DIGITAL TELEVISION FOR ALL

A report on usability and accessible design

APPENDIX E – INVESTIGATING THE INCLUSIVITY OF DIGITAL TELEVISION SET-TOP BOX RECEIVERS

JOHN CLARKSON & SIMEON KEATES
The DTI drives our ambition of ‘prosperity for all’ by working to create the best environment for business success in the UK. We help people and companies become more productive by promoting enterprise, innovation and creativity.

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Appendix E

Investigating The Inclusivity Of
Digital Television Set-Top Box Receivers

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18 September 2003
Introduction

This report contains a summary of work carried out by the Inclusive Design team at the University of Cambridge on behalf of The Generics Group. It describes the team’s audit of digital television (DTV) equipment with regard to its accessibility.

The aim of this study was to investigate the accessibility of DTV technology, focussing on the current generation of set-top boxes (STB) which provide ‘free to view’ services. Specifically, the objective of the study was to identify specific causes of concern with regard to user interaction with DTV that might lead to exclusion, i.e. situations where users may be unable to use the new technology. In particular, the team was keen to identify challenges presented to users by DTV that are not found when using the current analogue equivalent.

The number of STBs is increasing rapidly. Hence, for the purposes of this study, efforts were focused on looking at three set-top boxes selected by The Generics Group to be representative of the systems currently available. These will be referred to throughout the report as STB1, STB2 and STB3.

STB1 was selected because it was being marketed as ‘easy to use’; STB2 was chosen because it was the market leader at the time; and STB3 represents a non-DTT (Digital Terrestrial Television) service.

Note: the assessments described in this report were performed over the period April to June, 2003, and thus all comments expressed within this report are derived from the services available during that time period. With the continually evolving nature of DTV, some of the interaction details will have changed by the time that this report is published.
Approach
The objective of this study was to identify specific causes of potential user exclusion with regard to current DTV. This in turn raises two key questions:

1. What do we assess? and
2. How do we assess?

There are no standard answers to these questions since much depends on the nature of the products to be assessed and their potential users. The following sections provide a summary of the results of discussions with The Generics Group that led to a defined programme of assessment.

What do we assess?
To answer the first question it is important to take a ‘systems’ view of DTV. The STB, satellite or cable box and its remote form only a part of a larger system, which also includes the TV and service provider (see Figure 1 for an example).

In assessing DTV it is important to understand the contribution of each of the elements to the potential for exclusion. The system must therefore be tested as a whole in a way that represents ‘normal’ use. It is also important to remember that ‘use’ starts with the purchasing and commissioning of the system. In this case it is the selection and installation of the STB that is of particular interest. As a result, a number of use scenarios were agreed with The Generics Group that would be used to investigate the accessibility of DTV focusing on the purchasing, installation and use of STBs. These included:

- Choosing which STB to buy in a shop or from a web-site (e.g. how to tell the difference between them; is an £80 box better or worse than a £100 one; which one is easier to use? etc.);
- Identifying the set-up requirements for the STB (e.g. which aerial to buy; which cables do I need? etc.);
- Installation of the STB;
- Tuning the STB (or re-tuning, if after installation);
- Re-ordering the TV channels (setting up a list of favourites);
- Finding out what’s on and selecting the desired channel (using either the interactive guide, or by random surfing);
• Using subtitles, accessing additional settings, navigating the menu structure;
• Accessing interactive content (e.g. Teletext, BBCi).

The investigation needed to focus on identifying the broad steps involved in the interaction between the user and the STBs. The aim was to establish the potential causes of exclusion that may prevent users from interacting with the STBs effectively.

**How do we assess?**

In returning to the second question “how do we assess?”, typical approaches include expert assessment (using systematic analyses), simulation, user observations and user trials. However, the best approach is to use a combination of methods to ensure adequate identification of potential sources of difficulty. There is also a need for both quantitative and qualitative investigation, where generally the latter is necessary before attempting the former.

It is appropriate to use a human-computer interaction (HCI) type model as a basis for assessment as this allows a focus on the key elements of user interaction. For example, the Model Human Processor approach identifies perception, cognition and motor functions as the building blocks for any interaction (Card, Moran and Newell, 1983). These may be further decomposed into basic elements:

• Perception (sensory) – vision and hearing;
• Cognition – communication and intellectual functioning;
• Motion – locomotion, reach and stretch, and dexterity.

The advantage of this approach is that it also facilitates quantitative and qualitative investigation. The basic elements of interaction can be observed and data is available to identify the prevalence of such characteristics in the general population.

Three key techniques were identified as core to the assessment of DTV:

1. Expert assessment – the analysis of the accessibility of DTV systems by researchers with experience of other such assessments;
2. Exclusion analysis – the estimation of the levels of exclusion to be expected when using DTV;
3. User observations – the observation of individual users undertaking a range of specified tasks using DTV.

Of these approaches, all were to focus on STB1 and STB2 and the first two were also to investigate STB3. The scenarios identified above were to provide a basis for these investigations.

Steps 1 and 2 formed the basis of a preliminary analysis of the accessibility of DTV with a brief comparison with a typical analogue system. This provided an insight into the key problems to be expected with the new technology, allowing appropriate design of the user observations to further explore these issues.

This approach maximises the chances of identifying the principal areas of difficulty when interacting with an STB and, where possible, provides estimates of the levels of exclusion to be expected.
Summary

The following table provides a summary of the assessment approach, showing the mapping between the methods of assessment and the scenarios to be assessed.

Table 1 – Summary of assessment approaches and scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Expert assessment</th>
<th>Exclusion analysis</th>
<th>User observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STB1</td>
<td>STB2</td>
<td>STB3</td>
</tr>
<tr>
<td>1 System selection</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2 System set-up requirements</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3 Installation instructions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4 System installation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5 System tuning</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6 Setting ‘favourites’</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>7 Channel selection (on/off)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8 Subtitle selection (on/off)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>9 Teletext operation (on/surf/off)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10 Interactive operation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 General impressions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>12 Operating instructions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

The purpose here was not to ensure complete coverage of all scenarios by each method of assessment, rather to assess those scenarios most suited to the methods of assessment. For example, whilst ‘channel selection’ was evaluated using each approach, ‘setting favourites’ was considered too difficult for the user observation. ‘Preliminary observations’ were noted during expert assessment and therefore no longer appropriate during exclusion analysis. In a number of cases, more than one scenario was evaluated at a time. For example, scenarios 9 and 10 were considered together during the exclusion analysis.

‘General impressions’ and ‘operating instructions’, whilst not strictly scenarios, are included in the table to complete the list of issues addressed during the different stages of assessment.

Wherever appropriate, comparative assessments with analogue televisions were performed, to provide a baseline comparison for the levels of exclusion associated with the STBs. The assertion made is that any additional exclusion over and above that of the analogue televisions represents existing users who would be disadvantaged, and perhaps denied access to the new digital television services, by the design of the DTV systems.

Note: STB3 was not evaluated during the user observations due to the difficulty of setting up the receiving equipment. In addition, a number of STB3 features were not available, including the ‘interactive TV operation’.
Expert assessment

The accessibility of DTV systems was analysed by researchers with experience of other such assessments. The purpose was to provide an indication of where users may have difficulty interacting with a typical DTV system.

The qualitative assessment involved a simulation of the activities involved in installing and operating three typical STBs. Purchasing the STBs was not simulated in detail, because they had already been pre-selected by The Generics Group. However, supporting purchases, such as a new aerial, were included.

Four users participated in mock user observation sessions. Two were the authors of this report and the other two were experienced engineers, but digital television (DTV) novices. Of the authors, one had experience of digital cable TV and the other had no direct experience of digital TV.

The following sections are based on the list of scenarios in Table 1.
System set-up requirements (2)

When the set-top boxes arrived from The Generics Group the first problem was to find out how to get a strong enough digital TV signal. STB2 suggested checking a web-site (http://www.freeview.co.uk), so that was the first port of call. It was found out that a signal could be received in Cambridge, but it was suggested that a wide-band aerial may be needed. If access to the Web had not been available, the information could have also been obtained via the freephone telephone number provided.

Having determined that a signal could be received, the next step was to find a suitable aerial. Six high-street retailers were contacted to see if they stocked “an indoor aerial that would receive digital television signals.” Indoor aerials were chosen initially for their convenience for installation, compared to the purchase and installation of a new external aerial.

Most replied that they did not. Only one said that they stock one that “should work, but we couldn’t guarantee it.” Several of the high-street shops suggested contacting TV aerial companies. Three of these were contacted with the same request for an indoor aerial, but they only specialised in fitting external aerials, so could not advise on indoor ones.

In the end one of the authors went to the shop that had a potentially suitable indoor aerial, only to find out that they did not have one in stock. The final stop was a local catalogue shop and a browse through their catalogue showed that they offered several indoor aerials listed as being ‘digital compatible’, but only in “areas with strong signals.” As it was not known whether the signal available in Cambridge is strong or weak, but based on the poor quality reception Cambridge has for Channel 5, the assumption made was that the digital signal was probably be weak (this is in fact not a valid assumption, but a common one). Thus, to be on the safe side, the external aerial with the highest gain (i.e. the biggest and most expensive) was bought.

Next the aerial had to be assembled and installed. Constructing the aerial was a rather fiddly process and took 2 hours. Mounting it to receive a signal took a further 15 minutes. Connecting the cables remarkably took another 30 minutes, but this was primarily due to the co-axial connectors not being pre-attached and so a craft knife had to be used to strip away the layers of insulation and fasten the connectors on.

The other option would have been to get this operation performed by a specialist, but that would have been relatively expensive, since self-installation was free.

Finally, after approximately 4 hours, the TV was prepared for the set-top boxes.
Preliminary observations (3, 11-12)

The first stage of analysis was to view the components out of the box prior to installation. Table 2 provides a summary of the results.

Table 2 – Summary of preliminary observations

<table>
<thead>
<tr>
<th></th>
<th>STB1</th>
<th>STB2</th>
<th>STB3</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>buttons clearly labelled</td>
<td>two SCART sockets</td>
<td>remote control easy to hold</td>
</tr>
<tr>
<td></td>
<td>dedicated button for subtitles</td>
<td>audio output</td>
<td>good quality buttons</td>
</tr>
<tr>
<td></td>
<td>visually appealing instructions</td>
<td></td>
<td>two SCART sockets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>audio output</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>buttons felt ‘cheap’</td>
<td>remote control uncomfortable to hold</td>
<td>some buttons not clearly labelled</td>
</tr>
<tr>
<td></td>
<td>one SCART socket</td>
<td>buttons not clearly labelled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no audio output</td>
<td>difficult to access batteries</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>very technical instructions</td>
<td></td>
</tr>
</tbody>
</table>

STB1

STB1 was much more usable than STB2. The battery cover on the remote control was easy to remove and replace. The principal problem with the battery compartment was that the batteries needed to be inserted the other way round to most similar remote controls – usually +ve goes to the top, which did cause some confusion when the receiver did not appear to respond to the remote control when tuning.

The buttons on the remote control felt cheap, with a vague action, but were labelled clearly. Where icons were used, they appeared to conform to the user’s expectations. The power ON/OFF switch, though, could have been highlighted more clearly. The remote control had fewer buttons than STB2, primarily due to the absence of additional buttons such as the DVD controls, while simultaneously offering ‘shortcut’ buttons to more commonly-used features, such as subtitles. However, there is a trade-off to be maintained between allowing direct easy access to functions through the use of dedicated buttons, and the proliferation of new buttons on the remote control. Too many buttons, and the user is overwhelmed. Too few buttons and the user has to use on-screen menus to activate the functions. STB1 has five new buttons.

The most strikingly abnormal feature of the remote control was the positioning of the ‘0’ button to the right of the ‘9’, rather than below the ‘8’. This decision was clearly taken to maximise the use of the available space on the remote control, but is the kind of deviation from accepted design norms that can cause increased demand on users – in this case having to find the ‘0’ button that is not where expected.

The STB had one SCART socket on the back and no separate audio phono outputs. Consequently, while this was a reduction in available functionality compared to STB2, it was easier to connect.

The instructions are visually appealing and relatively easy to follow, although it was not immediately clear that there were two different sets of instructions on the two sides of the instruction sheet. This was only found after the ‘tuning’ screen did not coincide with what was expected, and it became clear that the SCART side, not the UHF one, should have been used.

STB2

First impressions of STB2 were not good. The remote control was particularly poor and the instructions were pretty sparse. The ‘small print’ was unnecessarily small, especially as it contained important health and safety advice.
Starting with the remote control, the cover to the battery compartment was far too stiff. It was finally opened, but only at unnecessary risk to the user’s fingernails.

The remote control was also comparatively unpleasant and uncomfortable to hold. No thought seemed to have been given to the profile to make it easy to grip and hold, especially over prolonged periods of time. It is a misconception to believe that the remote controls will only be used occasionally to change channels. The increase in channels available seems to lead to an increase in channel hopping, which involves fairly intensive use of the remote control, particularly during the adverts.

The buttons themselves generally had a reasonable action, with the noticeable exceptions of the PR+/- and VOL+/- buttons, which both had a strange profile and vague action. Those buttons, along with the arrow keys and OK, also suffered from insufficient contrast between the on-button markings and their background, making them very difficult to read. The colour contrast between the DVD button labels and the background was not as particularly good either. The on-button markings were particularly poor. The choice of offering DVD controls, but not video ones, was unusual.

The choice of icon for MUTE was non-standard and looked cheap. It seemed reasonable to assume that the STB button is STAND-BY, but it later transpired that the remote offered two modes of operation – television and STB. The QUIT button could be mistaken for the ON/OFF switch. The presumption is that the QUIT button has a particular function for the interactive elements, but QUIT seems to be an unnecessarily emotive label to use, especially for users who are unsure of how to use the STB, such as older adults, and who need reassuring feedback.

The labelling of the ON/OFF power button was poor, with little to suggest its important functionality. Even the icon used is a distorted version of the standard power one. The spacing of the buttons was generally a bit tight. For the numeric buttons, the horizontal spacing seemed to be acceptable, albeit inconsistent for buttons 3, 6 and 9, and 1, 4 and 7. The assessors found that the vertical spacing was too small for them to use comfortably. This could be confirmed by a full anthropometric analysis.

The set-top box itself had only three buttons, but again there was very little to suggest the purpose of each button, or to highlight the power ON/OFF one.

Finally, and associated with the difficulty with tuning in the STB, the quick set-up instructions were not very user-friendly. The instructions were complete (assuming no problems were encountered), but were presented in the same style as a technical manual, rather than a user guide. For example, the connection diagram showed the television, STB and cables in the format of a traditional circuit diagram, whereas pictures of the actual components would have been much more useful for most users.

**STB3**

STB3 had clearly had a great deal of thought put into its design, but still had features that exclude potential users unnecessarily. The remote control was larger than either the STB1 or STB2 ones and consequently had the space to house larger buttons, which were easier to use for people with both low vision and reduced dexterity. The remote control used different textures to indicate the best position for holding it, and the rubberised back made it easier to grip.

