

Digital TV user interface guidelines

Abstract

This document outlines the user interface requirements for digital television receivers. Although aimed specifically at visually impaired users, it includes many universal principles.

Introduction

Digital television services have been introduced more recently than the invention of the Internet, and as such they use a less mature technology. However, a number of issues are coming to light regarding the usability of the equipment by blind and partially sighted people. As experience with the Internet has proved, making these products more accessible to people with sight difficulties does not need to be an expensive process if taken into account early on in the design process. The benefit of doing so not only includes a wider range of users, but also has the potential to increase revenue through the use of such products by these additional users. By 2015, it is estimated that 50% of the British population will be over 50. They are the fastest growing proportion of society and are getting wealthier, possessing 80% of the wealth and disposable income. If the new products are made more accessible than their predecessors were, this can result in a proportionally greater uptake by people with sight difficulties. In addition, tackling the requirements of people with sight difficulties by applying inclusive design principles leads to products that are more usable for everyone. Indeed, one way to improve the usability of a product is by making it more inclusive.

These guidelines have been constructed using experience gained from case studies and cross-referencing it with the feedback received by service providers. In addition, findings of research from the University of Brighton and the RNIB Scientific department have been included.

Glossary

EPG	Electronic Programme Guide	A service providing the user with listing information about television programmes
RNIB	Royal National Institute of the Blind	Voluntary Sector Organisation (charity no 226227) working with industry to improve access to services for blind and visually impaired people
ETSI	European Telecommunications Standards Institute	A European Standards Organisation responsible for the area of telecommunications.
EPG	Electronic Programme Guide	Time schedule and information about scheduled TV and Radio services, available through the TV.
WGBH	American Public Service Broadcaster based in Boston	
NCAM	National Center for Accessible Media, owned by WGBH	

Guidelines

1	Presentation	
1.1	Provide user option to change the display to high contrast and inverted text	Essential
1.2	Provide user option to change the size of the displayed text	Essential
1.3	Use a clear font	Essential
1.4	Avoid text over textured background	Essential
1.5	Never rely solely on colour to convey information	Essential
1.6	Ensure that 'please wait...' messages are obvious	Essential
1.7	Avoid flashing and scrolling text	Essential
1.8	Apply readability guidelines	Essential
1.9	To highlight an option, favour markers over inversion	Essential
1.10	Avoid, or provide an option to disable, brief display messages	Essential
1.11	Avoid icons, or offer a text alternative	Essential
2	Navigation	
2.1	Provide numerical navigation to all functions and links	Essential
2.2	Provide the option of audible feedback of navigation	Essential
2.3	Provide spoken feedback	Optional
3	Remote control	
3.1	Buttons should contrast against the background	Essential
3.2	Legends should contrast against their backgrounds	Essential
3.3	Buttons should vary in shape and be arranged in clusters	Essential
3.4	The numerical 5 key should have a tactile identifier	Essential
3.5	Remote control should be usable by a single finger when resting flat on a table-top	Essential
3.6	Label buttons with both text and symbols	Essential
3.7	Conform to alphabetic allocation standards	Essential
4	Front-panel instrumentation	
4.1	Make good use of front panel indicators	Essential
4.2	Front panel controls must be able to operate basic functions	Essential
5	Miscellaneous issues	
5.1	Ensure consistency	
5.2	Timeouts	
5.3	Keep feature settings between services	
5.4	Tactile indications on connectors	

Details and rationale

1.1 Provide user option to change the display to high contrast and inverted text

Depending on the nature of the sight difficulty, the user may prefer to use a high-contrast version of the textual information. Some people find it easier to read light text on a dark background, while others prefer dark text on a light background. Both these options should be available for selection. In addition, some users appreciate a selection of colour combinations to choose from. For example, yellow on black is preferred by some to white on black.

1.2 Provide user option to change the size of the displayed text

Improving the contrast of the display is not always enough for users to see everything clearly. Consideration should be given to making all text a good size from the outset. Alternatively, the user should be able to enlarge the text that is presented. Caution should be given to how this is done so as not to compromise the usability and navigability of the system. For example, if the entire screen is 'zoomed', the inevitable result is that parts of the screen are no longer seen in context. This can cause confusion, making the situation worse. Being able to enlarge a selected block of text once the context has been established may be a reasonable way to solve this problem.

