the scale of the problem?

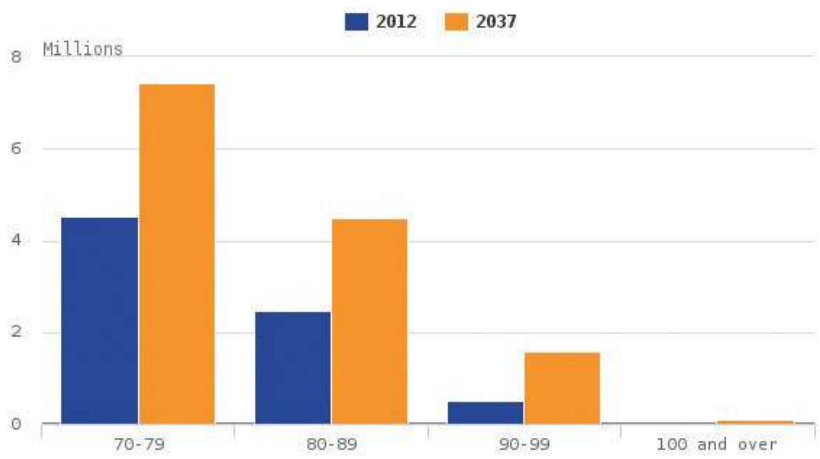
There are 11.6 million people aged over 65 living in the UK, equating to 18% of the population. The over 85s are the fastest growing age group, currently amounting to 1.5 million people.

While older people are in general healthier than ever before, the likelihood of both cognitive and physical disability inevitably increases with age. In 2016, Department for Work and Pensions (DWP) records indicate that 42% of adults over state pension age have a disability, and 67% of people aged 75 and over have a long-standing illness or disability.

Supported by the UK Government, there has been a continuous increase in the pervasiveness of Information and Communication Technology (ICT). UK households connecting to the Internet daily or almost daily reached 82% in 2016. The smartphone ownership of those aged 65+ has increased from 5% in 2012 to 18% in 2015, and would be 21% (or just over) in 2016 if the trend continues. The proportion of over 75s who have never used the Internet is declining. Lapsed and infrequent use of the Internet is still common, however. For example, nearly half of single over 65s have no Internet access, but this is expected to decline further.

Ageing is a major challenge to policy makers, technology designers and service providers. However, the heterogeneity of older people means that they cannot be considered as one entity.

Figure 1 UK 20 year projections for over 70yrs of age (ONS, 2016)



It would be a mistake to assume slowing down, forgetfulness, declining attention, resistance to new technology and change, or lack of fitness are characteristic of all older people. Indeed, these features can be present at all ages due to different rates of maturation and change among individuals. Therefore, the heterogeneity is likely to widen with age.

The evidence that the digital divide across all adults is a more important influence than ageing seems compelling. Low take-up of technology by older people with little previous experience of it requires help now and in the short-to-medium term future. Our evidence suggests that the over 85s may be particularly unlikely to engage with technology that supports mobility and assisted living. The situation will improve, as better connectivity and improved interfaces are developed or introduced. The evidence does point to a digital divide continuing to exist, albeit that its form and nature may change over the decades.

There is a strong view that getting it right for older people yields more positive experiences for younger people too – 'design for all'. But underpinning this is the need for technology to enable independence and control, rather than take control.

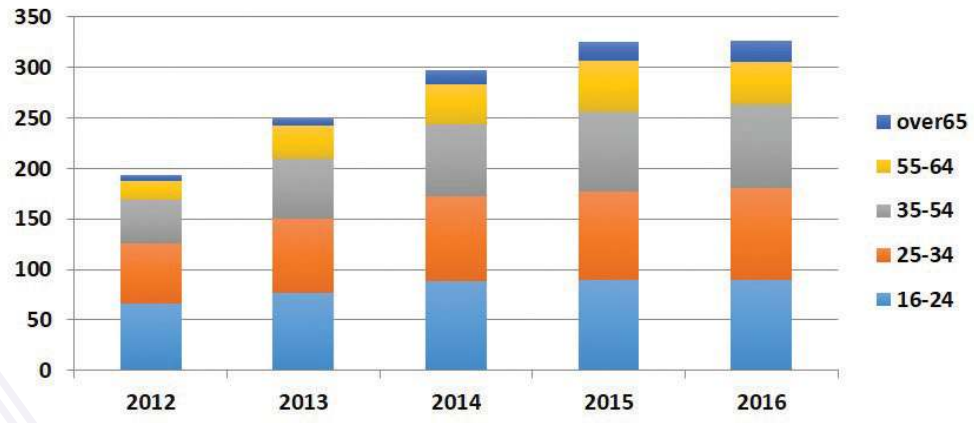


Figure 2 Smartphone ownership penetration in the UK in 2012-2016 by age (Ofcom, 2016b)

