Exploring Summative Depictions of Older User Experiences Learning and Adopting New Technologies

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Abstract. Older users with limited technology prior experience represent an important user group, in part due to their increase in the population in developed countries. The authorship team collectively have decades of research experience as well as significant industrial experience as part of knowledge transfer, conducting user trials and designing for this user group. It can be difficult to effectively communicate the depth of difficulties that older users can experience with new technologies and new technology interfaces, particularly to clients in technology sectors. Technology adoption models explain the factors that are at play in the likelihood of a user adopting and persisting with a particular type of technology, however they do not depict the temporal aspect of this journey. In previous work the user journey experience was simplified to aid comprehension from a design opportunity perspective and elapsed time. From some initial positive feedback from knowledge transfer clients with this simplified learning diagram, this paper proposes a series of depictions using this as a basis for communicating more specific and nuanced older user experiences to corporate stakeholders, principally designers and engineers.

Keywords: Inclusive design · Exclusion audit · Older user · Usability · HMI · User experience · Interface design · Interaction design

1 Background and Motivation

The authorship team and the Engineering Design Centre have researched and carried out user trials with older users both in academia [1–13], and in industry, many of which are not published for intellectual property and competitive commercial reasons, for over 25 years each as well as developing understanding [14], tools and resources such as the inclusive design toolkit [15], the third age suit [16] and resources to enable designers and engineers to better understand how to design for ageing. From our experiences and other researchers' work, making errors in unfamiliar digital interfaces for low technology experienced older adults is more likely [12], as a trial and error approach is more prevalent [17] and potentially highly problematic [2], partly due to limited prior technology experience [9, 18, 19] and partly due to age-related reliance on their crystallised intelligence [20]. These effects lead to exclusion from technology [5], lower adoption rates of technology [19], and digital exclusion [21].

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More recently the team's work has been focussed on knowledge transfer with clients in a broad range of sectors including automotive, medical, healthcare, construction machinery, telecommunications, domestic appliance, design consultancy and FMCG segments. Frequently, the challenge is to distil the diversity and potential severity of user experiences that older people are likely to have with a new service, product or interaction into an easily digestible model or framework that can be understood. Other sophisticated inclusive models for product interaction have been developed such as by Mieczakowski [22] which have demonstrated the need and usefulness of tools to assist designers in examining the detailed interactions between user and product. However, in our experiences the prior step is to communicate effectively the gulf of user experience between the designer's beliefs and expectations, and that experienced by low technology experienced older adults. We have found this can be particularly challenging in the domain of digital interfaces (ones where the interactions to be performed by the users, predominantly exist only in the digital world), and hence often where the stakeholders can be highly technical themselves. This is frequently where the 'system image' is complex, the 'designer's mental model' is sophisticated, and the 'user's mental model' is simple and often very different from those of either the reality of the 'system image' or the 'designer's mental model' (see Fig. 1).

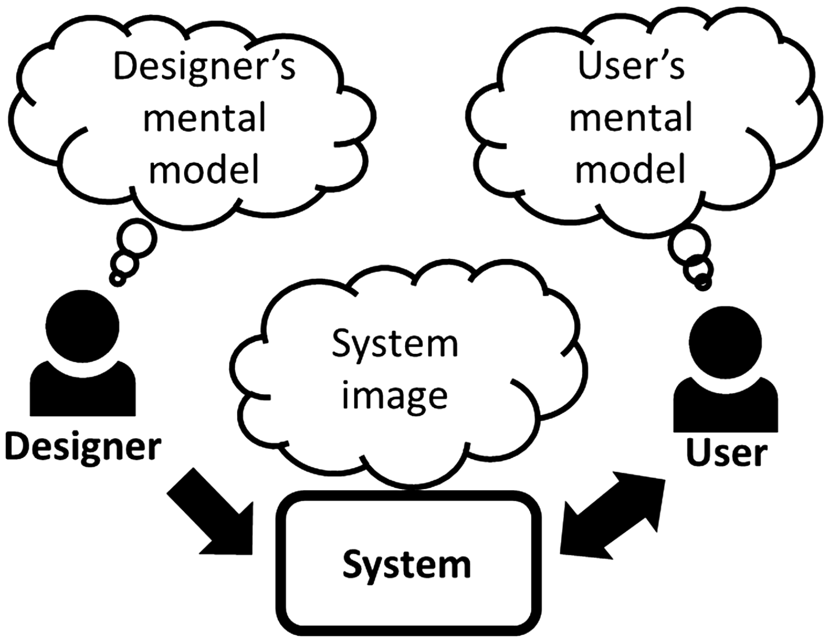

Fig. 1. System image compared with Users' (mental) model and the Designer's (mental) model adapted from 'The design of everyday things' [23]

