

# Access Prohibited?



Information for Designers of Public Access Terminals  
John Gill

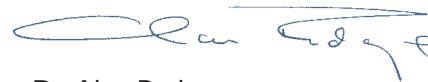
## Preface

The majority of us now take for granted the easy accessibility of familiar cash dispensers and other public access terminals, but infirmity or a disability brings a totally different dimension to their practicability.

The expansion of information technology has brought to the public enhanced levels of access to data systems and services. However, those of us closely linked with extending the potential for these technologies face the challenge of how to widen accessibility to these systems to ensure the elderly, and people with disabilities, find them as user-friendly as others without impairments.

Engineers are made conscious through their training that their role is to provide solutions to difficult problems and so are well qualified for this crucial role through the exercising of their ingenuity.

This brochure is a timely initiative by the Royal National Institute for the Blind to heighten awareness of the professional responsibilities of everybody involved in the concept, design, and operation of public access terminals.



Dr Alan Rudge CBE, FEng, FIEE, FRS  
Chairman of the Senate of the Engineering Council



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## Information for Designers of Public Access Terminals

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# Public access terminals



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, digital broadcasting comes onstream 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.

This publication explains the range of disabilities that make access difficult and provides information on how public access terminals can be designed to be as accessible as possible to all potential users.

# 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.

# The numbers of people with disabilities

In geographic Europe (with a population of about 800 million), the estimated number of people with impairments (such that they have problems in using public access terminals) is shown here.

It is not uncommon for an individual to have more than one disability; this is particularly common among older people.

The number of people over retirement age in Europe is likely to increase by over 1% per year for the next two decades, and as a result the number of people with disabilities will also increase. Some disabilities, such as incontinence, have little direct effect on an individual's ability to use a public access terminal and are therefore not covered in this publication.

## Mobility impairment

Reduced function of legs and feet leads to users depending on a wheelchair or artificial aid to walking. In addition to people who are born with a disability, this group includes a large number of people whose condition is caused by age or accidents.



Wheelchair user 3 million  
Cannot walk without aid 45 million

## Dexterity impairment

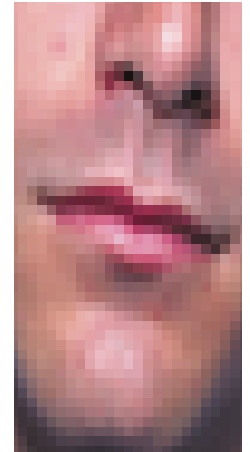
Reduced function of arms and hands makes activities related to moving, turning or pressing objects difficult or impossible. This does not influence speech communication itself but makes it hard to make a phone call or use a wide range of other equipment.



Cannot use fingers 1 million  
Cannot use one arm 1 million  
Reduced strength 22 million  
Reduced co-ordination 11 million

## Speech and language impairment

Speech impairment may influence speech in a general way, or only certain aspects of it, such as fluency or voice volume. Language impairment may be associated with a more general intellectual impairment.



Speech impaired 2 million  
Language impaired 5 million

## Cognitive impairment

Dyslexia can cause significant problems in remembering numbers in the correct order (such as a personal identification number). People with an intellectual impairment can often function well in familiar environments, but can be easily confused when required to respond to instructions quickly.



**Dyslexia** 25 million  
**Intellectually impaired** 30 million

## Hearing impairment

Hearing impairment can affect the whole range or only part of the auditory spectrum which, for speech perception, the important region is between 250 and 4,000 Hz. The term deaf is used to describe people with profound hearing loss such that they cannot benefit from amplification, while hard of hearing is used for those with mild to severe hearing loss but who can benefit from amplification.



**Deaf** 1 million  
**Hard of hearing** 80 million

## Visual impairment

Blindness implies a total or near total loss of the ability to perceive in form. Low vision implies an ability to utilise some aspects of visual perception, but with a greater dependency on information received from other sources.



**Blind** 1 million  
**Low vision** 11 million

## Elderly

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 the telephone or video cassette recorder even though they may not be familiar with all of its facilities.



**Elderly** 80 million

# 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 with low vision find it difficult to read a screen if type sizes are not sufficiently large. Also, persons with a hearing impairment need to be able to increase the volume when listening in a noisy environment. Other problems require more complex modifications, but often solutions are available but not implemented. The table shows the general problems with a public access terminal 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 inconsistency 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).

-  Few problems
-  Some problems
-  Many problems

		Wheelchair user	Cannot walk without aid	Cannot use fingers	Cannot use one arm	Reduced strength	Reduced co-ordination	Dyslexic	Intellectually impaired	Deaf	Hard of hearing	Blind	Low vision	Elderly
Locate terminal														
Access to terminal														
Read & understand instructions														
Insert card														
Read screen														
Use keypad														
Use touchscreen														
Listen to audible output														
Read printed output														
Retrieve card														

## Locating and accessing a terminal

In places such as shopping centres, car parks, railway and bus stations, locating an information terminal or cash machine can be difficult - particularly for people who are blind or have low vision.

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 fascia of the terminal will allow for the footrest of a wheelchair. A notch adjacent to the fascia 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).

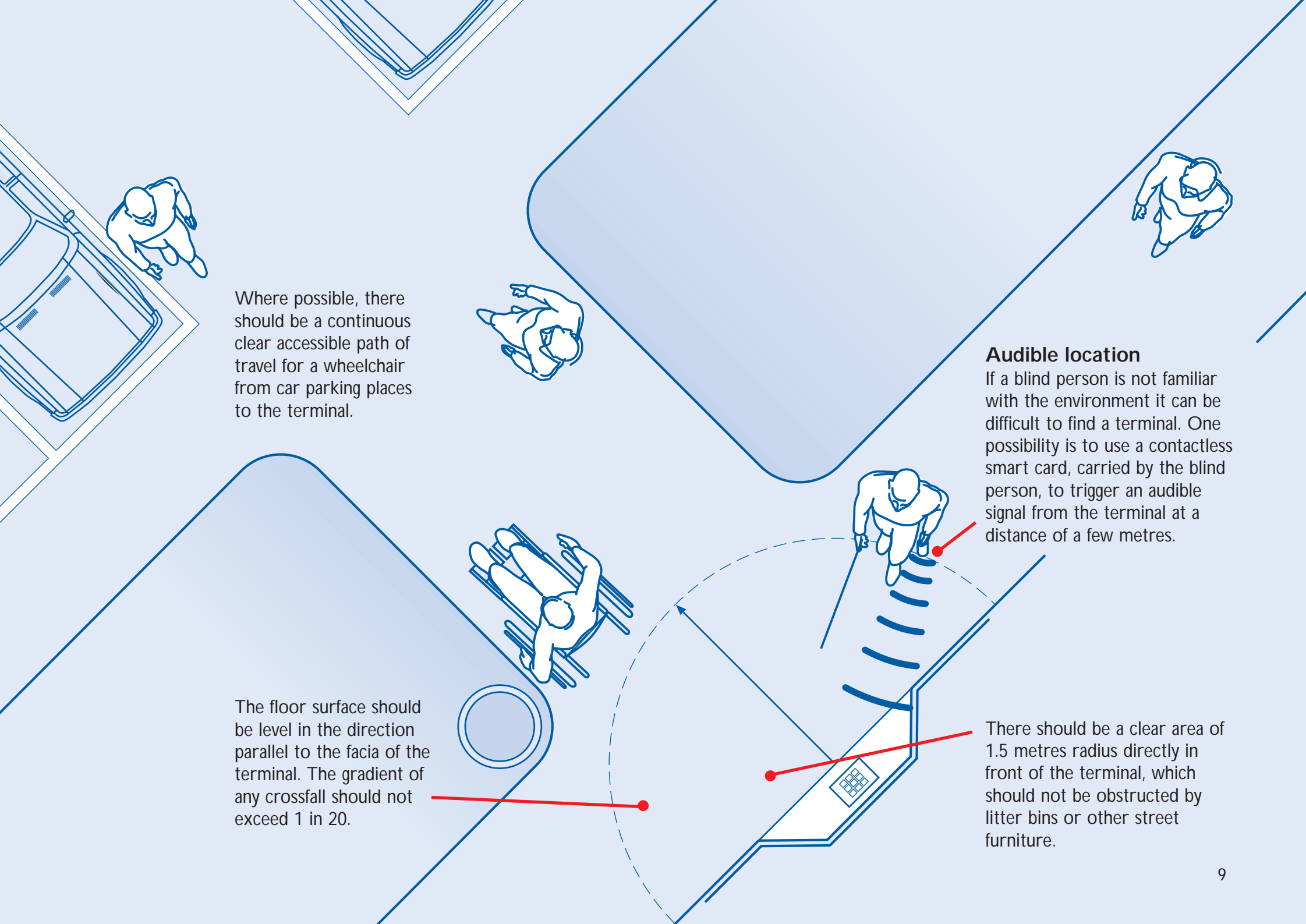


### Lighting

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 such as variation in colour of flooring or pavement. The system should maintain 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.