The plastic lip on the battery cover was a bit thick and slipped painfully under the user’s fingernail on occasion. However, the action was smooth and with practice (for example discovering that the cover could be opened using a fingertip, rather than a fingernail) the removal process became very straightforward. Once the cover had been removed, both battery slots were visible, with a helpful schematic to indicate which way round to insert the batteries. The label was adequate, but with a little bit more thought could have been even clearer, as it was a schematic representation, requiring some cognitive effort to translate that representation into the actual battery positions.
The buttons on the remote control had a good tactile quality, although the action was vague at times. The fonts used to label the buttons would have benefited from more ‘weight’ and the font size had been varied across the different button types, leading to some labels being too small for a number of users. Similarly, the contrast between the white lettering and the aquamarine background on the ‘special services’ buttons was not great. The ‘-’ on the VOL+/- and CH+/- buttons looked very stubby and not like a minus sign.

The Fastext (coloured) buttons were clear, well spaced and followed the expected standard layout. The use of icons on the remote control had been kept to a minimum, for example with the MUTE button being labelled as such in words rather than with the crossed out speaker icon. The use of words rather than icons is generally useful for novice users, as it removes the need to interpret potentially abstract icons. However, using words requires either more space (bigger remote control) or smaller fonts compared with the use of icons.

STB3 itself was more complex than either of the other STBs considered here, with the addition of two separate card slots for the interactive and viewing cards – although from a usability point of view, it would be desirable if only a single card was needed. STB3 also offered more button functionality on the box itself than either of the other STBs, including the ability to call up and control the interactive elements. However, all of the labels on STB3 were very small and difficult to read.

The connections at the back of STB3 were more complex, with 2 SCART connections, 2 RF outs, stereo, signal input, RF input, RS232 and telephone lead connections.

The instructions were quite complex, but effort had been made to make them more straightforward. The illustrations would have been better in colour, or with additional highlighting of the point of interest, rather than simply highlighting the appropriate button in white, a colour which is not used frequently for that purpose. Addition of arrows, for example, would have made the point of interest easier to identify.

The instruction manual had an unusual format in that the user instructions on operating STB3 were presented before the technically complex installation instructions. This was almost certainly because an installation service is provided to purchasers of STB3, so the user would most likely want to go straight to the operating instructions.
System installation (4, 5)

Having examined the components, the next stage was to connect the STBs to a television set and begin the installation process. Table 3 provides a summary of the results.

<table>
<thead>
<tr>
<th>STB1</th>
<th>STB2</th>
<th>STB3</th>
</tr>
</thead>
<tbody>
<tr>
<td>easy to install</td>
<td>straightforward to install</td>
<td>installed by professionals</td>
</tr>
<tr>
<td>automatic tuning</td>
<td>all cables supplied</td>
<td></td>
</tr>
<tr>
<td>all cables supplied</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ambiguous operation instructions</td>
<td>poor instructions</td>
<td>limited instructions</td>
</tr>
<tr>
<td>labelling too small</td>
<td>remote standby mode confusing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STB1

On switching on the receiver, the lights followed the patterns described in the instructions. The reset button was easy to press, although requiring the user to hold it for 5 or 6 seconds may be excessive. The labelling on that button was small, but offset by its red colouring.

The tuning screen appeared and the only question then was the need to press the SELECT button quickly. The manual implies that this needed to be done as a matter of urgency when the screen appears and may be unnerving to many users. It would have been interesting to see if there really was a time limit to this, why it exists and also what the implications were if the SELECT button was not pressed in time. However, these are all issues that a user should not really have to face.

The tuning process, once underway, was automatic and involved minimal user interaction. In this case, the receiver successfully received and decoded all of the free-to-view digital channels.

STB2

Connecting the box to the television was straightforward. However, despite numerous attempts, the box would not tune to the digital channels. At the time it was not known whether the failure to obtain a picture was due to the aerial, inadequate signal or some other failure. A troubleshooting guide would have been very helpful.

The fault was eventually tracked down to the remote control, which had placed itself in standby mode. According to the addendum sheet included in the instruction booklet, that particular type of remote control would enter the standby mode whenever the batteries ran out. Consequently it is worth noting that the problem that we encountered may reasonably be expected to be encountered by most of the STB users during their course of ownership and could easily lead to the STB being returned to the retailer as faulty by the consumer.

STB3

STB3 is typically installed for the customer by professionals. Thus installation should not be an issue in terms of the accessibility of the system. However, should STB3 need to be disconnected for any reason, the instruction manual offered a detailed connections diagram, but otherwise very little information. There was a fairly detailed troubleshooting guide, though, should problems be encountered.
Note that the television did not display a picture if the SCART cable was connected to the VIDEO out socket on the STB, as opposed to the TV out.
Operating the receivers (6-10)

The final stage of the qualitative analysis was to operate the STB in typical use scenarios, such as channel-hopping and using the interactive services. Table 4 provides a summary of the results.

Table 4 – Summary of receiver operation assessment

<table>
<thead>
<tr>
<th>STB1</th>
<th>STB2</th>
<th>STB3</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>good remote control layout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>good channel guide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TV volume control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TV channel controls</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>some screen text too small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>confusion with PR+/- and Ø</td>
</tr>
<tr>
<td></td>
<td></td>
<td>button layout confusing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no TV volume control</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>some screen text too small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no STB/TV mode indication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no obvious page up/down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no TV volume control</td>
</tr>
</tbody>
</table>

General comments on DTV interaction

First of all, when switching channels on analogue television, the new channel picture appears very quickly. However, for digital television there can be a long delay before either audio is heard or video output is seen. This sometimes leads the user to switch channels (thinking that maybe the signal is not strong enough) when all that is necessary is to wait longer for the programme to appear.

Teletext is present on all channels on analogue television, so no thought needs to be given as to where to find it. However, the closest analogous service on DTV is the interactive services such as BBCi, which are only present on particular channels. The DTV versions of services such as Teletext and FourText have their own dedicated channels, thus to use those services, the user first needs to find the appropriate channel number.

When on the dedicated Teletext channel, the page loading is different to analogue teletext, and not as obvious. As with the channel-changing, it is easy for the user to press the button a number of times, before realising that the receiver has recognised the input and is actually waiting to download the new page.

On some of the text pages (e.g. the sports headlines), the interaction changes from press a button, to select a headline, but the headlines are not immediately identifiable as being selectable.

STB1

Using STB1 confirmed the observations made under the ‘out of the box’ stage of analysis.

The remote control for STB1 had a single, multipurpose set of arrow buttons and no separate PR+/- button. This was cognitively more straightforward than the arrangement for STB2 (see below) for the users as most interaction involved using those arrow buttons. The disadvantage was that an equivalent to the computer keyboard PG DOWN key did not appear to be available and so scrolling down several pages of options was more time-consuming.

The on-screen display text was uniformly large and clear compared to analogue teletext and the STB2 electronic programme guide. The addition of the five special purpose function buttons at the bottom of the remote control made tasks such as activating subtitles significantly easier for the user to perform.
STB2
As with STB1, the observations made under the ‘out of the box’ stage of analysis were borne out by the user observations. Additional points that arose during use included that pressing the volume button on the remote control did not appear to actually do anything. Certainly the volume of the TV did not change and no reference to the function of the button was found in the instructions.

Another source of confusion was the use of both the ÷/Ø arrow buttons and the PR +/- button when navigating the interactive content and the programme guide. The ability to use the PR +/- button was useful when navigating interactive content because it enabled the user to skip forward or backwards to the next page of content without having to scroll through all the options on-screen first. However, navigating the content within a page required the use of the arrow buttons. Several users became confused with when to press the PR +/- button and when to use the arrow ones. The function of both buttons was not sufficiently clear when using the interactive content.

Similarly when changing channels, some users were unsure whether to use the PR +/- button or the arrow ones, especially those who had used STB1 first (see above).

Another anomaly was found when using the on-screen display (OSD) menu to adjust settings. When finishing altering a setting, the OSD shows the QUIT button on the right and the BACK button on the left, whereas the remote control has the buttons in separate locations, and on opposing sides to those on-screen.

The assessors (both wearing corrective glasses) found some of the OSD text to be a bit small and thus may cause difficulties for users with poor vision.

Finally, activating subtitles was more complex than for STB1, which had a special-purpose button on its remote control. For STB2 it was necessary to press the MENU button, use the ÷/Ø buttons to navigate to “SET UP”, press OK, navigate to “Languages”, press OK, use the Ò/Ö arrow buttons, to select the appropriate language and then use QUIT to exit.

STB3
While the remote control for STB3 was generally well designed, the interaction with the television when in use was unwieldy at times. For example, activating subtitles required a process of pressing the SERVICES button (not an obvious choice), then selecting “SYSTEM SET-UP” from the on-screen menu. This was followed by selecting the “LANGUAGE + SUBTITLES” option, selecting “SUBTITLES”, switching on using the Ò/Ö arrow buttons, DOWN to “SAVE”, pressing SELECT and then BACK UP twice to return to the television picture. This was similar to STB2 and clearly significantly more complex and demanding than the STB1 approach of a dedicated button.

An interactive card was not available at the time of the assessment, so it was not possible to investigate the dedicated interactive services.

A few problems with the remote control were found during the use of STB3. For example, the ÷ arrow and BACK UP buttons are too close and the wrong button was often pressed. The other major difficulty arose from the dual-purpose nature of the remote control. It has been designed to operate both as a television remote control and as the STB3 remote control. The respective mode of operation is selected by pressing either the TV or STB buttons. When in either mode, buttons such as CH +/- change their behaviour, changing the TV or STB channels respectively. This is a laudable attempt to reduce the number of remote controls required to view the digital television channels. However unless the remote control provides some kind of feedback about which mode it is in, the user has no way of predicting the outcome of pressing a button until the mode has been determined.

In terms of navigating the programme guide, a similar model of interaction to that of STB2 had been adopted, with the CH +/- offering an equivalent to PG UP/DOWN on a computer keyboard, and the ÷ and ù arrow keys offering selections within each page.
STB3 displayed information on 10 channels per page, compared with the 5 of STB2. This led to reduced numbers of key presses to find a distant channel, but more for nearby ones, and also the need to use smaller fonts on-screen to fit all of the information on.

Another idiosyncrasy that was encountered was that Teletext was entered by pressing TEXT, but BACK UP was the key for getting out of it again. This was inconsistent with accepted text accessing, where the same button is typically used for calling up the text and hiding it again.
Summary of expert assessment

In terms of summarising what has been learned, the following summary points provide a list of key challenges encountered when assessing the three DTV systems. Note that these summary points are drawn from all aspects of the expert assessment, not just the summary sections (1-10) presented earlier. Particular attention has been given to identifying general problems that will limit accessibility to DTV, rather than problems specific to an individual system. Points of comment or concern include:

Installation and set-up
1. Set-up requirements – retailers appear to have inadequate knowledge of installation requirements (signal coverage/strength, need for aerial etc.) and the necessary additional equipment is not always available at the point of purchase of the STB. There is also then an additional cost required to complete installation. This is not a problem for equipment which is ‘installed’ for the user as part of the purchased package (e.g. with STB3).
2. Set-up instructions – these are critically important for the users who attempt to self-install their STB. The instructions need to be clear and up to date (e.g. not referring to an earlier model of remote control as for STB2). Graphical instructions, if done well, can be particularly helpful if they identify buttons on the remote control and elements on the display that the user has to interact with. A complementary combination of graphical and written instructions minimises the potential for exclusion.
3. Tuning – the initiation of the tuning of the STB must be straightforward, both in terms of when it must be done and how it must be done. Clear instructions must be provided on both these points.
4. Battery replacement – remote controls use batteries, therefore it is important that access to the battery compartment is straightforward without compromising the safety of small children. The need to reactivate the remote after replacing batteries should also be avoided since this is unnecessary and uncommon practice.

Operation
5. Operating modes – there is potential for confusion regarding STB and TV modes and the buttons required to switch between them. Simpler operation and clearer instructions are required.
6. Volume controls – the presence of direct TV volume controls on the remote control is ambiguous. On only one of the remotes used did this feature actually work. In practice, this would be a very useful feature, allowing channel selection and volume adjustment from the same remote control.
7. Response times – the delay between pressing buttons on the remote and seeing a response on the TV screen is unacceptably long and is likely to lead to much confusion. Unless the user is familiar with the system and has the confidence that it will respond, many actions are interrupted by the user because no feedback has been provided that the user request has been received. Good practice is to ensure that the user is provided with direct and immediate feedback in response to an action (e.g. by using an hour-glass symbol).
8. On-screen menus – the use of on-screen menus must be done in such a way as to be intuitive for inexperienced users. The selection of highlighted options provides a particular cause of confusion since it is not immediately clear if the default selected item (usually at the top of the list) is a heading or a member of the list of options. This is particularly ambiguous for novice users and those unfamiliar with menu-driven systems.
9. **Subtitles** – the accessibility of subtitles is important. Expecting users to navigate multiple menu layers with ambiguous names (e.g. ‘language’) is not acceptable. A single button press is better.

Remote controls
10. **Nomenclature** – there is a lack of consistency in the use of nomenclature by the various providers of digital television. This, coupled to the use of different on-screen navigation paradigms, leads to unnecessary confusion. Some menu systems require navigation using cursor keys and a SELECT/OK button, others rely on selection by number. The latter is preferable for those without experience of menu-driven systems.

11. **Labelling** – appropriate fonts of appropriate sizes in appropriate colours should be used for labelling on the remote control. There is much guidance available in this area from a number of sources including the RNIB.

12. **Layout** – care needs to be taken that commonly used keys on the remote are not so close together as to invite the user to inadvertently select the wrong function. In addition, the legends used need to be informative to those without general experience of such devices. Confusion can arise between cursor control keys that are often unmarked and the keys used for programme selection that are often marked with ‘up’ and ‘down’ arrows.

13. **Sourcing** – the use of ‘off-the-shelf’ remotes can seriously compromise accessibility. They can provide buttons that are not used and layouts that are not suited to, or sympathetic with, the system they should control. A remote designed in conjunction with the system it controls is likely to be better suited to the task.

Note: all of the above recommendations are based directly on the results of the quantitative assessment. They should be viewed as complementary to commonly accepted good usability and accessibility practice. For example, buttons on remote controls should be positioned such that the most frequently used buttons should be most easily accessible. Similarly, where possible, the interface design should conform to well-established design standards, such as positioning the ‘0’ below the ‘8’ for STB1.
Exclusion analysis

Unlike the qualitative assessment, which focused on expert opinions and user observations to identify possible sources of difficulty when interacting with the STBs, quantitative assessment focuses on evaluating the number of people who are likely to experience those difficulties.

Introduction to the analysis process

The first step in examining any interaction is to expand the use scenario into its component steps to enable a systematic assessment to be performed. As with all studies of this type, there are many possible interaction paths, so assumptions have to be made about the context of the use. For example, it was assumed for this study that the STB was to be used in conjunction with a TV and a VCR that were already mounted on some kind of storage/display cabinet.

In general, it is helpful to split the interaction into high-, medium- and low-level activities. Each of these can be assessed individually to build up an overall picture of the interaction process. The assessment process is described in Annex B. In summary, the demands made by the product on the user for each interaction step are estimated. The number of people unable to meet such demands are then evaluated, where the demands are expressed in terms of the user capability required to interact with the product. The total number of people excluded from the interaction can be estimated by taking the maximum demands made by the product during the complete interaction.

