A Review of User-Interface Design Guidelines for Public Information Kiosk Systems

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Abstract

This paper reviews general guidelines on user interface design for self service and public information kiosk systems, based on the author's research and existing literature. The guidelines are divided into: defining user requirements, location and encouraging use, physical access, introduction and instruction, language selection, privacy, help, input, output, structure and navigation, and customisation. The paper also emphasises the need to design for stakeholders other than the end users, and offers some guidelines on user-based evaluation of kiosk systems.

1. Introduction

There is a continuing trend to develop terminals to deliver information and services to the general public, accessible in public locations. These terminals, or kiosks, can deliver services at the point of need (e.g. money near a shopping centre, tickets in a station), and at low cost. The information contained within a stand-alone kiosk can be updated at regular intervals via CD Rom. If the kiosks are networked, information can be transmitted electronically to many sites rapidly to update the database or provide on-line user access.

Successful early systems developed for special events were the Exhibition Information System at Expo'92 in Seville and the 1984 Olympic Message System (Gould et al, 1987). The CHI'89 conference system in Austin Texas (Salomon, 1995) contained multimedia data about the city of Austin, the conference program, and allowed participants to record personal information and enter a digital photograph of themselves (a major factor in its success). Other systems are tailored specifically to meet the needs of the local community such as those developed under the United States Congressional Office of Technology Assessment (OTA) initiative to offer government services through multimedia public access kiosks (Peltu, 1994). These range from advice on people's eligibility for welfare benefits, to health and environmental information. Similarly the EC Telematics Applications Programme have funded projects to develop kiosks to supply tourist, transport and local government information across Europe. These include the ATTACH project UR 1001 (Advanced TransEuropean Telematics Applications for Community Help) and the PD WEB project UR 1021 (The Public Data Web).

Kiosk systems present a challenge to designers if they are to be used effectively. Firstly a kiosk system has to be noticed by passers-by and the purpose of the system must be clear. Kiosk users will often be accessing the system for the first time. They may have been given introductory information on it beforehand, but the system must also appear simple and

intuitive if they are to start using it. The general public will include people with very different levels of skill, experience and confidence in using interactive computer-based systems. Therefore to be inclusive, kiosks must be designed to cater for those with limited skills or experience, physical and cognitive impairments, and should be supportive towards those who are inhibited in interacting with them in a public area. Systems are normally designed to be used on a casual 'walk up and use' basis. This also means that kiosk systems should be as self explanatory as possible. Users may have little time in which to use the system, so it must be capable of producing information or services quickly. Finally, if a user becomes stuck they will not necessarily feel impelled to continue with the interaction. Thus the system must be understandable at all stages of the interaction process, and return automatically to its initial state if it becomes abandoned.

This paper presents guidelines on the human aspects of kiosk system design drawn from the literature and the author's own experience of research into such systems.

2. Defining the user requirements for the kiosk

An important first step is to define the purpose of the kiosk, the user population who it is intended to serve, and their task goals. Such a user-centred process (Eason, 1981, Daly-Jones et al, 1997) is needed to ensure that the kiosk meets a genuine need and that people will motivated to use it. It is also necessary to consider typical task scenarios (Clark, 1991) defining specific examples of people using the kiosk. These should reflect the different tasks, variations in tasks, possible problems that users might face (e.g. being short of time, not having certain information to complete the task etc.) so that the kiosk can be designed accordingly. It is also important to understand the characteristics of the user population and the kinds of environment (physical and organisational) that the system will be located in, so that the design can reflect them. Design guidelines to meet these contextual characteristics are discussed later in this paper. Recommendations are also included to cater for peoples' different levels of experience, confidence, and ability. Discussion groups, interviews and user-based tests should also be carried out to get user reactions to the concept behind the kiosk and to test prototype versions of it at different stages of the development process.

3. Location and encouraging use

3.1 Location

Kiosk systems often rely on being noticed by the public, passing by, who decide on the spot whether to make use of them. However usage is likely to be much higher if the system has been advertised beforehand either in the local newspapers, through the post, or in the window of an information or service centre. Having become established in peoples' minds beforehand, they are then more likely to try out the system when they see it. People are also more likely to seek it out, if they perceive it as useful.

Within the vicinity of the kiosk, it may be necessary to provide signposting to its specific location. For instance, a public information system within local government offices or a multimedia system in a museum (such as the London National Gallery's 'Micro Gallery'), will need directions for finding it. If a system is placed in a secluded area to give the user some privacy, this will also need to be well signed in order that people do not pass it by. For users with low vision, Gill (1997) recommends that kiosk signs should be large and of high contrast (preferably white or yellow characters on a dark background) and illuminated

(preferably internally). Gill also recommends that if a blind person is not familiar with the environment, they will find it difficult to locate the kiosk or terminal. One way of dealing with this is to use a 'contactless smart card', carried by the visually impaired person ,which then triggers an audible signal from the terminal when they are a few metres away from it. In an evaluation report of the PD Web public information system, based in a local library, the following suggestions for system location reflect some of the issues (Maguire, 1997):

"Should be placed in the middle of the floor, near entrance so its not associated with any one dept of the library."

"Could be missed where it is. Needs a more prominent location."

