Digital technology competence and experience in the UK population: who can do what

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ABSTRACT

Digital interface designers often assume that users will have a certain level of digital interface competence, but this is often not the case. In a previous study in 2010, we showed that frequency of technology use and perceptions of ease of use decline with age, across a range of products. This paper updates and expands this work, presenting results from a survey in 2019 of 338 adults across England and Wales. The survey examined the frequency of use of digital devices and the execution of common computing tasks. In addition, it directly assessed users' ability to use some common technology symbols and interface patterns using simplified paper prototype testing. The results indicate that technology experience and competence decline with age, and many aspects also decline with decreasing social grade. However, there is no correlation with gender. We identify particular demographic groups with very low levels of digital competence, of which designers should be aware.

KEYWORDS

Technology experience, technology expertise, ageing, digital inclusion, inclusive design

Introduction

Interface designers often assume that the users they design for will have a certain level of digital interface competence (Bradley et al, 2016). This can lead to interfaces that are difficult for some people to use. For example, designers might use a symbol without any text description because they assume that users will know what it means (Bradley et al, 2011). Designers also often assume knowledge of digital interface patterns, such as how to operate a drop-down menu, pull up a hidden part of the screen or activate an on-screen keyboard. Users without knowledge of these symbols and patterns are likely to struggle when they appear in an interface with neither explanation nor alternative methods of interaction.

Some designers may assume that this situation is fine because users can 'learn through discovery', i.e. through trial and error. However, some users (particularly older users) are unwilling to engage in such behaviour for fear of making errors from which they cannot recover (Hawthorn, 2007). Furthermore, Murad et al (2012) found that older adults are less likely to be able to recover from an interaction error, such as those occurring in trial and error behaviour. They may lack the capability to work out how to return to the previous screen or amend their input. The situation is further affected by the increase in difficulty in learning computer skills as people age. In fact, Hawthorn (2000) showed that, for some older adults, their retention of new computer knowledge from one week to another was so low that it was equivalent to starting afresh each time.

This issue is increasingly important as many services now involve using digital interfaces. These include many government information, banking, shopping and healthcare services. As a result,

people who struggle to use digital technologies are increasingly likely to be excluded from many aspects of participation in society.

The impact of technology experience and basic technology competence on using an interface has been investigated in several studies. For example, Sengpiel and Dittberner (2008) found that knowledge of common computer symbols and terms predicted performance amongst older adults. Similarly, Hurtienne et al (2013) found that measures of basic technology competence, including symbol recognition, predicted usability on an unfamiliar interface. Other studies have shown that prior experience with similar technologies also affects performance (e.g. Blackler et al, 2010). Taking the prior experience and competence of users into consideration could therefore result in more usable interfaces. To do this effectively, it is important to know what levels of technology knowledge and competence target users actually have.

Previous studies have shown that technology experience varies demographically, particularly by age (e.g. Czaja et al, 2006). In particular, a previous survey that we conducted in 2010 (Tenneti et al, 2013) found that both frequency of technology use and ease of use declined with age, across a range of products. This is backed up by recent large-scale surveys of computer and internet use among the general population (e.g. Office for National Statistics, 2017), although these also show that the numbers of older people who do use computers is increasing. However, these studies tend to look only at top-level measures such as the frequency of internet use and not at details of actual competence with digital technology.

In this paper, we report on a new survey in 2019 of 338 adults across England and Wales. The survey examined several aspects that affect someone's ability to use an interface, including technology prior experience and competence.

Method

The data in this paper comes from a survey of 338 people aged 16 and over in England and Wales. The survey was developed by the authors and conducted by Cambridge Market Research, an independent market research company. Participants completed a 20-minute questionnaire with an interviewer using a CAPI (computer-assisted personal interviewing) system. Ethical approval was obtained from the University of Cambridge Engineering Department ethics committee.

Sample

Quota sampling was used to balance the sample so that it matched UK census 2011 data for gender, age, social grade and education. Social grade was classified using the National Readership Survey (undated) classification. A quota was also set on technology use based on data from Ofcom (2018) and Pew Research Centre (2017). This quota concerned the proportions of people who own and use a mobile technology device to access the internet more than once a week.

