ACCESS PROHIBITED - UPDATED

Information for Designers of Public Access Terminals

John Gill
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Introduction

Communications technology is a powerful tool in our everyday lives. Whenever we use a cash machine at a bank or building society, make a purchase with a credit or debit card, use a mobile phone or operate our television with a remote control we interact with this technology. A great deal of development is now taking place in the way information and services are delivered. Banks and building societies are developing new ways of providing services electronically, smart cards carry more and more information, telephone companies design new and more interactive communications equipment, the internet continues to weave its web, and governments plan to make services more accessible by delivering them electronically.

Electronic services are becoming a part of our everyday lives. For the public to benefit from these services, people must be able to interact with the wide range of public terminals that are now being designed. Public access terminals will become a feature of our environment. Banks, building societies and transport systems have used them for some time but more and different terminals will appear in libraries, post offices, health services and government offices.

To fully participate in society, individuals will need to be able to use self-service terminals. Increasingly, people will need to gain access and communicate via keyboards, screens, telephone handsets, smart cards, etc. Communicating this way is relatively easy for young people, people with good manual dexterity, good eyesight and good hearing. But for people who have a visual or hearing disability, poor mobility or dyslexia, access to this information and services can be severely restricted - denying access to a significant proportion of the population.

Design for All

To make significant progress in accessibility by disabled and elderly people public terminal designers, manufacturers and service providers will need to adopt a 'design-for-all' policy. In addition there will need to be agreement on standardisation.

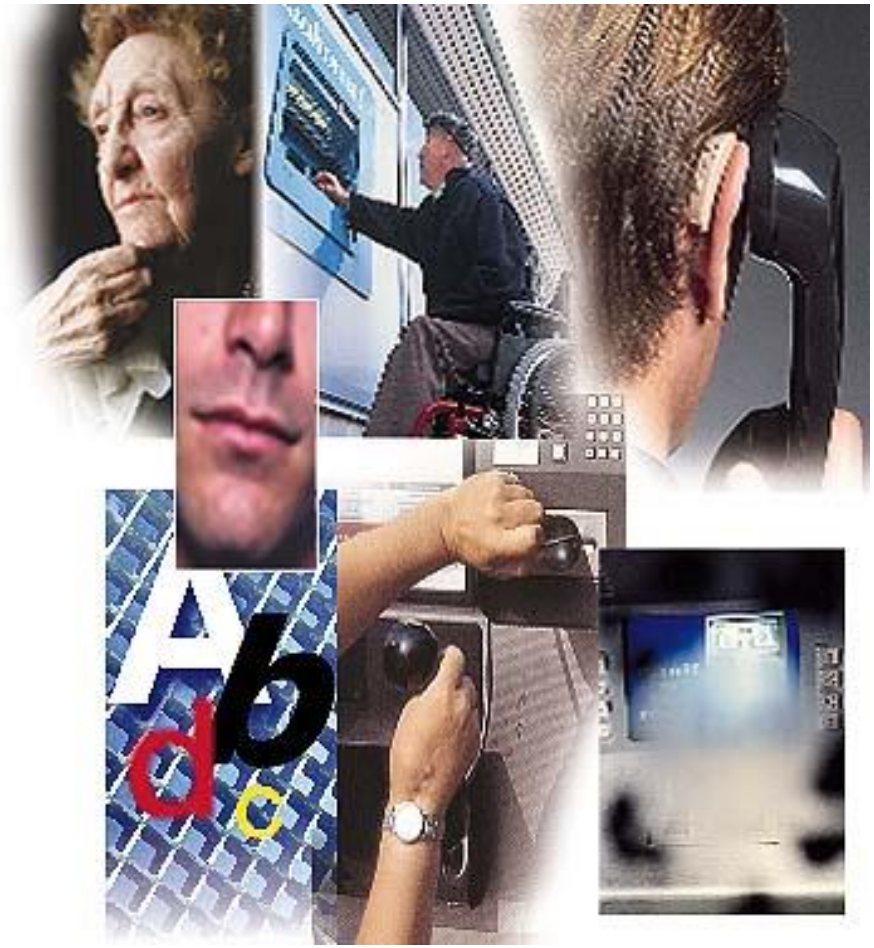
The aim of this publication is to encourage public access terminal manufacturers and service providers to adopt the following principles:

1. To review existing equipment and services to determine which ones need to be made more accessible.
2. To design and develop new equipment and services that can reasonably accommodate a broad range of diverse users, including individuals with disabilities.
3. To deliver equipment and services in a manner consistent with this level of accessibility (eg. instruction books in clear print and the provision of appropriate training in the use of a terminal).

Legislation may require service providers to make public access terminals accessible to people with disabilities. The Americans with Disabilities Act and the 1996 Telecommunications Act in the USA already require public access terminals to be usable by people with disabilities. The high cost of retrofits and the increasingly large number of people with disabilities means that it would be wise to consider their needs from the outset.

Good design for people with disabilities is frequently good design for everyone.

The Numbers of People with Disabilities



The user groups described here have been defined in terms of their functional ability, with specific emphasis on use of public access terminals.

In the elderly population in particular, there may be a tendency towards hearing, vision and mobility impairments arising in parallel. Therefore, while the numbers are 'best estimates' for single groups of users, they should not be aggregated. The group sizes have been estimated conservatively and very much larger numbers would be obtained if lower levels of impairment were included. The lower levels of impairment will not normally lead to difficulties in using information and communication systems but can cause problems in adverse circumstances.

Estimated number of people in the UK who are likely to experience problems using public access terminals:

Wheelchair users	260,000
Cannot walk without aid	3,250,000
Cannot use fingers	65,000
Cannot use one arm	65,000
Reduced strength	1,800,000
Reduced coordination	900,000
Speech impaired	160,000
Language impaired	400,000
Dyslexic	650,000
Intellectually impaired	1,950,000
Deaf	65,000
Hard of hearing	3,900,000
Blind	65,000
Low vision	980,000

Visually impaired

The eye conditions which most commonly cause low vision are:

- Macular degeneration
- Glaucoma
- Diabetic retinopathy
- Cataract
- Retinitis pigmentosa

• 67% of visually impaired people have another permanent illness or disability.
• 35% of visually impaired people experience some difficulty in hearing normal speech (about 50% of those over 75).
• 56% of visually impaired children have at least one other impairment.
• Over half of visually impaired people in the UK live alone.