"At the entrance but not in line of people entering."

"Infront of you when you enter."

"At wall opposite main entrance, not at pillar in middle."

In general, the system should be placed logically within the flow of peoples' movements and at the point of need (May, 1993). This will help the kiosk to be noticed and used. Poor positioning will have the opposite effect. For instance, if a ticket terminal is placed on a station platform beyond the manned ticket desk, then people will fail to see it before buying a ticket at the desk.

3.2 Encouraging use

A self running demonstration is a good way to encourage users to approach the system and to find out what it can provide. Such demonstrations should be bright and eye catching, presenting short phases about what is on offer and typical screens. It should also be clear that the demonstration can be interrupted to start using it and how this can be done.

As casual users decide if the system is usable or not, one of the criteria to take into account is the *look* of the system such as general clarity, familiarity, attractive appearance, etc.). The design of the screen content (colour, form and placing) was tested by Daniel and Krueger (1993) as part of an experiment. Four different layouts were developed, to find which was most appealing and easiest to understand. The screen content (number of buttons and fields, contents and naming of these) was identical, and only the representation of the elements (form, placing and colouring) was varied. The four basic design approaches were as follows:

(1) Used white and grey as dominant colours with colour added for help, break and confirm buttons and the selection of dialogue languages (flags).

(2) Used pseudo 3D elements similar to those used on an advanced 'Windows' user-interface. Shades of grey were dominant, adding colour to the main selectable buttons and languages (flags).

(3) Used similar colours as (2) but added no form of 3D. All colours pastel.

(4) Used saturated and bright colours, with added three dimensional shading for the buttons.

Interestingly, it was found that design (4) was preferred, characterised by subjects as playful, lively and motivating to use. It was rated best by both over and under 40 year olds with younger people having a greater preference for the design than older. The reason could be that for a public system, easy recognition of function, or the clear meaning of colour codes is important and a certain degree of motivating colour is preferred. Testing of the complete system confirmed the earlier findings and people commented favourably on the use of colour and function representation.

However colour should be used with care. See guidelines presented in section 10.3.

4. Physical access

The height of a kiosk has to be placed so that it is convenient for both standing users and wheelchair users to access the keyboard. Wheelchair users may have to line themselves up alongside the kiosk and twist around to use it. If there is recess underneath the terminal the user wheelchair can bring it closer and face the terminal, making it much easier to use. As recommended by Gill (1997), for wheelchair use, the maximum height of any interactive element on the kiosk system 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. In order for a person with visual impairment to access the kiosk easily, there should be a clear area of 1.5 metres radius around the terminal which should not be obstructed by litter bins or other street furniture (Gill, 1997). A well lit card entry slot, which is also funnel shaped to guide the card, can also be helpful.

5. Introduction and instructions for using the system

Off-line material such as a leaflet or poster is a useful way of stating what the system provides, the main facilities available, and can give some simple step-by-step instructions on how to use it. An effective technique is to make the poster equivalent to the leaflet so that if all leaflets get taken away, there is at least some fixed equivalent for users to refer to. While instructions are best presented at appropriate places on the system, some people will appreciate being able to refer to an instruction card and are more comfortable with this static medium which they can refer to in a flexible manner. Large print versions of the printed instructions should also be produced for those with visual impairments.

Users will not have the time or inclination to read lengthy instructions displayed on screen before using a system. Therefore the instructions should be short and presented at each stage of the interaction. A good way of introducing users to the system is to present a free running demonstration of it, possibly with simulated interactions. This technique has been adopted successfully within games machines. A demonstration can show users what the system is about, what to expect when they start to use it, and how to interact with it. However such demonstrations should be short enough to be viewed by the interested user and allow them to start interacting with it before their interest diminishes. It should also be made clear that the user can interrupt the demonstration and how to do this (e.g. with a prominent key labelled ‘start’).

6. Language selection

Where languages other than the primary language are widely spoken in the local community, or where the system will be used by foreign tourists, it is desirable to provide multilingual interfaces to the system (including instruction cards). This of course requires a lot of additional effort and resources which may or may not be available.

In order to choose the language on the system, instructions can be given in each language to select the appropriate option ‘e.g. Press here to select English’, ‘Poussez ici pour Francais’. An alternative, widely used method is to display a series of national flag symbols for each language (although nationals of countries such as Austria and Ireland may object to the use of the flag of another country). The user then touches the flag symbol they require on screen, or presses the associated key, to access the system interface in the language of their choice. This should be the first action that the user performs.

If it is not possible to present all the information in different languages, then just the most critical information could be translated (e.g. instructions to use the system and the most important parts of the content). However, for a system located in an information centre with multilingual staff, it may preferable to provide human support for foreign language speakers, possibly acting as intermediary users to the system.

7. Privacy

Users will normally prefer to use a system in public without being observed by others too closely. A study was carried out recently by the EC Telematics PD Web project, to evaluate a kiosk designed to offer tourist information, and information on local government and employment opportunities (Maguire, 1997). It was found that the need for privacy depended a great deal on the kind of information being sought. Typical responses to the question about whether users wanted more privacy were:

"If I was looking for personal information maybe a bit more privacy is needed."
"Privacy is preferred for pursuing queries relating to social welfare or low income."
"Some information (employment) is more sensitive that tourist information."
"Privacy is required if seeking job information."
"Would not like a line of people forming queue behind when using the system."