2 The Need to Communicate User Journey Experiences to Designers

Where there is a large difference between the designer's and user's model it is important to convey to the designer the scale of issues that a user may face. Our experience is that in the commercial environment time is tight, and designers need answers, so a detailed academic explanation tends to fall on deaf ears. What is required is something that creates a meaningful change in the designers' perspectives in order that they evaluate and consider the needs of novice and older users. This needs to be "packaged" in a way that is:

- Quick to deliver
- High impact on the designer
- Memorable
- Informs decisions made in the design process

2.1 Computers and Digital Technology Interface Design

The 'digital interface divide' can be considered to have been created by the rapid development of new interaction mechanisms for users to control technology devices, This in combination with an ageing population has created user groups polarised in digital ability from those considered to be 'digital natives' and at the other extreme 'digital immigrants' [24].

The process that causes interfaces to become more complex over time, is well understood [25]. The current users of a technology or interface become more expert and start to request enhanced functionality and more sophistication to meet their particular and evolving needs. The developer or interface designer is under pressure from product managers to make the product more 'saleable' and is encouraged to add the features that the current customers are requesting. If this process goes unchecked, the product will suffer from 'feature creep' (or 'featuritis'), and software bloat as well as sporting a progressively more complex user interface. The needs of the novices who would have to learn to use the interface from scratch, are not normally taken significantly into account in this iterative product 'improvement' process. This sophistication of current computer interfaces led a participant in one user trial to conclude that despite her having mastered using one of the first Apple Macintosh computers in the UK, she would be unable to use a modern Macintosh now 'because it's too complicated'.

2.2 Causes of Detailed Interaction Difficulties

In 2001 Docampo Rama [26] examined the predominant interaction styles for household technologies from the early twentieth century. She proposed that people are most receptive to learning new interaction styles in their early adulthood, and that those will be the ones in which they have the most proficiency. Interaction styles learned later in life are therefore potentially more cognitively demanding to become familiar with. Age reduces our fluid intelligence, and instead we rely more on crystallised intelligence, so the acquisition of new interface skills gets more difficult [20].

A population survey carried out in the UK in 2010, showed how age was inversely correlated with digital technology prior experience, and that age was inversely correlated to success with a paper prototype menu selection task with two types of then conventional interaction patterns [3].

2.3 Why Focus on the Older Novice Technology User?

Cognitive decline is a recognised facet of ageing for most people [27], so in an ageing society, the older novice user of digital technology remains a challenging user interaction case. As Hanson [28] observed, this group has the most difficult time learning new skills due to the age related changes, and currently have the least prior experience with interfaces of this type, so are the most demanding (potential) user group. The lessons learned understanding these behaviours and how to design for this group, are likely to be applicable to future technological interactions, which may render the current crop of younger tech-savvy users much closer to novice status than they would probably like to believe. The mantra being, that designing correctly for this group certainly guarantees that all other able bodied users can use the product, although arguably not necessarily in the way that may be the most efficient for them.

2.4 Technology Adoption Models (TAMs)

The Unified Theory of Acceptance and Use of Technology (UTAUT) [29] sought to synthesise several older theoretical models of acceptance, and is based on the theory of planned behaviour [30]. This states that a behaviour, for example using a technology, is preceded by a behavioural intention, which is determined by attitudes, norms and the perception of control over the behaviour.

Four components predict the behavioural intention. The first, ‘performance expectancy’, relates to the perception the potential user has about the utility of the system, how it can help them in what they want to achieve by using that system. ‘Effort expectancy’ refers to the effort the user has to make in order to be able to use that system. ‘Social influence’ relates to the user’s perception of what significant others would think if they started using the system. The ‘facilitating conditions’ determine whether it is possible to show the actual behaviour. Gender, age, experience, and voluntariness of use affect the four key constructs on usage intention and behaviour.

Other researchers have sought to extend the Technology Acceptance Models (TAMs) for older people, referred to as Senior Technology Acceptance Models [31], which attempt to take into account the particular distinguishing characteristics that determine older user technology adoption. One such model focussing on ease of learning is shown in Fig. 2.

A weakness of such models is the lack of a temporal dimension. Users’ experiences and potential rejection of a product are not easily represented. UX designers by definition are designing an “experience” and as such, this experience occurs over time.