Participants were recruited in two ways. The main body of participants (328 of the 338 participants) were recruited on-street using a screening questionnaire to select participants to match the quotas. These participants were given a £10 voucher to thank them for their participation.

On-street recruitment under-samples people who do not leave the house frequently. Therefore, an additional ten interviews were conducted with participants who reported that they left the house once a week or less. These people were recruited through a third-party recruitment agency and interviewed in their own homes. They received £20 in cash for taking part.

The resultant sample matched the quotas closely for gender, age, social grade and technology use. The sample was 50.9% female, 49.1% male and 0% other. The age distribution was: 16-24 (15.1%),

25-34 (15.7%), 35-44 (14.8%), 45-54 (16.9%), 55-64 (13.6%), 65+ (23.7%). 25.4% was in social grades AB, 35.2% in grade C1, 16.3% in grade C2 and 23.1% in grades DE.

The sample was a little low on those with no education (15.7%). Therefore, the results throughout this paper have been weighted to match the levels reported in the UK 2011 census in three main groups: no educational qualifications, levels 1-3/apprenticeship, and level 4 and above.

Questionnaire

The questionnaire contained questions on technology access and use, technology activities, attitudes towards technology, recognition of technology symbols, technology competence, sensory, motor and cognitive capabilities and demographics. This paper focuses on a subset of the questions.

Questions on technology experience were adapted from those in Office for National Statistics (2017) to enable comparison with national figures over time. Questions were added to ask about mobile phone, smartphone and tablet use. Participants were asked about the frequency with which they used various technologies.

Participants were then asked whether they had carried out various technology activities (listed in Figure 4) in the last 3 months. These questions and activities were adapted from those in Office for National Statistics (2017). Some activities were added to investigate topics of particular interest.

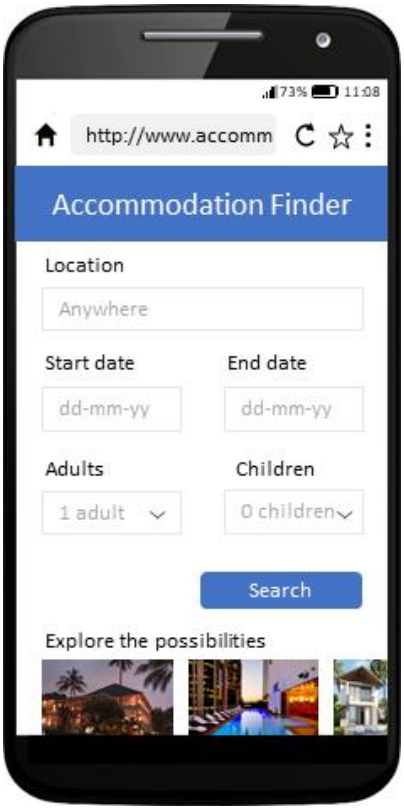

Figure 1: Example of one of the interfaces used in the digital competence tests

Digital technology competence was assessed using paper prototypes. Participants were shown pictures of smartphone interfaces, such as the one in Figure 1. They were asked what they would do to achieve a particular goal, such as setting the webpage in Figure 1 to be a bookmark or favourite. In some cases, achieving a goal might require several actions on the interface. Participants were asked to indicate just the first action they would do, by pointing to the appropriate place on the picture. The interviewer coded each response as one of a set of predetermined options such as: tapped on star symbol, tapped on menu icon, or said “I don’t know”. These pre-determined options

were used to increase consistency in recording. This method was adopted because full training of individual interviewers to conduct pencil-and-paper prototyping was not possible. In addition, this method helped to keep the length and cost of interviews down, enabling a larger sample size.

The questions examined common digital interface symbols and patterns, particularly on smartphones. The topics covered were: search, changing settings, creating a new event, opening a menu with more options, going back to a previous screen, activating a drop-down menu, activating an on-screen keyboard and setting favourites. As a result, the tests examined a fairly basic level of digital competence.

Results and Analysis

Frequency of technology use

The survey examined how often participants used various kinds of technology. It found that 68.7% of participants reported daily internet use, 58.9% daily internet use on a smartphone, 56.3% daily computer use and 71.2% daily smartphone use. Participants tended to use tablets less frequently with only 25.1% using them daily, although 44.3% used them at least once a week. 6.9% reported never using any kind of mobile phone and an additional 0.8% said that they did not know.