The idea of putting the terminal into a booth was proposed by some users to provide privacy when looking up sensitive information. However it was also felt that an enclosed kiosk would deter people from using it. In general, the kiosk should be located to one side of a thoroughfare where users, especially the elderly, can operate it without being too immersed in the general flow of people passing by. As recommended by Höynä et al (1995), for elderly people, it is important that the machine (or kiosk) is in a place where they feel at ease and secure. They may need more time and restarts in using the system if their first attempts fail.

For some systems such as a bank machine, where users are entering personal and financial details, it is essential that they can work privately. Thus the kiosk should be designed so that the user's body will conceal their interactions from others. A common solution is to place the screen and keyboard at about waist level (for a system to be used standing up) and recessed into a wall. However for people in wheelchairs, bank machines placed at this height are not always convenient as others can see over their heads. Thus seated versions of a system may need to be made available if wheelchair users are to use them comfortably (see also Section 4 on physical access).

Users will not wish to draw attention to themselves when interacting with a system, and so any use of sound should be at a very low level e.g. a low auditory tone to indicate the pressing of buttons. (See also section 10.8 on speech output.)

8. Help

It is useful to provide help information throughout the system. However casual users, such as members of the public, will not normally have time to search through a help system. It is therefore preferable to review each part of the system and decide what help may be needed at each stage. This can then be presented to the user as contextual help which can be accessed with a single press of a button, labelled 'help', or with a question mark ('?'). This may also

be coloured red to make it stand out. It should be clear to the user how to move between screens within the help facility and how to exit from them, or dismiss the help window, with a single key press or selection.

9. Input to the system

To cater for the wide range of experience that the general public have with interactive systems, it is important that little or no prior experience on behalf of the user is assumed when making inputs to the system. The nature of the input used should be as consistent as possible throughout the task. If a new form of input must be employed at any point (e.g. moving from a keypad to a roller-ball) this must be highlighted with specific instructions at that point (May, 1993).

9.1 General recommendations

In general user inputs to a kiosk system should be as simple as possible. The user should only be required to make one input at a time, either selecting an option on screen, typing in a short text string, or highlighting a menu option and confirming the selection (perhaps by pressing an 'Enter' or 'OK' key). If the user is required to make a sequence of inputs, it recommended that each item is presented with a prompt, one at a time, rather than adopting a form-filling style of input.

If the user is entering a number or text string into a field, it is necessary to ensure that the input position or focus on the screen is clearly highlighted. It is also important that the inputted characters are clearly distinguished from the system prompt by colour, font, case, or inverse video. The input may also be framed within an input box. The user should also have a means of changing or correcting any input errors. A 'go back' option may be needed to enable the user to return to previous inputs and re-enter them if required. To make corrections to a text string, a backspace key (labelled 'backspace' or 'delete') should be available. Alternatively a simple 'clear' is an option that may be provided to clear the whole input field.

9.2 Touch screens

Touch screens provide a way of presenting keys or touch areas on screen, which can be changed for individual screens in the dialogue. However there is a benefit in providing at least some common functions across screens and in fixed positions e.g. 'exit', 'go back', 'help' etc.

There is a certain level of skill associated with using touch screens and users can either find the screen buttons too sensitive or not responsive. Some systems only accept an input when the finger is lifted from the screen. Thus it may be necessary to explain this on the opening screen e.g. 'touch the screen cleanly and lightly, and that the button is only selected when the finger is raised'. It is also recommended that the active part of the touch screen should not necessarily be directly in front of the on-screen button. Parallax adjustments of the eye-line relative to the button should be considered, and the active area adjusted if necessary (May, 1993).

Brief feedback to show that a screen button has been pressed is helpful. This can be either an auditory tone, change of colour, inverse video, or a 3D pressed-in effect. To overcome imprecise pointing, each touch screen target must be no less than 2.6 square cm (Clarke et al,

1996) and preferably larger. It is important that the touch areas or screen buttons are easily distinguishable from other graphics. Prolonged use of a touch screen can cause arm fatigue.

Several years ago, the public in the UK were less familiar with the concept of touch screens and were less confident in using them compared with a keyboard. Now users are more familiar with them. In the PD Web study mentioned previously (Maguire, 1997) 38 users were asked to rate how easy they found the use of screen buttons:

Ease of use of buttons and commands				
Very easy				Very difficult
23	**11**	**2**	**2**	**0**

As the results show, the large majority found them either 'easy', or 'very easy' to use. Touch screen buttons are therefore a flexible solution for input via a kiosk. For each screen display, the relevant input buttons only, need be shown on the screen, thus simplifying the interface.

9.3 Keyboards and keypads

If a physical keyboard is required, it is preferable for the kiosk system to have a customised keypad with large clear keys and suitable key labels. Standard keys with definite 'travel' are preferred, although membrane covered keyboards are commonly used. If a membrane keyboard is used, it should have some form of tactile and auditory feedback to indicate when a key has been pressed.