**Audible location**

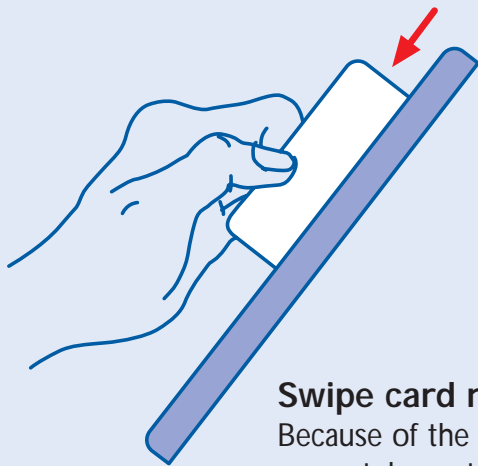
If a blind person is not familiar with the environment it can be difficult to find a terminal. One possibility is to use a contactless smart card, carried by the blind person, to trigger an audible signal from the terminal at a distance of a few metres.

The floor surface should be level in the direction parallel to the fascia of the terminal. The gradient of any crossfall should not exceed 1 in 20.

There should be a clear area of 1.5 metres radius directly in front of the terminal, which should not be obstructed by litter bins or other street furniture.

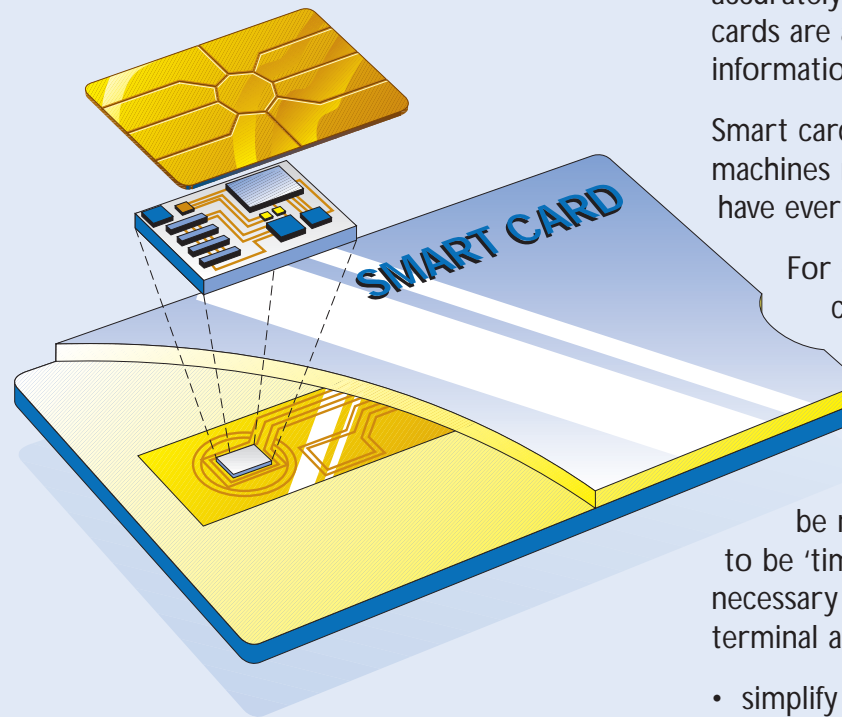
# Card systems

Card systems are already used extensively for telecommunications, public transport and self-service terminals. Many people now 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

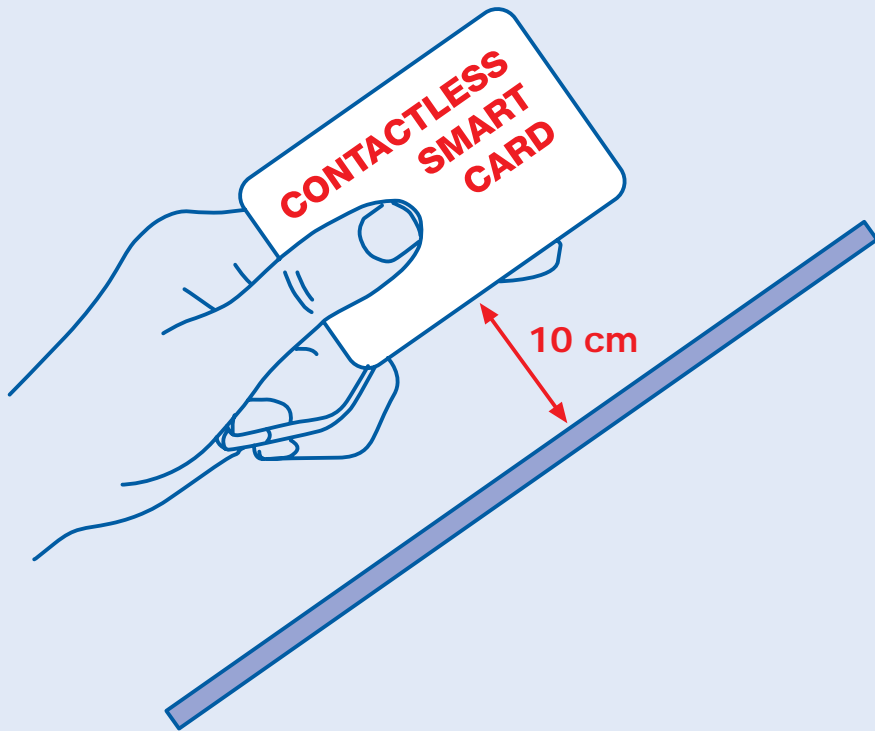
A smart card is a credit card sized plastic card incorporating an integrated circuit. This circuit holds information that can be securely and accurately read by all sorts of terminals. Smart cards are able to carry larger amounts of information than magnetic stripe cards.

Smart cards provide the opportunity to make machines much more 'user friendly' than they have ever been before.

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.

Currently, the coding of user requirements is specified in the draft European standard prEN1332-4 (a list of relevant standards is given on page 28).

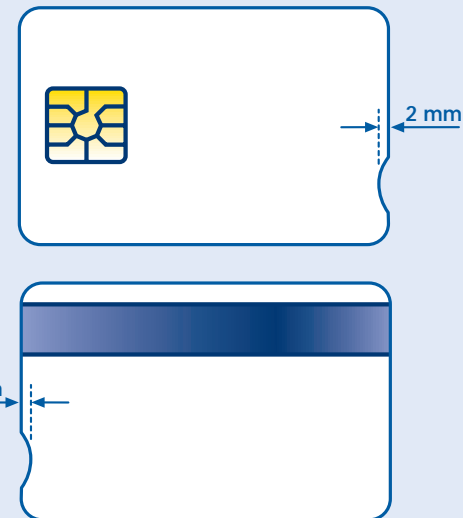
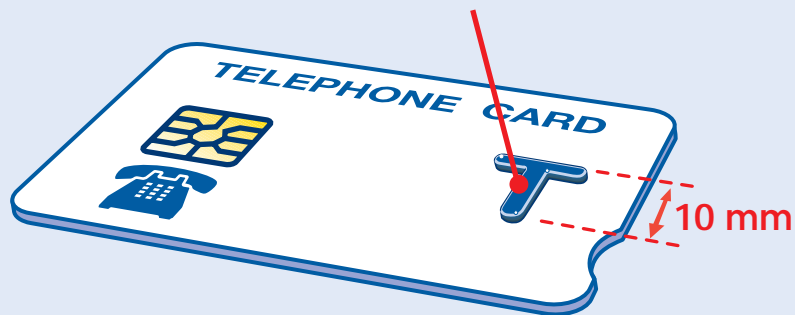


### Contactless smart cards

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.