2. What are the key barriers to engaging with new and emerging technologies for older people?

We have identified three key barriers to technology engagement for older people:

- Features of technology design and ergonomics
- Cognitive and perceptual abilities
- Psychological issues

2.1 Features of technology design and ergonomics

There are many examples of what constitute 'good' and 'poor' features from an ergonomic perspective, and to this we can also add design principles and what research on technology acceptance is telling us.

Technology design issues emerging from the literature and interviews with older people included the following:

- **Poorly designed keypads.** A major problem that troubles older people particularly is that keypads of some digital devices are too small for accurate operation in terms of getting the correct letters or numbers.
- **Complex interfaces.** Complexity may introduce errors and slow people down. If the interface has jargon and unfamiliar symbols, as well as too many things from which to choose, this will put off anyone who may be lacking in confidence. Perceived ease of use as well as perceived usefulness are critical in technology acceptance.
- **Counter-intuitive or difficult navigation.** Today's older people were born and grew up in the analogue world where information was presented by a continuously variable physical quantity, such as a clock showing the time by means of a pointer rather than displayed digits. For a digital interface to be intuitive, the design proposition must address their familiarity and comfort. Features such as flashing and alternating pictures that make websites aesthetically pleasing (or annoying) are often at the cost of usability.
- **Over-functionality or 'design for design's sake'.** The evidence shows that on many products there is more functionality than most people ever need. All our interviewees considered this an issue and it also appears in the design literature.
- **Lack of support in relation to technical issues.** Our interviewees all complained about this. Most or all were dependent on a friend or relative to help set up functions or provide advice when they could not get the technology to work; without this support, many more older people would become lapsed users. In addition, for technologies purchased

for the long term, there is also a concern associated with 'upgrades', both to software and upon renewal.

- **Trust and belief.** If the technology does not meet the current needs of an older person, some will be sceptical as to whether it will meet any needs yet to be identified.

Tablets, including the iPad, were one of the most cited examples of 'good' technology. From both ergonomic and design perspectives, tablets and other 'good' designs have all or most of the following features:

- Natural and intuitive navigation and transaction, with a clear and consistent structure such that related items are together. No need for complex instruction;
- Simple to use for easy and common tasks, using plain language;
- Straightforward visualisation, or else the complexity is not at all evident;
- Embedded reversibility and tolerance principle, allowing easy corrections through undo and redo;
- Large keypad or touchpoints, thereby reducing the chance of making errors;
- Visible options without distraction;
- Built-in feedback available so the user is informed of actions or changes;
- Tolerating varied inputs and sequences;
- Maintaining consistency with purpose so the user does not have to rethink and remember.

Technology that follows these principles can encourage engagement as it offers independence, allows the user to understand what they are doing and the needs it will meet. It does not require any special expertise or skills and its navigation elements are clear. Evidence is pointing towards some new technologies being poorly designed and not meeting many of these criteria, thus making them distinctly unattractive to people who are more analogue-oriented. There are lessons here for all technology design.

2.2 Cognitive and perceptual abilities

Ageing can bring decline in cognitive abilities, including speed of processing information, working memory, attention switching, and decline in situation awareness, navigating skills, episodic and autobiographical memory.

It has been shown that, in general, when asked to do tasks, older people can complete them as accurately as younger people, but often more slowly. So, response speed is the barrier rather than completion or accuracy issues. Dementia brings particular challenges in the areas of cognition and perception. Age additionally affects field of vision, interference of new incoming information with existing information, and slows down operations. However, deterioration does not occur at a universal rate in adulthood. Older drivers who have recognised these changes often take counteractive measures to minimize the effects, such as avoiding unfamiliar routes, rush hour travel, and driving in the dark. However, little is known about behaviour changes in older adults travelling on other transport modes.