Many people with visual impairments can use self service kiosks by learning the layout of the keyboard and of the function keys (Höynä, 1995). However the location of the function keys is not standardised. They should be clearly separated from the number keys and should have good tactile markings and provide good tactile feedback. A low volume tone or beep may be used to indicate a keypress, although for lengthy inputs, this can be annoying to the user.

For some public systems implemented on a standard PC, there is insufficient resources for a customised keypad, and so a standard full keyboard must be used. This is satisfactory, provided the range of keys that the user needs is constrained. For example, the system should not require the user to press the shift key. Inputs should be limited to, for example, the alphabetic keys, numeric keys, arrows, delete or backspace, space bar. Other keys should be covered or replaced with blank key caps to simplify the keyboard's appearance. If keys with other labels (e.g. print, help) are required, but are not available on the keyboard, then customised labels may be affixed to the keys provided they are hard wearing and cannot easily be removed. In general, autorepeat for character keys should be suppressed, as users may hold down a key for too long and have to correct repeated characters. However if the user is moving a cursor on screen with arrow keys, then autorepeat is useful, provided it is not too sensitive and difficult to control.

Members of the public will vary in their typing skills and ability to spell. Therefore try to avoid requiring long textual inputs to the system. Consider possible means to short cut the need for full text entry. For example, if the user is required to enter the name of their local district, ask them to just type the first 2 or 3 letters and them present them with a short list of possible names for them to choose from. If the user is required to enter their name and address, it is often possible to retrieve this information from standard national databases, by

entering a postcode, street name and number. Once the full details are displayed, the user should then give them the chance to check and correct them if necessary.

9.4 Speech input

Speech input is rarely used on a public kiosk. However the increase in the reliability of speaker independent speech recognition systems now makes it a possibility. For a kiosk, a telephone handset is perhaps the most practical input device as it is familiar and helps to shut out external noise. The main problem is that pronunciation and speech intonation vary between people and when speaking, people tend to run words together. Speech systems work best when the user is familiar with them and can speak words distinctly without raising their voice in irritation if they need to repeat an input. Speech input to a public system is subject to problems of: reduced privacy, making users feel less secure, possibly causing embarrassment, and being hampered by noise pollution. Gagnoulet (1989) describes a public phone booth equipped with a hands-free voice dialler developed by the research division of France Telecom. This system demonstrated the problems of public access; the recognition rate fell from 92% in the lab, to 75% in the field due to technical problems of noise and speaker independence, as well as the speaker's failure to follow directions (e.g. using non-vocabulary words). Despite these limitations, speech interfaces can important offer benefits to users with visual impairments, and in a commercial study carried out by the author, a small sample of visually impaired users were very positive about the concept of a speech-based bank machine.

If users are required to make inputs by hearing a menu of options and selecting one, the number of options should be limited to 4 or 5 to avoid overloading the short-term memory (Bruce, 1990; Schumacher et al, 1995). In choosing the wording for prompts, a 'goal-action' sequence (e.g. "To do x, say y") should be used, rather than an 'action-goal' sequence (e.g. "Say y to do x"). Simple, explicit, concise language should be used, rather than technical jargon. The passive voice, negative conditionals and double negatives should be avoided (Schumacher et al, 1995).

'Word-spotting' (where key words embedded in extraneous speech can be recognised) and 'barge-in' (where the user is permitted to speak during instructional prompts) are two techniques, based on natural language conventions, which can improve the speech dialogue (Brems et al, 1995). The latter is perhaps more useful for <u>regular</u> users of a public system. Robbe, Carbonell and Dauchy (1997) found that users will accept linguistic constraints during speech input, provided the resulting language is a subset of Natural Language. They also found that a short period of training is useful for beginners. However this may only be possible for kiosk systems designed for users who intend access the system regularly and where a training session will be worthwhile.

9.5 Other input devices

The mouse is now a familiar input device to many people but can take a little time for novice users to become competent with them. Also a mouse can easily be detached and stolen from a public system. However in locations where users are supervised, such as Internet access in a public library, this will be less of a problem. If a pointing device is required and a touch screen is not available, then a tracker ball may be preferred to a mouse which can be fixed to the kiosk, or onto a table. Trackerballs are however less suitable for wide area movement across a screen.

The input device for a public system in the open air has to be robust to sustain continued used and possibly attempted vandalism. Therefore keys should be constructed of metal or heavy duty plastic. Inside a building, where interaction may be partially supervised, a kiosk need only have input devices similar in quality to those in an office.

10. Output from the system

10.1 Text

The presentation of information on a display should be kept as clear and simple as possible. Text should be no smaller than 16 point (preferably larger) so that it can be more easily read by members of the public with visual impairments (Gill, 1997). Simple font styles should be used, preferably without (sans) serif. However a font with a serif may be used to help distinguish between system messages and user entry. Serif fonts should not be used with small typefaces. Unusual fonts, script and other highly stylised fonts (e.g. shadow, calligraphy) should be avoided. Fonts should be available in a range of sizes, in order to avoid the scaling of bitmap text when very large characters are required (Clarke et al, 1997). The contrast between the text and symbols, and the background, should be high whether it is dark text on a light background or light text on a dark background.