### Embossing on cards

For blind persons, there is the problem of selecting the right card from their wallet. It is recommended that cards incorporate an embossed capital letter at least 10 mm high with an embossing of at least 0.7 mm.



### 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.

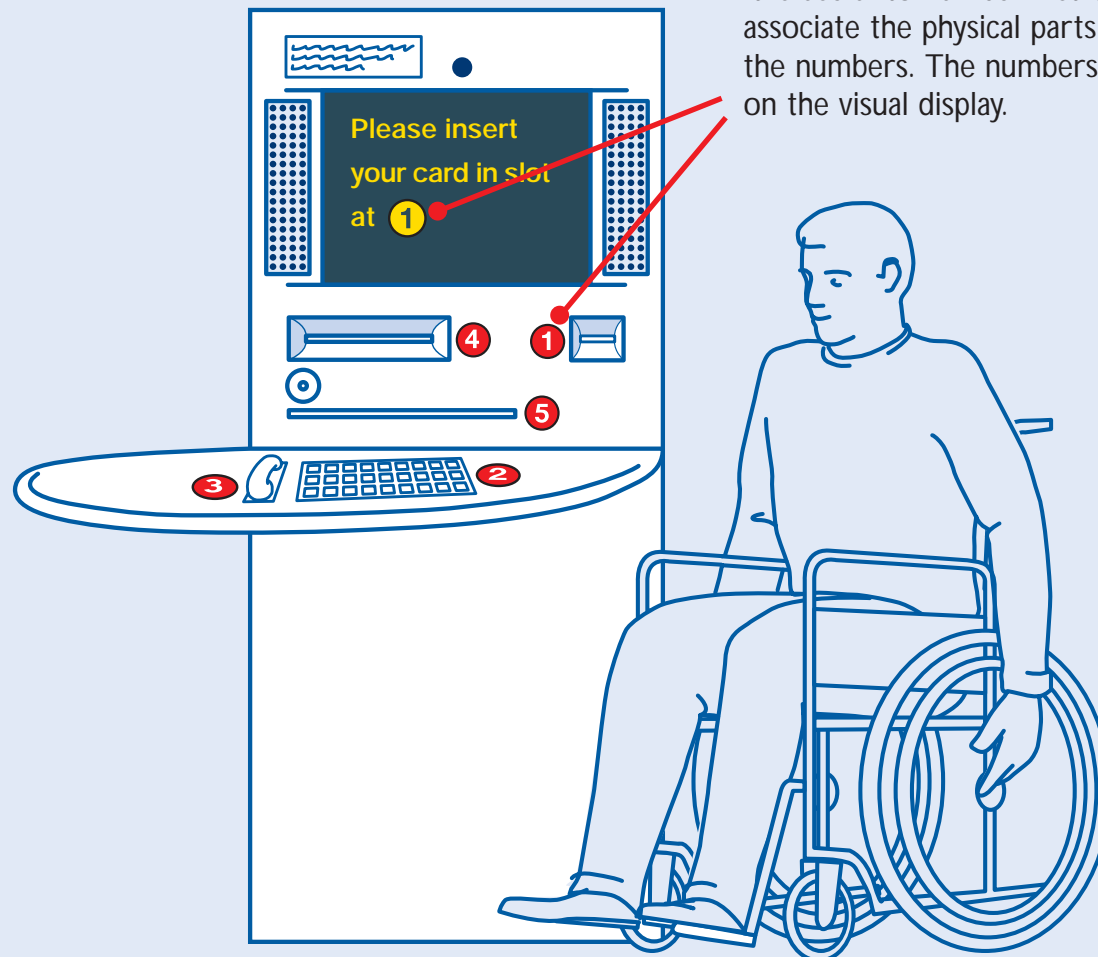
### Legibility

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

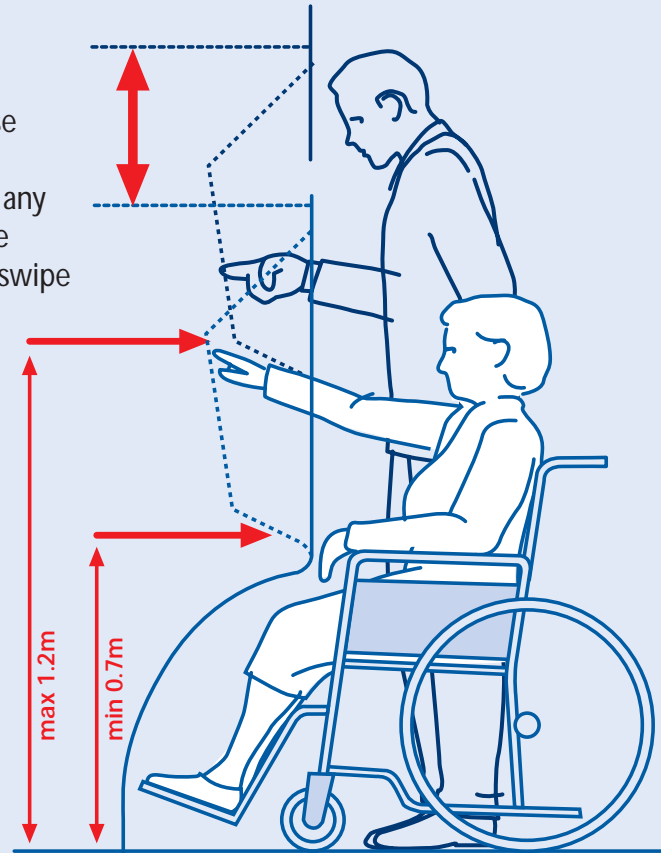
For many wheelchair users, such as those with arthritis, it is not just a problem of reaching the card reader, but still having any useful grip as the arm is raised above the horizontal. This is particularly acute for swipe card readers.

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.

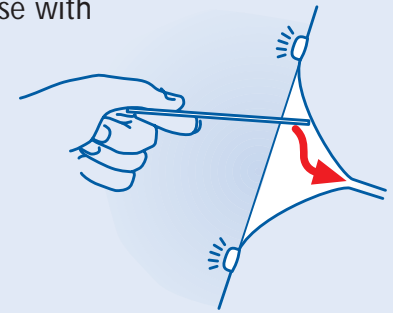
Ideally the terminal, or user controls, should be adjustable in height, as is done on some drive-in cash dispensers.

The problems of accessing the card reader are greatly alleviated if contactless smart cards are used.

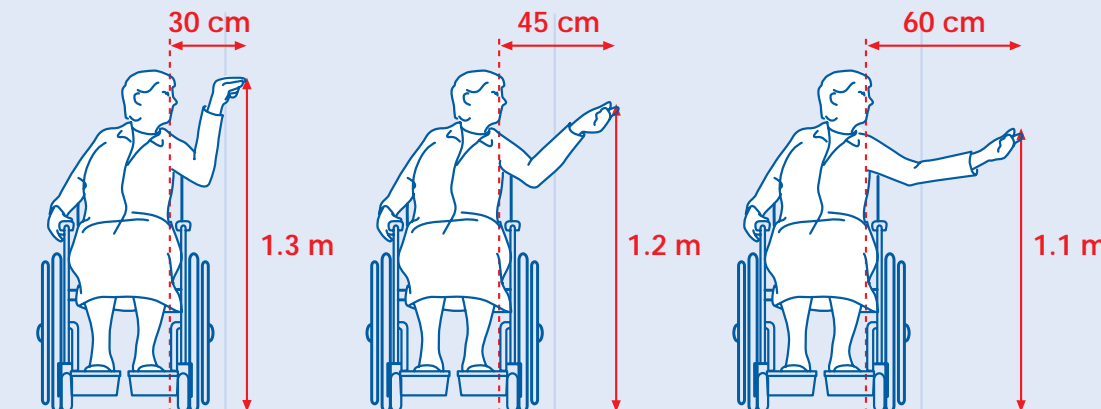


## Card entry

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.