Ageing also brings some benefits, for example:

- **Habituated skills and sustained attention;**
- **Prior experience enabling better anticipation;**
- **Increased vocabulary and knowledge;**
- **Recognition and other crystallised abilities that rely on culture-related lifelong learning.**

An important issue is the plasticity of the brain, which enables the brain to change throughout life. This means that many older people may indeed be able to handle new technology if given sufficient support and guidance. It also means that problems in integrating travel information from multiple sources, switching between information channels and linking names to images can all be helped by better designed information sources and presentation. Further, supporting age-counteracted behaviours by better information about what the person's options are can improve travel-related activities.

2.3 Psychological Issues

Examples of psychological issues extracted from interviews and the literature include:

- **Resistance to change**
- **Fear of changing too fast**
- **Attitudes to new technology**
- **Expectations and meeting needs**
- **Fear of being left behind**
- **Fear of losing control**
- **Risk perception and security issues**
- **Trust and confidence issues**

Technology acceptance has been investigated for decades and shows several demographic differences by income level, race, education and age. Whilst perceived usefulness and ease of use are both prominent in determining acceptance and positive attitudes to technology, there are other issues that must be addressed if acceptance is to increase. These include the perceived helpfulness of the technology, attitudes such as trust, motivation and experiential needs being met and perceived self-efficacy or confidence. Some research on older people suggests they hold more positive than negative attitudes regarding the technology they do use. These attitudes could be built on by encouraging older people to try other technologies that are similar to those they currently use, are helpful and easy to use. In that sense, the social context and influence of peers is something that must also be considered. Whilst ICT is becoming increasingly indispensable for various functions important to people's daily lives, including shopping, trip and holiday planning, banking, playing games, personal care functions and social networking, many older people wish to maintain face-to-face contact and will probably reject any technology that reduces that possibility. It must also be noted that technology acceptance is not the same thing as technology savviness.

A 2016 OECD analysis of 33 developed countries (including European, North American, and Pacific Rim) revealed that some 65% of adults aged 16-65 are only able to complete low-complexity computer-related tasks involving few steps and operations, such as emails and a web browser; that proportion will be even higher for older adults aged over 65.

This means that in the future there will be a contingent of older adults who, whilst likely to possess smartphones and tablets, are not otherwise 'tech-savvy', and thus are less able to adapt to technology developments in years to come. Our interviews revealed that those who are well engaged with technology appear to have these things in common:

- **They are more open to change than the average;**
- **They come from a work or other background that might predispose them to technology, for example an engineering base (more tech-savvy);**
- **They have the confidence to try technology intuitively and/or use a manual;**
- **They are confident of potential mastery of the technology.**

Those who did not engage with technology, who could be described in the main as non-tech-savvy, could be characterised as (not in any order):