Hearing impaired
Hearing loss is not simply a matter of reduced sensitivity that can be overcome by increasing signal loudness. Hearing loss is usually dependant on the frequency (pitch) of the sound. People with hearing loss have the same pain and discomfort thresholds for sound as hearing people, so that when sound is amplified so that it can be heard it is quite easy for the sound to reach the discomfort or pain thresholds.

Physically impaired
Physical problems can make holding a handset difficult and make keypad or touchscreen operation slow and inaccurate. These tasks may also be painful. Being in a wheelchair or needing a walking stick can make access to machines difficult. Physical difficulties include:

- weak grip
- arthritis
- cerebral palsy
- spinal cord injury
- head injury
- stroke
- loss of limbs or fingers
- Parkinson's disease
- multiple sclerosis
- muscular dystrophy

Cognitively impaired
The type of cognitive impairment can vary widely, from severe retardation to inability to remember, to the absence or impairment of specific cognitive functions (most particularly, language). Therefore, the types of functional limitations which can result also vary widely and include:

- Cognitive impairment
- Dyslexia
- Learning impairment
- Language impairment
- Dementia
- Seizure disorders

• 5% of children enter school with difficulties in speech and language.
• 30% of stroke sufferers have a persisting speech and language disorder.

Older people
Older people tend to be slower to learn new skills, have difficulty in memorising and reacting quickly to instructions. Also many elderly people prefer human assistance to using self-service terminals; however, this is not insuperable with suitable user interfaces and appropriate training. Many elderly people use a mobile phone even though they may not be familiar with all of its facilities.

For elderly people it is important to remember that hearing, vision and mobility impairments combine to make information technology more difficult to use.

The Problems with Public Access Terminals

The solutions to some of the problems of people with disabilities may appear trivial to a non-disabled person, but they can nevertheless have a major effect on the usability of a piece of equipment or access to a service. For instance many people would like a notch in the facia of the terminal so that they can lean their walking stick against the terminal without the stick falling over. Other problems require more complex modifications, but often solutions are available but not implemented. The table shows the problems with a cash dispenser for different groups of people with disabilities.

General Design Considerations

For many disabled and elderly users, the most important aspect is consistency in the user interface of public terminals; this is particularly important for visually, intellectually and cognitively impaired users. A prime example of this is the lack of a single standard relating to the layout of numeric keypads.

With public terminals, the user may only use it occasionally and has probably been provided with minimal training in the use of the terminal. What is “logical” to the average user may be different from what is “logical” to the designer, so it is essential to test any new user interface with a cross-section of potential users (including disabled and elderly people).

	Wheelchair user	Cannot walk without aid	Cannot use fingers	Cannot use one arm	Reduced strength	Reduced co-ordination	Dyslexia	Intellectually impaired	Blind	Low vision
Locate terminal								●	X	●
Access to terminal	X	●								
Read instructions							●	X	X	X
Insert card	X	●	X	●	●	X		●	●	●
Read screen	X						●	●	X	X
Use keyboard	X		X			●		●	●	●
Use touchscreen	X		X			●	●	●	X	●
Retrieve money	●	●		●		●			●	
Read receipt			●				●	●	X	X
Retrieve card	X	●	X	●	●	●			●	

Few problems	● Some problems	X **Many problems**

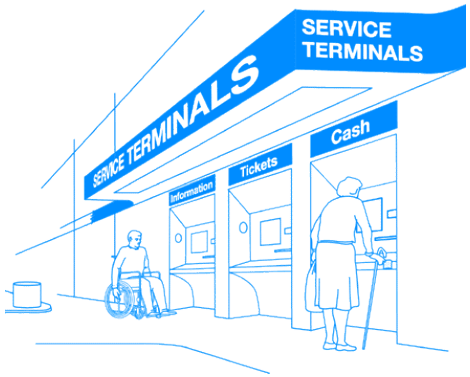
Locating and Accessing a Terminal

There are many things that can be designed around a terminal to make it more accessible to disabled and elderly users. For example, a space beneath the facia of a terminal will allow for the footrest of a wheelchair. A notch adjacent to the facia would be useful for those needing to prop their walking sticks while using the terminal. It is also important to ensure that the pathways around a terminal are clear and uncluttered.

Location Signs
For low vision users, signs showing where a terminal is should be large and high contrast (preferably white or yellow characters on a dark background) and illuminated (preferably internally illuminated).

Lighting
It is recommended that a background illumination of at least 50 lux be provided at floor level so that dropped objects can be easily located. The illumination on the interactive areas of the terminal should be at least 200 lux. The lighting should not cause any direct glare to the eyes of the users, or reflections from the screen.

Queuing
Where queuing is likely, consideration should be given to some non-obstructive method of queue control (eg variation in colour of flooring or pavement) that maintains privacy and security for the user.



Where possible, there should be a continuous clear accessible path of travel for a wheelchair from car parking places to the terminal.

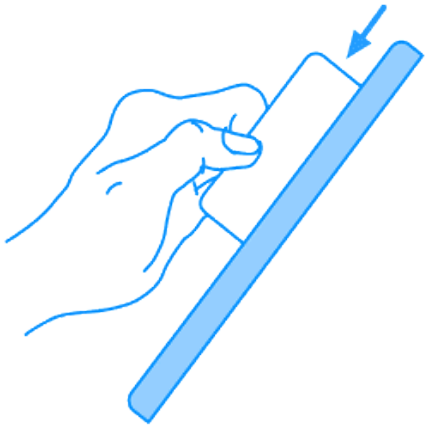
The floor surface should be level in the direction parallel to the facia of the terminal. The gradient of any crossfall should not exceed 1 in 20. There should be a clear area of 1.5 x 1.5 metres directly in front of the terminal, which should not be obstructed by litter bins or other street furniture.

Audible Location
If a blind person is not familiar with the environment it can be difficult to find a terminal. One possibility is to use a contactless smart card, carried by the blind person to trigger an audible signal from the terminal at a distance of a few metres.

Card Systems

Card systems are used extensively for telecommunications, public transport and self-service terminals. Many people carry cards to access banking terminals. These cards could hold information on the user's requirements or preferences.

Swipe Card Readers
Because of the need to accurately control the way the card is swiped, elderly and disabled persons are likely to find these difficult to use.