Note that in this report, we will focus primarily on the user capabilities demanded by the product for successful interaction. In other words, the user must have this level of capability to accomplish that task. Reduced levels of capability can arise from many causes. These include congenital medical conditions such as Cerebral Palsy, acquired medical conditions such as strokes and Parkinson’s Disease, trauma (accidents) and the process of ageing. We will not distinguish between any of these causes, as it is the effect of the symptoms, i.e. the reduced capabilities of the user, that are of principal importance when interacting with the STBs.

The levels of exclusion are calculated from the 1997 Disability Follow-up Survey (Grundy et al., 1999) to the 1996/7 Family Resources Survey (Semmence et al., 1998) available from the Office of National Statistics (ONS). Table 4 summarises the number of adults in Great Britain with a loss of capability, as defined by the ONS.

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>total ,000s</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>1484</td>
<td>5.4</td>
<td>617</td>
<td>2.3</td>
<td>862</td>
<td>3.2</td>
<td>1975</td>
<td>7.2</td>
</tr>
<tr>
<td>50-64</td>
<td>1940</td>
<td>20.9</td>
<td>968</td>
<td>10.4</td>
<td>752</td>
<td>8.1</td>
<td>2234</td>
<td>24.0</td>
</tr>
<tr>
<td>65-74</td>
<td>1317</td>
<td>27.0</td>
<td>792</td>
<td>16.2</td>
<td>393</td>
<td>8.0</td>
<td>1475</td>
<td>30.2</td>
</tr>
<tr>
<td>75+</td>
<td>1970</td>
<td>47.2</td>
<td>1603</td>
<td>38.4</td>
<td>615</td>
<td>14.7</td>
<td>2442</td>
<td>58.5</td>
</tr>
<tr>
<td>16+</td>
<td>6710</td>
<td>14.7</td>
<td>3979</td>
<td>8.7</td>
<td>2622</td>
<td>5.7</td>
<td>8126</td>
<td>17.8</td>
</tr>
</tbody>
</table>

Each of the motion, sensory and cognitive scales represents the total level of exclusion from the relevant capability scales used in the ONS data set. The scales are comprised as follows:

- Motion: consists of Locomotion (Loc), Reach & Stretch (R&S), Dexterity (Dext)
- Sensory: consists of Vision (Vis), Hearing (Hear)
• Cognitive: consists of Intellectual Functioning (IF), Communication (Comm)

The levels of exclusion have been calculated by identifying the bottlenecks in the interaction associated with each of the ONS scales (Locomotion, Reach & Stretch, etc.). These levels of exclusion are summed to produce a total level of exclusion for each of the motion, sensory and cognitive scales, after correcting for multiple counting (because some people will have multiple capability losses). These are the values reported in the tables that follow (Tables 5 to 13).

**Interpreting the results**

For each of the scenarios, the following are provided:

• a list of the high- and medium-level breakdowns of activities for typical examples of use;

• the quantified levels of exclusion that can be expected.

In the tables that follow, the high-level breakdowns are listed on the left, while the medium-level ones are listed in italics on the right.

The levels of exclusion calculated are presented in tables such as Table 5a. The first column represents the age bands of the users. Five age bands have been chosen: all adults (16+); younger adults (16-49); middle-aged adults (50-64); older adults I (65-74); and older adults II (75+). These age bands correspond to those used in the ONS data. The next six columns represent the levels of exclusion calculated for the motion, sensory and cognitive demands of interacting with DTV under the particular use scenario. The results are displayed as both absolute number of people (in ,000s) and as a percentage of people in that age group. The final two columns show the total number of people excluded in each of the age bands. These totals are derived by adding the number of people excluded under the motion, etc. categories and then correcting for multiple counting.

It is important to note that the levels of exclusion calculated for each of the use scenarios are based solely on users with functional impairments. It does not include users with learning difficulties, as they are not typically classified as disabled under the ONS definitions. As such, the estimated levels of exclusion in the tables above can be considered to be **significantly conservative** since the ONS data is based on self-reporting (which is most often conservative) and represents only those living in private homes and with functional impairments. Nor does it include users who may be excluded through simple lack of experience or familiarity with the interaction paradigms, or the technical knowledge to differentiate one cable from another, for example.

It is obviously difficult to provide accurate estimates of how the exclusion will increase beyond the members of the population included in the ONS database. However, our best estimate is that the exclusion associated with the cognitive demand may need to be scaled up by perhaps as much as an order of magnitude.

One of the principal causes for this increase in exclusion associated with the cognitive demand is that the user is unlikely to have a clear mental model of how to interact with the STB. For example, as noted in the qualitative analyses, there are inconsistencies between the OSD and the remote controls. There appears to be a merging of both web-browsing and traditional analogue television interaction paradigms, and it is not always clear which one is being used at any particular point in the interaction. What is needed is a clear ‘cause and effect’ relationship that ideally matches the user’s preconceptions of what the STB should be doing.
The levels of exclusion

The calculations of the levels of exclusion have been broken down into the scenarios of use presented in the Introduction. For brevity the full systematic breakdowns of the interactions are not provided, as these would be very lengthy per task. Instead the principal causes of exclusion are presented (“causes of exclusion”), along with the constituent actions that cause the greatest exclusion within each scenario (“predominant reasons for exclusion”).

Note that although the same predominant reasons may be given for different scenarios, the level of exclusion associated with those reasons may vary. For example, the dexterity demand (and hence exclusion) associated with pressing a small button is higher than for a large button, although both will have the same ‘predominant reason’ listed – “pressing a button”.

A summary of the exclusion analysis is given in Figure 2a for all users over 16. The red bar represents all those with some form of functional impairment and the green bar the level of exclusion expected for channel-hopping by an expert user with an analogue TV. Figure 2b shows a similar graph for those over 75. Note the different scales at the lower edge of the graphs, the absolute level of exclusion for those over 75 is less than a third of the level of those over 16. However, the upper scales tell a different story. The percentage exclusion for those over 75 is more than three times higher than for those over 16. Hence, although the absolute numbers for those over 75 are lower than for those over 16, the relative numbers (proportions) are higher.

Figure 2a – The levels of exclusion in the 16+ GB population
System selection (1)

The process of identifying and purchasing a new digital receiving system. This process can be undertaken in person at a shop or remotely via the WWW or by telephone.

Informed purchasing (from a shop)

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify potential stockists</td>
<td>reading newspapers, watching TV adverts, listening to radio</td>
</tr>
<tr>
<td>Go to shop</td>
<td>locomotion and transport</td>
</tr>
<tr>
<td>Find shop assistant</td>
<td>visually locating assistant and attracting attention</td>
</tr>
<tr>
<td>Talk to shop assistant</td>
<td>hearing assistant, planning and conducting conversation, understanding the answers</td>
</tr>
<tr>
<td>Examine different STBs</td>
<td>visually examining boxes, reading and understanding technical descriptions</td>
</tr>
<tr>
<td>Decide on STB</td>
<td>compare prices, form informed judgement</td>
</tr>
<tr>
<td>Purchase it</td>
<td>understand price, complete money transaction</td>
</tr>
<tr>
<td>Transport it home</td>
<td>pick up STB box, carry it, locomotion and transport</td>
</tr>
</tbody>
</table>
Table 5a – Estimate of number of people in Great Britain excluded from informed purchase of STB

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion (,000s)</th>
<th>motion (%)</th>
<th>sensory (,000s)</th>
<th>sensory (%)</th>
<th>cognitive (,000s)</th>
<th>cognitive (%)</th>
<th>total (,000s)</th>
<th>total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>0</td>
<td>0.0</td>
<td>260</td>
<td>1.0</td>
<td>523</td>
<td>1.9</td>
<td>678</td>
<td>2.5</td>
</tr>
<tr>
<td>50-64</td>
<td>0</td>
<td>0.0</td>
<td>370</td>
<td>4.0</td>
<td>393</td>
<td>4.2</td>
<td>648</td>
<td>7.0</td>
</tr>
<tr>
<td>65-74</td>
<td>0</td>
<td>0.0</td>
<td>354</td>
<td>7.2</td>
<td>196</td>
<td>4.0</td>
<td>469</td>
<td>9.6</td>
</tr>
<tr>
<td>75+</td>
<td>0</td>
<td>0.0</td>
<td>830</td>
<td>19.9</td>
<td>339</td>
<td>8.1</td>
<td>990</td>
<td>23.7</td>
</tr>
<tr>
<td>16+</td>
<td>0</td>
<td>0.0</td>
<td>1813</td>
<td>4.0</td>
<td>1451</td>
<td>3.2</td>
<td>2785</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Assumptions made:

- no motion demand, i.e. STBs easily within reach (or line of sight), consumer already in shop

Predominant reasons for exclusion:

- Motion – not applicable
- Sensory – small print on packaging (Vis) need to hear shop assistant (Hear),
- Cognitive – interaction with shop assistant (Comm), understanding of technical information (IF)

Purchasing from the WWW

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform web search to find vendors</td>
<td>know how to use a computer and the Internet, have the capabilities to interact with the computer</td>
</tr>
<tr>
<td>Go to those sites</td>
<td>as above, plus decide which web-sites to go to</td>
</tr>
<tr>
<td>Find product directories</td>
<td>read through site, understand how to navigate, decide on search terms</td>
</tr>
<tr>
<td>Examine different STBs</td>
<td>read through descriptions, study photographs</td>
</tr>
<tr>
<td>Decide on STB</td>
<td>compare prices, form informed judgement</td>
</tr>
<tr>
<td>Purchase it</td>
<td>understand price, complete money transaction</td>
</tr>
<tr>
<td>Arrange for delivery</td>
<td>decide date, complete delivery form</td>
</tr>
</tbody>
</table>

Table 5b – Estimate of number of people in Great Britain excluded from informed purchase of STB

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion (,000s)</th>
<th>motion (%)</th>
<th>sensory (,000s)</th>
<th>sensory (%)</th>
<th>cognitive (,000s)</th>
<th>cognitive (%)</th>
<th>total (,000s)</th>
<th>total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>0</td>
<td>0.0</td>
<td>195</td>
<td>0.7</td>
<td>523</td>
<td>1.9</td>
<td>637</td>
<td>2.3</td>
</tr>
<tr>
<td>50-64</td>
<td>0</td>
<td>0.0</td>
<td>257</td>
<td>2.8</td>
<td>393</td>
<td>4.2</td>
<td>560</td>
<td>6.0</td>
</tr>
<tr>
<td>65-74</td>
<td>0</td>
<td>0.0</td>
<td>246</td>
<td>5.0</td>
<td>196</td>
<td>4.0</td>
<td>381</td>
<td>7.8</td>
</tr>
<tr>
<td>75+</td>
<td>0</td>
<td>0.0</td>
<td>615</td>
<td>14.7</td>
<td>339</td>
<td>8.1</td>
<td>818</td>
<td>19.6</td>
</tr>
<tr>
<td>16+</td>
<td>0</td>
<td>0.0</td>
<td>1312</td>
<td>2.9</td>
<td>1451</td>
<td>3.2</td>
<td>2396</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Assumptions made:

- computer configured to be accessible for user, user pc-literate
Predominant reasons for exclusion: as for purchasing from a shop, also potentially increased exclusion due to use of computer (Dext, Vis, IF) and potentially reduced exclusion due to reduced interpersonal communication demands (Comm)

Purchasing over the telephone (e.g. STB3)

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify telephone number</td>
<td><em>know how to use a telephone book</em></td>
</tr>
<tr>
<td>Telephone the supplier</td>
<td><em>know how to operate a telephone and have the capabilities to do so</em></td>
</tr>
<tr>
<td>Talk to telephone assistant</td>
<td><em>hearing assistant, planning and conducting conversation, understanding the answers</em></td>
</tr>
<tr>
<td>Decide on STB</td>
<td><em>compare prices and options, form informed judgement</em></td>
</tr>
<tr>
<td>Purchase it</td>
<td><em>understand price, complete money transaction</em></td>
</tr>
<tr>
<td>Arrange for delivery</td>
<td><em>decide date, complete delivery form</em></td>
</tr>
</tbody>
</table>

Estimated exclusions similar to Table 5a

Assumptions made: telephone configured to be accessible for user, making similar demands on them as may be experienced talking in a shop

Predominant reasons for exclusion: as for purchasing from a shop

Comparison with analogue TV

The purchasing process may be compared to that required for a typical analogue TV system. Expected levels of exclusion are shown in Table 5c for an experienced TV user. Table 5d shows the equivalent data for iDTV. It is assumed that no new aerial is required. If a new aerial is required there will be an additional cognitive load on the purchaser.

**Table 5c – Estimate of number of people in Great Britain excluded from informed purchase (analogue)**

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>Total ,000s</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>0</td>
<td>0.0</td>
<td>99</td>
<td>0.4</td>
<td>181</td>
<td>0.7</td>
<td>258</td>
<td>0.9</td>
</tr>
<tr>
<td>50-64</td>
<td>0</td>
<td>0.0</td>
<td>172</td>
<td>1.8</td>
<td>120</td>
<td>1.3</td>
<td>270</td>
<td>2.9</td>
</tr>
<tr>
<td>65-74</td>
<td>0</td>
<td>0.0</td>
<td>168</td>
<td>3.4</td>
<td>77</td>
<td>1.6</td>
<td>227</td>
<td>4.6</td>
</tr>
<tr>
<td>75+</td>
<td>0</td>
<td>0.0</td>
<td>404</td>
<td>9.7</td>
<td>125</td>
<td>3.0</td>
<td>475</td>
<td>11.4</td>
</tr>
<tr>
<td>16+</td>
<td>0</td>
<td>0.0</td>
<td>844</td>
<td>1.8</td>
<td>503</td>
<td>1.1</td>
<td>1230</td>
<td>2.7</td>
</tr>
</tbody>
</table>

**Table 5d – Estimate of number of people in Great Britain excluded from informed purchase (iDTV)**
<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion .000s</th>
<th>sensory .000s</th>
<th>cognitive .000s</th>
<th>Total .000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>0</td>
<td>99</td>
<td>181</td>
<td>258</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.4</td>
<td>0.7</td>
<td>0.9</td>
</tr>
<tr>
<td>50-64</td>
<td>0</td>
<td>172</td>
<td>120</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>1.8</td>
<td>1.3</td>
<td>2.9</td>
</tr>
<tr>
<td>65-74</td>
<td>0</td>
<td>168</td>
<td>77</td>
<td>227</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>3.4</td>
<td>1.6</td>
<td>4.6</td>
</tr>
<tr>
<td>75+</td>
<td>0</td>
<td>404</td>
<td>125</td>
<td>475</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>9.7</td>
<td>3.0</td>
<td>11.4</td>
</tr>
<tr>
<td>16+</td>
<td>0</td>
<td>844</td>
<td>503</td>
<td>1230</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>1.8</td>
<td>1.1</td>
<td>2.7</td>
</tr>
</tbody>
</table>

It is evident in comparing Tables 5a, 5c and 5d that the new digital systems that use an STB impose a greater demand on the user during purchasing. The differences in the assumptions behind the tables are as follows:

- motion demand is similar and assumes ready access to the shop;
- sensory demand is reduced for analogue TV and iDTV where the focus is on choosing the size/shape/cost of the TV, rather than necessarily having to read detailed ‘technical’ small print (see ‘cognitive demand’ below) making lower visual demands;
- cognitive demand is reduced for analogue TV and iDTV where again the focus is on choosing the size/shape/cost of the TV where many of the technical features are well-known to the consumer, rather than considering the relative merits of unfamiliar technological features of an STB.