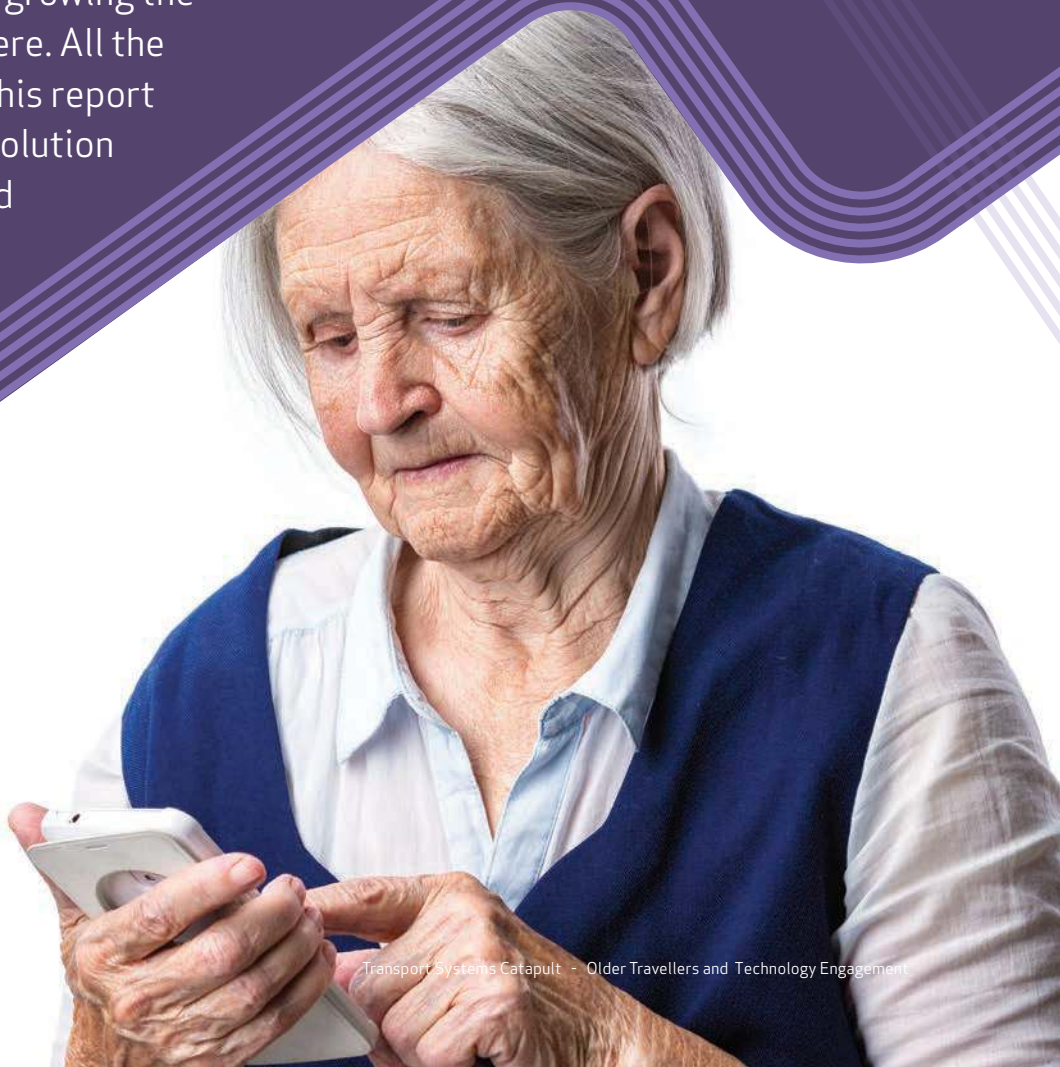
- **Being more resistant to change;**
- **Seeing no need for the technology in relation to their needs;**
- **Finding a lot of technology too complex or over-functional;**
- **Lacking in confidence to use technology;**
- **Lacking in trust in technology, in terms of it not working, being insecure, not doing what they want and costing money;**
- **Being worried that technology would take control from them or would be intrusive;**
- **Able to see a few potential uses but only once these were raised with them;**
- **Not wanting to be engaged with technology more than they already were. Some, for example, did not want to feel dependent on connectivity and did not think they were 'missing out'.**

Some of these reasons may be driving others. For example, someone who lacks confidence in using technology may appear resistant to change and find some of it too confusing.

Within our sample, age was not related to these characterisations. All valued face-to-face contact as a premium activity. Data privacy and security concerns have been

widely documented in the literature. Security was of concern to most of our interviewees. Older people often do not automatically recognise the potential value of technology in meeting their future needs and are concerned about the "unknown unknowns". This presents a direct explanation in some part of the failure to engage with new technology.

Being non-tech-savvy is a perceived state of the individual and may indeed be very resistant to change. However, older people can be encouraged to use more of the 'good' and 'easy' technology. That means starting with familiar things and growing the technology use from there. All the evidence gathered for this report is pointing to that as a solution for all travel-related and other new technology.



3. Why have some technologies successfully engaged older people?

Almost all of those interviewed had access to the internet at home via a desktop computer or laptop, and almost two thirds possessed a tablet.

From our interviews, the most-cited example of technology that supports transport was the Internet. Pre-trip planning was often made using the Internet. During journeys, people valued conventional system information, such as digital displays on board vehicles and at stations/stops, as well as traditional timetable information. The most-owned transport-related technology identified by our interviewees and from our previous study with older people is navigation technology (either standalone or mobile phone-based). This technology appears to be much-needed for both driving and walking (in unfamiliar areas or for unfamiliar routes). It can promote a more active lifestyle and encourage people to venture further. Hence, it encounters no resistance, despite requiring time to learn how to use it and perceiving the technology often lacking more intuitive features such as using landmarks for navigation cues. The commonly used technology we have observed from the literature and our previous research on smart ticketing technology is the concessionary bus pass. Here, the complexity of the technology is hidden from the users' point of view. To the pass holders, it is effortless to use, seamless on a national level and brings a clear financial benefit.