1.3 Use a clear font

Being able to read text is not just about size. For example, a smaller sans-serif font is usually more readable than a larger serif font. When choosing a font, consider its readability. Tiresias [1][2] is recommended.

1.4 Avoid text over textured background

All text should be rendered on a plain background. Textures, and certainly pictures, should be avoided. When displaying text overlaid on pictures, ensure a block background to the text and adequate border to separate the text from the background. Remember that the picture content may include text of its own and there must be adequate isolation between that and the overlaid text.

1.5 Never rely solely on colour to convey information

Colour is a great way to identify context, relations and meaning. However, it should never be solely relied upon. Colour-blindness affects about eight per cent of men, so this is a major issue. Typically, it causes an inability to distinguish red from green, but vision can be entirely monochrome. A product should remain usable even with a monochrome display. In the case of the 'fast-text' colour buttons - red, green, yellow, blue - reference to these buttons should either appear in a consistent and correct order (with all present, even when not all are used), or include an alternative method to identify which colour is being referenced. If the product wishes to assume that the user knows what colour the buttons are, they should be clearly stated early on in the instruction manual and quick installation guide.

1.6 Ensure that 'please wait....' messages are obvious

It is not always obvious when the screen that a user is looking at is complete, or whether more information is going to be displayed in due course. Whenever the device is going to take more than one second to complete an operation, a message should be displayed, or equivalent, to that effect. This message must be clearly seen and draw attention to itself. It is one exception when flashing text may be used.

1.7 Avoid flashing and scrolling text

Text must never be displayed flashing or scrolling (except as in 1.6 above). This is not only distracting, but can be distressing and makes the text hard to read. If it is necessary convey an important message and draw the user's attention to it, it should be displayed in a suitable window, adequately isolated from its surrounding and in such a way that there is no doubt as to its independent nature.

1.8 Apply readability guidelines

Follow these suggestions [5] to maximise readability of text:

- Favour lower case text over upper case.

Studies have shown that lower case text is easier to read than upper case because their ascenders and descenders make distinctive and memorable images.

- Avoid italic, oblique and condensed text.
- Favour sans-serif over serif font.
- Favour left-align against centred or right-align.
- For arrows, follow ISO7001 specification.
- Ensure words have a clear space around them.

Words immediately adjacent to symbols can be more difficult to read. Here is an example.

1.9 To highlight an option, prefer markers over inverting

There are two problems with inverting text to indicate a selection or highlight. Firstly, it may render the selected text less readable than unselected text. This results in the opposite effect to that required. Secondly, if only two options are presented, one of which is highlighted and the other not, it is not necessarily obvious which one it is that is selected. For example, which of these is selected: YES NO

1.10 Avoid, or provide an option to disable, brief display messages

If any messages are usually displayed for a few seconds and then disappear, these will not be reliably read. They should either be avoided entirely, or else an option should be provided to disable the timeout, so that the user has to acknowledge the message. However, it should not be assumed that the user can see such a message, so the normal method of navigation should not be modified. In other words, be extremely careful about displaying unsolicited messages that require a response, unless the user is expecting such a message, and that is always the result of a particular operation. Otherwise, the user may get locked into an unfamiliar situation that they cannot get out of. A possible way around this problem is to provide additional audible feedback.

1.11 Avoid symbols, or offer a text alternative

The majority of visually impaired people do not like symbols, because they are much harder to interpret than plain text. Due to their typically intricate design, they do not lend themselves to high visibility. However, symbols are preferred by people with learning difficulties and foreign language speakers, so the design should be done in such a way that both can be available. Conventions should be followed where they exist, and the user given the opportunity to learn what new symbols mean. However, using the instruction manual to provide this training is **not** a reliable method.

2.1 Provide numerical navigation to all functions and links

Each and every selectable on a screen should have a single key associated with it, typically the numerical number keys. Where the number of selectable items exceeds the practicable number of keys, consideration should be given as to how two strokes could provide access. The usefulness of this feature is twofold. Firstly, the shortcut keys can make navigation through the hierarchy of pages quicker than moving a cursor around

and pressing select (enter/OK). Secondly, if the screen cannot be seen at all, a key sequence can be learnt by the user to access the required features.

This only applies to static links. Blocks of information that change dynamically (for example, EPGs) may not be able to usefully provide this function.

Key access should also be given to all options, and these must always be 'absolute'. For example, if an option is presented that can be 'on' or 'off', the user must not have to know its current state in order to set it to an intended state. It must be assumed that the user does not know any of the current states, nor can know them unless a speech interface is provided.