In other words, most of the increased demand on the users arises from the need to understand a new set of technical features and associated terminology.

Figures 3a and 3b show the different levels of exclusion predicted for the GB 16+ and 75+ populations with typical analogue, iDTV and STB systems. Note the different axis scales, highlighting the increasing proportion of exclusion for the older users. Nearly four times as many people in percentage terms are excluded in the 75+ age range than in the 16+ age range.

In summary, for the purchasing process, an integrated digital TV system is likely to generate similar levels of exclusion to the analogue TV, because the additional circuitry for decoding the digital television signals is built-in. So, rather like a gearbox in a car, the user needs to know that it is there, but not how to connect it. A DTV system with an STB, however, is likely to exclude many more people as the focus of the purchasing process shifts from the choice of the size/cost/shape of the TV (a familiar process) to the assessment of the features of an STB (a potentially unfamiliar process).
Figure 3a – The levels of exclusion in the 16+ GB population

Figure 3b – The levels of exclusion in the 75+ GB population
System installation (3)

The process of installing the new digital receiving system. This can be via self-installation or with the assistance of professional help.

Self-installation – assuming aerial OK

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpack STB</td>
<td>cut through outer packaging, open box, pick up contents, put down contents, find and recognize instructions</td>
</tr>
<tr>
<td>Follow instructions</td>
<td>open and hold instructions, read instructions, understand instructions</td>
</tr>
<tr>
<td>Plan cable connections (what goes where)</td>
<td>match box contents to instructions, identify AV components (e.g. VCR, TV, amplifier, speakers) and cables, plan signal flow, identify cables to be moved</td>
</tr>
<tr>
<td>Move components to get access to cable slots</td>
<td>grip components, pull forward</td>
</tr>
<tr>
<td>Disconnect cables to be moved</td>
<td>identify cables, grip and pull them</td>
</tr>
<tr>
<td>Place STB near AV components</td>
<td>pick up and carry STB, put it down</td>
</tr>
<tr>
<td>Connect cables in correct order</td>
<td>identify cables, identify cable sockets, pick up cables, connect them</td>
</tr>
<tr>
<td>Replace AV components to usual position</td>
<td>grip components, push back</td>
</tr>
</tbody>
</table>

Table 6a – Estimate of number of people in Great Britain excluded from installation of STB

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion 000s</th>
<th>motion %</th>
<th>sensory 000s</th>
<th>sensory %</th>
<th>cognitive 000s</th>
<th>cognitive %</th>
<th>Total 000s</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>1283</td>
<td>4.7</td>
<td>226</td>
<td>0.8</td>
<td>655</td>
<td>2.4</td>
<td>1613</td>
<td>5.9</td>
</tr>
<tr>
<td>50-64</td>
<td>1798</td>
<td>19.3</td>
<td>291</td>
<td>3.1</td>
<td>530</td>
<td>5.7</td>
<td>1962</td>
<td>21.1</td>
</tr>
<tr>
<td>65-74</td>
<td>1217</td>
<td>24.9</td>
<td>293</td>
<td>6.0</td>
<td>261</td>
<td>5.3</td>
<td>1290</td>
<td>26.4</td>
</tr>
<tr>
<td>75+</td>
<td>1788</td>
<td>42.9</td>
<td>688</td>
<td>16.5</td>
<td>436</td>
<td>10.5</td>
<td>2005</td>
<td>48.1</td>
</tr>
<tr>
<td>16+</td>
<td>6086</td>
<td>13.3</td>
<td>1498</td>
<td>3.3</td>
<td>1882</td>
<td>4.1</td>
<td>6870</td>
<td>15.1</td>
</tr>
</tbody>
</table>

Assumptions made: aerial OK

Causes of exclusion: manipulation of AV components, ability to read and understand instructions, ability to identify cables and sockets

Predominant reasons for exclusion: Motion – reaching behind AV components (R&S) manipulating and connecting cables (Dext) Sensory – reading instructions (Vis) Cognitive – understanding instructions (IF)

Professional installation (e.g. STB3)

This should make little or no demand on the user, although there may be some if the consumer has to identify and contact the installers personally, for example in the case where a new aerial is needed.
Comparison with analogue TV

The installation process may be compared to that required for a typical analogue TV system. Expected levels of exclusion are shown in Table 6b for an experienced TV user. Table 6c shows the equivalent data for iDTV. It is assumed that no new aerial is required.

Table 6b – Estimate of number of people in Great Britain excluded from installation (analogue)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>sensory ,000s</th>
<th>cognitive ,000s</th>
<th>Total ,000s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>1283 4.7</td>
<td>88 0.3</td>
<td>250 0.9</td>
<td>1409 5.2</td>
</tr>
<tr>
<td>50-64</td>
<td>1798 19.3</td>
<td>102 1.1</td>
<td>197 2.1</td>
<td>1858 20.0</td>
</tr>
<tr>
<td>65-74</td>
<td>1217 24.9</td>
<td>110 2.3</td>
<td>95 1.9</td>
<td>1250 25.6</td>
</tr>
<tr>
<td>75+</td>
<td>1788 42.9</td>
<td>322 7.7</td>
<td>173 4.1</td>
<td>1878 45.0</td>
</tr>
<tr>
<td>16+</td>
<td>6086 13.3</td>
<td>623 1.4</td>
<td>715 1.6</td>
<td>6395 14.0</td>
</tr>
</tbody>
</table>

Table 6c – Estimate of number of people in Great Britain excluded from installation (iDTV)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>sensory ,000s</th>
<th>cognitive ,000s</th>
<th>Total ,000s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>1283 4.7</td>
<td>88 0.3</td>
<td>250 0.9</td>
<td>1409 5.2</td>
</tr>
<tr>
<td>50-64</td>
<td>1798 19.3</td>
<td>102 1.1</td>
<td>197 2.1</td>
<td>1858 20.0</td>
</tr>
<tr>
<td>65-74</td>
<td>1217 24.9</td>
<td>110 2.3</td>
<td>95 1.9</td>
<td>1250 25.6</td>
</tr>
<tr>
<td>75+</td>
<td>1788 42.9</td>
<td>322 7.7</td>
<td>173 4.1</td>
<td>1878 45.0</td>
</tr>
<tr>
<td>16+</td>
<td>6086 13.3</td>
<td>623 1.4</td>
<td>715 1.6</td>
<td>6395 14.0</td>
</tr>
</tbody>
</table>

It is evident in comparing Tables 6a, 6b and 6c that the new digital systems that use an STB impose a similar demand on the user during installation. The differences in the assumptions behind the tables are as follows:

- motion demand is similar and assume similar requirements for reaching and dexterity (e.g. the need to reach sockets on the back of the television);
- sensory demand is reduced for analogue TV and iDTV where the connections required are simpler, using familiar cables (aerial and power cables are all that should be required) and reducing the need to read labels and identify connectors;
- cognitive demand is reduced for analogue TV and iDTV where again the connections required are simpler, using familiar cables.

Figures 4a and 4b show the different levels of exclusion predicted for the GB 16+ and 75+ populations with typical analogue, iDTV and STB systems. Note the different axis scales, highlighting the increasing proportion of exclusion for the older users. More than three times as many people in percentage terms are excluded in the 75+ age range than in the 16+ age range.

In summary, for the installation process, the levels of exclusion are similar for analogue TV, iDTV and DTV with an STB. This is due to the fact that the levels of exclusion are dominated by the motion demands of the installation process, which will be similar for each of the systems. This outweighs the significant gains made by analogue TV and iDTV with regard to the sensory and cognitive demands.
Note also, that this assessment does not take into consideration the additional demands that will be placed upon the user should the existing aerial not be satisfactory for receiving and decoding digital television signals. In this case, the levels of exclusion for STBs and iDTVs will increase.
System tuning (5)

The process of tuning the digital receiver to receive free-to-view digital TV channels.

High-level activities | Medium-level activities
--- | ---
Check cables connected | identify cables, see and feel that they are connected
Switch on STB | pick up STB remote control, identify and press POWER ON button
Switch on TV | pick up TV remote control, identify and press POWER ON button
Follow on-screen instructions | read and understand on-screen instructions
[Press OK button on remote] | identify and press appropriate buttons on remote control
or [Press button on back of box] | walk to TV, place hand on button, push and hold button, release button

Table 7a – Estimate of number of people in Great Britain excluded from re-tuning (button on remote)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>total ,000s</th>
<th>total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>44</td>
<td>0.2</td>
<td>250</td>
<td>0.9</td>
<td>626</td>
<td>2.3</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>44</td>
<td>0.5</td>
<td>197</td>
<td>2.1</td>
<td>804</td>
<td>8.6</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>50</td>
<td>1.0</td>
<td>95</td>
<td>1.9</td>
<td>510</td>
<td>10.4</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>181</td>
<td>4.3</td>
<td>173</td>
<td>4.1</td>
<td>754</td>
<td>18.1</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>320</td>
<td>0.7</td>
<td>715</td>
<td>1.6</td>
<td>2693</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Table 7b – Estimate of number of people in Great Britain excluded from re-tuning (button on box)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>Total ,000s</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>642</td>
<td>2.4</td>
<td>44</td>
<td>0.2</td>
<td>250</td>
<td>0.9</td>
<td>818</td>
<td>3.0</td>
</tr>
<tr>
<td>50-64</td>
<td>955</td>
<td>10.3</td>
<td>44</td>
<td>0.5</td>
<td>197</td>
<td>2.1</td>
<td>1053</td>
<td>11.3</td>
</tr>
<tr>
<td>65-74</td>
<td>651</td>
<td>13.3</td>
<td>50</td>
<td>1.0</td>
<td>95</td>
<td>1.9</td>
<td>700</td>
<td>14.3</td>
</tr>
<tr>
<td>75+</td>
<td>936</td>
<td>22.4</td>
<td>181</td>
<td>4.3</td>
<td>173</td>
<td>4.1</td>
<td>1069</td>
<td>25.6</td>
</tr>
<tr>
<td>16+</td>
<td>3184</td>
<td>7.0</td>
<td>320</td>
<td>0.7</td>
<td>715</td>
<td>1.6</td>
<td>3641</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Assumptions made: *DTV system connected and operational*

Causes of exclusion: *Button on remote – ability to follow simple procedure (NB – may hide further scope for exclusion – e.g. remote control in STANDBY mode)*

*Button on box – ability to reach and press red button on STB, will probably need to walk to box*

Predominant reasons for exclusion: *Motion – pressing buttons on remote (Dext) reaching red button on box (R&S)*

Digital Television for All – Appendix E
John Clarkson & Simeon Keates - 30 -
Sensory – *reading on-screen display and button legends (Vis)*
Cognitive – *understanding instructions (IF)*

Note, that for STB3 this process is done for the user.

System tuning for analogue TV, and iDTV is likely to place similar demands on users as for tuning a DTV with an STB via a button on the remote control.
Setting ‘favourites’ (6)

The process of reallocating channel numbers from their original values to those deemed to be more convenient to the user.

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press MENU on TV remote control</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Follow on-screen display (OSD) instructions</td>
<td>read and understand on-screen instructions</td>
</tr>
<tr>
<td>Press appropriate remote control buttons</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Clear menu</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
</tbody>
</table>

Table 8 – Estimate of number of people in Great Britain excluded from re-ordering (button on remote)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion</th>
<th>sensory</th>
<th>cognitive</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>,000s</td>
<td>%</td>
<td>,000s</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>44</td>
<td>0.2</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>44</td>
<td>0.5</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>50</td>
<td>1.0</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>181</td>
<td>4.3</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>320</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Assumptions made: DTV system connected and operational
Causes of exclusion: ability to follow and understand procedure
Predominant reasons for exclusion: Motion – pressing buttons on remote (Dext)
Sensory – reading on-screen display and button legends (Vis)
Cognitive – understanding instructions (IF)
Channel selection (7)

The process of selecting a different TV channel. This may be executed using an on-screen guide or via a simple search method by indexing up or down through the channels. A third option, that of typing in the channel number directly was investigated further in the user observation sessions.

A distinction is made here between the ‘novice’ and ‘expert’ user. For the novice, no previous experience is assumed – this represents the ‘worst case’ scenario. For the expert, familiarity with the system (on-screen menus and remote control) is assumed. The sequence that follows is common to all the systems reviewed.

Guide method

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the correct button to press on remote</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Press GUIDE button</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Follow navigation method</td>
<td>identify active elements on screen, make mental map of navigation</td>
</tr>
<tr>
<td>Press ↑/↓ and PG UP/PG DN buttons</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Identify desired channel</td>
<td>identify and understand informational elements on screen, read content</td>
</tr>
<tr>
<td>Press OK button</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
</tbody>
</table>

Table 9a – Estimate of number of people in Great Britain excluded from channel-hopping (novice)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>Total ,000s</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>195</td>
<td>0.7</td>
<td>250</td>
<td>0.9</td>
<td>705</td>
<td>2.6</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>257</td>
<td>2.8</td>
<td>197</td>
<td>2.1</td>
<td>896</td>
<td>9.6</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>246</td>
<td>5.0</td>
<td>95</td>
<td>1.9</td>
<td>629</td>
<td>12.9</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>615</td>
<td>14.7</td>
<td>173</td>
<td>4.1</td>
<td>1029</td>
<td>24.7</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>1312</td>
<td>2.9</td>
<td>715</td>
<td>1.6</td>
<td>3258</td>
<td>7.1</td>
</tr>
</tbody>
</table>

Table 9b – Estimate of number of people in Great Britain excluded from channel-hopping (expert)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>Total ,000s</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>10</td>
<td>0.0</td>
<td>250</td>
<td>0.9</td>
<td>610</td>
<td>2.2</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>2.8</td>
<td>5</td>
<td>0.1</td>
<td>197</td>
<td>2.1</td>
<td>785</td>
<td>8.4</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>5.0</td>
<td>7</td>
<td>0.1</td>
<td>95</td>
<td>1.9</td>
<td>484</td>
<td>9.9</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>25</td>
<td>0.6</td>
<td>173</td>
<td>4.1</td>
<td>669</td>
<td>16.0</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>46</td>
<td>0.1</td>
<td>715</td>
<td>1.6</td>
<td>2549</td>
<td>5.6</td>
</tr>
</tbody>
</table>
Assumptions made: DTV system connected, tuned and operational; components co-located

Causes of exclusion: operation of remote control, following and understanding on-screen information

Predominant reasons for exclusion: Motion – pressing buttons on remote (Dext)
Sensory – reading OSD and button legends (Vis)
Cognitive – understanding instructions, search planning (IF)

Note: there is a marked reduction in exclusion with increased user experience and expertise. This is primarily due to the reduction in sensory demand, as the users become more familiar with the layout of the remote control and begin to recognise buttons by shape and location, rather than by legend. Clearly, though, this reduction in exclusion can only be achieved once the users have become experienced in interacting with the STB. It is only possible to gain that experience if the user can overcome the ‘novice’ demands.

