ACHIEVING ACCESSIBILITY THROUGH PERSONALISATION

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ABSTRACT

Accessibility is a goal towards which all public technology should aim. That is, to create technology which is usable by all people, regardless of their abilities. Achievement of this goal is limited by what is possible with current technology, what is commercially viable, and what is understood about matching technology to individuals, particularly of people with disabilities which can create barriers to Automated Teller Machine (ATM) access. This paper presents findings of our initial studies on the accessibility of ATMs.

Keywords
accessibility, disability, personalisation.

1. INTRODUCTION

A truly universally accessible ATM is one designed specifically for each user, personalised to individual needs and preferences. It would recognise users as they approach and automatically adapt its input and output mechanisms, and services offered to suit each user and the current environment. It would adapt its content, style and rate of presentation to maximise the user’s efficiency and satisfaction. It would also change appropriately as the user’s requirements changed. Clearly we have not yet achieved this goal and there are still many questions to answer in the pursuit of this objective. Accessibility has many definitions ranging from the previous utopian scenario to a more practical goal.

“A focus on designing products so that they are usable by the widest range of people operating in the widest range of situations as is commercially viable” [15].

Using an ATM can be prone to many different access problems. What seems like a simple task can be demanding. Even the basic cash withdrawal transaction requires the user to remember, see, reach, be dexterous, and have fine motor control. Accessibility does not simply refer to disabled access. Although disability results in some of the user needs addressed under this banner, it is not the only consideration. Some needs are permanent in the case of a life-long disability, such as blindness or deafness. Other needs are more short term or transient, perhaps due to an accident, the progression of a disease or simply the normal aging process. In other instances, the environment can disable a usually able-bodied person. For example sunlight on the screen may cause symptoms similar to a visual impairment or extreme cold may cause problems similar to a mobility impairment.

Commercial interest in accessibility is not completely altruistic. Companies are now forced to abide by emerging legislation and standards. Recent laws have mandated that some products be made more accessible for people with disabilities. There are worldwide standards for ATMs to adhere to, including America [1], Canada[2}, and UK [3,4].

In addition to the government and standards boards, the rapid increase in the number of individuals who are “older” is providing “market pull” for more accessible products. There are also many guidelines created by advocates for disabled access. In the UK, the Royal National Institute for the Blind has created many such documents, for instance “Access Prohibited”[5].

It should be remembered that standards do not drive access, they are a reaction to current implementations of technology that make access more difficult. To drive the design of new technology from the perspective of accessibility requires research into the needs of individual users and how to best match technology to those needs.

1.1 Accessibility research

Enabling design for a diverse community of users, requires research into the needs and preferences of those users. There has been a steady and major stream of ATM-focused research in the US, mainly centred on the issues concerning older users, their
technology use and training approach [e.g. 6,9,10,11,12]. They have studied cognition and aging as it applies to ATMs using a variety of quantitative and qualitative methods. In comparison, there has been very little systematic research into the needs of disabled users of public technology. Research on disabled access to public technology tends to be focused on specific disabilities, for instance a sign language interface for the deaf [13] or an interface for the visually impaired [7,8].

It is difficult to carefully design and evaluate accessibility features. A solution, which removes one problem, may well aggravate a problem for another user. For instance, increasing the font size may help shortsighted users but disadvantage those with tunnel vision. A three-tier pragmatic approach has been suggested [15] ranging from Level 1 where lack of a feature makes access impossible for some people, to level 3 where the feature would make a system easier for some people but it is not essential.

Efficiency is also an essential feature of ATM access. The need for efficiency of interaction comes from the sense of urgency invoked from the user's feelings of vulnerability when in front of an ATM, be it due to disapproval from those queuing behind when they are slow or to theft.

NCR is currently carrying out research to investigate requirements for new interaction paradigms and personalisation to
- reduce the number of users who are excluded;
- ensure independent access;
- ensure an efficient and satisfying interaction experience for all users.

2. THE APPROACH

When dealing with a truly diverse community of users, designing an interface to match an individual user’s requirements can be a demanding task from both the system and users' perspectives. Many of today's systems allow the user to configure the system to match their preferences. In many systems, personalisation facilities have not been fully utilised by those who may benefit. There are many reasons for this. Users may lack confidence to make the changes, lack knowledge of how to make the changes, not see the value of doing so or simply not have been provided with appropriate options.

Personalisation can be controlled by users or those representing the user, either software or human agents, such as a member of bank staff. There are four stages to personalisation: initiation, proposal, decision and implementation. Each of them should be addressed separately when considering where control should reside.

In our study, some additional features were added to a standard NCR ATM, some of which could be personalised. The user was required to customise their interaction. The interaction was then presented to match their individual set up.

2.1 The personalisation approach

Personalisation took the form of customisation by the user, with assistance from a member of staff. The four steps were
- **Initiation**: user decided when to change the interface,
- **Proposal**: the options available were presented to the user by the system.
- **Decision**: the user decided which features to turn off or on, and how to fine-tune them.
- **Implementation**: the system set up the ATM interface.

This approach has the advantage of leaving the control with the user, not making stereotypical judgements about a disability, and not requiring the user to describe their problem to a third party. However it does have the disadvantage of being time consuming and requires the user to know what is best for them. This problem was minimised by showing the user the interaction they were building up rather than just setting parameters.