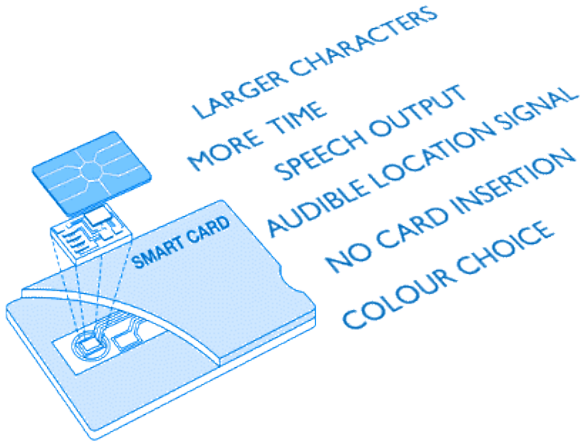


Smart cards
A smart card is a credit card sized plastic card incorporating an integrated circuit. This circuit holds information that can be securely and accurately read by all sorts of terminals. Smart cards are able to carry larger amounts of information than magnetic stripe cards.

For disabled and elderly people, a smart card can carry information that tells a terminal to:

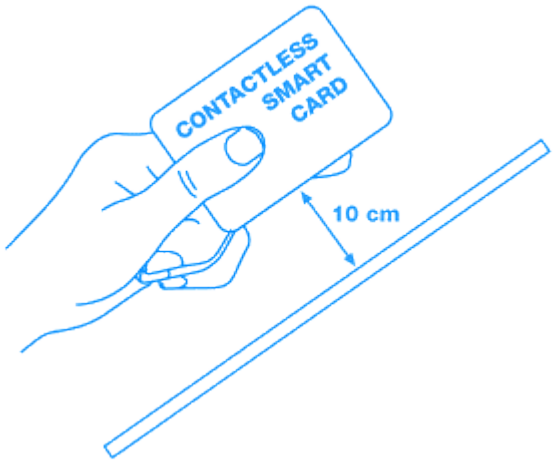
- allow the user more time. Many elderly people and those with a cognitive impairment do not like to be rushed or to think that they are likely to be 'timed out' by the machine, so it is necessary to allow for such people to use the terminal at their own pace
- simplify the choices such as issuing a pre-set amount of money
- larger characters for people with low vision
- audio output of non-confidential information.

The coding of user requirements is specified in the European standard EN1332-4.



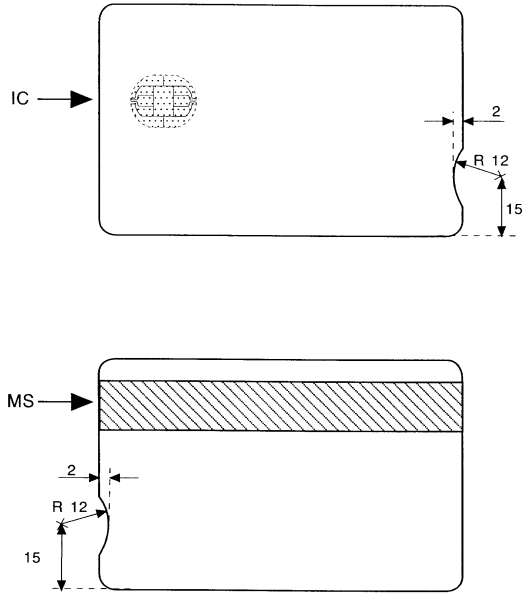
Contactless smart cards

A contactless card, working at a distance of up to 10 cm, will help those who have problems placing a card in a slot. This is of particular importance to wheelchair users, those with Parkinson's disease or arthritis, and people with a visual disability.



Card orientation

Blind persons, and many elderly persons, have problems in inserting the card in the correct orientation; this is a particular problem with cards which are not embossed. It is recommended that a 2 mm notch is incorporated in the trailing edge.

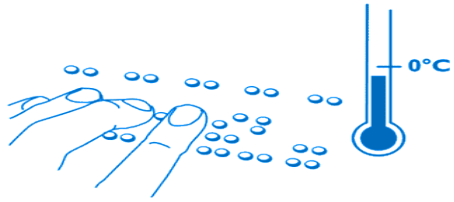


External Features, Labels and Instructions

When a person has located a terminal they need to know what type of machine it is, what it will do and how they can interact with it. The initial instructions are usually in the form of labels and signs applied to the surface of the terminal casing or as messages on the screen.

Positioning labels
Labels should be placed where they can be easily read. If labels are positioned near the keyboard it is important that the labels are not scuffed or worn away. If this is likely then the labels should be replaced periodically.

Braille instructions
On outdoor terminals, braille has limited value in cold weather since tactual sensitivity is dramatically reduced with decreasing temperature. The estimated number of braille readers in Europe is less than 0.02% of the population; so although useful for some blind users, braille is not a total solution for visually impaired users.



Legibility
Any instructions applied to the surface of the terminal should be written in simple and clear language. Type sizes as small as 10 point are not legible for many people. It is recommended that type size of at least 16 point (4 mm cap height) be used for labels.

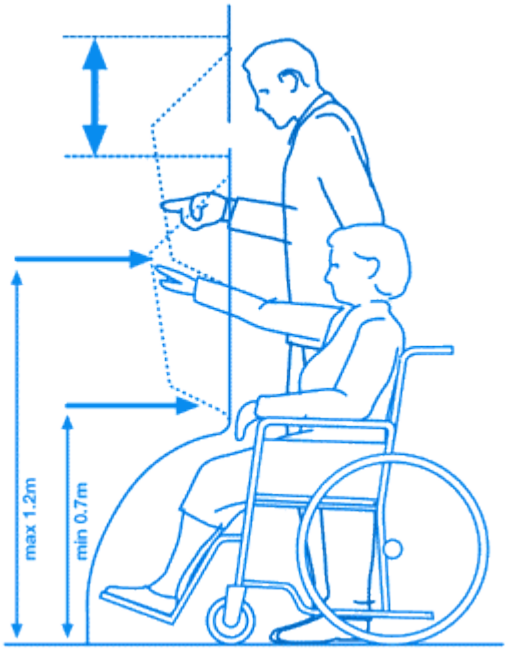
This is an example of 16 point size type in a medium weight.

Numbered instructions
It is useful to number instructions and then associate the physical parts of the interface with the numbers. The numbers can also be shown on the visual display.

Wheelchair users
For many wheelchair users, such as those with arthritis, it is not just a problem of reaching the card reader, but still having any useful grip as the arm is raised above the horizontal. This is particularly acute for swipe card readers.