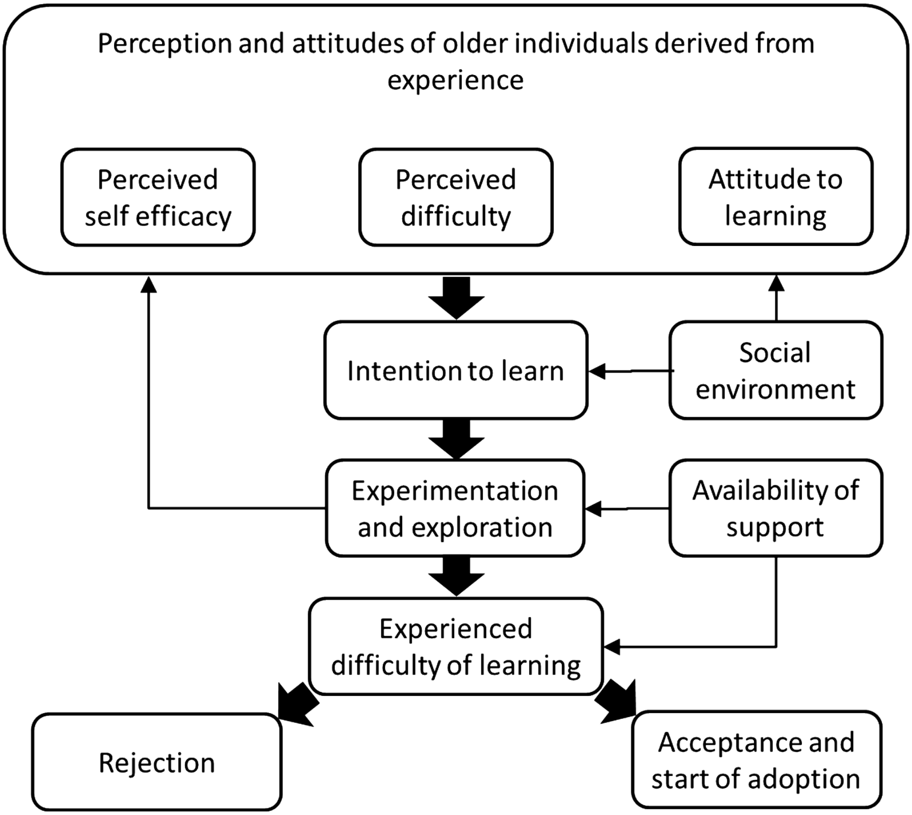

Fig. 2. Users perspective of model of technology acceptance or rejection from an ease-of-learning perspective adapted from [1]

2.5 Depiction of User Experiences

As described earlier, our studies [2, 3, 12, 19, 32, 33] and those from other researchers [9, 34] have found that older people with low technology prior experience (typically the 'digitally excluded' - see [21]) can have an extremely poor user experience using new technologies and new interfaces. To summarise this initial experience, which predominantly includes the learning phase of using something, we developed a simplified graph to depict this (see Fig. 3). It shows a simplification of how a novice user might perceive the journey of learning how to use a technology, taking into account the magnitude of the perceived difficulty of learning and then the opportunity of how much easier the particular task might be once they have acquired the necessary skills. It is proposed that a technological interface that allowed an older user to follow the 'Ideal' curve, i.e. without needing to learn anything new, would be highly beneficial for older users, and others with low technology prior experience promoting adoption amongst these groups. Further, we propose that this is a realistic goal for products and services that desire to be inclusive, and that this can be achieved through an understanding of interface design which takes into account the learning needs and abilities of older novice and digitally excluded potential users.