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.



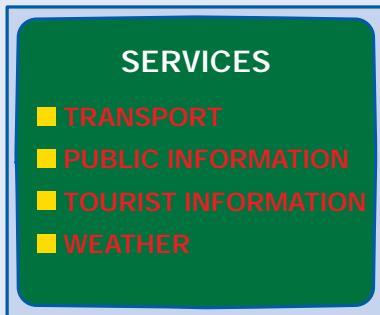
Reach in cm	Maximum height in metres
30	1.3
45	1.2
60	1.1

# 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.

## 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).



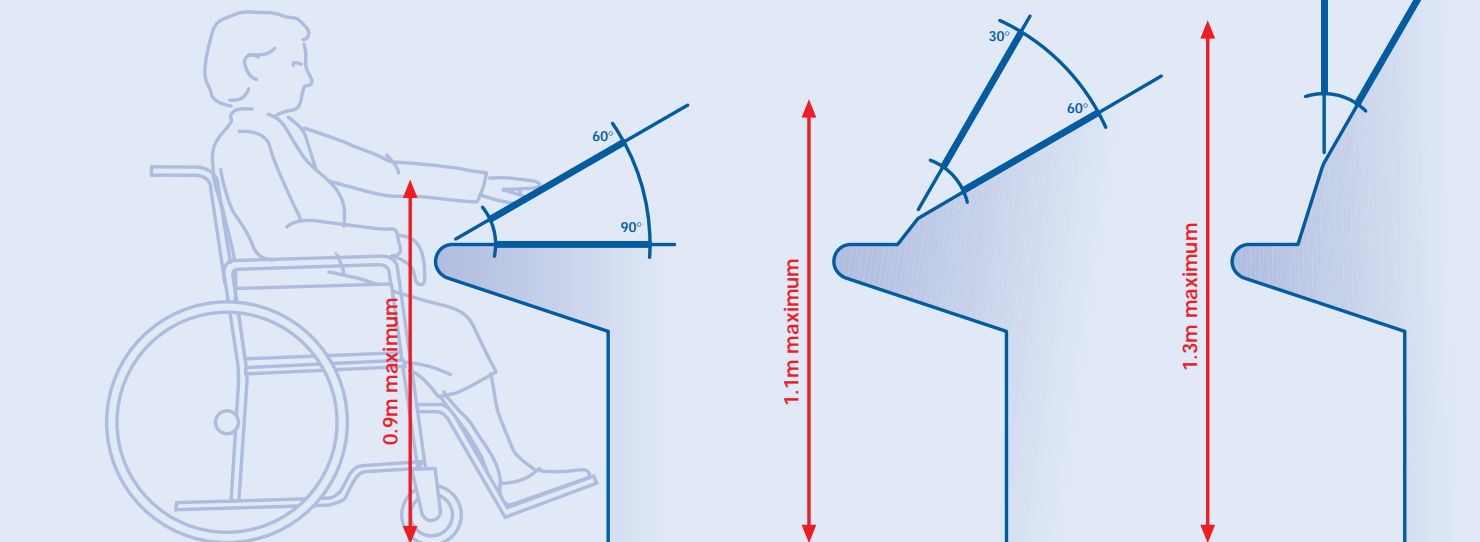
People who wear bifocals find it difficult to read the screen of most public access terminals, since the screen may not be at a suitable distance for the near or far segments of their spectacles. In addition many people leave their spectacles in the car or do not wear them in public. So the number of people who have problems in reading the screen is much more than the 1.5% of the population considered to be blind or to have low vision.

## 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.





### Parallax problems

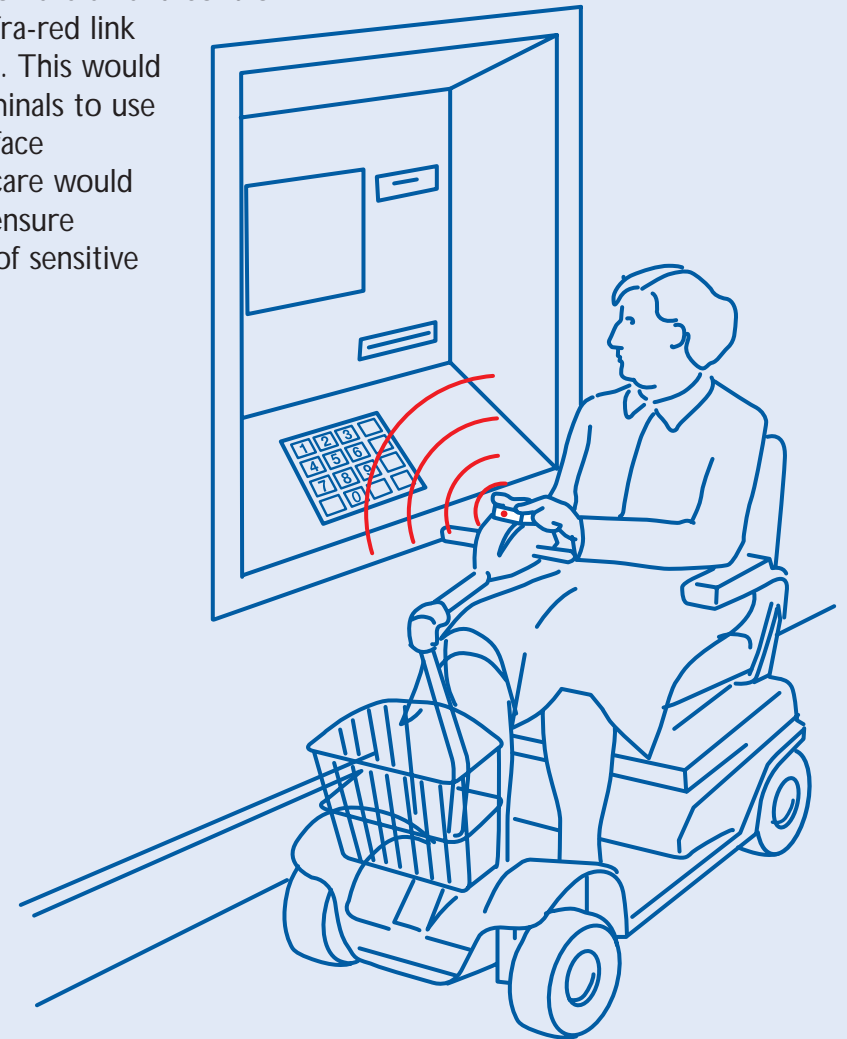
The conflicting requirements of tall pedestrian users and short wheelchair users can lead to a significant group of users having parallax problems when lining up the function keys with the displayed option. Lines on the user-interface leading from the key to the surface of the display can alleviate this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

### 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.

### Infra-red links

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.