If only a forward approach in a wheelchair is possible, then the maximum height of any interactive element on the terminal should not exceed 1.2 metres. The lowest height of any operable part of the user interface should not be less than 0.7 metres. Ideally the terminal, or user controls, should be adjustable in height, as is done on some drive-in cash dispensers. The problems of accessing the

card reader are greatly alleviated if contactless smart cards are used.

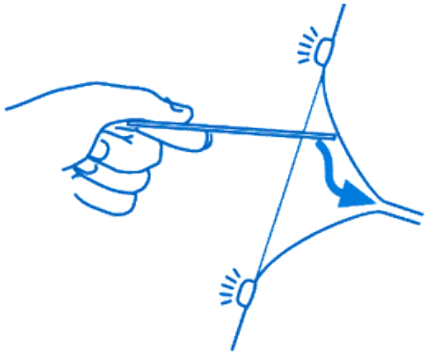


For a parallel approach in a wheelchair, the maximum height of any interactive element on a terminal should not exceed the distances shown in the table.

Reach in cm	Maximum height in metres
30	1.3
45	1.2
60	1.1

Card entry

For the naïve user, it is often far from obvious where to insert the card. A flashing light around the card entry slot has been found beneficial. For those with hand tremor, it is useful if the entrance to the card reader acts as a funnel to guide the card in correctly.



Screens and Interaction

On most terminals the visual instructions on the screen are the main guide for the user. There are a large number of factors that determine whether reading the screen will be difficult or easy for disabled or elderly persons.

The consumer expects consistency of user interface across a range of devices even if they have very different functionalities. They also expect controls to be laid out in a logical order (eg top to bottom, or left to right).

Screen position
Sunlight can degrade the viewability of the display for all users. The screen should be shielded from direct or reflected sunlight or other bright light sources. The display should be viewable from the eye level of a person sitting in a wheelchair. People with low vision should not be prevented from getting their faces close to the screen.

Display angle degrees from vertical	Maximum height from ground metres
0° - 30°	1.3 metres
30° - 60°	1.1 metres
60° - 90°	0.9 metres

Parallax problems
The conflicting requirements of tall pedestrian users and short wheelchair users can lead to a significant group of users having parallax problems when lining up the function keys with the displayed option. Lines on the user-interface leading from the key to the surface of the display can alleviate this problem.

Colour blindness
Total colour blindness is rare (less than 0.0025% of the population) but problems with discriminating red and green are common (over 6% of the male population).

People who wear bifocals find it difficult to read the screen of most public access terminals, since the screen may not be at a suitable distance for the near or far segments of their spectacles. In addition

many people leave their spectacles in the car or do not wear them in public. So the number of people who have problems in reading the screen is much more than the 1.5% of the population considered to have low vision.

Other languages

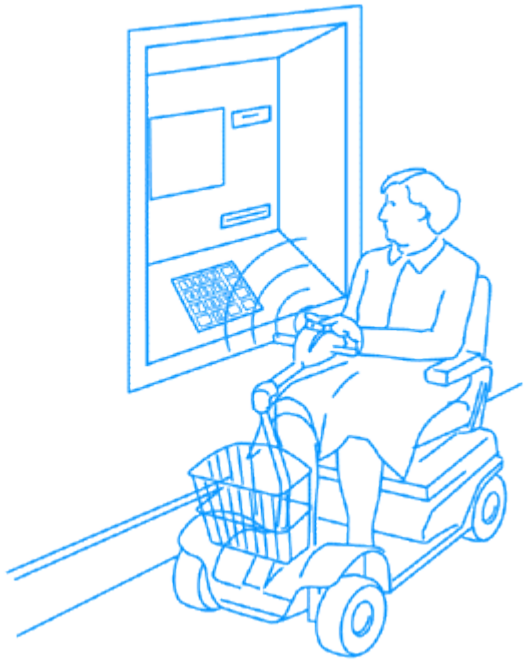
Ideally users, including foreign visitors, should be able to choose the language; frequently this is only viable if the instructions are displayed on the screen or given audibly. It would be preferable if the user's card stored their preferred language so that the terminal automatically switches to this as soon as the card is inserted.

Remote control

Developments in infra-red links make it feasible for a disabled user to have a hand control unit with an infra-red link to the terminal. This would require all terminals to use the same interface protocol, and care would be needed to ensure confidentiality of sensitive information.

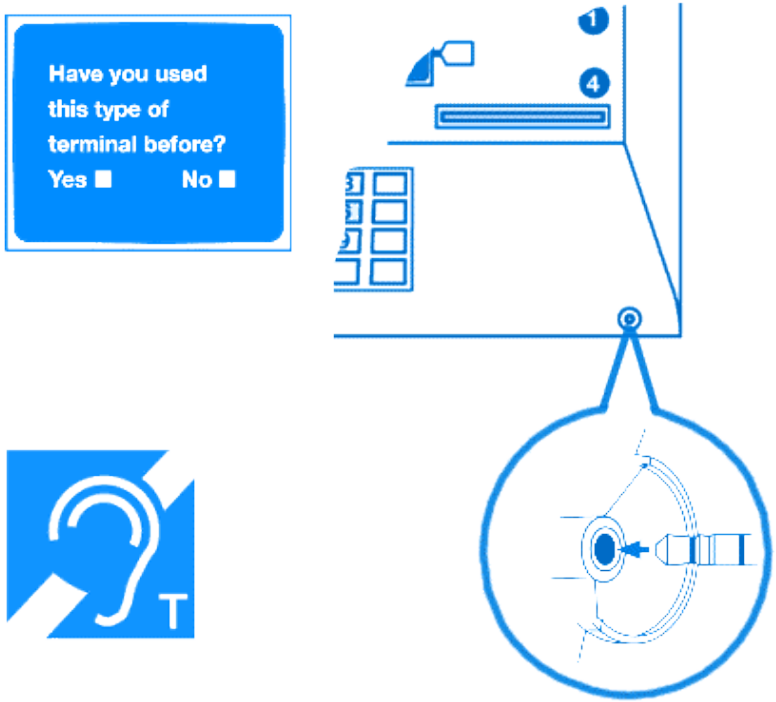
WiFi could also be used for this purpose, but some form of encryption would be needed to ensure that the transaction is secure. Bluetooth has a higher level of security but it is not always easy to initiate the connection of the two devices, and it assumes that the disabled user has a smartphone with Bluetooth capability.