10.2 Use of language

Check that the terms used by the system are meaningful to the general public. Care is required to avoid the use of computer terms which may not be understood (e.g. ‘files’, ‘directories’, ‘server’, ‘spooling’ etc.). Another area is the use of technical terms related to the application itself, which the user may be unfamiliar with. For example ‘distance learning’ may be used to describe home learning but may not be understood. While it is appropriate to use such terms when they are commonly used in the application area, it may be necessary to provide an explanation of them on a help page.

10.3 Colour

Colourful displays can be attractive to members of the public. However the use of too many colours can produce a confusing display. The number of colour codes should be kept within reasonable limits (4 or 5) if the user is to easily identify particular elements easily e.g. symbols or areas on a map. Of course, with multimedia displays incorporating diagrams and images, the system may use 256 or thousands of colours. Here significant components of the display, e.g. buttons, input fields or icons should be made to stand out by putting distinctive borders around them or placing them within a plain area on the screen.

The following guidelines are also proposed in relation to colour:

- Total colour blindness is rare, but problems in discriminating red and green are common and suffered by over 6% of the male population (Gill, 1997).
- Large adjacent areas of red and blue should be avoided as users have difficulty focusing on these colours at the same time, causing visual fatigue (Helander, 1987).
- Use colours to structure the display and group categories of data, and to help identification (labels, entry fields, prompts).
- Use colour as an additional cue to help users recognise graphic symbols (RACE ISSUE, 1992).
- If text is to be used, it should not be colour-coded. Similarly text associated with graphical symbols should not be coloured (Clarke et al, 1996)

- Coloured text is preferable for short or temporary elements such as menu choices or messages rather than permanent elements such as long lines of text.
- Start by designing the display in monochrome. Then add colours, maintaining consistency in use, and test to ensure the resulting display does not create unexpected effects, (RACE ISSUE, 1992).

10.4 Icons

Icons provide a means of presenting commands or information elements in an easily recognisable form, and can be understandable to speakers of different languages. However for a kiosk system icons must be understandable without too much explanation, and distinguishable from other icons on screen. Simple icons are preferable to complex digitised images - e.g. a simple bank note icon has been found to be more readable than the complete image (Noirhomme-Fraiture, 1993).

It is important to test out any icons used by the system to check that they are clearly understandable. It is however very difficult to design icons that are self explanatory to all users. One solution is to place the meanings of icons within the system introduction, on a help page, or as short labels under the symbols themselves. If they are well designed, then having been informed of their meaning, a user will be able to memorise them more easily. While icons are often thought of as standalone items, they often work well with text labels, for example to enhance text commands such as choice confirmation, going to previous or next screen, undoing an action and quitting the application.

In designing icons, take account of conventions that exist such as arrows to move forward or back between screens (as on a hi-fi or video recorder), a telephone symbol to make a call, and a magnifying glass to zoom into and out of a display. However beware of symbols which are used within computer packages but which may not be known to non-computer users. The 'home' symbol to go to a top level display, for instance, is becoming well known to Internet users but may be unfamiliar to others without explanation.

10.5 Feedback

If the system response to user input takes more than 2 or 3 seconds, users may start to feel that a fault has occurred. Some form of indication should therefore be provided that the response is in progress. This may be a simple 'please wait' message or, for responses of, say 10 seconds or more, a progress bar to show how long the wait will be. If the result of the interaction is printed output, again some indication of this (e.g. 'printing now') and possible the length of the delay (e.g. 'this will take about 30 seconds') will be helpful for the uninitiated user.

10.6 Images

Photographs show a detailed portrayal of reality, in contrast to graphics which simplify complex information or emphasise essentials. Photographs or images are used to represent factual and documentary information. They should therefore be used to reproduce things as close to reality as possible. Coloured images appear more lively and if showing, for example, people or landscapes, it is natural to use colour. Black and white images are suitable for showing a concept or theme in general terms, or to ensure that an image does not distract the user too much from the text. Simplifying or emphasising certain details on an image requires some graphic design skills. (Vossen et al, 1997)

An image is a good way to supplement text; for example, a multimedia holiday system may present pictures of hotels, famous buildings, local dishes etc. By seeing the images (closely representing the real object) as well as the textual descriptions, the user can quickly locate the item of information they are interested in. As with text, presenting too many pictures can reduce their impact. One of the main errors in using images is to take an image designed for use on a large scale (say on a brochure front cover) and shrinking it down to fit onto a small area of screen. This can result in details becoming lost, and the overall effect indistinct. Images are much better if designed for the size they are displayed in. If an image zoom function is required, it should be implemented in discrete steps (e.g. 2x, 4x or 100%, 200%), and by pointing at the area on screen which is to be zoomed in or out. The aspect ratio should also be kept constant. Finally, the user should not have to scroll the image to see the complete picture.