Figure 2 shows how this technology use varies by age. To enable ease of comparison across technologies and age groups, the graph only shows the prevalence of daily technology use. The correlations between key demographic variables and the frequency of technology use are shown in Table 1 (on the following page). Frequency of technology use declined with age for all the technologies. It declined with decreasing social grade for internet and computer use only, and the effect was smaller than with age. Gender was not correlated with the use of any of the technologies.

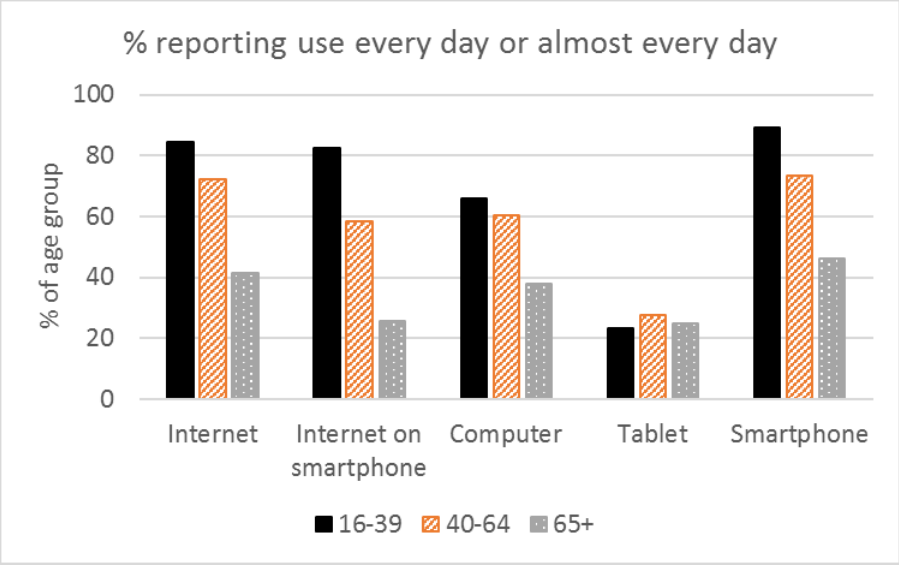

Figure 2: Daily use of various technologies by age group

Technology activities

Figure 3 (on the following page) shows the percentage of each age group that had carried out various technology activities in the previous 3 months. All of the activities were reported by at least 42.3% of the sample. Internet search and e-mail were the most common activities with 74.8% and 73.2% respectively. The total number of activities declined with increasing age (r_s = -0.456, $p<0.001$) and decreasing social grade (r_s = -0.239, $p<0.001$) but was not correlated with gender.

Table 1: Correlations of demographic variables with frequency of technology use. Starred values are significant at p<0.01. Age and social grade tests were 1-tailed and gender tests were 2-tailed. Note that there is a significant correlation between tablet use and age, even though this is not apparent in Figure 2, because this takes the whole range of frequencies of use into account. (Some of the figures in this table have been corrected from the previously published version of this paper)

	Internet	Internet on smartphone	Computer	Tablet	Smartphone
Age	$r_s = 0.420$*	$r_s = 0.541$*	$r_s = 0.311$*	$r_s = 0.200$*	$r_s = 0.434$*
Gender	$r_s = 0.005$	$r_s = 0.027$	$r_s = 0.100$	$r_s = -0.042$	$r_s = -0.008$
Social grade	$r_s = 0.128$*	$r_s = 0.102$	$r_s = 0.257$*	$r_s = 0.094$	$r_s = 0.141$