Search method

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use CH +/- buttons</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Read programme descriptions</td>
<td>identify and understand informational elements on screen,</td>
</tr>
<tr>
<td></td>
<td>read content</td>
</tr>
<tr>
<td>Stop once desired channel</td>
<td>reached</td>
</tr>
</tbody>
</table>

Estimated exclusions similar to Tables 9a and 9b

Assumptions made: as for Scenario (9a)

Predominant reasons for exclusion: as for (9a), but with a potential reduction in cognitive demand due to reduced planning demand

The above analyses assume that the STB is used on its own, i.e. with no reference to the television remote control. The interaction of the TV remote will be considered below.

Comparison with analogue TV

The search method may be compared to that required for a typical analogue TV system with a limited number of channels. Expected levels of exclusion are shown in Table 9c for an experienced user.

Table 9c – Estimate of number of people in Great Britain excluded from channel-hopping (analogue)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion,000s</th>
<th>sensory,000s</th>
<th>cognitive,000s</th>
<th>Total,000s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>212</td>
<td>10</td>
<td>27</td>
<td>233</td>
</tr>
<tr>
<td>50-64</td>
<td>357</td>
<td>5</td>
<td>18</td>
<td>372</td>
</tr>
<tr>
<td>65-74</td>
<td>230</td>
<td>7</td>
<td>24</td>
<td>252</td>
</tr>
<tr>
<td>75+</td>
<td>336</td>
<td>25</td>
<td>46</td>
<td>375</td>
</tr>
<tr>
<td>16+</td>
<td>1134</td>
<td>46</td>
<td>115</td>
<td>1231</td>
</tr>
</tbody>
</table>
It is evident in comparing Tables 9c and 9b that the new digital systems impose a greater demand on the user even for the simplest of operations – such as channel selection. The differences in the assumptions behind the two tables are as follows:

- motion demand is assumed to be reduced in line with a remote design specifically for a television with easily accessible channel ‘up’ and ‘down’ keys;
- sensory demand is similar based on the use of similar labels and fonts;
- cognitive demand is reduced since interaction is more immediate for analogue, with fewer channels to search and no need for on-screen descriptions.

In summary, the typical STB system is likely to exclude twice as many users as the typical analogue system for channel selection. The levels of exclusion predicted for other digital TV activities may similarly be compared to the basic analogue channel selection activity summarised in Table 9c.

The need for users to use two remote controls (STB + TV) also needs to be considered. It may be assumed that to use the TV remote for volume control will add to the motion and cognitive loads experienced by the user. This will modify the results of Tables 9a and 9b. Considering the case of the expert user, Table 9d shows the expected levels of exclusion.

Integrated digital TV systems (iDTV) may be assumed to result in the levels of exclusion much nearer to that for the analogue systems, with small increases in motion and cognitive loads due to the increased functionality of the remote controls and increased number of channels. Table 9e shows the expected levels of exclusion.

### Table 9d – Estimate of number of people in Great Britain excluded from channel-hopping (two remotes)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion</th>
<th>sensory</th>
<th>cognitive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>,000s</td>
<td>%</td>
<td>,000s</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>485</td>
<td>1.8</td>
<td>23</td>
<td>0.1</td>
</tr>
<tr>
<td>50-64</td>
<td>820</td>
<td>8.8</td>
<td>15</td>
<td>0.2</td>
</tr>
<tr>
<td>65-74</td>
<td>548</td>
<td>11.2</td>
<td>25</td>
<td>0.5</td>
</tr>
<tr>
<td>75+</td>
<td>739</td>
<td>17.7</td>
<td>75</td>
<td>1.8</td>
</tr>
<tr>
<td>16+</td>
<td>2592</td>
<td>5.7</td>
<td>138</td>
<td>0.3</td>
</tr>
</tbody>
</table>

### Table 9e – Estimate of number of people in Great Britain excluded from channel-hopping (one remote)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion</th>
<th>sensory</th>
<th>cognitive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>,000s</td>
<td>%</td>
<td>,000s</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>255</td>
<td>0.9</td>
<td>10</td>
<td>0.0</td>
</tr>
<tr>
<td>50-64</td>
<td>420</td>
<td>4.5</td>
<td>5</td>
<td>0.1</td>
</tr>
<tr>
<td>65-74</td>
<td>270</td>
<td>5.5</td>
<td>7</td>
<td>0.1</td>
</tr>
<tr>
<td>75+</td>
<td>383</td>
<td>9.2</td>
<td>25</td>
<td>0.6</td>
</tr>
<tr>
<td>16+</td>
<td>1328</td>
<td>2.9</td>
<td>46</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Figures 5a and 5b show the different levels of exclusion predicted for the GB 16+ and 75+ populations with typical analogue, iDTV and STB systems. Note the different axis scales, highlighting the increasing proportion of exclusion for the older users. More than
three times as many people in percentage terms are excluded in the 75+ age range than in the 16+ age range.

In summary, for the most basic of TV operations, e.g. channel-hopping, an integrated digital TV system with one remote control has a far greater potential to minimise exclusion, but will still have some additional exclusion through, for example, the presence of the extra channels to search through.

A DTV system with an STB, where the remote control can control common TV functions, such as changing the volume, (without the need to change modes) will approach the iDTV levels of exclusion.

Note the levels of exclusion shown here are lower than those shown below in Tables 13a, 13b and 13c since these analyses focus only on channel-hopping and not the wider range of remote functions.
Subtitle selection (8)

The process of selecting, and de-selecting, subtitles and the altering of system settings. Again a distinction is made here between the ‘novice’ and ‘expert’ user. For the novice, no previous experience is assumed – this represents the ‘worst case’ scenario. For the expert, familiarity with the system (on-screen menus and remote control) is assumed. With subtitles, it is assumed that selection may be via a set-up menu or the use of a dedicated remote control button. The sequence that follows is common to all the systems reviewed.

Using subtitles/altering settings (on-screen menu)

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use MENU button</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Identify appropriate option</td>
<td>identify and understand informational elements on screen, read content</td>
</tr>
<tr>
<td>Use ARROW keys</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Use SELECT button</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>[repeat]</td>
<td></td>
</tr>
<tr>
<td>Use menu clear button (QUIT)</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
</tbody>
</table>

Table 10a – Estimate of number of people in Great Britain excluded from adjusting settings (novice)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion</th>
<th>sensory</th>
<th>cognitive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>,000s</td>
<td>%</td>
<td>,000s</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>195</td>
<td>0.7</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>257</td>
<td>2.8</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>246</td>
<td>5.0</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>615</td>
<td>14.7</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>1312</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Table 10b – Estimate of number of people in Great Britain excluded from adjusting settings (expert)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion</th>
<th>sensory</th>
<th>cognitive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>,000s</td>
<td>%</td>
<td>,000s</td>
<td>%</td>
</tr>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>44</td>
<td>0.2</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>44</td>
<td>0.5</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>50</td>
<td>1.0</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>181</td>
<td>4.3</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>320</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Assumptions made: DTV system connected, tuned and operational, system supports required functions/settings
Causes of exclusion: operation of remote control, following and understanding instructions

Predominant reasons for exclusion:  
Motion – pressing buttons on remote (Dext)  
Sensory – reading OSD and button legends (Vis)  
Cognitive – understanding instructions, search planning (IF)

Note: the same reduction in sensory exclusion is seen as for Scenario (5). In this case, there is also a marked reduction in cognitive demand, as users become familiar with the terminology and concepts used in the OSD menus. The same caveat remains as for (5), though, that users will only become experienced if they can still use the STB successfully as novice users.

Note: the ‘expert’ cognitive demand in Table 10b is higher than for Table 9b because the underlying task is fundamentally more complex – similarly when compared to Table 11b, as well.

Using subtitles/altering settings (dedicated buttons)

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toggle [SUBTITLE] button</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
</tbody>
</table>

Table 10c – Estimate of number of people in Great Britain excluded from adjusting settings (novice)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>Total ,000s</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>195</td>
<td>0.7</td>
<td>250</td>
<td>0.9</td>
<td>705</td>
<td>2.6</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>257</td>
<td>2.8</td>
<td>197</td>
<td>2.1</td>
<td>896</td>
<td>9.6</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>246</td>
<td>5.0</td>
<td>95</td>
<td>1.9</td>
<td>629</td>
<td>12.9</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>615</td>
<td>14.7</td>
<td>173</td>
<td>4.1</td>
<td>1029</td>
<td>24.7</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>1312</td>
<td>2.9</td>
<td>715</td>
<td>1.6</td>
<td>3258</td>
<td>7.1</td>
</tr>
</tbody>
</table>

Table 10d – Estimate of number of people in Great Britain excluded from adjusting settings (expert)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>Total ,000s</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>10</td>
<td>0.0</td>
<td>45</td>
<td>0.2</td>
<td>455</td>
<td>1.7</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>2.8</td>
<td>5</td>
<td>0.1</td>
<td>27</td>
<td>0.3</td>
<td>688</td>
<td>7.4</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>5.0</td>
<td>7</td>
<td>0.1</td>
<td>26</td>
<td>0.5</td>
<td>446</td>
<td>9.1</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>25</td>
<td>0.6</td>
<td>58</td>
<td>1.4</td>
<td>614</td>
<td>14.6</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>46</td>
<td>0.1</td>
<td>155</td>
<td>0.3</td>
<td>2203</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Assumptions made: DTV system connected, tuned and operational, system supports required functions/settings

Causes of exclusion: operation of remote control

Predominant reasons for exclusion: as for (10a)
Note: reduced cognitive demand may be expected because reduced forward planning is required. However, memory demands increase, as the user has to remember which channels are where.
**Teletext and interactive operation (9-10)**

The process of using Teletext and interactive TV. Again a distinction is made here between the ‘novice’ and ‘expert’ user. For the novice, no previous experience is assumed – this represents the ‘worst case’ scenario. For the expert, familiarity with the system (on-screen menus and remote control) is assumed.

Interactive elements (BBCi & Teletext)

<table>
<thead>
<tr>
<th>High-level activities</th>
<th>Medium-level activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use [e.g. RED] button to launch elements (or go to the [Teletext] channel)</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Read content</td>
<td>identify and understand informational elements on screen, read content</td>
</tr>
<tr>
<td>Decide on navigation</td>
<td>identify active elements on screen, make mental map of navigation</td>
</tr>
<tr>
<td>Use ARROW keys</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Use SELECT</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>[repeat]</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
<tr>
<td>Use [e.g. RED] button to end</td>
<td>identify and press appropriate buttons on remote control</td>
</tr>
</tbody>
</table>

Table 11a – Estimate of number of people in Great Britain excluded from interactive TV (novice)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>Total ,000s</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>195</td>
<td>0.7</td>
<td>655</td>
<td>2.4</td>
<td>990</td>
<td>3.6</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>257</td>
<td>3.8</td>
<td>530</td>
<td>5.7</td>
<td>1106</td>
<td>11.9</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>246</td>
<td>5.0</td>
<td>261</td>
<td>5.3</td>
<td>710</td>
<td>14.5</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>615</td>
<td>14.7</td>
<td>436</td>
<td>10.5</td>
<td>1165</td>
<td>27.9</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>1312</td>
<td>2.9</td>
<td>1882</td>
<td>4.1</td>
<td>3971</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Table 11b – Estimate of number of people in Great Britain excluded from interactive TV (expert)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>Total ,000s</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>44</td>
<td>0.2</td>
<td>27</td>
<td>0.1</td>
<td>467</td>
<td>1.7</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>44</td>
<td>0.5</td>
<td>18</td>
<td>0.2</td>
<td>707</td>
<td>7.6</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>50</td>
<td>1.0</td>
<td>24</td>
<td>0.5</td>
<td>472</td>
<td>9.7</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>181</td>
<td>4.3</td>
<td>46</td>
<td>1.1</td>
<td>700</td>
<td>16.8</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>320</td>
<td>0.7</td>
<td>115</td>
<td>0.3</td>
<td>2346</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Assumptions made: as for Scenario (10a)

Causes of exclusion: as for Scenario (10a)

Predominant reasons for exclusion: as for Scenario (10a)
Comparison with analogue TV

The information gathering process may be investigated further to compare the differences between using teletext on a typical analogue TV system and the new digital Teletext and interactive services which may be menu- or number-driven. Expected levels of exclusion are shown in Tables 11c, 11d and 11e for an average user. The differences in the assumptions behind the three tables are as follows:

- motion demand is similar based on similar use of the remote control;
- sensory demand is similar based on the use of similar labels and fonts;
- cognitive demand is reduced for analogue teletext since the interaction is more immediate, with fewer keys to press for access to information.

In summary, for the information gathering process, the levels of exclusion are similar for analogue teletext and digital TV. This is due to the fact that the levels of exclusion are dominated by the motion demands of the process, which will be similar for each of the systems. This outweighs the significant gains made by analogue teletext and number-driven digital systems with regard to the sensory and cognitive demands.

Table 11c – Estimate of number of people in Great Britain excluded from analogue teletext

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>total ,000s</th>
<th>total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>44</td>
<td>0.2</td>
<td>27</td>
<td>0.1</td>
<td>467</td>
<td>1.7</td>
</tr>
<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>44</td>
<td>0.5</td>
<td>18</td>
<td>0.2</td>
<td>707</td>
<td>7.6</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>50</td>
<td>1.0</td>
<td>24</td>
<td>0.5</td>
<td>472</td>
<td>9.7</td>
</tr>
<tr>
<td>75+</td>
<td>571</td>
<td>13.7</td>
<td>181</td>
<td>4.3</td>
<td>46</td>
<td>1.1</td>
<td>700</td>
<td>16.8</td>
</tr>
<tr>
<td>16+</td>
<td>2104</td>
<td>4.6</td>
<td>320</td>
<td>0.7</td>
<td>115</td>
<td>0.3</td>
<td>2346</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Table 11d – Estimate of number of people in Great Britain excluded from digital number-driven systems

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>total ,000s</th>
<th>total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-49</td>
<td>430</td>
<td>1.6</td>
<td>44</td>
<td>0.2</td>
<td>103</td>
<td>0.4</td>
<td>516</td>
<td>1.9</td>
</tr>
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</tr>
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<td>13.7</td>
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<td>2.1</td>
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<td>17.2</td>
</tr>
<tr>
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<td>305</td>
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</tr>
</tbody>
</table>

Table 11e – Estimate of number of people in Great Britain excluded from digital menu-driven systems

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>motion %</th>
<th>sensory ,000s</th>
<th>sensory %</th>
<th>cognitive ,000s</th>
<th>cognitive %</th>
<th>total ,000s</th>
<th>total %</th>
</tr>
</thead>
<tbody>
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<td>16-49</td>
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<td>44</td>
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<td>250</td>
<td>0.9</td>
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<tr>
<td>50-64</td>
<td>672</td>
<td>7.2</td>
<td>44</td>
<td>0.5</td>
<td>197</td>
<td>2.1</td>
<td>804</td>
<td>8.6</td>
</tr>
<tr>
<td>65-74</td>
<td>431</td>
<td>8.8</td>
<td>50</td>
<td>1.0</td>
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<td>1.9</td>
<td>510</td>
<td>10.4</td>
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<td>75+</td>
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<td>4.3</td>
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<tr>
<td>16+</td>
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<td>715</td>
<td>1.6</td>
<td>2693</td>
<td>5.9</td>
</tr>
</tbody>
</table>
In practice, these figures are likely to be conservative especially for the digital menu approach, since the users’ capability to use the information systems will be affected by their previous experience. The higher exclusion rates for the menu-driven system, in particular, will depend of the user’s experience of similar systems. Inclusion of the effect of experience will accentuate the trend shown in Figures 6a and 6b. This is highlighted in the section on user observations.
Comparing the STBs

Most of the levels of exclusion shown in Tables 6 to 11 arise from the process of interacting with DTV and as such are largely independent of the STB and remote control chosen. This is because elements of the interaction are dictated by other parts of the DTV system (see Figure 1). For example, the navigation of Teletext and BBCi is influenced as much by the display of the content on the screen as it is the layout of the remote control.