10.7 Graphics

Graphics (or diagrams) are good for schematic representations, expressing ideas, or futuristic objects. Where an image is of poor quality, and contains a certain amount of detail, a graphic may be clearer than a photograph. Graphics can be used to show things that do not exist in reality, or can be used to simplify a picture or accentuate or highlight essentials. A graphical expression should be as simple and pure as possible. Noirhomme-Fraiture (1993) recommends providing high quality graphics. Sometimes black and white graphics with high quality grey shades are more legible than too colourful an illustration especially as colour displays do not always render all the colours as intended. Graphical coding of objects can be effective; for example, different shaped elements representing components on an electrical circuit, colours to show political boundaries on a map, line lengths and angles to represent wind speed and direction, etc. Careful design is needed to avoid inappropriate graphical coding and the overuse of graphical codes. (Vossen et al, 1997).

10.8 Speech output

There is a growing use of speech output to provide guidance, to supplement screen information, or to transmit information as part of a multimedia presentation. If it is necessary to maintain a quiet environment e.g. in a cathedral or library, the use of a telephone handset or surrounding screens can be used to mask the sound. For general information being presented via a kiosk in an open environment, the use of speech is acceptable provided it is not obscured by passing traffic or other sounds.

As suggested by Noirhomme-Fraiture (1993), speech synthesis should be used to reinforce visual channels - vocal transcriptions of screen titles, labels, and questions. In this way speech is able to reinforce screen text. In a presentation by Schofield (1997) on the Deawoo car showroom system for the public, speech was used to describe buttons as they were being displayed on screen. This allowed people to become familiar with a screen before interacting with it. Speech output can facilitate use for people with visual impairments. If used in this way, the speech output channel should be an alternative to screen output and provide appropriate prompts for input e.g. via speech or input keys supporting tactile identification. A speech output volume control will assist people who have hearing impairments although the control itself must be easily identifiable.

Users generally prefer natural speech over synthesised speech as it is more intelligible. However as technical improvements occur and features of the system such as rhythm and intonation are included, this becomes less of an issue. General recommendations for speech

output with kiosks (drawn from Clarke et al, 1996, Vossen at al, 1997 and Mamdani, 1997) are to avoid using speech output for confidential information. It should also be limited to short messages (particularly for instructions) so that users can remember the content. Speech should be used sparingly when the system is in a public place to avoid sound pollution. Having a visible speaker can add impact to the voice output and as an 'interface agent' can point to items on screen. However for short messages or information referring to the primary visual scene, a simulated speaker is not needed and can be disruptive.

10.9 Music

Music can provide extra information. For example in a multimedia presentation about Mozart, excerpts from his works might be included to supplement the pictures and text, or, if about John Kennedy, short sections from his speeches used to add impact. Music can be used as background to set the scene, or raise the users attention by adding dramatic elements. If musical sequences are used, it is important that copyright is not infringed. It is also helpful to show the actual position and the total length of the music sequence on a time scale (Vossen, et al, 1997).

11. Structure and Navigation

11.1 User interface structure

It is important that a kiosk system presents a clear and simple structure to the user (Maguire, 1983). By doing this, the user will feel more confident in moving or navigating through the system. The system should have a single starting point which the user can return to when they wish. This may be called the 'starting screen', 'main menu', or possibly the 'home page'. The interface should covey a clear structure to the user such as:

- A sequence of screens where the user makes a selection at each stage in order to reach some useful information.
- A set of on-screen objects that, when selected, present information in a window, dialogue box or speech bubble.
- A network of screens which allow the user to browse randomly supported by an overview map to show paths followed.

If the user is being presented with a sequence of screens, the system should try to show the path followed by the user, or their position in a path. This may be achieved by a simple feedback message 'screen 2 of 5'. If the user is moving down through a sequence of hierarchical menus (a maximum of 3 levels is recommended), it may be possible to present a conceptual pathway by showing the current menu overlaid on the previous one.

Each screen should also have a clear title which is short and distinctive. This will help the user maintain an idea of their location within the system. To give the user a sense of consistency and control, a good approach is to split the screen up into a number of fixed panel areas containing different types of information e.g. a 'control panel' containing the main control buttons, a 'menu panel' to display choices, and an 'information panel' to display information from the system. Hypertext links which allow the user to jump around within a network structure are appropriate for special applications where the user simply wishes to browse through screens looking for information of interest. However users are unlikely to form a good mental picture of the structure and so may find it hard to navigate with certainty.

11.2 Navigation

The user should be provided with some basic controls for navigating through the system. Examples of useful controls that may be considered are:

- Start, Finish, Restart - Start or finish interacting or exit and start again.
- Step back or Go back - Go back to the previous screen or step in the interaction.
- Next page, Previous page - Step through information screens.
- Enter or OK - Complete keyboard input, select menu option or acknowledge system message.
- Cancel or Exit - Cancel or exit from the current part of the system.

Note that 'OK' is a useful general affirmative key label as it is a fairly common term in a number of European languages. If there was a need to provide a very simple interface, this could be based on a series of straight questions to which the user may only be required to answer yes, no or don't know. This would allow the interface to be based on just 3 keys (Yes, No, ?), with possibly 'Go back' and 'Start/Finish' keys.