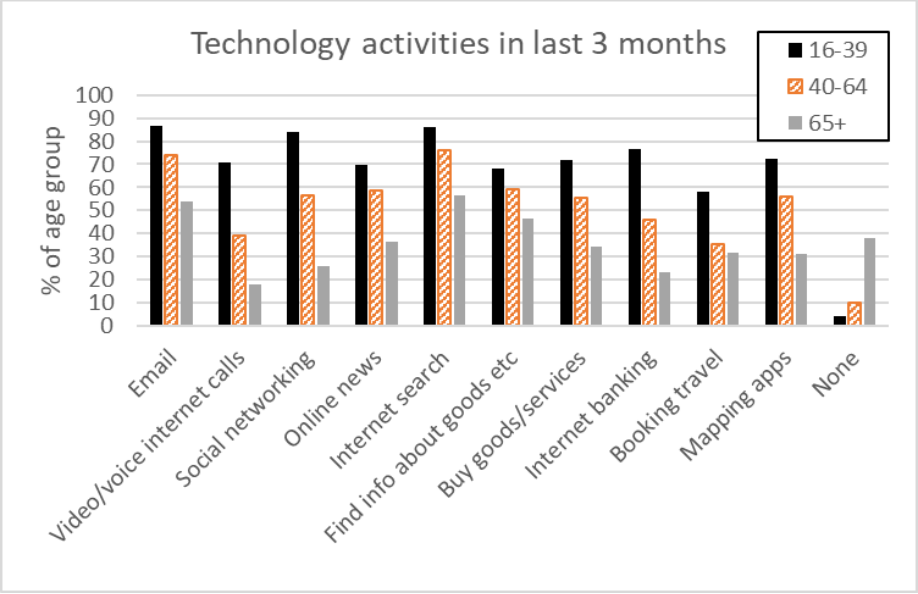

Figure 3: Technology activities in the previous 3 months (This graph has been corrected from the previously published version of this paper)

Digital competence

Participants' responses to the digital competence tests were coded into correct and incorrect, with "I don't know" coded as incorrect. The total number of correct responses (out of a maximum of eight) was used as an overall indicator of digital competence. The results are shown in Figure 6.

As explained above, the tests examined a fairly basic level of digital competence. We estimate that people with fewer than half of the tests correct (i.e. a score of less than four) are likely to struggle with many modern digital interfaces, particularly on smartphones and tablets. Those with more than two incorrect responses (i.e. a score of less than six) are still likely to have some difficulties. One or two incorrect answers are to be expected in a pencil and paper test due to fidelity and feedback factors. Therefore, a score of six and above indicates a fairly good degree of basic digital competence. Note that this does not mean that they will definitely be able to use an interface; it is just a measure of basic competence.

There is a marked difference in the responses from different age groups: more than three quarters (75.9%) of 16-39 year olds got at least six tests correct, while only 18.8% of those aged 65+ did. In fact, over half (54.2%) of the 65+ group got fewer than half of the tests correct, and 27.1% did not get *any* correct. Levels of digital competence declined even further with increasing age. Among those aged 75+, nearly half (45.2%) did not get any of the tests correct and 71.0% got fewer than

half correct. Performance was particularly poor on activating an on-screen keyboard on a touchscreen device, setting favourites and changing settings.

The total number of digital competence tests performed correctly declined with increasing age (r_s = -0.553, $p<0.001$) and decreasing social grade (r_s =-0.250, $p<0.001$), but was not correlated with gender.

