Making elevators truly accessible to blind people

Alistair D N Edwards

Department of Computer Science
University of York
York
England
YO10 5DD

email: alistair@minster.york.ac.uk

1. Motivation

In a previous article (McAuley, 1996) Helen McAuley described some of the facilities which can be provided in elevators for people with disabilities. Among them are people who are blind. Many people (particularly those in the USA) might believe that much has already been done to accommodate their needs from the proliferation of braille labels on the button panels in elevators. However, there is a suggestion that such labels are of little use – and might even be an example of ineffective tokenism. A more effective alternative is proposed herein.

To pay attention to the needs of blind users is not just a matter of goodwill or even of widening accessibility; to *not* provide a facility that is genuinely accessible where one exists, may well be illegal (according to the Americans with Disabilities Act in the USA, the Disability Discrimination Act in the UK and similar legislation in other countries).

2. Limitations of braille

The first problem with braille labels is that the proportion of blind people who can read braille is very low (contrary to many people's expectations). Hard statistics are difficult to obtain, but the American Printing House of the Blind (APH, 1993) estimates it to be as low as 9% of blind people (and it is only people with a total lack of sight who use braille at all, those with visual impairments do not). Thus, to the vast majority of people for whom the adaptation is intended it is quite useless.

Given the low number of braille readers, another alternative mandated by many accessibility standards is to provide raised, tactual representations of the printed labels. These can be read visually by sighted people but also felt by blind users, but once again they have severe limitations. First, the shapes of print characters are familiar only to those blind people who lost their sight after they had learned to read visually (tactual print recognition is *not* a skill taught routinely to blind people). Second, it has been shown that the (tactile) readability of such letters is low, compared to braille (Loomis, 1981) and reading times are very slow (of the order of 6 to 16 seconds, according to Austin and Sleight (1952) .

Even for those blind people who can read braille, the labels are far from optimal. Under even the best of conditions it can take a long time to read, but when entering an elevator for the first time the blind person must:

- locate the button panel;
- locate and read a braille label on the panel;
- work out the layout of the buttons;
- locate the desired label;
- locate and press the corresponding button.

Clearly this will take time – and within that time the chances are that the lift doors will have closed and it may well be on its way to another floor having been summoned from there. So, now the blind person is on his or her way to a floor other than the intended destination.

Another problem arises on arrival at a floor. Some elevators have a voice output which announces the floor number on arrival, but for those that do not the blind traveller has no (easy) way of knowing the number of the floor at which the doors have opened. One blind person has described an attempt to solve his attempt to solve this in a building which did have braille labels on the floors – *outside* the elevator car. Hence, on arrival in the lift it was necessary to lean out through the door to touch the wall outside and attempt to locate and read the braille – while ensuring that the door remained blocked so that it would not close leaving the person possibly on the wrong floor.

There are further problems with the braille on the button panel. Braille books are conventionally read by being laid on a table or desk and read with the hands held over that horizontal plane. However, elevator buttons are on a horizontal surface, forcing the braille to be read at an unfamiliar, awkward angle. This can be made even worse if the panel is at a low height – as it might well be in order to facilitate access for people in wheelchairs.[1]

3. The alternative: keypad input

Are braille labels completely useless? An informal survey through an Internet mail group of visually impaired people (*blind-l*) generated mixed reactions. Many of the respondents said that they do make use of such labels and there was also a wide feeling that they were better than nothing and at least an attempt to give a further measure of independence to blind people. This suggests that conventional button panels should retain their braille labels, but that an additional, alternative floor selection mechanism should be provided.

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[1] All these problems are well illustrated by an anecdote of a blind colleague. On entering an elevator alone in an unfamiliar hotel he searched for the button panel. He located it at a low, wheelchair-compatible level. He found it impossible to read the braille at that height and so dropped to his knees from where he could read it with his hand at a more natural angle. However, while he was undertaking these manoeuvres the doors closed and the elevator moved to another floor. There the doors opened to admit two new riders – who were greeted by the sight of a blind man on his knees in one corner. His quick-witted explanation to them was that he was 'Worshipping the technology'.

That mechanism would be based on the use of a telephone-style keypad. The great advantage of such keypads is that they have a standard (ITU-T, 1993) layout (as in Figure 1). Once the blind user has located the central 5 button (and many keypads include a tactile dot on that key to assist in its location) it is easy to dial any number relying only on memory of the finger movements required and without any visual feedback.

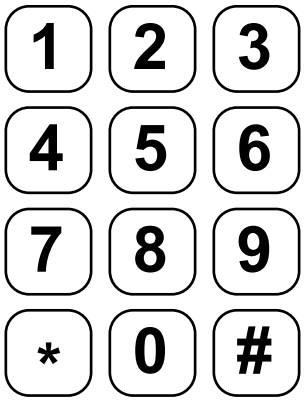

Figure 1. The standard layout of the telephone keypad.

The proposal is, therefore, that a telephone-style keypad should be provided in elevators on which the user can 'dial' the required floor. The keypad would be in a standard position in all elevators (to assist location) and would be *in addition* to the conventional button panel. On entering the elevator, the blind person would locate the keypad and type the number of the required destination.

4. Technical problems

There are a number of technical problems to make the keypad work in this manner, but as outlined below, none of them is insoluble.