Soft keys are commonly used to support navigation through the system. Here a series of physical keys are placed alongside the screen, and input options presented adjacent to each one, which change for each screen. Thus on a bank machine, the labels may be used to represent different services (withdraw cash, balance enquiry etc.). If the user presses 'withdraw cash', the labels are changed to different monetary amounts to withdraw. This is a flexible means of interacting and is fairly intuitive. However if the screen is poorly adjusted, the labels may become out of line with the keys, particularly for labels displayed horizontally, which the user is looking down onto. Another general problem is that the physical keys may be placed too far from the screen labels, and it is not obvious that the two are associated. The benefit of having keys down the side of the screen rather than along the base is that more keys can be presented (if both sides are used) and the option labels can be longer.

11.3 Menus

Menus provide an easy means of input for kiosk users since they simply select the input they require from a list of options. Make sure that each menu option is concise and clearly worded so that the user has a good idea of what they will get when making a selection. It may be useful to add a line of text alongside each option. Alternatively, as the user moves a selection bar down a menu list with, say an arrow key, additional information about each option can be displayed in an adjoining window (a feedback window). This technique has been used successfully by the author for a public system providing information on local training courses, with a 3 level menu structure being used to select a course topic from a list of 1200 categories.

General menu design guidelines are as follows:

- Ideally a maximum of 12 options should be presented on one menu.
- Menu lists require careful structuring, such as by alphabetical order, the most common options first, or in the logical order in which they will be selected (e.g. search, display, print). Blank lines between groups of items in a menu can help emphasise the structure.
- If menu items are numbered, start from 1, and avoid gaps in the sequence. However a common option, say, to exit should be given a common number e.g. 9, which may force a gap in the numbering.
- Avoid abbreviations in menu options unless well known to the public.
- Avoid technical or computer jargon in menu options.

- Try to avoid splitting a menu over two pages, possibly by having two columns of options on one page. If it is essential to split it over two pages, provide clear controls for 'more options...' and 'return to previous options'.

11.4 System reset

Make the system auto-reset after a few minutes if no input is made. Thus when a system is abandoned by a user in the middle of a dialogue, the next user will see the introductory screen. However auto-reset should not take place too quickly as it is very frustrating for a system to reset when a user is reading system output or deciding what step to take next (Maguire, 1983).

12. Customisation

The idea of customising the user interface to the needs of individual users is becoming well established. For example, a cash point machine could be equipped with a telephone receiver (Höynä, 1995) so that people with visual impairments could receive instructions in spoken language. Alternatively voice output could be obtained via a connection point allowing users to plug in their own headphones. Such verbal support could also assist new users of a service that need additional instructions.

The SATURN project (RNIB, 1996) have tested the feasibility of bank customers carrying smart cards which carry information about each user's particular needs when operating a bank machine or other kiosk. The information would instruct the terminal to adapt to each person accordingly. Kiosk features that could be modified include increased time, larger characters, colour choice, speech output (of non-confidential information), language change, pictorial output etc. Such a facility would be particularly helpful to the elderly and disabled but would also benefit the population of users in general.

13. Other stakeholders

It is important to consider the needs of kiosk users other than the general public. For example, it may be necessary for a member of staff at an information centre to use a system on behalf of a member of the public. Such users may need short cuts through the system, or the results of frequent enquiries saved, so that they can call them up easily whenever such enquiries are made.

It is important to consider the needs of the people maintaining the information in the system. If it is not easy to update the information, then the tendency is for it to be left and become out of date. There are advantages in updating the system locally (i.e. flexibility of content, not depending on the reliability of a central service) and updating it centrally (i.e. consistent style, more efficient). This decision has to made in the context of the specific application.

14. Testing kiosk systems

If a prototype system for the public is being tested, then the following factors are worth considering to help ensure that the results are valid and will transfer to the real environment:

- If testing with user subjects, then make sure that a fair proportion of users have little or no previous experience of interactive systems. Such users will normally be tend to pose unexpected problems for the system and will therefore test the system more thoroughly.

- If possible, include elderly and disabled users. Any physical impairments of people in these groups will also test whether the system meets the need to 'design for all'.
- Define a set of possible scenarios of use and specify representative tasks based on them. It may not be possible to test all parts of the system, so concentrate on the most common and/or the most critical tasks.
- The main concern in terms of user performance is whether users can complete tasks smoothly without too many errors, rather than their speed of performance. Many people, if confronted with a new system are happy to work through it step-by-step fairly slowly to complete a task, rather than rush through it.
- Obtain user comments to complement performance measures. Users opinions may differ from what one would expect when viewing their performance times.

15. Conclusion

Systems for the general public are now in widespread use, and are likely to increase as organisations recognise them as a cost effective means of offering information and services to the public. It is clear that a proportion of the public, particularly those with experience of interactive systems, will be able to use them successfully. However the public includes a wide range of differing levels of experience, ability and levels of confidence. Care is required in the design of public information systems if the services they offer are not to be denied to large sections of the population. This paper has tried to provide some general assistance which can help designers try to achieve 'interfaces for all'.

16. References

Brems, D. J., Rabin, M. D., Waggett, J. L., Using natural language conventions in the user interface design of automatic speech recognition systems. *Human Factors* 37(2), pp265 - 282, June 1995.

Bruce, I., Voice guidance for interactive speech systems. Voice systems worldwide 1990. *Official proceedings of the international voice applications conference and exhibition*, pp115 - 119, 30 May - 1 June 1990.