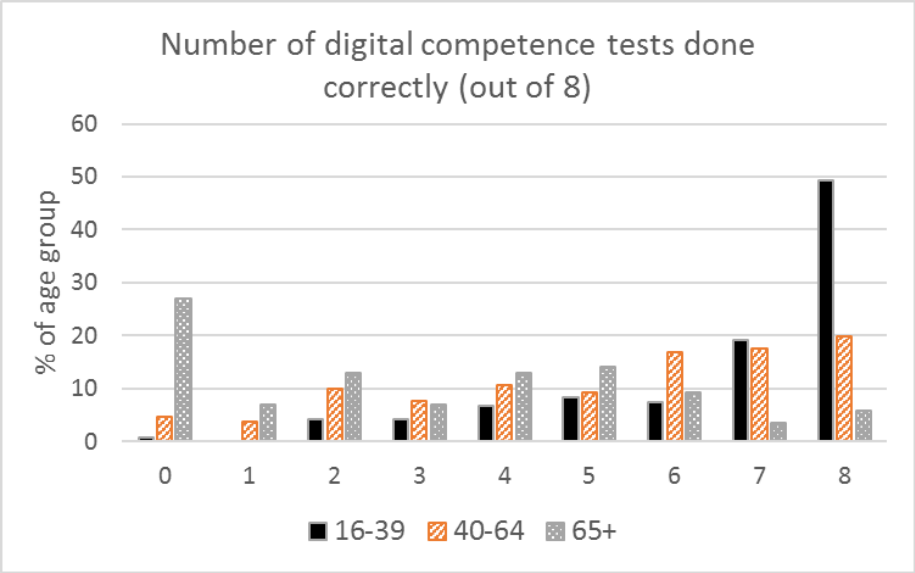

Figure 6: Number of digital competence tests done correctly by age group

Groups with very low digital competence

There was no effect of gender on digital competence. Therefore, the following analysis focuses on age and social grade. In it, social grades have been combined to create large enough groups for analysis. As a rough approximation, social grades A, B and C1 indicate middle class, and C2 (skilled manual workers), D and E indicate working class (Wikipedia contributors, 2019).

Table 2 shows the mean number of interface tests done correctly for each group. A group was coded as having Very Low digital competence if this mean was significantly below four, and Low if it was significantly below six (see previous section for an explanation of these thresholds). Otherwise, it was coded as Fair. Significance was tested using one-sample Wilcoxon T one-tailed tests ($p<0.01$).

Table 2: The mean number of interface tests done correctly for each demographic group.

	16-39	40-64	65+
Social grades A, B and C1	6.91 (n=74) Fair competence	6.10 (n=63) Fair competence	3.47 (n=63) Low competence
Social grades C2, D and E	6.15 (n=46) Fair competence	4.32 (n=69) Low competence	1.78 (n=22) Very Low competence

Discussion

The results from this survey agree with previous surveys (e.g. Czaja et al, 2006; Tenneti et al, 2013; Office for National Statistics, 2017) on the decline of technology experience and competence with age. This survey adds to previous work by examining basic digital technology competence and identifying groups with very low levels of this competence. These people struggled with interface

symbols and patterns that are commonly used in smartphones and other touchscreen devices. They are therefore likely to have significant problems with many (if not most) smartphone interfaces in practice, as well as many other types of digital interfaces.

The survey identified extremely low levels of digital competence in older groups: more than a quarter of the 65+ age group and nearly half of those aged 75+ did not get *any* of the digital competence tests correct. Furthermore, over half of those aged 65+ and 71% of those aged 75+ got fewer than half of the tests correct, which also indicates a very low level of digital competence.

Levels of digital technology competence also declined with decreasing social grade. Overall the group aged 40-64 in social grades C2DE had a Low level of digital competence, and the group aged 65+ in these social grades had a Very Low level of digital competence.

Therefore, we recommend that designers should take special care if they are targeting demographics that include people aged 65+ in any social grades. If their target demographic includes social grades C2DE, then care should be taken if it includes people over the age of 40. These are not just unusual edge cases, but key parts of mainstream populations.

This applies not just to smartphone interfaces but also to other digital interfaces that use similar interface symbols and patterns. Increasing digitalisation of interactions means that this includes a whole range of interfaces such as check-in terminals for doctors' waiting rooms, elevator controls, ticket machines, domestic applications and in-car interfaces.

Designers wishing to create a ‘digitally inclusive’ interface should avoid the use of interaction patterns that have no real-world analogue equivalents. If using them is unavoidable, then we encourage designers to provide clear explanation and guidance on how to use them, e.g. by providing text labels on symbols or step-by-step guidance through a new interface pattern.

Conclusions and further work

The results from this survey indicate that both technology experience and basic digital competence decline with increasing age and decreasing social grade. There are sizeable numbers of people with very low levels of digital competence, particularly in older age groups and lower social grades. They are likely to struggle with common interface patterns and symbols, and thus with the use of smartphone interfaces and other touchscreen and digital devices. We recommend that designers avoid the use of interaction patterns that have no real-world analogue equivalents. If using them is unavoidable, then we encourage designers to provide clear guidance on how to use them.

Further work is planned to compare results from the digital competence tests in the survey with performance on more complex interfaces, such as a doctors' check-in terminal, a bespoke health monitoring device, and a navigation app on a smartphone.

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