# Operating instructions

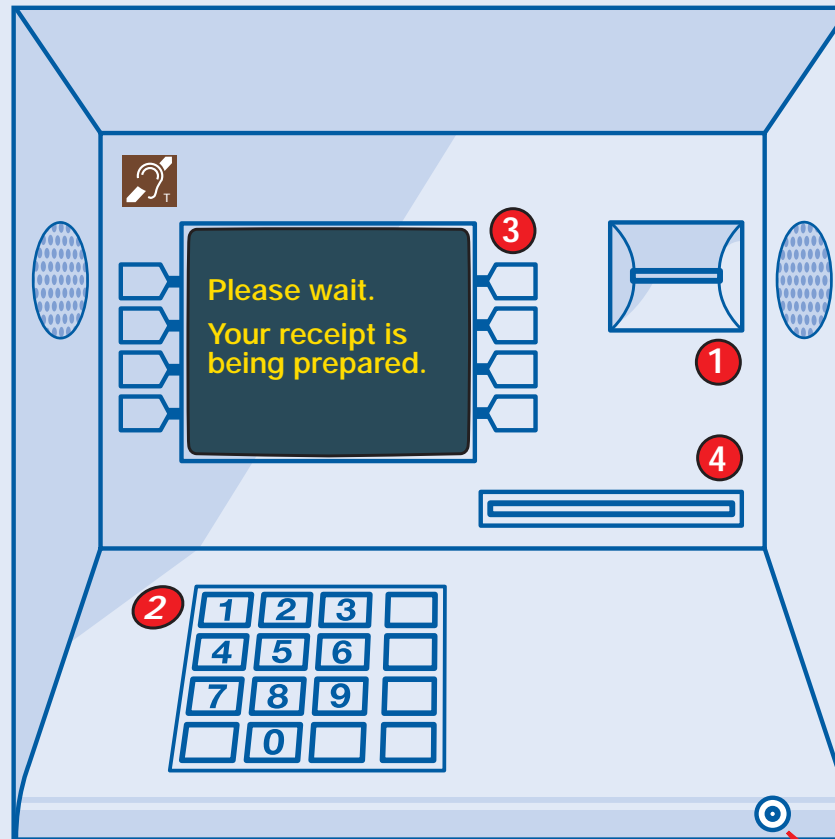
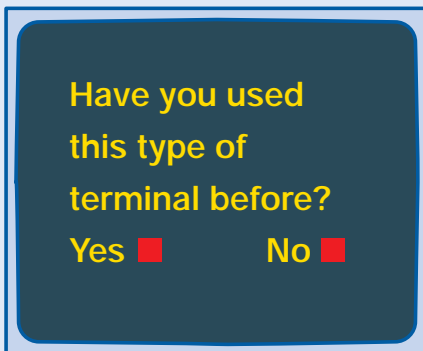
Few people are trained to use public terminals. It is therefore very important that the instructions for using the terminals are carefully designed, particularly for elderly and disabled users.

## 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.



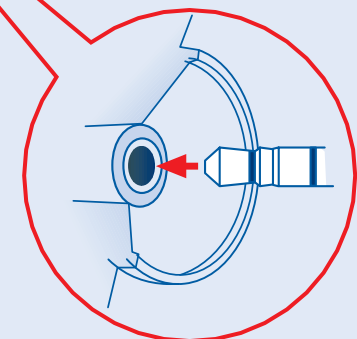
## Hearing aid users

If there is an inductive loop for hearing aid users, there should be a clear visual indication that this is the case. This is an example of the Induction Loop sign used in the UK.

(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

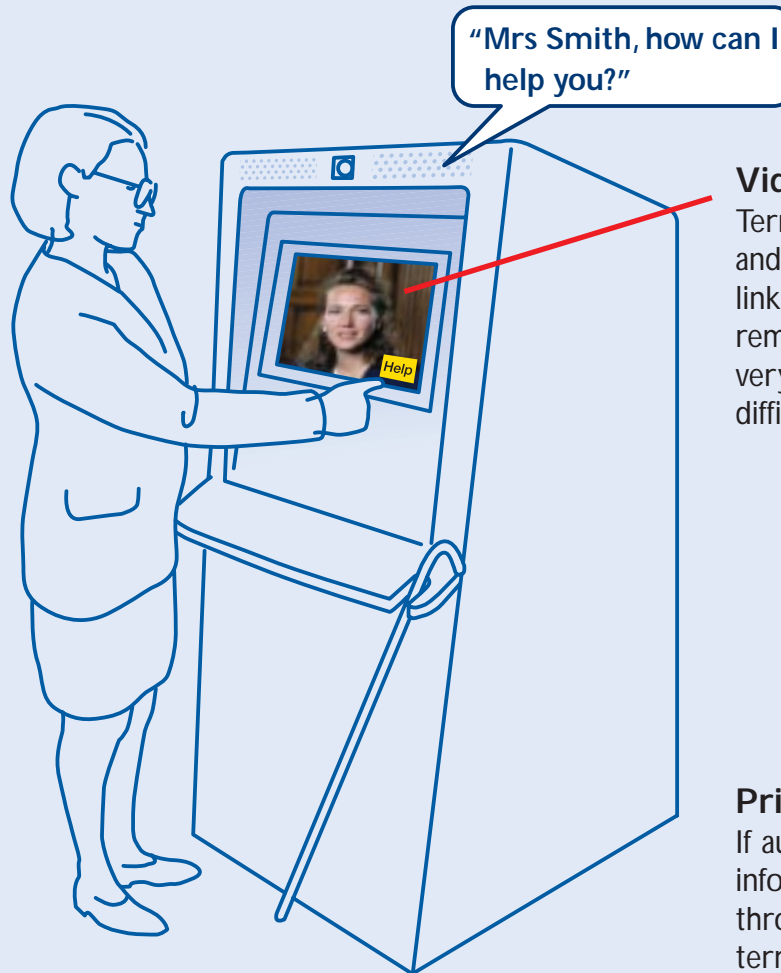
On some terminals a 'beep' will sound when a key press has been registered. However, this does not help a visually disabled person know whether they have pressed the correct key; one solution is for coding on the user's card to request speech output of key pressed for non-confidential information.

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, as shown here.

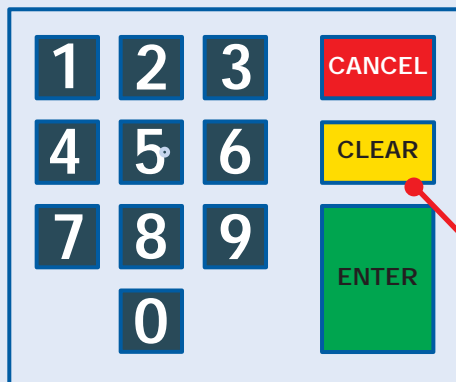
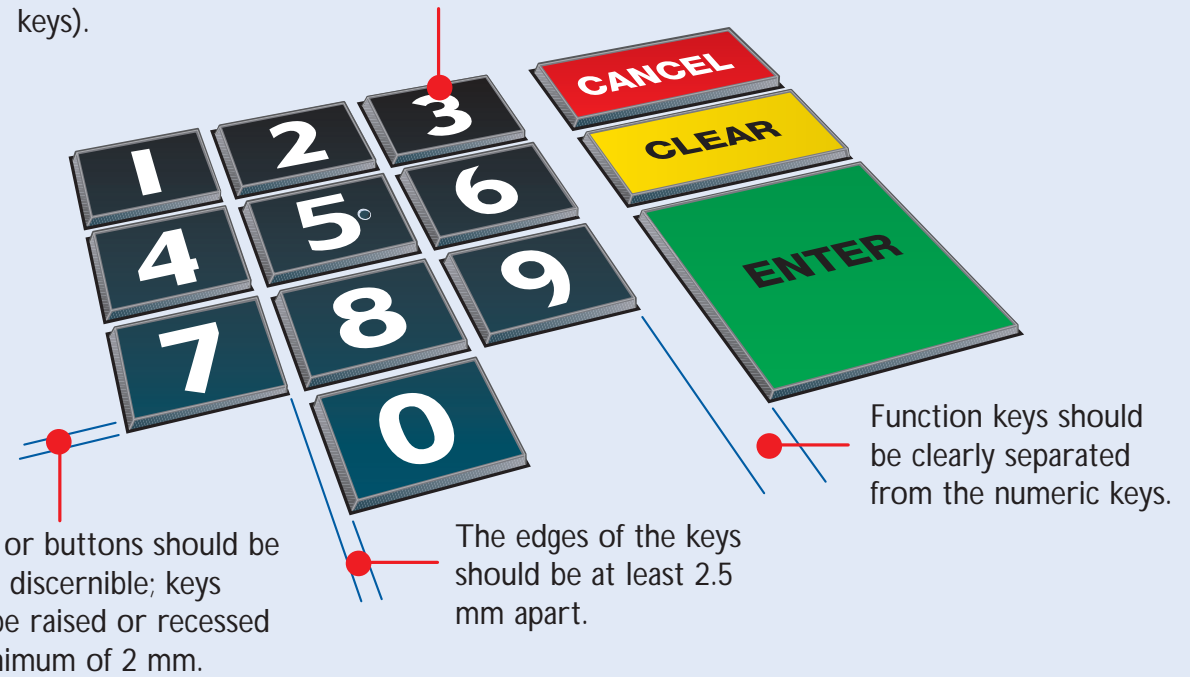
## Numeric and command keys

People with low vision find some numeric characters difficult to read. It is important that a typeface is used that has numerals with open shapes. Page 22 gives further details on the use of type.