One of the non-numerical keys (#) would have to be used as a confirmation key to mark the end of the number, so that to go to the second floor one would enter '2 #', while the tenth floor would be entered as '1 0 #'.

Spoken feedback would be essential for announcing the floor number when the elevator stops. In general it would not be required during the entering of a number on the keypad (most blind people are well used to using such keypads and would probably be *slowed down* if they have to wait for spoken feedback of each digit – and as a consequence are more likely to make errors. Nevertheless, once a whole number has been entered, confirmation of the number selected could be spoken (e.g. 'floor ten').

There might be arguments that it should be possible to edit and/or cancel incorrectly entered numbers, perhaps through use of the '*' key. However, there is the counter-argument that there is no way of cancelling an incorrectly pressed button on most conventional panels; one has to live with one's mistake and go to the wrong floor. If the user recognizes an error before the '#' button has been pressed there is the tactic of entering an impossible floor number as a means of cancelling the entry. For instance, suppose the destination is floor 10 and the user has entered '1 8' then by pressing (say) '5

5 *' the apparent number will be 1855 – which will be out of range in most buildings and can be ignored (with a suitable spoken error message).

Another reason for not using the '*' key for error correction is that it has a much more important potential role. Few buildings label all their floors by numbers alone; there are special floors with corresponding elevator buttons ('B' for basement, 'M' for mezzanine and so on). There are three possible solutions here.

- One is to use a different numbering scheme for the keypad and the conventional buttons. That is to say that the lowest floor (be it at ground level or in the basement) would always be numbered 1 – as far as the keypad user is concerned. This does not seem a good idea, however, since it will lead to confusion. Imagine a blind person asking a sighted one on which floor they will find a particular facility. The sighted person will presumably answer according to the conventional numbering and the blind person would have to translate arithmetically. This would also be inconsistent with the room numbering convention in many buildings, whereby rooms numbers 100 to 199 are on the first floor and so on.

- A second possibility would be to try to persuade architects and building owners to adopt a consistent numbering scheme, so that floors are labelled by numbers alone and that numbering scheme is always the same and logical (0 for the lowest floor and so on). That numbering scheme would therefore be the same on both the keypad and the button panel. In time such schemes *might* be adopted (particularly if keypads become common) but it seems unlikely that they would be taken on easily and would be very expensive to retro-fit to existing buildings.

- The third possibility is to use the numeric keys for alphabetic input. There is a standard assignment of letters to keys, as in Figure 2 (though not all keypads adhere to this particular standard). There is a problem in that there are 26 letters, to be entered using 12 keys – and hence the assignment of more than one letter per key. However, there are a number of techniques that have been proposed to achieve input of letters through such keypads. (McLaughlin, 1997 surveys a number of methods, including Butterbaugh and Rockwell, 1982; Detweiler, Schumacher et al., 1990 and Fast and Ballatine, 1988).

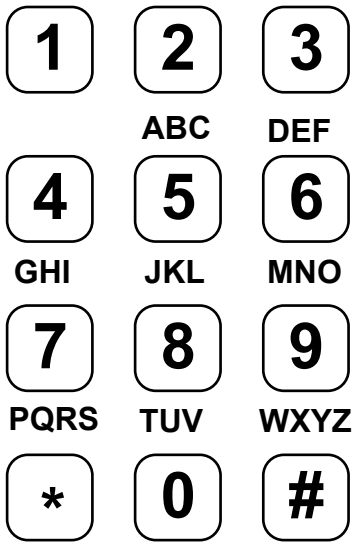

Figure 2. One standard allocation of letters to number keys.

Other functions normally found on the button panel (alarms, door open etc.) would remain as accessible only through the conventional button pad.

5. Conclusions

It is suggested that elevators could be made truly accessible to blind people by the use of a keypad as an alternative input device. Solutions to some technical problems have been suggested, but the idea's feasibility cannot really be asserted unless a usability study is carried out, using blind people and preferably a working elevator.

6. References

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While visiting the US recently I noticed the use of braille in elevators, particularly labelling the destination buttons. My first reaction was to be impressed by this effort on accessibility, but then when I thought about it a bit more I began to wonder about the practicalities; is that braille actually any use to anyone? If not, its presence is at best misguided, and at worst is tokenism.

Let us consider a blind person in an elevator - and assume that they are among that minority of people who can read braille. It seems to me that the time it would take to locate the buttons, orientate yourself, read some of the buttons, work out the arrangement and finally locate the button you require is much too long. By the time you had done that the elevator would have set off to another floor - either by someone calling it from another floor, or by someone else on board pressing their request (and if someone else was in the lift with you, they would presumably have asked you what floor you want and pressed it for you).

So, my first question is, is there anyone out there who find such braille labelling useful? Are there independently minded people who have got over the impediments I have outlined and found their way to the right floor?

If I am right about the limited usefulness of such solutions, then surely there must be a better one. I have one I would like to suggest. It is to have an additional keypad similar to that on a telephone. (The traditional buttons would be retained for those who prefer them). The user would then 'dial' the number of the floor they require. * and # could be used for erase and enter. Feedback could be given on key presses - either speech or the same tones which phones generate. There would have to be special entries for non-numerical floors (B - basement etc), but I am sure something could be devised.

Given the general familiarity with phone keypads I would think this would be a quick and convenient alternative. Does anyone agree?