2.2 Provide the option of audible feedback of navigation

Audible feedback would usually be in the form of short beeps. These should be of a sensible frequency and duration: for instance, less than 5 kHz due to the natural loss of high-frequency hearing in elderly people. Additionally, information can usefully be conveyed with the beep - a short, high beep can indicate a successful operation, contrasting with a long, low beep to indicate an error. Information should not be conveyed by pitch alone - consider a number of beeps in addition to the duration. This is particularly useful for someone navigating without the use of the screen as defined in 2.1 above. In addition, it gives the user confidence that the remote control has successfully conveyed an instruction to the controlled device, and thus the response to the key-press should be immediate, even if the operation may take a while to complete. When the user is required to wait before an operation will be completed, this should be conveyed, for example by a series of short beeps continuing until the operation has completed.

2.3 Provide spoken feedback

Where practicable, provide spoken feedback to the user. This should include details of navigational options, confirmation of user commands and a rendering of all displayed information. Care should be given to the mapping between the non-linear nature of the screen elements, and the inherently linear nature of a string of spoken text. There must be clear differentiation between informational and navigational elements; for example one could be male and one a female voice. It should ideally be possible to adjust both the volume and the speed of the speech. The programme sound should be dimmed or muted when speech output is in progress. Guidelines for this are available from WGBH-NCAM [6].

3.1 Buttons should contrast against the background

Even if a sight difficulty is such that no print can be read - in any form - the user should be given as much help as possible to locate buttons on a remote control. Therefore the buttons themselves should be of a colour that contrasts effectively with the colour of the remote control's casing. Since a dark colour is often preferred for the casing - to reduce the visibility of general dirt - the buttons are best in a light grey.

3.2 Legends should contrast against their backgrounds

Printed text must always contrast well against the background on which it is printed. In the light of 3.1 above, the colour of the ink on buttons is therefore expected to be very different from the colour of any ink on the remote control casing.

3.3 Buttons should vary in shape and be arranged in clusters

It should be possible for a user to locate buttons without using sight (and this also is true of sighted users operating in dark conditions such as may be the case in home cinema set-ups). This does not have to relate directly to the number of buttons. A large number of carefully laid out buttons are more navigable than a smaller number of buttons in a single block. Buttons should be gathered into logical groups. These groups should differ in shape of both the arrangement and the individual buttons. Using a two-way rocker button for converse functions, such as volume up and volume down, reduces the cognitive loading for that function, but no more than two buttons should be covered by a single piece. In particular, the four buttons for navigation (up, down, left, right) is better as four separate pieces, and if a single piece is used, it should certainly not be loaded with a fifth select function. Since it is more logical to have the 'select / OK / enter' button in the centre of the four navigation buttons, it is conclusive that these buttons should all be separate.

3.4 The numerical 5 key should have a tactile identifier

Follow ETSI standards [3] to include a tactile identifier on the numerical 5 key. The numeric keypad should be laid out as for a standard telecommunications device. It should be a three by four button grid, with digit one at the top left hand corner, five in the centre, and zero in the centre of the bottom line. The two buttons either side of the zero can be any numeric-related function, such as (but not restricted to) 10+, -1, +1, Enter, Back. Any alpha keyboard should have identity marks on the 'F' and 'J' keys.

3.5 Remote control should be usable by a single finger when resting flat on a table-top

It should be possible to place the remote control on a table-top and operate it with a single finger. This is important for those with motor-control difficulties. Consideration should be given to the different ways in which a remote control might be held. People from the 'texting' generation are likely to hold it in their preferred hand and use their thumb to operate the buttons. Conversely, those of the older generation are likely to hold the controller in the opposite hand and operate the keys with the fingers of the preferred hand.

3.6 Label buttons with both text and symbols

Each button should have a symbol relating its function on the top, and a textual description on the casing above, where appropriate. This can also apply to numerical buttons, where the digit can appear on the button as well as on the casing. The restrictions on the minimum size of the buttons, and the minimum spacing between them, dictates that there must be enough room to place the labels between the buttons. Because the buttons contrast with the casing, the ink used on each will naturally be the opposite. Therefore, people whose eyesight makes it easier to see white on black, or black on white, both have their preference available. The text is good for functions that are unfamiliar to the user, whereas the symbol is a faster way to find and recognise a familiar function, as well as for people with textual difficulties due to dyslexia or foreign language. [4]

3.7 Conform to alphabetic allocation standards

If numeric keys are to also be used for letters, these should conform to the standard set by ETSI ETS 300 640 (August 1996) "Human Factors (HF); Assignment of alphabetic letters to digits on standard telephone keypad arrays".