The personal profile was stored in a central database and accessed by the application when the user enters their card. This allows the scenario to be plausible without requiring a change to the existing card base and ATM card readers.

3. THE ACCESSIBILITY FEATURES

A standard NCR ATM was adapted to demonstrate improved accessibility. Some of these features were personalisable; others were standard to all users. The physical features can be seen in Figure 1 and then described below.

Alternative input methods: A wide range of input methods was provided namely: a touchscreen, PIN pad, lower PIN pad, and large move/select keys. The user could select the method they preferred.

**Figure 1: Customised PersonaS75**
Tactile interaction: Simple tactile “icons” were designed to represent each of the devices on the ATM and leader-lines from a central point to each device. An additional indicator was used to indicate which device was currently active. The tactility of the keyboard was improved by raising the height of the key by adding key tip extensions. The tactile icons and leader-lines are illustrated in Figure 2.

Figure 2: Tactile icons and leader-lines

Audio interaction: Audio interaction was created by using a text-to-speech engine to ensure all visual information was accessible via the audio channel. All button labels, instructions and screen feedback was read out to the user. All user input was echoed to the user verbally. The user could personalise the speed, pitch and gender of the voice. Audio was provided via a mini audio jack socket on to headphones to ensure privacy.

Visual interaction: A more personalisable visual interaction was presented to accommodate the range of visual needs. The user could change font size, screen colours and touch screen button size. Larger fonts and higher contrasts between background colours and text were made available to the user. Figure 3 illustrates two alternative screen designs.

Figure 3: Illustration of potential screen designs

4. METHODOLOGY

Three pieces of evaluation work have been carried out with these features. Firstly, experts in HCI and accessibility carried out a heuristic evaluation of features. This was followed by detailed qualitative work carried out in collaboration with the University of Dundee. In this study individual users (N=41) spent approximately an hour exploring the different features and deciding which worked best for them. Finally, focus groups were carried out in Toronto. In these sessions, 7 groups of people (N= 56) with similar access issues were shown the features and asked to discuss their user needs and how well they felt the features matched their needs. In both pieces of work a range of users from the following categories were tested: Blind, Visually-impaired, Deaf, Hearing-impaired, Wheel-chair bound and Motor-impaired. These groups experience a wide range of physical access problems. A comparison group of able bodied people was also included in the studies.

5. FINDINGS

The findings reminded us that, as designers, we sometimes cannot predict what is suitable for other people. Some of the tactile features directed at blind users were particularly ineffective. The leader-lines did not match how blind users currently explore physical machines. Blind users did not want to be guided from a central location to a device, they preferred to browse the interface with their hands and locate autonomously the devices before beginning the interaction.

We also found that experience played a part in the matching process, those people who were current ATM users preferred different devices to those who did not use ATMs. For the non-users, interaction was learning rather than performance orientated.

The research to date has not been able to find a single optimum input device; each device had both advantages and disadvantages for different people. The findings illustrate that a feature may lead to higher compliance levels for certain disabilities but it is difficult to find a single design, which is optimised for all users. A summary of findings is presented.

Audio interaction: Blind users were very satisfied with the audio interaction. Blind users could not use a new machine without the audio lead-through.

Tactile interaction: Without this, the system would be more difficult to use for blind users, but not impossible. People appreciated the improved keyboard design and the idea of the tactile icons. However, they found the leader-lines did not match their interaction style.

Visual interaction: The larger fonts, higher contrast and simplicity of the text improved accessibility to the visually-impaired. Without visual lead-through sighted user would find it difficult to use the system. They do not like to use audio as an alternative.

Personalisable output: Without the ability to change volume, pitch and speed of voice would make it more difficult for some users to use. Personalised screen design made it easier for many users to use the screen. Without the font size variability some visually impaired users would have been unable to interact with the system.

Input Devices: There were pros and cons of each of the different devices depending on disability
Move/select input was the only device that could be used by all users. For many users with limited reach and dexterity, this input method was the only one that it was possible to use. Blind participants who had not used ATMs also found this very intuitive.

6. DISCUSSION

The study has served to illustrate how much we still need to learn about matching the design of public technology to the individual needs of a diverse user population. We are continuing to iterate and evaluate potential features.

For currently excluded user groups to achieve access to public technology such as ATMs, interfaces must be configured to match individual requirements. We found that individual differences appeared in the configuration of audio and screen. We also found differences in the preference for, and ability to use input devices that must be accommodated. ATM experience was also an important factor.

This research explored the role of personalisation to achieve accessibility. In the future there is potential for configuration agents to support users with low initial levels of control or low levels of knowledge about configuration. The relationships between adaptive interfaces, user control and user privacy has yet to be resolved. The ability of agents to perform such tasks based on a model of the user and changes in behaviour is uncertain in this environment but warrants further investigation [14].

More research is required into the disabled communities experience of and attitude towards online privacy and the notion of informed consent. Profiles are indicative of user attributes. These profiles are therefore sensitive. This is particularly problematic if the profile can be linked to an individual and is then available to other parts of the organisation, for instance assessing insurance premiums.

Reach and simplicity are key issues in the design of public technology. This may be achieved by reducing the number of access points to devices for the user, by adopting a single or dual slot approach. Further investigation of the design and placement of access points is required.

The current conflict between the demand to add functionality to machines and the desire to enable the system to be simple, accessible and intuitive will require further work on managing the complexity for the users.

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