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).

Colour coded keys should be:  
Red: Cancel  
Yellow: Clear or Correct  
Green: Enter or Proceed



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.

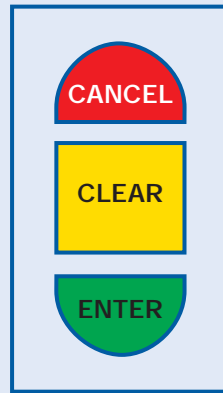
Because these keys are positioned beneath the numerical keys they will be a problem to visually disabled persons. They are likely to be pressed accidentally when entering numbers.

The words on the command keys shown here are smaller because of the narrow size of the keys. The keys should be as large as possible so that the words can be larger and thus easier to read.

## Enhancing feedback

### 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

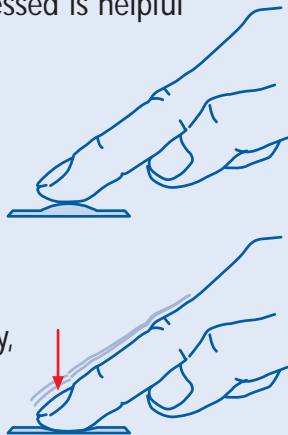
Ideally keys should be internally illuminated when the terminal is waiting for input from that keypad.

### 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.

### 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).

### 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.

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.

## 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.

## 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.

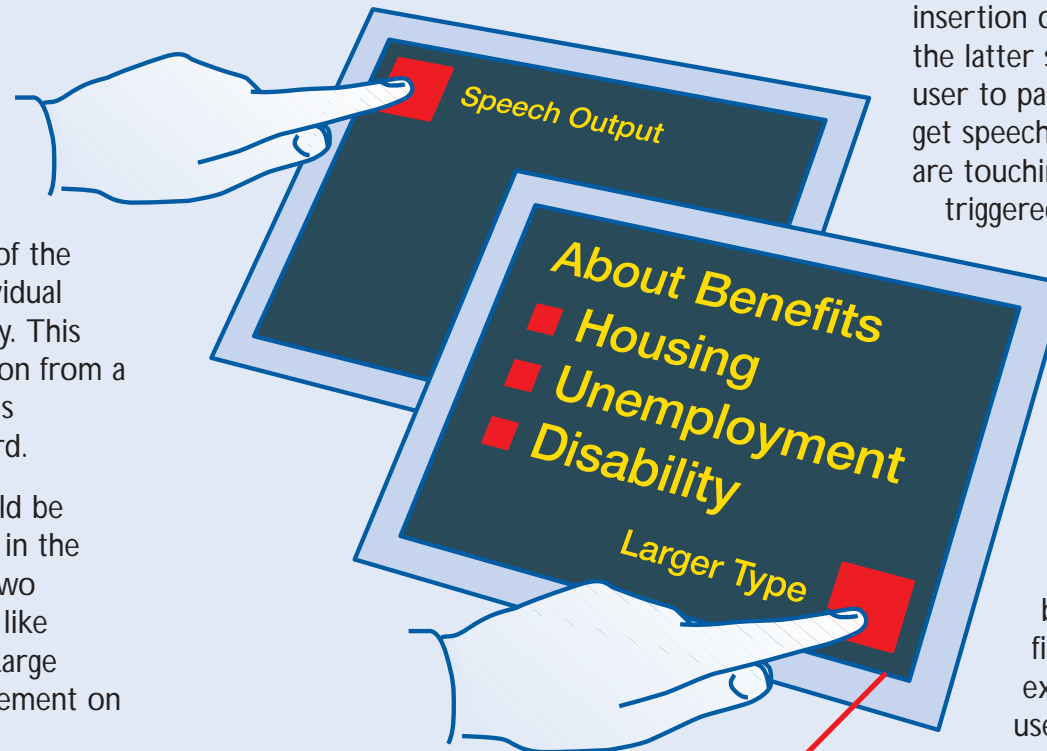
## Activation

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.

## 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.



Touch the screen in this corner and characters will be displayed at a larger size.

## Privacy

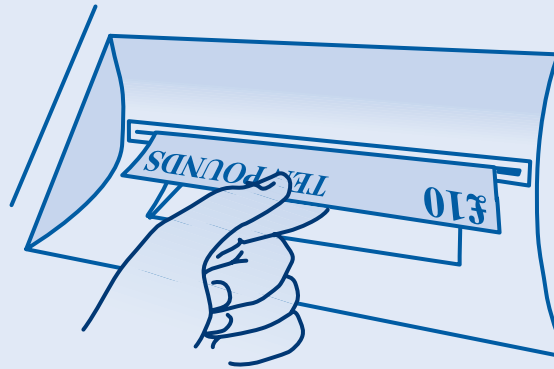
Information, which is sensitive and private to the cardholder, should not be visible to any other person; screen filters improve privacy but often at the expense of visual quality. However, the user may wish to display information with large character size, but they should be made aware of the privacy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



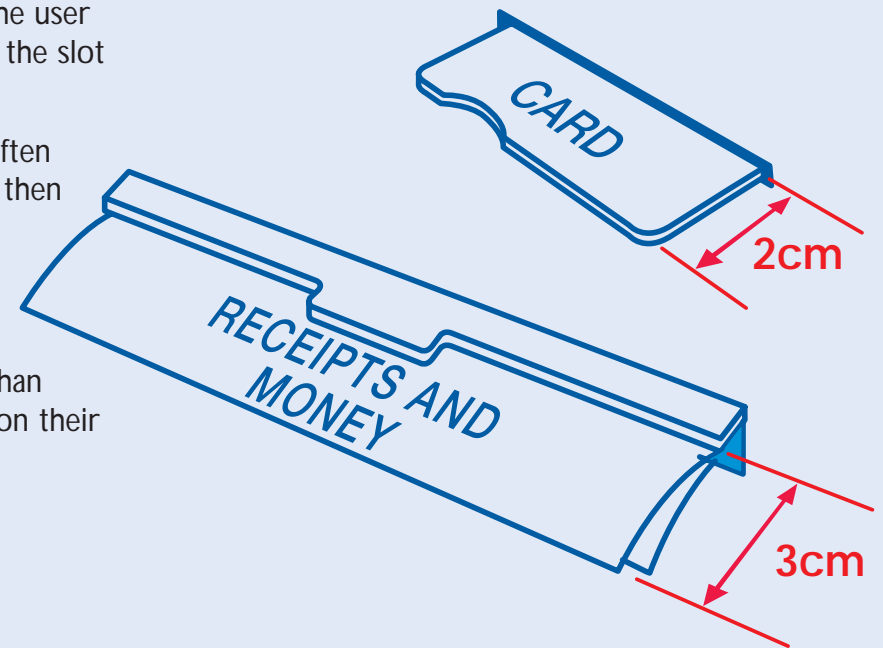
## Card retrieval

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.

## 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.



# 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.



## 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.



**Some small type tends to blur when reversed**

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.

The Royal National Institute for the Blind has recently funded the development of a typeface, called Tiresias, that has been designed to improve the legibility of television subtitles. Further information on this typeface can be found on the World Wide Web ([www.eyecue.co.uk/tiresias](http://www.eyecue.co.uk/tiresias)).

An example of the work carried out to develop Tiresias 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.



### 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.

### 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.

**RECEIPT**

-----

Cash withdrawal:           £30.00  
Date 27/8/97

Account balance  
after withdrawal:       £1,296.00

Machine ref.  
L227C173

Thank you

-----

This shows an example of 16 point size type.

# 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?
- Embossing for card identification?
- 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?