However the advantage of having control via a remote device, such as a smartphone handset, is that the interface can be customised to suit the individual needs of the user. For instance it could incorporate speech output in the user's preferred language.



Operating Instructions

Few people are trained to use public terminals. It is therefore very important that the instructions for using the terminals are carefully designed, particularly for elderly and disabled users.



Concise and simple sentences
Sentences should be concise and simple in structure, and only natural vocabulary should be used. Informative messages which advise the user of the progress of the transaction and inform the user when or how to perform a step in the transaction, should be clear and to the point, and provide confirmation of task completion.

Messages
Message content should be chosen very carefully since a message that might be acceptable to the users for the first few times they hear it may become unacceptable when they hear it for the hundredth time.

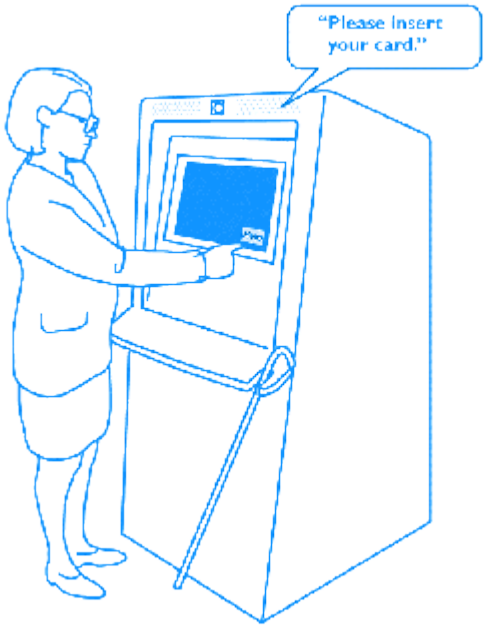
Hearing aid users
If there is an inductive loop for hearing aid users, there should be a clear visual indication that this is the case. (NB not all hearing aids have facilities for loop connection).

To help a visually disabled person locate a jack socket there should be a raised ridge around the socket. A funnel into the centre of the socket will also help guide the plug into the socket.

Audible instructions
On some terminals a ‘beep’ will sound when a key press has been registered. However, this does not help a visually disabled person

know whether they have pressed the correct key; one solution is for coding on the user's card to request speech output of key pressed for non-confidential information.

It is recommended that new equipment should provide guidance in the form of audible instructions. Audio guidance can assist people with visual or cognitive impairments, as well as first time users. For example an audible message could be "Your card has been inserted upside down. Please remove your card, turn it over and insert it again".



Speech output

Digitally stored speech can give very good audio quality, but it is effectively limited to pre-stored messages. Full vocabulary synthetic speech is often difficult to understand for naïve users, particularly if they have a hearing impairment.

Many users with impaired hearing, can only hear lower frequencies, so they can more easily hear a male voice than a female one.

Video links

Terminals can include a small television camera and microphone. Users can talk over a video link to a customer service assistant at a remote location. This human assistance can be very helpful to an elderly person having difficulty.

Privacy

If audio output is used to provide private information to the user, then it should be through a telephone handset located at the terminal or through a headset connected through a standard mini jack to the terminal; however, it is essential that the position of the jack socket is standardised. If a handset is provided, inductive coupling and amplification should also be incorporated. Non-confidential information can be output on a loudspeaker, but the volume should be a function of the ambient noise level.

Keypads

A standard layout for keypads is essential for blind people. There are currently two common layouts for numeric keys; the telephone layout and the calculator layout. It is recommended that the telephone layout be used exclusively on public access terminals.

Numeric and command keys

To help blind people, there should be a single raised dot on the number 5 key. This should be positioned so as not to reduce legibility.

Visual markings on the keys should be characters at least 4 mm high and should have good contrast with the colour of the key (eg. white characters on matt black keys).

All keys or buttons should be tactually discernible; keys should be raised or recessed by a minimum of 2 mm. The edges of the keys should be at least 2.5 mm apart. Function keys should be clearly separated from the numeric keys.

Colour coded keys should be:

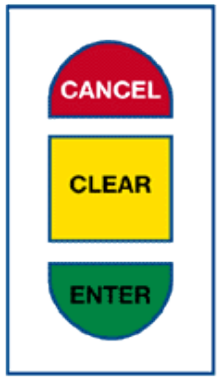
Key meaning	Colour
Enter or proceed	Green
Clear or correct	Yellow
Cancel	Red

When command keys are vertically arranged, ‘cancel’ should be the uppermost key and ‘enter’ the lowest. It is better to position the command keys to the right of the numeric keys. They are then less likely to be inadvertently touched when entering numerals.

When the command keys are horizontally arranged, ‘cancel’ should be located the furthest left, ‘enter’ the furthest right. Because these keys are positioned beneath the numerical keys they will be a problem to visually disabled persons; they are likely to be pressed accidently when entering numbers.

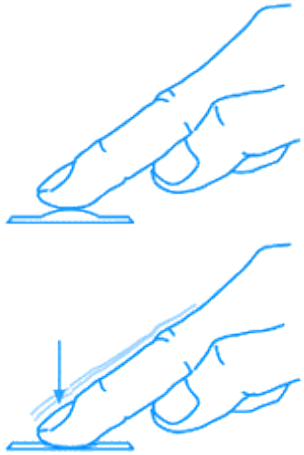
The command keys should be as large as possible so that the words can be larger and thus easier to read.

Shaped keys
Colour should not be the only distinguishing feature between keys, since red/green colour blindness is not uncommon; if possible, the keys should have different shapes and be marked with symbols.



Illumination
Ideally keys should be internally illuminated when the terminal is waiting for input from that keypad.

Sound
Feedback in the form of sounds such as a ‘beep’ or ‘click’ when a key is pressed is helpful to many people.



Tactile feedback
Tactile indication can be provided by a gradual increase in the force, followed by a sharp decrease in the force required to actuate the key, and a subsequent increase in force beyond this point for cushioning.

More time
Many elderly people and those with a cognitive impairment do not like to be rushed or to think that they are likely to be ‘timed out’ by the machine, so it is necessary to allow for such people to use the terminal at their own pace; this requirement could be stored on the user's card.