If we refer back to the scenario breakdowns presented earlier in this report, it is possible to associate each of the medium-level activities with one or more system components: the remote control; the STB; the TV; and, the service being provided.

If a step that causes exclusion is associated with only one of those components, e.g. the remote control, then providing suggestions for removing the cause of the exclusion is comparatively straightforward. For example, virtually all of the dexterity difficulties experienced by the users originates in the design of the remote control., the size, shape and positioning of each of the buttons.

However, the often the exclusion is a function of the interaction between 2 or more of the system components. For example, activating the interactive content on BBCi and activating Teletext should be fundamentally the same task on the remote control. However, since the service providers are independent, they have chosen different buttons to launch their interactive content. Thus users may be confused as to which button to press on the remote control as a function of both the design of the remote control and also the executive decisions made by the service providers.

Tackling either cause will reduce the level of exclusion, but only tackling both roots of exclusion will provide the potential to remove it completely. The design of both the user interfaces for both the services and the STBs needs to be co-ordinated, complementary and consistent in terms of user interaction with DTV.
However, it is possible to compare specific features of individual STBs. For example, Tables 12a, 12b and 12c compare the instruction booklets provided for STB1, STB2 and STB3, where the STB2 instructions are primarily textual and the STB1 and STB3 ones are more illustrated.

Note – the exclusions shown in Tables 12a-c assume that the user understands English. For Tables 12b and 12c, where the instructions have a strong written component, anyone who does not understand English may be disadvantaged. Since the ONS data does not take this into consideration, the exclusions calculated do not, and thus will be conservative.

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>total ,000s</th>
<th>%</th>
</tr>
</thead>
<tbody>
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<td>0.0</td>
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<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
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<th>%</th>
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<table>
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<th>Age bands</th>
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<th>%</th>
<th>sensory ,000s</th>
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<td>488</td>
<td>1.1</td>
<td>734</td>
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</table>
It is similarly possible to compare the accessibility of the remote controls as well, as shown in Tables 13a, 13b and 13c. This is based on an assessment of the general layout, features, use of colour and labels. Note that for STB2 (Table 13b) and STB3 (Table 13c), it was assumed that the remote was in the correct mode, i.e. communicating with the STB. Operation in the incorrect mode (i.e. communicating with the TV), cannot immediately be detected and would lead to a number of unexpected results.

Table 13a – Estimate of number of people in Great Britain excluded by remote control (STB1)

<table>
<thead>
<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>total ,000s</th>
<th>%</th>
</tr>
</thead>
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<td>250</td>
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<td>197</td>
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<td>804</td>
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<tr>
<td>65-73</td>
<td>431</td>
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<td>50</td>
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<td>95</td>
<td>1.9</td>
<td>510</td>
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<tr>
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<td>181</td>
<td>4.3</td>
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<td>754</td>
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<tr>
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</tbody>
</table>

Table 13b – Estimate of number of people in Great Britain excluded by remote control (STB2)

<table>
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<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>total ,000s</th>
<th>%</th>
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<td>938</td>
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<td>554</td>
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<td>252</td>
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<td>882</td>
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Table 13c – Estimate of number of people in Great Britain excluded by remote control (STB3)

<table>
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<tr>
<th>Age bands</th>
<th>motion ,000s</th>
<th>%</th>
<th>sensory ,000s</th>
<th>%</th>
<th>cognitive ,000s</th>
<th>%</th>
<th>total ,000s</th>
<th>%</th>
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<td>283</td>
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<tr>
<td>75+</td>
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<td>1134</td>
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<td>0.4</td>
<td>305</td>
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<td>1479</td>
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</table>

The differences between the remote controls arise from the differences discussed in the earlier qualitative analysis. For example, STB3 has larger buttons that are easier to press than either STB1 or STB2, thus has lower motion exclusion. Similarly, the larger buttons also have larger legends that are easier to read, contributing to the lower sensory exclusion.
**Summary of exclusion analysis**

Each of the scenarios begins to highlight the many possible sources of difficulty with interaction that users of all capabilities and experience levels may encounter. Of course, users with functional impairments or reduced capabilities are almost certain to experience either increased frequency or increased severity of difficulty than their able-bodied counterparts.

If we look at the very first step of the first scenario, "reading newspapers" when buying a new STB, that step can be broken down into its component actions. For example, reading a newspaper involves picking it up (reach and stretch, dexterity), opening it (dexterity), reading the headlines (low visual demand) and reading the text (high visual demand). An able-bodied person with high vision, dexterity and reach and stretch capabilities would not experience significant difficulties with any of these steps. However, anyone with reduced levels of any of those three capabilities would experience some level of difficulty, ultimately leading to an inability to complete the step if their capabilities were not sufficiently high.

In terms of summarising what has been learned, the following provides a list of key observations made when analysing the three DTV systems. First, it is interesting to note which of the users’ capabilities have most impact on user interaction. There are no surprises here, but for note:

- **Locomotion** – only an issue during purchasing, installation and ‘re-tuning’ if this required access to a button on the STB;
- **Reach and stretch** – only an issue during purchasing, installation and ‘re-tuning’ if this required access to a button on the STB;
- **Dexterity** – an issue at almost all stages – exclusion greatly influenced by small changes to size and layout of the remote control;
- **Seeing** – an issue at all stages, including when having to look for buttons, having to read on-screen text and shifting focus between the screen and the remote control – exclusion greatly influenced by small changes to labelling, size and layout of the remote control;
- **Hearing** – primarily an issue during purchasing and installation of the STB;
- **Communication** – primarily an issue during purchasing of the STB, and also whenever seeking help, such as from a call centre;
- **Intellectual functioning** – exclusion greatly influenced by the experience of the user and the complexity of the interaction.

Note that the sources of difficulty for each capability are for first-order effects only. In other words, they relate to those stages of interaction that are dependent upon those capabilities. However, it must be borne in mind that many users with any of these individual capability losses may also have associated second-order difficulties. For example, the exclusion predicted for ‘intellectual functioning’ is restricted to the capabilities measured by the ONS and does not account for the experience of the user. The differences shown in the tables for the ‘novice’ and ‘expert’ relate only to those users recorded by the ONS as having some disability. The effect of different levels of experience in the able-bodied population will be much greater. Another example is that while loss of hearing does not appear to be a major concern for most of the scenarios considered, many people with hearing loss from birth also have an associated increase in difficulty with communication.

The exclusion analysis will therefore be conservative. In this respect, user observation will help to clarify the possible level of under-reporting.

With regard to the specific scenarios investigated, the following may be observed:

- **Purchasing** – users may not be physically excluded any more than for other similar products, however, they are unlikely to be fully ‘informed’ purchasers;
• **Installation** – results in the highest levels of exclusion with nearly 15% of all users predicted to be excluded (nearly 50% over 75) – the ability to purchase an ‘installed’ system is attractive;

• **Set-up/tuning** – is easier to do via a remote control when the on-screen instructions are clear and the process is straightforward;

• **Channel selection** – using an on-screen electronic programme guide (EPG) can add a considerable load to novice users, here experience makes a difference; a traditional search may be easier;

• **Interactive TV** – adds a significant cognitive load and can add to the sensory load even for the expert users – a greater need for understanding of the underlying interaction paradigm and a need to use more buttons contributes to this load.

In comparing the different STBs it is clear that small changes can have a large impact on the levels of exclusion predicted. Larger, better-spaced buttons reduce the load on the user’s dexterity; fonts and colours affect the load on seeing; and the interaction design greatly affects cognitive load. The STB3 remote, specifically designed for purpose, will exclude fewer users than the other two devices.
User observations

The aim of an assessment of accessibility is to identify and evaluate the nature (the kind of capability) and magnitude (the level of capability) of the capability demands imposed upon the user. Whatever the assessment approach adopted, it has to provide objective identification and measurement of any existing mismatches between the product demands and the capabilities of the user, so that designers know what needs to be changed.

To verify the results of the earlier assessments, a series of user observation sessions were conducted. User observations are an invaluable tool when assessing both the usability and accessibility of a product.

Background

User observation involves an observer (the assessor) watching users interact with the product. Ideally the observation should take place in a realistic environment, such as the user’s home or work-place, but most often takes place in a specially constructed usability laboratory. The assessment is often recorded using video cameras.

The user is normally briefed on the objectives and procedures of the evaluation and, once underway, the observer should interfere as little as possible, to ensure that the interaction is as natural as possible. The advantages of user observation are that real users are involved in the assessment, so few assumptions about their behaviour need to be made by the assessor.

Sampling users

Ideally, the users sampled for participation in product assessments should represent the full range of end-user capabilities that can reasonably be expected to be found in the intended target population. However, to achieve statistical significance at all possible levels of capability across the target users would require a large number of participants. So, methods of reducing the number of users are needed.

The most popular approaches to sampling issues are to either find users that represent a spread across the target population, or else to find users that sit at the extremes of that population. The advantage of working with users that represent a spread across the population is that they ensure that the assessment takes the broadest range of needs into account. The disadvantage, though, is that there is not much depth of coverage of users who may experience difficulties in accessing the product.

The advantage of working with the extreme users is that the user observation sessions will almost certainly discover difficulties and problems with the interaction. However, the disadvantage is that there is a real danger of discovering that particular users cannot use the product, and little else beyond that. For example, giving an instruction book to a user with complete sight loss yields the obvious difficulty arising from the inability to read the text. However, subsequent questions about the content of the instructions are not possible because of the over-riding difficulty of reading. This is of only limited value in an assessment such as this, as the difficulties encountered by the extreme users are comparatively predictable and provide little information about how many other users may or may not be able to use the product. It could also be argued that such users may reasonably be expected to make use of assistive technology to help access particular products.

Of more use is to identify users who are more likely to be ‘edge-cases’, those who are on the borderline of being able to use the product, and who would commonly be accepted as should be able to use the product. Going back to the example of someone with a visual impairment attempting to read an instruction book, while someone with complete vision loss would certainly not be able to use the instructions, someone with
only partial sight loss may be able to do so. Even more interestingly, that person might be able to read some bits and not others and thus it is possible to begin to infer a wide range of very useful data from such a user. On top of that, if the user cannot read the instructions, then it may be inferred that any user with that level of sight loss or worse will not be able to use them, automatically encompassing the users with complete sight loss in the assessment of product exclusion.

Figure 7 – The different approaches to sampling the users

Figure 7 summarises the different approaches to sampling the users. The implication of this is that whichever group of users participates in the assessment, it is important that their capability profiles are known so that it is known how many users share the same characteristics.

**Finding users**

Having decided which types of users should be included in the product assessments, the next stage is to find suitable participants. For traditional usability assessments, the users would typically be customers or employees, and would often be readily to hand. However, when considering users with a wide range of capabilities, it is often necessary to commit explicit effort and resource to seeking out potential participants.

Good sources of users include charities specialising either in helping older adults or people with functional impairments arising from specific medical conditions. Social clubs are often a good source of more active older adults, whereas residential homes often house less capable potential participants. User groups can be found in most towns and cities, but effort does need to be expended in trying to find them and then to identify candidate users who match the user sampling profiles.

**Working with users**

As with all usability testing, the participating users need to be treated with respect and courtesy at all times. When dealing with users with more severe impairments, it is especially important to be sensitive to their needs. For example, such users will often tire more easily than the person supervising the assessment may normally expect.

One of the other major issues to consider when working with users, especially for assessments, is the presence of coping strategies (DTI, 2000). Many people with functional impairments find strategies for compensating for their impairments - sliding heavy objects that were designed to be lifted, using two hands instead of one, making customised alterations to products to make them easier to use.

Identifying coping strategies can be difficult for someone who is not familiar with the nature of functional impairments. Users will often perform the coping strategy as if it
was second nature to do so (through practice) or alternatively may actively disguise any such strategies to avoid drawing attention to any functional restrictions that they may have.

However, even when coping strategies have been identified, finding the cause of them is not always straightforward. For example, performing a one-handed operation with two hands may be a coping strategy for manoeuvring an object that is too heavy, but it is also a strategy for increasing accuracy.

**User selection**

A total of thirteen users were recruited and the observation took place over a period of six days in two locations. The first of these was at The Generics Group in Harston and the second was the Hester Adrian Centre of the Papworth Trust in Cambridge. The latter is a multi-purpose day-care centre for both older adults and younger adults with severe functional impairments.

The users were identified based on a number of criteria, primarily focused around whether they were strong candidates for being edge-cases in terms of their ability to interact with STBs. Based on the results of the earlier assessments, it was decided to focus on recruiting older adults not living in residential care. As discussed in the Sampling Users section above, more extreme users could have been selected for the user group, however, the level of information that can be obtained is then limited.

Older adults typically exhibit a range of different kinds of capability loss and are more likely to show multiple minor impairments. This is important because most assistive technology is predominantly aimed at single major impairments and thus users with multiple minor impairments are less likely to be able to find assistive technology to aid them should they encounter severe difficulty interacting with a product.

Older adults as a whole are also more numerous than younger disabled ones. Thus if it was shown that older users generally experienced difficulty interacting with the STBs, irrespective of their capability losses, then this equates to a much higher level of exclusion within the general population.

The decision to select users still living in private homes, rather than residential care was based on the desire to have users who still have enough functional capability to support independent living to some degree. They should therefore be able to perform tasks such as operating a television on their own. If they experienced significant difficulty, then it could be argued that the STBs are causing undue exclusion. As a comparison, a younger user with a more severe impairment was also recruited to highlight whether a more extreme user would also encounter the difficulties experienced by the older adults.

During the recruitment process efforts were made to ensure that the users exhibited a range of capabilities. For example, it was known that those with arthritis would exhibit a loss of dexterity, that many older users would exhibit macular degeneration or loss of hearing, and that it would be very likely that a range of intellectual functioning capability would be observed. Care was taken not to skew the sample towards any particular capability loss, rather to provide a balanced representation of motion, sensory and cognitive losses.