## **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?
- 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?

# Publications

Ballabio E, Placencia-Porrero I & Puig de la Bellacasa R (Eds) **Rehabilitation Technology: Strategies for the European Union**. *Studies in Health Technology and Informatics, Vol 9, ISBN 90 5199 131 2, ISSN 0926 9630, IOS Press, Amsterdam, 1993.*

Brandt Å **Telephones for All**. *Nordic Design Guidelines (NNH/3/95), The Nordic Committee on Disability, Stockholm, ISBN 87 89501 46 2, 1995. Copies free of charge, except for postage, from Danish Centre, Department of Technology, Communication and Special Education, Graham Bells Vej 1a, DK 8000 Aarhus N, Denmark (Tel +45 86 78 37 00; fax +45 86 78 37 30; Email daniscen@inet.uni-c.dk).*

Clarke A **Human Factors Guidelines for Designers of Telecommunication Services for Non-expert Users**. *Loughborough University, 1996. Primarily written for designers of telecommunication services and terminals for non-expert users, such as the general public. Available on CD-ROM from Anne Clarke, Husat Research Institute, The Elms, Elms Grove, Loughborough LE11 3BN, England (Tel +44 1509 611088; Fax +44 1509 234651; Email a.m.clarke@lboro.ac.uk).*

Gill J M **Smart Cards: Interfaces for People with Disabilities**. *Royal National Institute for the Blind, ISBN 1 86048 007 1, February 1996. Also available at <http://www.trace.wisc.edu/docs/smartcards/schome.htm> Contains information on cost and potential demand for various interfaces in financial, telecommunication and transport systems.*

Porreiro P & Puig de la Bellacasa R (Eds) **The European Context for Assistive Technology**. *Proceedings of the 2nd TIDE Congress, Assistive Technology Research Series, IOS Press, Amsterdam, ISBN 90 5199 220 3, 1995.*

Roe P R W (ed) **Telecommunications for All**. *COST 219, The European Commission, CD 90 95 712 EN C, 1995. This book gives a general overview of issues related to accessibility and usability of telecommunications equipment and services for disabled and elderly people. The social, demographic and marketing aspects are also discussed while highlighting the significant role that can be played by standardisation and legislation. The second part of the book looks more specifically at some of the available and forthcoming telecommunications equipment and services, identifying some of the existing accessibility problems and potential solutions. Out of print, but accessible on <http://www.nta.no/cost219/cost95/indeks.html>*

Silver J H, Gill J M & Wolffsohn J S W **Text Display Preferences on Self-Service Terminals by Visually Disabled People**. *Optometry Today, Vol 35:2, 30 January 1995, pp 24-27. This paper includes guidance on character size and colours for use on public access terminals.*

Thorén C (Ed) **Nordic Guidelines for Computer Accessibility**. *Nordiska Nämnden för Handikappfrågor NNH 4/93, 1993. Copies available free of charge from Nordic Committee on Disability, Box 510, S-162 15 Vällingby, Sweden (Tel +46 8 620 18 90; Fax +46 8 739 24 00).*

von Tetzchner S (ed) **Issues in Telecommunication and Disability**. *COST 219, The European Commission, ISBN 92 826 3128 1, 1991. This book contains general discussions related to disability, descriptions of field trials and experimental work, and overviews of equipment and services suitable for different groups of people with disabilities. Also available in Spanish and Portuguese, and on computer diskette in English. Copies available from COST 219 (Fax +358 9 396 72054; Email jan.ekberg@stakes.fi). Also available on <http://www.nta.no/cost219/issues/issues.bok.html>*

# Web sites

## **Include**

<http://www.stakes.fi/include>

This is the main European web site concerned with designing information and communication technology systems so that they are accessible to everybody including disabled and elderly people. This site contains a wealth of information including demographics of disability in Europe, relevant standards as well as legislative aspects.

## **Trace Center**

[http://trace.wisc.edu/world/kiosks/ksk\\_nav.html](http://trace.wisc.edu/world/kiosks/ksk_nav.html)

This is the main American web site concerning access to public access terminals by people with disabilities.

## **Access to Telecommunications Equipment and Customer Premises Equipment by Individuals with Disabilities**

<http://www.access-board.gov/pubs/taacrpt.htm>

This contains the final report from the Telecommunications Access Advisory Committee (TAAC).

## **World Information on Disability**

[http://www.dais.is.tohoku.ac.jp/~iwan/foreign\\_res.html](http://www.dais.is.tohoku.ac.jp/~iwan/foreign_res.html)

A useful starting point for a web search on disability.

## **RNIB Scientific Research Unit**

<http://www.rnib.org.uk/wedo/research/sru/sruhome.htm>

This Unit is concerned with influencing the design of equipment and systems for the general public such that they are accessible by visually disabled persons, and influencing the development of relevant standards.

## **Bobby**

<http://www.cast.org/bobby/>

Bobby is a graphical web-based program designed to help web site designers and graphic artists make their web pages accessible by the largest number of people. It will help find design problems which prevent a web page from being displayed correctly on different web browsers (i.e. America On-Line, Netscape Navigator, Mosaic, Microsoft Explorer, Lynx) without having to individually test the page on each of those programs. In addition, Bobby performs a series of tests to determine the ways in which a web site is inaccessible to those with disabilities like blindness, deafness or physical disabilities.

## **National Center for Accessible Media**

<http://www.boston.com/wgbh/pages/ncam/symbolwinner.html>

A web access symbol which may be used by webmasters to denote that their site contains accessibility features to accommodate the needs of disabled users. There is no charge to use this symbol; simply copy it from this page and paste it into your document.

## **Americans with Disabilities Act**

<http://janweb.icdi.wvu.edu/kinder/>  
The Americans with Disabilities Act Document Center contains the ADA statute, regulations, ADAAG (Americans with Disabilities Act Accessibility Guidelines), federally reviewed tech sheets, and other assistance documents.

## **Australian Disability Legislation**

[http://www.austlii.edu.au/au/legis/cth/consol\\_act/dda1992264/](http://www.austlii.edu.au/au/legis/cth/consol_act/dda1992264/)  
Provides details of the Australian Disability Discrimination Act 1992.

## **UK Disability Legislation**

<http://www.open.gov.uk/ndc/ndchome.htm>

The Disability Discrimination Act gives people with disabilities new rights in the areas of: employment; access to goods, facilities and services; and buying or renting land or property. In addition, it requires schools, colleges and universities to provide information for people with disabilities and allows the Government to set minimum access standards for new taxis, trains and buses.

## **Tiresias**

<http://www.eyecue.co.uk/tiresias>  
Gives details of a typeface specifically designed to be easy to read on screens.

# Standards

## STANDARDS AUSTRALIA

1 The Crescent, Homebush, New South Wales 2140, Australia. Tel +612 746 4600. Fax +612 746 8450.

- **AS 3769:1990** Automatic Teller Machines - User Access

## COMITE EUROPEEN DE NORMALISATION

Rue de Stassart 36, B-1050 Brussels, Belgium. Tel +32 2 519 6811. Fax +32 2 519 6819.

- **EN 726** Requirements for IC cards and terminals for telecommunications use
- **prEN 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

## EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE

PO Box 52, Route des Lucioles, Sophia-Antipolis, Valbonne, F-06561 Alpes Maritimes, France. Tel +33 92 94 42 00. Fax +33 93 65 47 16.

- **ETR 029** Access to telecommunications for people with special needs: Recommendations for improving and adapting telecommunication terminals and services for people with impairments
- **ETR 068** European standardization situation of telecommunication facilities for people with special needs
- **DTR/HF-02009: 1996** Characteristics of telephone keypads
- **ETS 300 381** Telephony for hearing impaired people; Inductive coupling of telephones earphones to hearing aids
- **ETS 300 488** Telephony for hearing impaired people; Characteristics of telephone sets that provide additional receiving amplification for the benefit of hearing impaired
- **ETS 300 679** Telephony for the hearing impaired; Electrical coupling of telephone sets to hearing aids
- **ETS 300 767** Human factors: Telephone prepayment cards tactile identifier

- **ETR 039: 1992** Human factors standards for telecommunications applications
- **ETR 068: 1993** European standardisation situation of telecommunication facilities for people with special needs
- **ETR 167: 1995** User instruction for public telecommunications services: Design guidelines
- **TCR-TR 023: 1994** Assignment of alphabetic letters to digits on push button dialling keypads
- **ETR 160: 1995** Human factors aspects of multimedia telecommunications
- **ETR 165: 1995** Recommendation for a tactile identifier on machine readable cards for telecommunication terminals
- **DTR/HF-02003: 1996** 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.  
Fax +41 22 73 33 843.