Speech input
Speech input for commands is an option in some situations. If this is adopted then the user should have the choice of keyboard or speech input. It is likely that speech input would be preferred by people without hands and those with intellectual impairments, but the keyboard is easier for those with a speech impediment.

Problems with PINs
Personal identification numbers (PINs) are a particular problem for many dyslexic and intellectually impaired people. In Europe over 25 million people have dyslexia to the extent that they cannot reliably remember and use a four digit PIN, unless they can choose their own number. The main problem for people with an intellectual impairment is to keep the number secret. Therefore both groups would find it advantageous to have the option of using a biometric method for identification (eg. fingerprint).

With biometric methods of identification it is essential that users have a choice between the biometric method and some other method (eg. PIN); the reason being that for every biometric system there is some group of disabled people who cannot use it (eg. fingerprint identification requires the user to have fingers).

The user's PIN should not be displayed, printed or broadcast by any means. However it would be useful to have both an audible feedback and a visual one (eg. an X or a tick on the screen) to show that a digit has been input. Many people with even slight memory problems find it difficult to remember and input their PIN quickly, so it would be helpful to allow a generous amount of time before they are timed out.

Touchscreens

As touchscreens become more common it is essential that they are designed for ease of use by everyone, including disabled and elderly people.

Choice of technology

Touchscreens are activated by the insertion or removal of the fingertip or by pressing the controls, active areas or targets with a mouthstick, headstick, or other similar device (stylus). Some touchscreens support stylus input and others do not. The difference is in the device's touch sensor technology, of which there are several common types:

- Resistive touchscreens are pressure sensitive, so they can be operated with any input device, including a gloved hand or stylus. However, resistive screens can be easily damaged by sharp objects and they offer only 75% clarity, which may create additional problems for people with low vision.
- Capacitive touchscreens offer higher clarity and are more durable, but they do not respond to gloved hands or most styluses (the pointing device must be grounded).
- Infrared touchscreens can be operated by either human touch or stylus. They also provide high clarity and durability. However, they are more receptive to false responses (by dirt, flying insects, etc.) and do not respond well to users whose fingers hover before pressing a control.
- Surface acoustic wave (SAW), is a more advanced technology that provides high clarity and durability and can be operated by either human touch or stylus. This technology, however, is considerably more expensive than the more common technologies and is not as well supported.

Larger type

It is possible to increase the size of the characters on the screen for individual customers who require this facility. This can be done by selecting this option from a menu or, preferably, by storing this information on the customer's card.

With touchscreen systems, it could be arranged that holding one's finger in the bottom right corner for at least two seconds indicates that one would like larger characters on the screen. Large characters will be difficult to implement on small screens.

Ease of use

To help elderly people and those with hand tremors, key fields should be as large as possible and separated by a 'dead area'. There should be high contrast between touch areas, text and background colour. Graphical symbols (such as icons) should be accompanied by text.

Whilst being used, the finger and hand can obscure what is on the screen. Smudges left by fingers on the screen can decrease legibility.

Speech output
For blind users, it is possible to arrange that holding one's finger in a specified corner of the screen for at least two seconds or tapping twice in the corner, initiates speech output. Another method would be to store this requirement on the user's card.

Cognitive impairment
For those with cognitive impairments, labels that are made to look like controls can cause confusion. If screen designs and controls are constantly reconfigured so the design is flexible, this can render them difficult to use for cognitively impaired people, meaning that they are not given a chance to learn where the controls lie and with what they are associated.

Activation
Touch screens can either be triggered by insertion or withdrawal of the fingertip. With the latter system, it is technically possible for the user to pass their fingertip over the screen and get speech output describing the active area they are touching at the time. Then the system is only triggered by withdrawing the fingertip from over an active area.

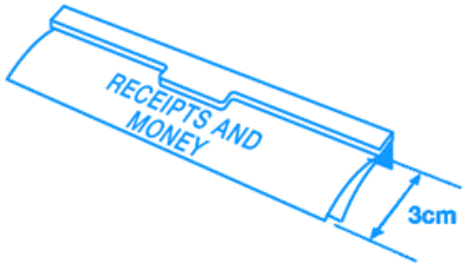
Latency
A noticeable timelag between activating a touch sensitive control and the resulting action is likely to cause significant problems for many users. Incorporating a feature to minimise double activation would be particularly helpful for users with hand tremors.

Privacy
Information, which is sensitive and private to the cardholder, should not be visible to any other person; screen filters improve privacy but often at the expense of visual quality. However, the user may wish to display information with large character size, but they should be made aware of the privacy problem.

Retrieving Money, Cards and Receipts

Retrieving items from a terminal can be very difficult for people with poor manual dexterity and persons with low vision. Often more time is needed, retrieval points need to be clearly indicated and within reach for wheelchair users.

Security
Security at cash dispensers is a major concern for many elderly people, and is often given as a reason for not using such terminals. Therefore anything which improves the user's perception of safety is to be welcomed (eg. better illumination in the vicinity).

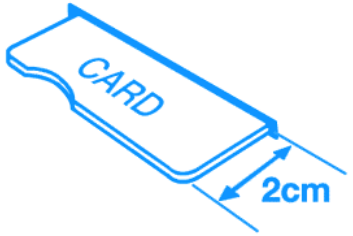


Money retrieval
Cash, receipt, or any other document issued from the terminal for withdrawal by the user should protrude at least 3 cm beyond the slot surround.

Persons with poor manual dexterity often find taking a card from a terminal and then taking the money difficult to do in the allowed time.

Increasing the time for everybody, increases the security risk. However it would be possible to let users decide if they want more time than the norm and store this requirement on their card.

Card retrieval
Many people with arthritis have difficulty in gripping and pulling the card from the reader, particularly when the arm is extended above the horizontal. The card should protrude at least 2 cm from the slot surround. It is recommended that the force necessary for the user to retrieve the card from the terminal should be not any greater than that needed to stop the card from falling out of the reader.



Typefaces and Legibility

Good standards of legibility help all users, but for many people with low vision the issue is fundamental to their use the terminal.

Type size
Larger type will significantly improve legibility for most people with low vision. 16 point type is recommended as the minimum type size that will help low vision users.

This is an example of 16 point medium weight type.

This is an example of 16 point bold weight type.

Type weight
Type weight is very important in determining legibility. Light weight typefaces should be avoided. Regular weight type is sometimes not sufficiently legible, and it is recommended that medium and bold typefaces are used to give maximum legibility.