Clark, L., The use of scenarios by user interface designers. *HCI'91 conference proceedings*, 20-23 August, Diaper D. and Hammond, N. (eds.), Cambridge: Cambridge University Press, pp103-115, ISBN 0-521-416949-9, 1991.

Clarke, A. M., Allison, G., Carter, C. J., Graham, R., Maguire, M. C., Parker, C. G., Pomfrett, S. M. and Stapleton, L. J. (eds.), *Human Factors Guidelines for Designers of Telecommunication Services for Non-Expert Users. Volumes 1 and 2*, ISBN 1 901267 00 8, HUSAT Research Institute, 1996.

Daly-Jones, O., Bevan N. and Thomas, C., *Handbook of User-Centred Design*, EC Deliverable 6.2.1, Telematics Applications Programme, Project IE 2016 INUSE, NPL Usability Services, National Physical Laboratory, Queens Road, Teddington, Middlesex, TW11 0LW, UK, 1997.

Daniel, F. and Krueger, H., Designing the look, *INTERCHI'93 (adjunct)*, pp 47-48, 1993.

Eason, K. D., A task-tool analysis of the manager-computer interaction. In B. Shackel (ed.) *Man-computer Interaction*, Amsterdam: Sijthoff and Noordhoff, 1981.

Gagnoulet, C. (1989), Voice replaces dial in new public phones. I*nternational Voice Systems Review* 1(1), pp1-39 Jan/Feb, 1989

Gill, J., Access Prohibited, Information for Designers of Public Access Terminals, *Royal National Institute for the Blind*, 224 Great Portland Street, London W1N 644, UK, ISBN 1 86048 014 1, 1997.

Gould, J. D., Boies, S. J., Levy, S., Richards, J. T. and Schoonard, J., The Olympic Message System: a test of behavioural principles of system design'. *Communications of the ACM*, 30, 9, pp758-769, 1987.

Helander, H. G., Design of visual displays. In G. Salvendy (ed.): *Handbook of Human Factors.* New York: McGraw-Hill, 1987.

Höynä, U-K., Jönsson, L., Lorentzon, P., Fasen, P., (eds.) *Automatic service machines. Service for everybody?*, The National Swedish Board for Consumer Policies, Box 503, S-162 15 Vällingby, Sweden, and The Swedish handicap Institute, Box 510, S-162, 15 Vällingby, Sweden, ISBN 91-7398-543-1, 1995.

Maguire, M. C., ISLA — an experimental local information system for the general public, *Information design journal*, vol. 3/3, pp 198- 205, 1983.

Maguire, M. C., *TIER 2 Evaluation Report*, EC Telematics Applications Programme PD Web project, WP08, HUSAT Research Institute, The Elms, Elms Grove, Loughborough, Leics. LE11 1RG, UK. September 1997.

Mamdani, S., Barton, G., Poulson, D, Allison, G., Ashby, M., and Maguire, M., *ATTACH interface guidelines*, Internal document, EC TAP ATTACH project internal document, 1997.

May, A. J., *Development of generic user requirements for interactive public information systems*, Master of Science thesis in Ergonomics, Faculty of Science, University College, London, 1993.

Noirhomme-Fraiture, M. and Vanderdonckt, J. M., Screen usability guidelines for persons' with disabilities, *INTERCHI'93 (adjunct)*, pp 25-26, 1993.

Peltu, M., Power to the people, *Computing*, 9th June 1994.

RACE Project 1065 - *ISSUE Usability Guidelines, Volume III: Human Factors Guidelines for Multimedia*, HUSAT Research Institute, Loughborough,1992.

RNIB, 1996, *Smart cards - Interfaces for people with disabilities*, SATURN project brochure, (ed.) Gill, J., Royal National Institute for the Blind, 224 Great Portland Street, London W1N 6AA, UK. ISBN 1 86048 007 1.

Robbe, S., Carbonell, N., Dauchy, P., *Constrained vs spontaneous speech and gestures for interacting with computers: A comparative empirical study*, INTERACT 97 conference proceedings, IFIP TC13 International Conference on Human-Computer Interaction, Howard, S., Hammond, J. and Lindgaard, G., ISBN 0 5412 80950 8, pp445-452, 1997.

Salomon, G. B., Iterative design of an information kiosk, In: *Human-computer interaction: towards the year 2000*. Morgan Kaufmann Publishers, 1995, ISBN 1 55860246 1.

Schofield, J., Issues and solutions to designing usable multimedia systems, *NPL Usability Forum* 'Multimedia Design and Evaluation - Practical Experiences', DTI Conference Centre, Victoria Street, London SW1, 10th September, 1997.

Schumacher Jr, R. M., Hardzinski, M. L., Schwartz, A. L., Increasing the usability of interactive voice response systems: research and guidelines for phone-based interfaces. *Human Factors* 37(2) June 1995 pp251 - 264, 1995

Vossen, P., Maguire, M., Graham, R., Heim, J., Design Guide for Multimedia, *EC Telematics Applications Project IE 2016, INUSE*, Version 2.1, July 1997. (Available from M. Maguire, HUSAT Research Institute, The Elms, Elms Grove, Loughborough, Leics. LE11 1RG, UK). September 1997.

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