- **IEC 73** Colours of pushbuttons and their meanings
- **IEC 118-4** Hearing aids: magnetic field strength in audio frequency induction loops or hearing aid purposes

## **INTERNATIONAL ORGANIZATION FOR STANDARDIZATION**

1 Rue de Varembé, Case postale 56, CH-1211  
Geneva 20, Switzerland. Tel +41 22 749 0111.  
Fax +41 22 733 3430.

- **ISO 3461** General principles for the creation of graphical symbols
- **ISO 7000: 1989** Graphical symbols for use on equipment
- **ISO 7001: 1991** Public information symbols
- **ISO 7239: 1990** Development and principles for application of public information symbols
- **ISO 7816** Identification cards - Integrated circuit cards with contacts
- **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
- **ISO/IEC 10536** Identification cards - contactless integrated circuit cards

## **INTERNATIONAL TELECOMMUNICATIONS UNION**

Place des Nations, CH-1211 Geneva 20,  
Switzerland. Tel +41 22 730 5111.  
Fax +41 22 733 7256.

- **ITU E118** Automatic international telephone credit cards
- **ITU E133** Operating procedures for cardphones
- **ITU E134** Human factors aspects of public terminals - generic operating procedures
- **ITU E135** Human factors aspects of public telecommunications terminals for people with disabilities
- **ITU E136** Tactile identifier on pre-paid telephone cards
- **ITU E161** Arrangement of figures, letters and symbols on telephones
- **ITU-T P370** Magnetic field strength around the earcap of telephone handsets which provide for coupling to hearing aids

# Pan-European disability organisations

## **European Disability Forum**

Square Ambiorix 32, Bte 2/a, B-1000 Brussels, Belgium. Tel +32 2 282 4600.

Fax +32 2 282 4609. Email [edf@arcadis.be](mailto:edf@arcadis.be)

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**

Generalsekretariat, Wurzerstraße 4a,

D-53175 Bonn, Germany. Tel +49 228 820 930.

Fax +49 228 820 9346.

## **Alzheimer Europe**

Route de Thionville 145, L 2611, Luxembourg.

Tel +352 29 79 70. Fax +352 29 79 72.

## **Association Internationale Aphasie**

Av. M. Thiry 12 B.36, B-1200 Brussels, Belgium.

Tel +32 2 762 3638. Fax +32 2 762 5877.

## **Autisme-Europe**

Avenue E Van Becelaere 26B, bte 21, B-1170

Brussels, Belgium. Tel +32 2 675 75 05.

Fax +32 2 675 72 70.

Email [autisme.europe@arcadis.be](mailto:autisme.europe@arcadis.be)

## **Cerebral Palsy in the European Communities Association**

19 St Mary's Grove, London W4 3LL, England.

Tel +44 181 995 5721. Fax +44 181 742 7512.

## **Disabled People's International**

11 Belgrave Road, London SW1V 1RB, England.

Tel +44 171 834 0477. Fax +44 171 821 9539.

Email [100726.136@compuserve.com](mailto:100726.136@compuserve.com).

## **Eurolink Age**

Astral House, 1268 London Road, London

SW16 4ER, England. Tel +44 181 765 7717.

Fax +44 181 679 6727.

## **European Alliance of Neuromuscular Disorders Associations**

7-11 Prescott Place, London SW4 6BS, England.

Tel +44 171 720 8055. Fax +44 171 498 8963.

Email [mail@eamda.sonnet.co.uk](mailto:mail@eamda.sonnet.co.uk)

## **European Blind Union**

58 Avenue Bosquet, 75007 Paris, France.

Tel +33 1 47 05 38 20. Fax +33 1 47 05 38 21.

Email [100616.1023@compuserve.com](mailto:100616.1023@compuserve.com)

## **European Brain Injury Society**

17 rue de Londres, B-1050 Brussels, Belgium.

Tel +32 2 502 3488. Fax +32 2 502 2046.

## **European Dyslexia Association**

12 Goldington Avenue, Bedford MK40 3BY, England.

Tel +44 1234 261897.

## **European Federation for Mental Health**

Boulevard Clovis 7, B-1000 Brussels, Belgium.

Tel +32 2 280 04 68. Fax +32 2 280 16 04.

Email [erc.wfmh@optinet.be](mailto:erc.wfmh@optinet.be)

## **European Federation of Hard of Hearing People**

PO Box 51, SF-00401 Helsinki, Finland.

Tel +358 9 58031. Fax +358 9 5803331.

## **European Growth Federation (Asociación CRECER)**

C/ Cuartel de Artillería, 12 - bajo, E-30002, (Spain).

Tel +34 68 34 62 18.

Fax +34 68 34 62 02.

Email [asoc\\_crecer@geocities.com](mailto:asoc_crecer@geocities.com)

## **European Parkinson Disease Association**

22 Upper Woburn Place, London WC1H 0RA,

England. Tel +44 171 391 6704.

Fax +44 171 383 5754.

## **European Union of the Deaf**

Rue Franklinstraat 110, B-1000 Brussels, Belgium.

Tel +32 2 735 72 18. Fax +32 2 735 53 54.

Email [eudeaf@pophost.eunet.be](mailto:eudeaf@pophost.eunet.be)

## **Help Age International**

67 - 74 Saffron Hill, London EC1N 8QX, England.

Tel +44 171 404 7201. Fax +44 171 404 7203.

Email [hai@helppage.org](mailto:hai@helppage.org)

## **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.

Fax +32 2 502 8010. Email [secretariat@ilsmh-ea.be](mailto:secretariat@ilsmh-ea.be)

## **Mobility International**

18 Blvd Baudouin, B-1000 Brussels, Belgium.

Tel +32 2 201 5608 + 5711. Fax +32 2 201 5763.

Email [mobint@dproducts.be](mailto:mobint@dproducts.be)

## **Rehabilitation International**

Square Ambiorix 32, Boite 8, B-1000 Brussels,

Belgium. Tel +32 2 230 43 97. Fax +32 2 230 53 90.

# Other sources of information

## **INCLUDE**

Include is funded by the Commission of the European Union to advise projects on how to incorporate the requirements of disabled and elderly users in the design of telematic systems. They provide direct advice to projects, as well as producing publications on good design. They also disseminate information relating to standardisation and legislation in this area.

For further information, please contact Prof Jan Ekberg (Fax +358 9 967 2054; Email [jan.ekberg@stakes.fi](mailto:jan.ekberg@stakes.fi)).  
Web site <http://www.stakes.fi/include>

## **COST 219bis**

A project, called COST 219, covered future telecommunication and teleinformatic facilities for disabled and elderly people, and eighteen countries actively participated. The project organised a large number of seminars and conferences, and produced various reports and publications. This project finished in September 1996, but has been succeeded by COST 219bis (Telecommunications: Access for Disabled and Elderly People) which will run until 2002.

For further information, please contact Prof Jan Ekberg (Fax +358 9 967 2054; Email [jan.ekberg@stakes.fi](mailto:jan.ekberg@stakes.fi)).  
Web site <http://www.stakes.fi/cost219>

## **COST 219 UK Group**

This group is the independent UK focal point for telecommunications and the needs of disabled and elderly people. The group acts as a catalyst in this area by organising conferences and seminars on telecommunications and disability.

For further information, please contact Mr Mike Martin (Tel/Fax +44 1428 72 3184).

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Dr John Gill is Chief Scientist at Royal National Institute for the Blind, 224 Great Portland Street, London W1N 6AA, England.  
(Tel +44 171 391 2371; Fax +44 171 388 7747; Email [jgill@rnib.org.uk](mailto:jgill@rnib.org.uk)).

This booklet is also available at <http://www.eyecue.co.uk/pats>

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INCLUDE

Price £5.00

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