Extra bold type is not recommended because the centres of the letters are very small and thus become blurred for some people with low vision.

Spacing and line length
Many readers are daunted by large amounts of close-set type. Space between lines of type should be as open as possible. Word spacing on screens should be even and slightly more open than on printed documents.

Unjustified right hand margins are helpful to persons with low vision. Avoid splitting words at the ends of lines.

The width of columns of type is an important factor that affects readability. If lines of type are too long the eye has difficulty finding its way back to the beginning of the next line. A maximum of 8 words per line is recommended for continuous text on a screen.

Layout
Good ‘navigational’ aids such as bullet points, differentiated headings and rules to separate unrelated sections will help readability.

If type is set in two or more columns, the margins should be wide enough to clearly separate the columns. If space is limited then a vertical rule can help.

Moving text on a screen can be very difficult to read with even a mild visual impairment; it should thus be avoided.

Contrast
An important factor affecting legibility is the contrast between the type and the background on which it sits.

Reversal of type
White or yellow type on black or a dark colour is more legible provided that the typeface weight and size are suitable.

Small type and very bold type tend to blur for some people, reducing legibility. Pale colours and colours which are close in tone should be avoided.

Type should not run across photographs or illustrations. This can limit the contrast and confuse the eye.

Using capital letters
Upper and lower case type is easier to read than type set in all capital letters; although a few words in capitals may present no serious difficulties.

THE USE OF ALL CAPITALS SHOULD BE AVOIDED FOR CONTINUOUS TEXT.

Typeface styles
Most typefaces in common use are legible. Many people with low vision find contrast, size and weight more important than the choice of typeface. Bizarre and indistinct typefaces should be avoided. Narrow condensed typefaces should also be avoided.

An important consideration relates to the design of the numerals. Many people with low vision can easily misread the numerals 3, 5, 6, 8 and 9 because the tails curl over, which tends to blur or merge the shapes (as shown in the top row of the following example). Choosing a typeface with more ‘open’ character shapes helps improve legibility on screen.

Receipts

To aid users with low vision, receipts should be printed with a minimum type size of 12 point and in a sans serif typeface with upper and lower case text. If space permits, 16 point type would be preferable.

It is important that the print has good contrast on opaque paper with a minimum of background pattern. A common complaint is poor print quality on receipts; often this is the result of the printer ribbon not being replaced regularly.

Checklist

The following checklist is a summary of the main aspects which, if taken into consideration, could significantly improve access to public terminals by people with disabilities.

It is essential to test any prototype with a cross section of potential users, including people with disabilities.

Locating and accessing a terminal

- Location signs easy to read?
- Adequate lighting levels?
- Queuing arrangements?
- Clear path for wheelchairs?
- Level surface?
- Location system for blind users?

Card systems

- Ease of use for someone with poor manual dexterity?
- Card contains user requirements?
- Notch on card for orientation?
- Contactless card system?

External features, labels and instructions

- Labels positioned to be easy to read?
- Legible labels?
- Numbered instructions?
- Controls reachable from a wheelchair?
- Funnelled card entry slot?

Screens and instructions

- Screen shielded from sunlight?
- Touch screen reachable from a wheelchair?
- Minimised parallax problems?
- Foreign languages for screen instructions?
- No noticeable flicker on the screen?
- Plain background for textual information?
- Good contrast between text and background?

Operating instructions

- Simple vocabulary?
- Inductive loop facility?
- Audio jack socket?

- Audible feedback of key input?
- Speech output?
- Video link?

Keypads

- Telephone layout for numeric keys?
- Raised dot on number 5?
- Clear visual markings on keys?
- Raised or recessed keys?
- Well spaced keys?
- Internally illuminated keys?
- Tactile feedback on keys?
- Generous time allowed for key input?

Touchscreens

- Option to increase character size?
- Large key fields?
- Generous spacing between touch areas?
- High contrast between touch areas, text and background?
- Minimal latency?
- Labels are easily distinguishable from controls?
- Text accompanies graphical symbols?
- Speech output option?

Retrieving money, cards and receipts

- Adequate security?
- Documents protrude at least 3cm?
- Cards protrude at least 2cm?
- Minimum force needed to withdraw card?

Typefaces and legibility

- Instructions at least 16 point type size?
- Good contrast text?
- No background patterns?
- Easy to read typefaces?
- Short line length?
- Readable receipt?

Training

- Instruction booklets in clear print?
- Instructions on audio tape?
- Assistance for first time users?

Standards

British Standards Institute

389 Chiswick High Road, London W4 4AL, United Kingdom. Tel: +44 20 8996 9000.

BS 8300	Design of buildings and their approaches to meet the needs of disabled people

Canadian Standards Association

5060 Spectrum Way, Mississauga, Ontario L4W 5N6, Canada. Tel: +1 416 747 4000.

B651.1-01	Barrier-free design for automated banking machines
B651.2	Accessible design for self-service interactive devices

Comite Europeen de Normalisation

Avenue Marnix 17, B-1000 Brussels, Belgium. Tel + 32 2 550 08 11.

EN 726	Requirements for IC cards and terminals for telecommunications use
EN 1332	Machine readable cards, related device interfaces and operations. Part 1 Design principles and symbols for the user interface; Part 2 Dimension & location of tactile identifier for ID1 cards; Part 3 Keypads; Part 4 Coding of user requirements for people with special needs
EN 29241	Part 4 Keyboard requirements; Part 11 Usability statements
EN 301 549	Accessibility requirements for public procurement of ICT products and services in Europe

European Telecommunications Standards Institute

PO Box 52, Route des Lucioles, Sophia-Antipolis, Valbonne, F-06561 Alpes Maritimes, France. Tel +33 92 94 42 00.

ETR 029	Access to telecommunications for people with special needs. Recommendations for improving and adapting telecommunication terminals and services for people with impairments
ETR 160	Human factors aspects of multimedia telecommunications
ETS 138	Public terminals for the elderly

ETR 334 The implication of human ageing for the design of telephone terminals

International Electrotechnical Commission

3 rue de Varembé, CH-1211 Geneva 20, Switzerland. Tel +41 22 73 40 150.