4.1 Make good use of front panel indicators

If indicator lights or 7-segment displays are provided on the front panel of the box (and it is recommended that such a facility is included), maximise the usage of such. Display the currently selected service (channel number), which should also respond to each digit of a multiple digit entry from the remote control when being entered. An indication should be given of whether the unit is receiving mains power, and of whether it is on. Also of when a button press is being received from the remote control. These features also enable the box to be operated without switching on the television: vital if the user wishes to select a radio station to listen to through a hi-fi. Indicator lights should follow colour conventions: Red for error or stopped; Yellow for caution or delay; Green for on, go or accepted; Blue for advisory. It should be possible to identify which lights are on without being able to read the legend.

4.2 Front panel controls must be able to operate basic functions

In situations where the remote control is unavailable due to loss, flat batteries, malfunction, being out of reach or inaccessible to the user, all the basic functions of the product should be available. As a minimum, this should include switching on/off and selecting a service (channel number +/-).

5.1 Ensure consistency

All symbols and text should be consistent on the remote control, on-screen information, user manual and speech output.

5.2 Timeouts

Different users have differing needs in terms of their speediness. This is particularly an issue when entering a multiple digit channel number. Supposing the channel number might be one, two or three digits, the user might rightly expect to be able to select a one-digit channel with a single digit entry. But the system cannot know whether to wait for more digits to be entered or change to the channel selected. If the assumption is made that after a delay this must be all the information that is coming, then the choice of this delay is not only crucial, but the optimum will change from user to user. If it is too long, the user will have to wait out that delay until their selected channel is changed to. If it is too short, it will not be so easy, or even possible, for them to select a multiple digit channel.

Alternatively, the user might be required to press an additional button to indicate that a two or three digit channel is being entered. But this increases the number of keys to press and is cumbersome. This problem presents such a conundrum that some service providers have elected to have all channel numbers with exactly three digits, starting at 101. Even in this case, if the response of the unit is not prompt, difficulties are created by the user's entry getting out of sync with the unit's response. This situation was common with the Teletext service.

5.3 Keep feature settings between services

If an access feature is switched on, then it should stay on when changing from service to service. This does not apply to digital text, but should apply to subtitles, audio description and signing.

5.4 Tactile indications on connectors

When attempting to make connections at the back of equipment, consumers typically have a lot of difficulty locating and aligning the plug with the socket, irrespective of visual acuity. Space is usually limited, as well as available light. SCART plugs are notoriously difficult to orientate with the socket because it is difficult to tell which way round the socket is and where it is. The plug is less of a problem as the slanted point is easy enough to feel, but the socket needs an obvious tactile marker at the end of the slanted point (next to pin 20).

References

[1] Tiresias is a font designed specifically for high readability. It is available in five variations: Tiresias Screenfont for Television subtitling; Tiresias PCfont for Screen systems; Tiresias Signfont for Sign systems; Tiresias Infofont for Information labels; Tiresias LPfont for Large print publications. Tiresias, in Greek mythology, was a blind seer. For more information on the font, see www.tiresias.org/fonts.

[2] Silver J H, Gill J M, Sharville C, Slater J & Martin M: **A New Font for Digital Television Subtitles**. May 1998. www.tiresias.org/fonts/design_report_sf.htm

[3] ES 201 381 (v1.1.1 1998-12) Human Factors (HF); Telecommunications keypads and keyboards; Tactile identifiers

[4] EG 201 379 (V1.1.1 1998-12) Human Factors (HF); Framework for the development, evaluation and selection of graphical symbols

[5] Barker P, Fraser J: **Sign Design Guide** ISBN 1858784123

[6] Chris Schmidt and Tom Wlodkowski **A Developer's Guide to Creating Talking Menus for Set-top Boxes and DVDs** July 2003 available at <http://ncam.wgbh.org/resources/talkingmenus/>

Dr J M Gill. Ms S A Perera: **Accessible Universal Design of Interactive Digital Television** <http://www.tiresias.org/reports/brighton.htm>

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