Touchscreens were cited as an accessible feature of technology. Unlike a keyboard, they facilitate the use of natural gestures, thereby bringing intuitiveness to the use of digital devices. Tablets and smartphones were described as simple, intuitive and easy to use. Indeed all 'good' technology possessed these attributes according to our interviewees and experts. Tablets are an interesting example of a successful technology in that they have a much larger screen than a smartphone, but remain portable, whilst allowing a range of the functions of a computer.

Examples of non-transport related technologies cited by our sample as well designed included a variety of

household appliances (e.g. digital TV, computer and camera) and personal wearable devices (e.g. fitness trackers such as 'Fitbit', digital jewellery and 'Buddi'). These technologies were viewed as delivering convenience, comfort and entertainment, allowing people to monitor personal health, reduce the number of visits to GPs and hospitals, and provide emergency responses. Healthcare wearables were valued by those we interviewed as making a positive difference to their quality of life. Whilst some of our interviewees stated that they did not use their smartphone for social media, playing games, online banking or shopping, they all have a mobile phone (of which 20 were smartphones) and considered 'Whatsapp' and 'Streetlife' (new name 'Nextdoor') useful, as well as apps for checking the weather/ news and points of interest.

Many of our interviewees did not understand the word 'apps' and chose not to use them. Although all smartphone owners among our interviewees had various apps on their phone, many were unaware of that. After we explained and pointed out those that were available, many said they would now consider using apps for, for example, booking taxis, providing live bus times and locating nearby bus stops.

To sum up, technologies welcomed by older people are:

- **Relevant and useful to daily life, meeting their needs at an individual level;**
- **Enhancing social interactions and local group activities;**
- **Supporting physical activities, independence and quality of life;**
- **Allowing control;**
- **Simple rather than complex or over-functional.**

They have features such as readily understood icons and visual displays and are able to be operated without a manual and feedback. There are fewer ways to make an error and errors are reversible. They contain simple clues to guide their use and do not require operations to be memorised. There are no codes or settings to worry about.

4. What specifically needs to change to enable greater numbers of older travellers to access technology?

The following would do much to promote older travellers' engagement with transport-related technology:

- Involving older people in the design process;
- Developing technologies that make journeys much easier for older people to negotiate; and
- Meeting individual needs for support

4.1 Involving older people in the design process

As the proportion of older people grows, there will be a concomitant increase in those people with functional decline. These people will have specific needs at a personal level.

People with mild dementia will have different needs to those with some physical incapacities. A better corpus of knowledge is required to help establish the design parameters of how technology can be bespoke and easily operationalised to meet user needs. For example, algorithms could be developed to take the user towards those functions they need and to direct them away from what they do not want, thus reducing a much-cited dis-benefit of technology, over-functionality. A particularly difficult issue for design is that solutions for one disability may present problems for another.

However, most technologies are not designed with older people in mind. It is clear from the literature review and interviews that designers would benefit from pursuing a user-centred 'participatory' approach for their design to be useful, usable and therefore attractive to this demographic. Engaging older people with new and emerging technologies is, therefore, fundamental to increasing technology engagement.

Inclusive, user-centred and participatory design is responsive to this challenge and can achieve flexibility and convenience, whilst being welcoming, realistic, and accommodating for all. Further, this approach has the additional benefit in designing services and products usable by those with the lowest technological skill level.

Inclusive design has several basic principles:

- **It is based on an explicit understanding of users, tasks and environments;**
- **Users are involved throughout the design and development stages;**
- **User-centred evaluation drives and refines the design (e.g. Kansei engineering); and**
- **The process is iterative, i.e. design-prototype-test-modify repeated.**

In addition, it should take account of Norman's (2013) main themes, these being:

- **Visibility** – the technology must show its functions to the user. If instruction is needed, then the designhas failed.
- **Conceptual models** – the designer's model of how the user perceives the operation of the device or technology. If there is none, we make up our own.
- **Mapping** – relationship between the controls and the resulting effects.
- **Feedback** – showing the effect of every action and ensuring the effect is immediately obvious.
- **Affordance** – appropriate actions, providing clues for how the technology is to operated, and defining how it will be used.
- **Constraints** – lead to inappropriate actions, difficult to use, choices constrained.