IEC 73 Colours of pushbuttons and their meanings

International Organization for Standardization

1 Rue de Varembé, Case postale 56, CH-1211 Geneva 20, Switzerland. Tel +41 22 749 0111.

ISO 7000 Graphical symbols for use on equipment

ISO 7001 Public information symbols

ISO 7239 Development and principles for application of public information symbols

ISO 7165-5 Wheelchairs – Determination of overall dimensions, mass and turning space

ISO 9186 Procedures for the development and testing of public information symbols

ISO 9241 Ergonomic requirements for office work with visual display terminals

ISO/IEC 9995 Information technology: keyboard layout for text and office systems

International Telecommunications Union

Place des Nations, CH-1211 Geneva 20, Switzerland. Tel +41 22 730 5111.

ITU E134 Human factors aspects of public terminals - generic operating procedures

ITU E135 Human factors aspects of public telecommunications terminals for people with disabilities

Standards Australia

1 The Crescent, Homebush, New South Wales 2140, Australia. Tel +612 746 4600.

AS 3769 Automatic Teller Machines - User Access

Telecommunications Technology Association

267-2 Seohyeon-dong, Bundang-gu, Seongnam-City, Gyonggi-do, Korea. Tel: + 82 31 724 0114

KO-09.0040 Automatic Teller Machine's Accessibility Guidelines 1.0

Pan-European Disability Organisations

European Disability Forum

Square de Meeus 35, 1000 Brussels, Belgium. Tel +32 2 282 46 00. info@edf-feph.org http://www.edf-feph.org/
This is the group which is recognised by the European Commission as representing the non-governmental disability organisations in the European Union.

Action Européenne Des Handicapés

Sozialverband VdK Deutschland, In den Ministergärten 4, 10117 Berlin. Tel +49 30 72629-0400. info@aeh-europe.de or general.secretariat@aeh-europe.de http://www.aeh-europe.de/en/

Alzheimer Europe

14 rue Dicks, L-1417 Luxembourg. Tel.: +352-29 79 70. info@alzheimer-europe. http://www.alzheimer-europe.org/

Age International

Tavis House, 1-6 Tavistock Square, London WC1H 9NA, UK. Tel +44 800 032 0699. contact@ageinternational.org.uk http://www.ageinternational.org.uk/

Association Internationale Aphasie

Av. M. Thiry 12 B.36, B-1200 Brussels, Belgium. Tel +32 2 762 3638. avn@afasie.nl http://www.afasie.nl/aphasia/

Autisme Europe

Rue Montoyer 39, Bruxelles 1000, Belgium. Tel +32 2 675 75 05. secretariat@autismeurope.org http://www.autismeurope.org/

Cerebral Palsy in the European Communities Association

c/o APPC Rua Delfim Maia 276, 4200-253 Porto, Portugal.

Disabled People's International

via Dei Bizantini, 97 88046 Lamezia Terme (CZ), Italy. Tel +39 0968 463499. http://www.dpi-europe.org/

European Alliance of Neuromuscular Disorders Associations

7-11 Prescott Place, London SW4 6BS, England. Tel +44 171 720 8055. http://www.eamda.eu/

European Blind Union

6 rue Gager-Gabillo,t 75015 Paris, France. Tel +33 1 47 05 38 20. ebu@euroblind.org http://www.euroblind.org/

European Brain Injury Society

17 rue de Londres, B-1050 Brussels, Belgium. Tel +32 2 502 3488.

http://www.internationalbrain.org/articles/european-brain-injury-society/

European Dyslexia Association

c/o Bureau Felix & Felix sprl, Chaussée de Tubize 135, B-1440 Braine Le Château, Belgium. eda-info@eda-info.eu http://www.eda-info.eu/

European Federation for Mental Health in Intellectual Disability

c/o KNMG Congresbureau Royal Dutch Medial Association, Mercatorlaan 1200, 3528 BL Utrecht, The Netherlands. Tel +31 30 282 3203. info@mhid.org http://www.mhid.org/home

European Federation of Hard of Hearing People

c/o Action oh Hearing Loss, 19-23 Featherstone Street, London EC1Y 8SL, UK. office@efhoh.org http://www.efhoh.org/

European Parkinson's Disease Association

1 Northumberland Avenue, Trafalgar Square, London WC2N 5BW, UK. Tel +44 207 872 5510. info@epda.eu.com http://www.epda.eu.com/en/

European Union of the Deaf

Rue de la Loi - Wetstraat 26/15, 1040 Brussels, Belgium. eudeaf@pcphost.eunet.be http://www.eud.eu/

Help Age International

22-28 Avenue D'Auderghem, 1040 Brussels, Belgium. helpage@gn.apc.org http://www.helpage.org/

Inclusion Europe (formerly International League of Societies for Persons with Mental Handicap - European Association) Galerie de la Toison d'Or, 29 Chaussée d'Ixelles, B-1050 Brussels, Belgium. Tel +32 2 502 2815. secretariat@ilsmh-ea.be http://www.siwadam.com/hmm/euie.htm

Rehabilitation International

Square Ambiorix 32, Boîte 8, B-1000 Brussels, Belgium. Tel +32 2 230 43 97. http://www.riglobal.org/

Other Sources of Information

Web Content Accessibility Guidelines
http://www.w3.org/TR/WCAG20/

Guidelines for the Design of Accessible Information and Communication Technology Systems
http://www.johngilltech.com/guidelines/guidelines_list.htm

Information Transaction Machines Accessibility Checklist
http://www.justice.gov/crt/508/archive/olditm.html

USA Voting System Standards
http://www.fec.gov/agenda/agendas2001/mtgdoc01-62/v1/v1s2.htm

Section 508 of the USA Rehabilitation Act
http://www.section508.gov/?fuseAction=stdsdoc

Trace EZ Access
http://trace.wisc.edu/world/ez/

United Nations Accessibility for the Disabled - A Design Manual for a Barrier Free Environment
http://www.un.org/esa/socdev/enable/designm/AD5-02.htm

Irish National IT Accessibility Guidelines
http://universaldesign.ie/Technology-ICT/Irish-National-IT-Accessibility-Guidelines/

UK Equality Act
http://www.legislation.gov.uk/ukpga/2010/15/contents

Designing User Interfaces for People with Visual Impairments
http://www.johngilltech.com/reports/controls/index.htm

Smart Cards: Interfaces for People with Disabilities
http://www.johngilltech.com/reports/urcai.htm

Telecommunications: Guidelines for Accessibility
http://www.johngilltech.com/reports/telecoms/index.htm

Digital Accessibility Laws around the Globe
http://lflegal.com/2013/05/gaad-legal/