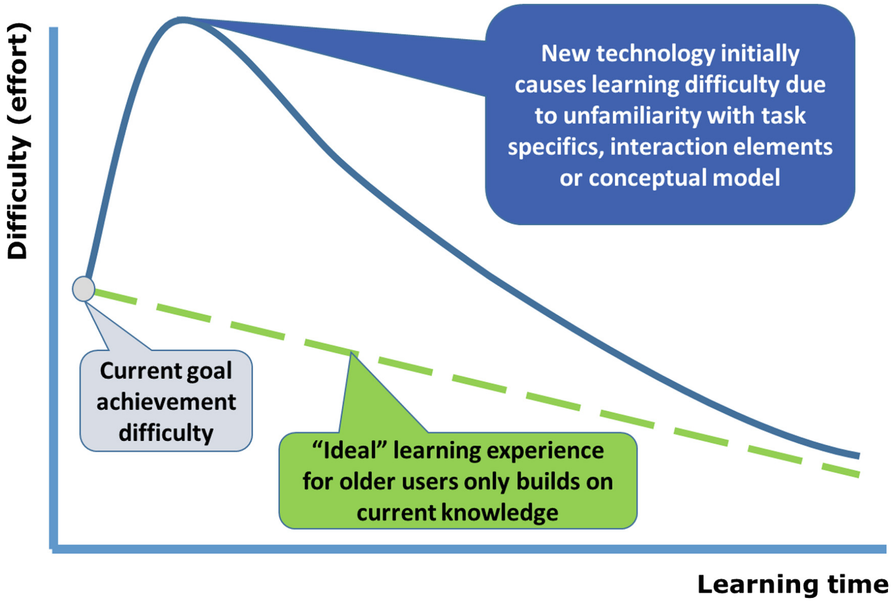

Fig. 3. The novice digital technology user learning experience – task difficulty vs. learning time heavily adapted from [1]

This model can be extended to other user scenarios to take into account the varying timescales, and other experiences. Figure 4 shows how for some users the user experience never reaches the level that they enjoyed when carrying out the task in their original way. This is likely to happen with more complex interfaces, when attempting to migrate from a well understood and practiced way of doing something, such as from a familiar basic pushbutton mobile phone to a smartphone.

Figure 5 shows how a technologically induced, or user error induced problem occurring can seriously derail the user experience for someone with low technology prior experience, for example if their mobile phone needs a reboot to operate correctly, but they do not know that this is required, nor how to achieve it.

Figure 6 shows how a subsequent error state is unresolvable by the user, and so either they abandon the technology as they are unable to use it, and/or they decide it is not worth the effort to get help to fix it. A typical example of this may be someone trying to learn to use a PC to send emails, finding the update process too complicated and giving up.

The current Inclusive Design Toolkit [15] takes into account vision, hearing, reach, dexterity and mobility adequately, but does not have cognitive (thinking) scales well matched to the demands of technological interfaces. The desire was to be able to communicate the aggregated experiences that these older users have when faced with a

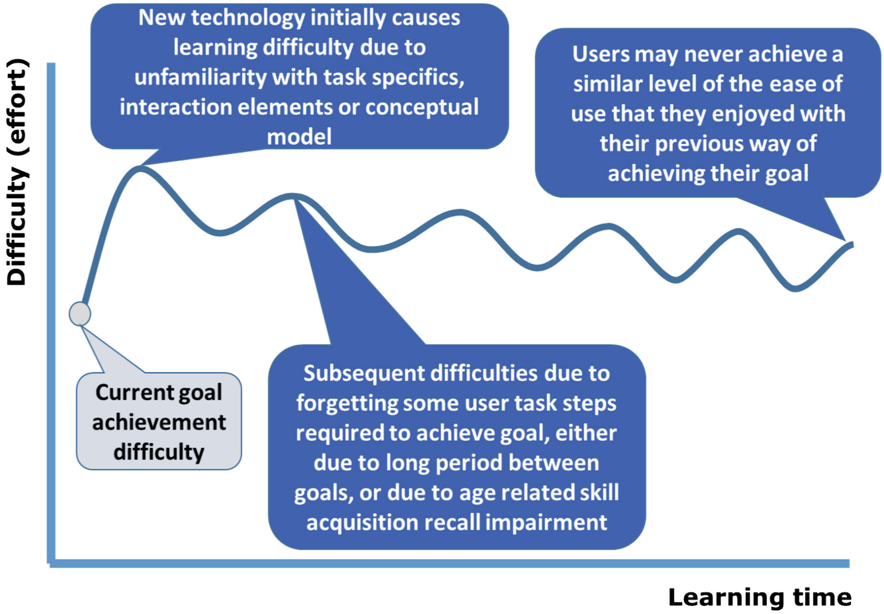

Fig. 4. User experience never reaches that for the previous level due to learning difficulties, or long duration between carrying out tasks to achieve the goal.