Involving a range of older people on an inclusive basis in the design of products and services will help ensure greater levels of engagement with the technology. This means designers having consultative teams of older people with mixed levels of tech-savviness to ascertain the types and depths of need. Prototypes can then be designed and tested with these users, adopting an iterative process until the needs of the older users are satisfied. In addition, particularly in terms of how the technology looks and feels to the user, a Kansei engineering approach may be appropriate to obtain responses. It should, however, be borne in mind that panels of older consumers will need to be regularly refreshed, as their involvement in the design process is likely to increase their confidence in using technology generally, thereby making them potentially unrepresentative.

4.2 Developing technologies that make journeys much easier for older people to negotiate

Evidence from both the interviews and the literature suggests that the transport system can present difficulties for older people. Technology has the potential to remove some of these barriers, thereby better enabling older people to undertake social/recreational activities, go shopping, volunteer, remain in employment etc.

Innovations that create a seamless, door-door experience could simplify the process of planning and making journeys, and potentially increase levels of independent mobility for older people. Indeed, 'Mobility as a Service' could be a game changer for older people, so long as technologies of this nature are designed to be inclusive of their needs.

Journey information that may be particularly beneficial to some older people includes:

- **Availability and location of parking**
- **Walking distances**
- **Physical accessibility features**
- **Availability and location of toilets, seating and refreshments**
- **Information on what to do in case of service disruption**
- **Real-time trip information**
- **Route mapping**
- **Availability and reliability of support**
- **Reliable multi-operator trip information.**

The availability of open data can assist developers in providing such information. It could also be helpful to crowd-source information from older travellers themselves (e.g. ratings and reviews of services, identified barriers or aids). Obtaining contributions from older people can help other older people when planning trips, as well as help service and operation providers, designers and developers to identify accessibility gaps, shortcomings and improvements.

4.3 Meet individual needs for support

So long as technology continues to develop, there will always be varying levels of tech-savviness. Changing attitudes as an entrée into changing behaviour might be possible but it will be slow and the changes may be small, and even change back again.

Learning to use technology is neither straightforward, intuitive nor pleasurable for many people. Helping older people to build confidence in using new technology that supports their mobility could increase its take-up, particularly amongst lapsed or infrequent users. Although some older people receive support from friends and relatives, those who do not could be in danger of becoming excluded.

Therefore, technology developers could usefully consider involving older people when designing help functions and marketing new and emerging technologies. In doing so, this would help to avoid jargon and alien terms, ensure ease of use and support the independent self-learning process. Support could usefully start from the base of 'good' technology i.e. devices/ features many people have or may be familiar with. These could be used as a platform/stepping stone for further new developments and apps.

One particular challenge is that some older people may not associate themselves with the technology on offer. This can be countered, at least in part, through more use of images of older people in promotional material.

5. Where is further research needed?

The literature review and interviews have revealed several areas where further research is required:

Feature of Technology

- Research and develop new learning methods to allow for self-pacing, taking account of memory issues, learning styles, experience, and skill level in older people.

- Research on how to present technology that focuses on memory support, allowing for reversibility of actions and containing sufficient appropriate reminders. Technical complexity should be disguised so that advanced functionality is a positive choice, not the default position.

Big Data and Algorithms

- Research on how older people's engagement with technology can be enhanced by, for example, the use of citizen data, and the impact of involving older people in participatory design from the early stage.

- Research on how big data will impact on social and demographic changes, and how travel behaviour and experience by older people will be affected by the use of big data.

- Develop algorithms and systems within new technology that allows users to easily control the display of information without being distracted by irrelevant or unneeded instructions or information. The engagement with new technologies must essentially

6. Summary and Recommendations

In summary, the number and proportion of those aged 65+ years is growing, and those aged 85+ present particular challenges for encouraging the use of technology to support mobility.

Those involved in developing technologies aimed at travellers are encouraged to take account of the needs of this expanding market. In doing so, it is recommended that developers take an inclusive design approach where possible. This involves working with older people throughout the iterative design process, including help functions, to ensure the resulting products/services meet their needs and are likely to be used by them. Older people vary greatly, and so efforts to include their needs and wants should embrace this heterogeneity. It is also worth noting that designing for older users is also likely to benefit younger travellers too.

There are a wide range of reasons why older people do, and do not, engage with some forms of technology. Technology that is simple to use, easy to make choices, provides clear value to the user and enables people to readily understand what they are doing are more likely to successfully engage older travellers. Technology that supports independent mobility but is not perceived to take away control is particularly likely to be welcomed by older travellers.
To increase the use of technology that supports this independence, it is recommended that developers make use of natural gestures and features familiar to older people and involve them in the design and development process.

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