Table 14 shows the users selected to participate in the user observation sessions. To maintain consistency with the earlier STB assessments the users were asked to self-report their own assessments of their capabilities, from which their scale points were deduced. This is the same approach as the ONS adopted in the collection of the data used in the exclusion analyses. The summary scale points are shown in the table. See Annex A for a detailed definition of the scores. More detailed user summaries are provided after Table 14.
**Table 14 – The user observation participants**

<table>
<thead>
<tr>
<th>User</th>
<th>Age</th>
<th>Gender</th>
<th>DTV owner?</th>
<th>No. of hours TV watched per evening</th>
<th>PC user</th>
<th>Capability profile (self-reported)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85</td>
<td>M</td>
<td>No</td>
<td>&lt;1</td>
<td>Yes</td>
<td>L4, H8, C4, IF5</td>
</tr>
<tr>
<td>2</td>
<td>82</td>
<td>F</td>
<td>No</td>
<td>1 to 2</td>
<td>No</td>
<td>H8</td>
</tr>
<tr>
<td>3</td>
<td>65-69</td>
<td>F</td>
<td>No</td>
<td>2 to 4</td>
<td>No</td>
<td>L5, RS4, D5, S9, IF7</td>
</tr>
<tr>
<td>4</td>
<td>80-84</td>
<td>F</td>
<td>No – analogue cable</td>
<td>&gt;4</td>
<td>No</td>
<td>L1, S9</td>
</tr>
<tr>
<td>5</td>
<td>69</td>
<td>M</td>
<td>Yes – STB</td>
<td>1 to 2</td>
<td>Yes</td>
<td>RS8, H7, IF2</td>
</tr>
<tr>
<td>6</td>
<td>62</td>
<td>F</td>
<td>Yes – STB</td>
<td>1 to 2</td>
<td>Yes</td>
<td>IF2</td>
</tr>
<tr>
<td>7</td>
<td>65-69</td>
<td>M</td>
<td>Yes – satellite</td>
<td>&gt;4</td>
<td>Yes</td>
<td>H7</td>
</tr>
<tr>
<td>8</td>
<td>65-69</td>
<td>M</td>
<td>Yes – iDTV</td>
<td>1 to 2</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>60</td>
<td>F</td>
<td>No – analogue cable</td>
<td>2 to 4+</td>
<td>Yes</td>
<td>L1, RS9, D5</td>
</tr>
<tr>
<td>10</td>
<td>70-74</td>
<td>F</td>
<td>No</td>
<td>2 to 4</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>70-74</td>
<td>F</td>
<td>No</td>
<td>&gt;4</td>
<td>No</td>
<td>RS5, D5, S9, H8</td>
</tr>
<tr>
<td>12</td>
<td>70-74</td>
<td>F</td>
<td>No</td>
<td>&gt;4</td>
<td>No</td>
<td>L1, S9, IF5</td>
</tr>
<tr>
<td>13</td>
<td>24</td>
<td>M</td>
<td>No</td>
<td>&lt;1</td>
<td>Yes</td>
<td>S3</td>
</tr>
</tbody>
</table>

*User 1* was a retired academic. He had limited locomotion capability, and walked with frequent, short steps, using a walking stick for support. This user also had a slight, but constant tremor in his hands, making activities involving hand-eye co-ordination difficult. He also wore spectacles and a hearing aid on one ear.

*User 2* was a retired civil servant. She self-reported only a mild hearing impairment, but had difficulty following many of the instructions during the course of the observation session. She also exhibited a tendency to forget things and occasionally lost track during conversations. Otherwise she exhibited no signs of capability loss, beyond being slightly slower in her physical movements than would be expected for a younger person.

*User 3* had a range of minor impairments, covering all of the motion, sensory and cognitive capabilities. However, none of the impairments appeared to have a specific medical cause and may be attributed to the ageing process. This user led an active life, including cooking lunch for other members of her day-care group. She appeared to be nervous around high-technology. She had tried to learn to use a computer in the past, but gave up on it because, in her own words, her “memory isn’t very good.”

*User 4* was a retired nurse. She was a wheelchair user, and was thus unable to participate in any of the activities involving locomotion. Her only other noticeable impairment was a need to wear reading glasses to read small print (such as button legends on a remote control). She regarded many high-technology products with disdain, proudly declaring her house to be “a computer-free zone.”

*User 5* was a retired member of the clergy, who exhibited a strong affinity for high-technology products. He was one of the few participants who would have bought an STB with a view to installing it himself. This user exhibited mild capability loss in all three categories, i.e. sensory, motion and cognitive. As with many of the other users, there was no apparent medical cause for these losses and so were attributed to the ageing process.

*User 6* was a retired deputy-head teacher, who only exhibited a mild loss of cognitive capability. She also displayed a fear of high-technology products, often relying on her husband or children to operate the STB that she had at home.

*User 7* was also a retired deputy-head teacher, who was a self-professed fan of high-technology products. He did not appear to exhibit any capability loss, beyond a mild hearing impairment.

*User 8*, despite being a computer manager during his working life, does not consider himself
to be very adept with high-technology products. However, he showed himself to be willing to try and learn new things, even though he did not rate his chances of success as terribly high. He exhibited no obvious capability loss.

User 9 was a wheelchair user who exhibited moderate to severe loss of motion capability, including the inability to use one hand through arthritis. This user needed to use distance glasses to read the television on-screen text, but reading glasses to read the button legends on the remote control. Thus, she had to keep changing between two remote controls and two pairs of glasses, while having the use of only one hand. Although she did not self-report any, she appeared to exhibit a degree of loss of cognitive capability as well and had difficulty understanding sections of the user observation sessions.

User 10 had no discernible impairment beyond having an artificial eye, although she had a number of severe illnesses in the year or so before participating in these user observation sessions. She was very dismissive of high-technology and frequently repeated that she was too old to be learning new things and that she probably “would not be around” when analogue television was switched off.

User 11 exhibited a range of mild sensory and moderate motion capability losses. However, she was a very active individual and along with user 3, frequently prepared lunch for the other members of the day-care group.

User 12 was a wheelchair user with moderate cognitive and mild vision capability loss. However, on the day of the user observation session, she forgot to bring her distance glasses, and so had to use her reading glasses throughout. This resulted in difficulty read the on-screen text, and so all such text had to be read aloud to her.

User 13 was the youngest participant in the trials by approximately 35 years. He exhibited the most severe sensory loss, being registered as having a severe and permanent loss of sight, and being eligible for legal classification as blind. His particular visual condition was congenital, and primarily involved loss of central field of view. Otherwise he was fully able. He was also a PhD student in Computer Science and thus had a strong affinity for high-technology products.

It is worth noting that a range of user capabilities was observed. Two users showed no obvious impairment on the ONS data scales, four showed single impairments and the remaining seven exhibited multiple impairments. Three of the users reported a loss of dexterity at levels likely to cause difficulties using DTV. Five of the users reported a loss of intellectual functioning, where three were at levels that might also be likely to cause difficulties.

A number of PC-literate and DTV users were recruited to investigate the effect of prior experience of DTV and PC-based menu systems on the use of otherwise unfamiliar STBs. Note: both users 5 and 8 went home after the user observation session and were able to find additional functionality on their digital television systems that they thought was previously missing.

**Methodology**

The user observation sessions were organised to be a subset of the usage scenarios used in the earlier assessments. Annex C shows the actual experimental protocol sheets used during the sessions.

Each user session was limited to 2 hours to ensure that user fatigue was kept to a minimum. Thus the user activities were restricted to those operations that could be considered fundamental to watching television, such as the ability to change channels, and also to those advanced features that could be explored within the available timeframe. 2 STBs were assessed (STB1 and STB2), to ensure a balance between breadth and depth of study. The STBs were selected for the trial by The Generics Group and reflected different design approaches, with one focused more on ease-of-use and the other on functionality.
Initially the users were interviewed for 30 minutes to find out their capability profiles and also background information on their attitudes towards television use and exposure to DTV. Two or three observers attended each interview, each recording the user responses.

Following the interview, the users began an equipment trial. This began with a familiarisation exercise with the analogue television set being used. All users used the same television and remote control. The users were asked to perform basic operations, such as changing channel and volume. They were also asked to use teletext services and to call up subtitles.

The users were then asked to choose which of the two STBs being assessed they would prefer to buy. This involved showing them the external packaging and then the STBs themselves. Again, the same STBs were used for all of the observation sessions. [Equivalent to Scenario 1 – Purchasing]

The next stage was to provide the users with the installation instructions for their chosen STB and to ask whether they would install the box themselves. Those users who felt up to doing so were encouraged to connect up the STB to the television. For those users who declined to do so, the STB was connected for them. [Equivalent to Scenario 2 – Installation]

This was followed by simple television operations such as changing channels and channel-hopping. Users were encouraged to use the EPG for one of the channel hops. [Equivalent to Scenario 5 – Finding out what’s on and selecting]

The more advanced interaction activities included finding weather and television programme guide information from both Teletext and BBCi [Scenario 7 – Interactive elements], as well as calling up subtitles [Scenario 6 – Using subtitles/altering settings].

The equipment trial took an average of one hour to complete. Detailed results are given in Annex D.

Finally, a closing de-brief session was held, that lasted approximately 15 minutes. During this session, the users were asked what they thought of their experience with the STBs.

The following represent a summary of the observations made.

Table 15 provides a summary of the incidence of difficulties experienced by the users. The following text reiterates these numbers and provides further explanation as to the likely cause of the difficulties. In many cases there are a number of reasons why problems arise, sometimes more than one for any particular user.
Table 15 – The distribution of causes of difficulty

<table>
<thead>
<tr>
<th>Activity</th>
<th>Users having difficulty</th>
<th>Motion problems</th>
<th>Sensory problems</th>
<th>Cognitive problems</th>
<th>Number of problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching on</td>
<td>8</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Changing to a specified channel</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Channel-hopping</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Changing volume</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Using teletext</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Using subtitles</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Connecting up the STBs</td>
<td>4 (out of 6)</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Switching on the television</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Switching on the STB</td>
<td>6</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Changing DTV channels</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Changing volume</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Changing to a high channel number</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Changing channel via the EPG</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Teletext</td>
<td>13</td>
<td>2</td>
<td>4</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Subtitles – button (STB1)</td>
<td>6</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Subtitles – menu (STB2)</td>
<td>13</td>
<td>-</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>BBCi</td>
<td>13</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Switching off</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Analogue TV**

Switching on
Of the 13 users, 8 tried switching the television on using the POWER button on the remote control (cognitive). Those same 8 users had to be told to use another button instead, such as a channel number. One user experienced difficulty pressing a number button (dexterity).

Changing to a specified channel (ITV – channel 3)
Only one user experienced difficulty and that arose from a dexterity difficulty in pressing button #3.

Channel-hopping
None of the users experienced difficulty when channel-hopping randomly.

Changing volume
None of the users experienced difficulty when changing the volume.

Using teletext
Of the 13 users, 4 never use teletext and 3 seldom do so. 6 users experienced some difficulty in viewing teletext:
- reading the screen (vision) – 3 users
- interpreting the index (cognitive) – 1 user [the user thought that the numbers were to the left of the index item, rather than the right]
• pressing the remote control buttons (dexterity) – 2 users
• identifying the button for calling up teletext (vision + cognitive) – 3 users
• identifying the button for clearing teletext (vision + cognitive) – 3 users [NB only 1 user from group above]

Using subtitles
8 of the users had to be told that subtitles are on page 888. None of the users had difficulty going to that page to activate them.

Set Top Boxes
Note that this section shows the results from STB1 and STB2. Unless specifically highlighted as arising from one particular system design, the results can be interpreted as generic across both STBs.

Please also note that unless explicitly identified, the problems described are not necessarily mutually exclusive. Thus it is possible that the apparent total number of users experiencing problems with particular tasks may be higher than 13. In such circumstances, at least one user will have experienced multiple difficulties.

Self-installation
Only 2 users would consider installing an STB themselves. All of the other users would either get it installed professionally, or else ask a relative to do so.

Connecting up the STBs
7 users declined to attempt to connect up the STB. Of the remainder, only 2 experienced no difficulty in doing so. 2 had loose connections (dexterity), while the other 2 had difficulty planning the connections and knowing which bits to connect where (cognitive).

Switching on the television
Only 1 user experienced difficulty switching on the television, namely pressing the buttons on the TV remote control (dexterity).

Switching on the STB
No users had difficulty switching on STB1, whereas 6 users had difficulty switching on STB2. 3 of those experienced difficulty finding the POWER button (vision + cognitive), while the other 3 pressed the STB button on the remote control (cognitive). Misuse of the STB and TV buttons on the STB2 remote control is a potentially catastrophic error. If the TV button is pressed, then the remote control ceases controlling the STB until the STB button is pressed. Given that none of the users understood the purpose of both buttons, they were often pressed as part of a random search for particular functions. Consequently, the user could be faced with the catastrophic (in a usability sense) chain of events. User is unsure what to do, presses buttons randomly, presses the TV button, the STB appears to stop responding, user has no idea why. This could very easily end with the user believing that the STB is broken or faulty and returning it.

Changing DTV channels
3 users experienced difficulty when changing channels.

One user tried using the television remote control (cognitive). This is a potentially serious error for an inexperienced user, as the result of the use of the television remote control would most probably be to swap to the analogue channels from the digital ones. If the user is not aware of the change from digital to analogue (and 5 of the 9 non-DTV owners could not tell the difference), then it may appear that the STB remote control
will have ceased to work when trying to change channels. Again, this could very easily end with the user believing that the STB is broken or faulty and returning it.

Another user had difficulty reading the arrow buttons (vision), while the third user had difficulty understanding how to use the $\uparrow/\downarrow$ arrow buttons to change channel (cognitive).

**Changing volume**

7 of the 13 users tried to change the television volume by using the STB remote control (cognitive), while the other 6 used the television remote control. Given that neither of the STB remote controls supported volume change, this may suggest additional functionality that could be provided on the STB remote controls.

**Changing to a high channel number**

The users were asked to change channel to BBC News 24 on channel 40.

One user only used the EPG to change to unfamiliar channels, all of the other users pressed the number buttons on the STB remote control. Only 2 of those users experienced no difficulty with either STB. 2 users misunderstood the request and tried to go to channel 24 (cognitive). One user tried using the television remote control (cognitive).

The most common difficulty was with the STBs timing out. 10 of the users had the STBs time-out on them, typically ending up on Channel 4 (dexterity). This was compounded in the case of STB1 by the 0 button being in a non-standard position that led one user to spend increased time finding it (vision). Users with distance and reading glasses found it particularly difficult to beat the time-outs, especially when trying to focus on both the television and the remote control (vision).

For User 12 the time-out problem proved to be insurmountable and channel changing was only possible via the EPG or the arrow buttons (dexterity).

**Changing channel via the EPG**

None of the users managed to use either STB EPG successfully, with the single exception of User 8 with STB1.

Deciding which button to press to call up the EPG presented difficulties to 9 of the 13 users. Of those users, one chose TEXT, another RED, 3 chose MENU and 2 chose INFO. The remaining 2 users had no idea which button to press (cognitive). Once in the EPG, 6 users had no idea about how to navigate within the guide (cognitive). 3 users had difficulty mapping the direction of movement of the channel selecting bar against the $\uparrow/\downarrow$ arrow buttons (cognitive). 3 users experienced difficulty swapping between the page jump buttons, PR+/- and $\leftrightarrow$ (cognitive).