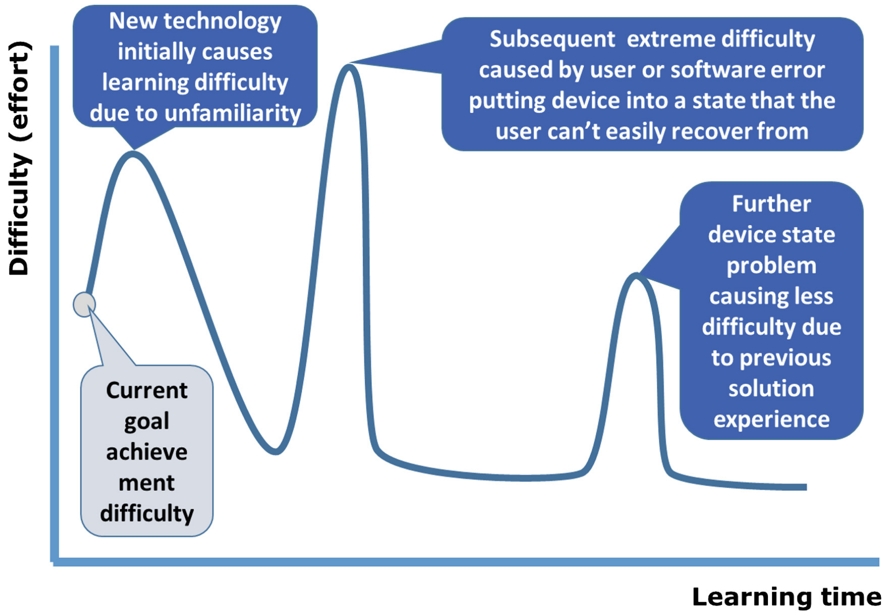

Fig. 5. User difficulty experienced dramatically changes over time either due to system or user error putting device into a state from which it is hard for low technology user to recover from. A repeated event becomes less problematic due to experience learned from the first one.

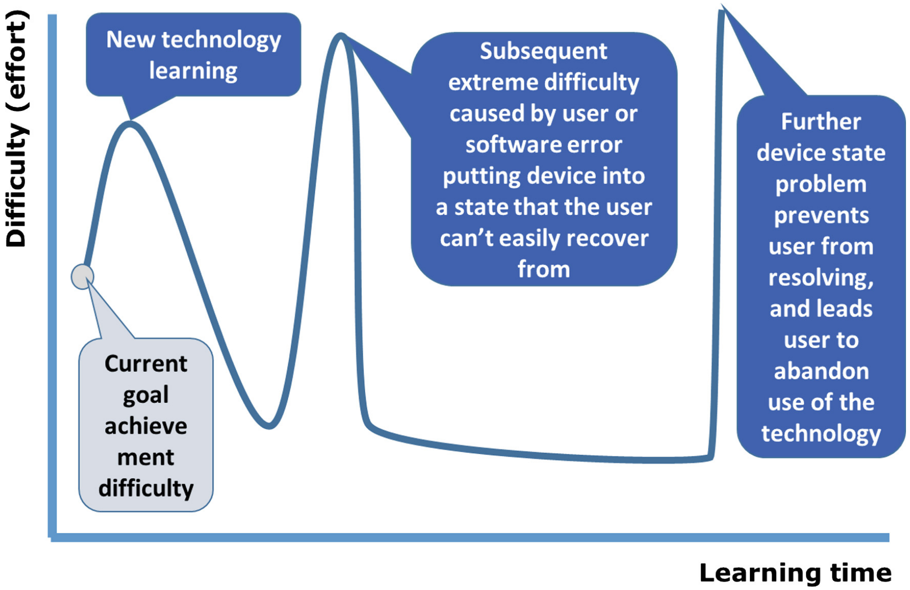

Fig. 6. User experience through difficulties resolving and attempting to resolve error states, leading user to abandon use of technology.

new technology or a new interface for a familiar technology. This is comparable to NASA TLX i.e. global versus sub-scales. This is a global judgement and in this case it is conveying a concept rather than a specific representation of a particular characteristic or product. The use is in then breaking the user journey down into steps and ensure that the "learning hump" is minimised without impacting other stages in the journey.

These models could be evaluated by setting a user interface evaluation task with two groups of designers where one group is introduced to the learning experience models and the other is not. The impact could be measured by looking at the quality and number of usability problems identified.

3 Conclusion

Entity relationship Technology Adoption Models can be enhanced by the use of temporal depictions of a users' experiences over time. This paper outlines a number of extensions to the temporal TAM that aim to deepen the designers' understanding of the user experience over different periods of time and scenarios. Such depictions are useful for communicating with product stakeholders the importance of considering the user journey for this often overlooked group, and how this may vary and lead to the rejection of products. This can have an impact from initial purchase, through the usage lifecycle, to the purchase of a replacement product. This paper extends this model by depicting different adoption profiles showing how the user journey can vary and potential pitfalls that a user interface design needs to take into account.

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