4 users had difficulty with pressing the remote control buttons (dexterity), with the SELECT or OK button being the most frequent source of this problem. 2 users also frequently overshot the target channel using the $\uparrow/\downarrow$ arrow buttons (dexterity + vision).

7 users had difficulty finding specific buttons on the remote control. GUIDE was the culprit twice and SELECT/OK six times (vision). One user also had difficulty reading the EPG (vision).

7 users experienced difficulties with the EPG timing out (dexterity, vision and/or cognitive).

Finally, 9 users had difficulty remembering to use SELECT/OK (cognitive).
Teletext

All of the users had to be told or reminded that Teletext is on channel 9 (cognitive). This included the 2 STB owners and the owner of an iDTV, all of whom thought that their home systems did not receive Teletext.

When trying to call up Teletext, 2 users attempted to use the analogue television remote control, leading to the potentially catastrophic usability difficulty discussed under ‘Changing DTV Channels’ (cognitive). Despite the on-screen instruction to ‘Press TEXT to start’, 4 users had to be prompted to use the TEXT button (cognitive + vision). 3 users tried other buttons – the arrow buttons, BLUE and even the POWER button (cognitive). Note that this last choice was represented a serious usability failure. One user understood the need to press TEXT, but could not find the appropriate button (vision).

Only 6 users managed to follow the on-screen instruction, locate and activate the TEXT buttons on both remote controls. Once in Teletext, the first task was to find the local weather in Cambridge. The users were presented with a home page, with numbered sub-headings. Of these ‘weather’ was number 7 and the weather in Cambridge was number 5 on the next screen.

10 users navigated to the main weather pages without any problems. Only 2 users experienced any difficulty deciding, finding and pressing ‘7’. One of those users had difficulty reading the text on-screen (vision) and pressing the number 7 button (dexterity). The other user inadvertently chose the channel change (PR) button (cognitive), which led to the STB changing to the next channel and the user being dumped out of Teletext.

Once in the ‘weather’ pages, 3 users tried to enter the temperature in Cambridge as the code to call up the weather forecast for the city (cognitive). However, all 3 quickly realised their error (to their amusement) and selected button number 5, the correct choice.

One user tried to navigate within the pages by using the arrow buttons and became confused as to how to use them. That user quickly reverted to using the numbers to call up the desired page.

Going from the ‘weather’ pages to the programme guide (‘TV Navigator’) proved more difficult. From the home page, the TV Navigator could be reached by simply pressing button number 3. However, from ‘weather’ it needed the user to either return to the home page, or else to navigate through the pop-up menus activated by the colour ‘Fastext’ buttons.

Only 4 users were able to navigate to the TV Navigator with no difficulty, compared with 10 for finding the weather pages. Most were confused by the pop-up menus. 2 users had no idea how to navigate the menus (cognitive). 6 users had difficulty identifying that the menu required was ‘Control’, i.e. BLUE (cognitive). Of those 6 users, 3 had to be told which button to press, while the other 3 tried variously the channel change button (PR), GUIDE and TEXT. All three of these options dumped the user out of Teletext.

4 users had difficulty interpreting the names given to elements on the screen, especially within the menus, and found the language used either misleading or unclear (cognitive).

3 of the users tried to navigate back to the ‘home’ page rather than through the pop-up menu. Only one of those users succeeded without getting lost at some stage, and that user was the most frequent computer and youngest user.

One user had difficulty mapping the arrow buttons to the direction of movement of the highlight bar with the pop-up menus (cognitive) and another had difficulty with overshooting the item sought after (dexterity).
2 users tried exploring further. One of those users had difficulty telling the difference between the GREEN and BLUE buttons (probably colour-blindness - vision), while the other tried using the PR channel change button to go to ‘page 2 of 3’, and ended up dumped out of Teletext and into another channel.

Exiting Teletext was also problematic. The experimental protocol had been designed so that users should be able to use the TV Navigator to exit, following the on-screen instruction to ‘Press SELECT to exit’. 5 users were able to do this successfully. No other page within Teletext appears to offer instructions on how to exit the service.

Of those users who did not do so, one tried the TV button [note - mode change] and one tried using the analogue remote control [note - mode change]. Both of those users resorted to using the POWER button to exit (cognitive). Another user tried QUIT, and along with 5 other users had to be told to use the TEXT button (cognitive). Even then, one of the users pressed the TEXT button twice and ended up back in Teletext.

Note 1: User 13 did not participate in the Teletext stages of the observation sessions owing to fatigue
Note 2: several users clearly experienced frustration with the slow loading speed of each new page, albeit that only 1 commented directly on this.

Subtitles
The two STBs used for the usr observation sessions had distinctly different approaches to calling up subtitles. STB1 had a SUBTITLES button on the remote control that acted as an on/off toggle. STB2, however, had the subtitles activation on the third level down of an on-screen menu display. Of these two approaches, the SUBTITLES button proved to be much more usable and accessible.

Using button:
7 users experienced no problems using the SUBTITLES button. Once told that there was a SUBTITLES button (cognitive), a further 4 users had no other difficulties. The remaining 2 users had some difficulty finding the button, but did so after a visual search (vision).

Using menu:
11 of the 13 users had to be told to use the MENU button to begin the process of activating the subtitles (cognitive). The users had variously attempted buttons such as TEXT, TV [note – mode change], and STB.

Once in the on-screen menu structure, 12 of the 13 users were not able to find the subtitles option unaided (cognitive). 4 users also had difficulty with overshooting when trying to select an item on the menu.

Having reached the ‘Languages’ menu, 9 of the users were unable to swap to using the ↩/払い arrow buttons to switch subtitles on, from the ↡/払い arrow buttons used to navigate through the menus (cognitive). 8 users also failed to identify the need to press the QUIT button to exit the menu from the on-screen instructions (cognitive). 3 users also had difficulty finding the QUIT button (vision). 2 users even tried the TV and POWER buttons. This difficulty finding QUIT was exacerbated by the on-screen display showing the QUIT and BACK buttons the opposite way round to where they were positioned on the remote control. Again the user who experienced least difficulty navigating through the menus was the youngest participant, despite his severe visual impairment.

BBCi
The final section of the user observation sessions was to call up and navigate through the BBCi service on BBC1 (not the dedicated data channel). Note that difficulty was experienced trying to access BBCi services while subtitles were still active, and thus the subtitles had to be cleared first.
Despite the adverts on the television, none of the users were able to press RED to call up the interactive content without prompting (cognitive). The users also begin to experience frequent difficulties with navigating through the content, although this may have been an effect of fatigue. 3 users had difficulty with overshooting (dexterity) and 3 other users had difficulty remembering how to use the arrow buttons to navigate (cognitive). 6 users had to be reminded to use OK/SELECT (cognitive).

The change in language from the Teletext menu content was also confusing. In particular, the BLUE ‘Fastext’ option on the screen was labelled ‘Menu’ causing difficulty with the remote control for STB2 that had a separate button also labelled MENU, that called up the STB on-screen menu for box set-up and the like. 4 users pressed this button by mistake (cognitive). 2 users got lost in the menu structure and a further 2 tried pressing button number 2 to get to ‘Page 2 of 3’ (cognitive).

2 users also had difficulty pressing the necessary buttons on the remote control (dexterity). Finally, 2 users did not follow the on-screen instructions when attempting to exit, with one trying QUIT and the other trying TV [note – mode change] (cognitive + vision).

Switching off
8 users switched off the STBs and the television without any problems. Of the remaining users, 4 tried using QUIT to switch off, and one tried CANCEL, instead of the POWER button (cognitive). The remaining user used the POWER button, but became confused when the television reverted to the analogue signal and thought that the STB had not been switched off properly (cognitive).

Summary of user observations
The difficulties recorded during the user observation sessions correspond closely to those predicted during the earlier assessments. The most notable additions identified through the user sessions were problems such as:

- time-outs (using the EPG and channel-hopping) – dexterity;
- arrow button overshooting (e.g. on menus) – dexterity;
- switching between distance and close proximity reading (different pairs of spectacles) – vision.

However, as predicted in the earlier assessments, that majority of difficulties encountered were cognitive in origin, unlike for the analogue television, where the sources of difficulties were evenly distributed. Table 16 shows the spread of causes of difficulty.

<table>
<thead>
<tr>
<th></th>
<th>Vision</th>
<th>Dexterity</th>
<th>Cognitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogue (out of 10)</td>
<td>3/10 (30%)</td>
<td>3/10 (30%)</td>
<td>4/10 (40%)</td>
</tr>
<tr>
<td>STBs (out of 65)</td>
<td>15/65 (23%)</td>
<td>11/65 (17%)</td>
<td>39/65 (60%)</td>
</tr>
</tbody>
</table>

Many of the cognitive difficulties experienced were not directly attributable to any kind of ‘medical model’ impairment. Instead, lack of experience with, and mental model of, the interaction paradigms used in digital television was the principal cause of the difficulties encountered.
Countering user exclusion

For the case of STBs, a number of key areas for re-design can be identified. Several of these are shown in Table 17. This is not a complete list, instead it is intended to highlight the origins of some of the common problems and how they may be countered.

Table 17 – Key areas for re-design

<table>
<thead>
<tr>
<th>Category</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-level understanding:</td>
<td>1: Poor user mental model of interaction</td>
</tr>
<tr>
<td></td>
<td>2: Inconsistent language/labelling</td>
</tr>
<tr>
<td>Performing interaction:</td>
<td>3: Poor accessibility of remote control</td>
</tr>
<tr>
<td></td>
<td>4: Multiple modes</td>
</tr>
<tr>
<td></td>
<td>5: Use of OK/SELECT button</td>
</tr>
<tr>
<td></td>
<td>6: STB times out on user input</td>
</tr>
<tr>
<td></td>
<td>7: Delay in responding to user input</td>
</tr>
<tr>
<td></td>
<td>8: Switching on subtitles via menus</td>
</tr>
<tr>
<td>Instructions:</td>
<td>9: Unclear set-up instructions</td>
</tr>
<tr>
<td></td>
<td>10: Unclear instructions for use</td>
</tr>
</tbody>
</table>

Having identified which features present difficulties to users, there are several factors that need to be considered when prioritising which features may need re-designing.

**Number of users excluded**

The most important factor to consider when prioritising which features to re-design is the number of target users excluded from using the product by each feature. However, simply prioritising the re-design in order of decreasing levels of exclusion (i.e. most excluding first, least excluding last) is over-simplistic in many cases.

For example, it may be that most of the exclusion arises because several features of the product exclude users for the same reason. If it is not possible to re-design all of those features, for example because of time or cost constraints, then it may be better to address features that exclude users for a different reason, but that might be able to be corrected within the allotted time and budget.

**Magnitude of impact**

As with usability, not all problems with accessibility are ‘catastrophic’ (i.e. prevent use of the product) in terms of the ability to use the product. There is an argument for prioritising those features that are central to the fundamental use of the product, rather than those that are primarily peripheral or supplementary to it.

**Frequency and severity of problem encountered**

Finally, the re-design effort should also address problems that, while not ‘catastrophic’, are encountered sufficiently frequently and are sufficiently severe to deter users.

When considering which features present the most difficulty, most accessibility assessment methods assume a ‘can or cannot’ approach. In other words, the user either
can use a feature or cannot. However, as for usability assessments, there is an issue regarding ‘cannot’ and ‘will not’. If a user is able to use a feature, but experiences severe difficulty in doing so and has to use the feature often, then the user is likely to stop using the product (‘will not’), just as surely as if the user could not operate the feature at all (‘cannot’). The corollary is that the user may tolerate more severe difficulties if they are only rarely encountered.

For example, if a user has severe difficulty operating the on/off button on an STB, then this is likely to deter the user from using it. However, if the same level of difficulty was encountered in plugging the STB power cable into the electricity socket, then the user would probably be able to bear with this, as many people may leave their STB permanently plugged in, and so would only encounter the problem occasionally.

Even if the problem was nominally catastrophic, then this may not necessarily prohibit use of the device. If a friend, relative or even an installer could be found to plug the STB power cable in, then the problem would have been overcome, as it is likely not to be encountered again unless the STB was unplugged. However, clearly such reliance on third party assistance is contrary to the aim of promoting independence, and so should only be relied upon in exceptional circumstances.

**Summary of prioritising re-design**

There is no single answer as to how to prioritise re-design. As with many aspects of inclusive design and accessibility, there are many factors that need to be considered simultaneously and satisfactory trade-offs found. Only when all of the above factors have been considered in depth is it possible to draw up a prioritised list of features to re-design.

The aim of addressing prioritisation is to ensure that designers consider all of these issues and make an informed decision about which features need to be re-designed. Of course, if there are many features that are identified as being excluding, then it should be acknowledged that the basic design is in need of a more fundamental re-think and it may be necessary to go back to the drawing board and develop a new concept.

The problems shown in Table 17, along with their symptoms, causes results and possible fixes, are shown over the following pages. Just as the list of problems in Table 17 is not a complete list, the list of potential solutions provided for each problem are not complete lists either. Again they are intended to indicate potential solution directions and illustrate how some of the potential fixes are straightforward to implement.

A study of the possible fixes show that many are complementary, and that particular solutions may benefit more than one problem. For example, the use of appropriate affordances could aid the user’s mental model of the interaction, at the same time as providing reminders to use the OK/SELECT button.

At first sight, Problems 6 and 7 may appear to require contradictory solutions, with one wanting slower response and the other requiring faster response. However, Problem 7 does not require that the STB has to perform the requested action quickly, simply to indicate that it has received the input and also what the response will be. Thus, rather than rushing off headlong on half an instruction, a dialogue can be constructed between the user and the STB, such that the user is always in control of the interaction.
### Problem 1: Poor user mental model of interaction

**Symptoms:**
User does not understand the ‘flow’ of interaction, e.g. gets lost in menus

**Encountered:**
- Whenever interacting with hierarchical menu structures
- Interacting with multiple remote controls

**Results:**
- User confusion and indecision
- Potential time-out problems (problem 2)
- User not making full use of all available functionality
- Reinforcement of perception that DTV is ‘difficult’

**Causes:**
- Principal cause is move away from traditional TV interaction paradigms to PC ones
- Weakening of ‘cause and effect’ models (e.g. through need to OK/SELECT options)
- Introduction of new elements into interaction (e.g. pop-up menus)
- Inconsistencies between similar elements (e.g. terminologies)

**Possible fixes:**
- As for Problem 5
- Use of good GUI/web-site design practice e.g. use of ‘breadcrumbs’ when drilling down menus, consistent use of “back” to mean previous screen, not up the hierarchy, etc.
- Use of ‘affordances’ (Gibson, 1997) to reinforce meaning and indicate correct action
**Problem 2: Inconsistent language/labelling**

**Symptoms:**
User unsure of which button to press or action to perform

**Encountered:**
Typically when trying to relate on-screen instructions to the buttons on the remote control

**Examples**
- “Press SELECT to view channel” on Teletext, but OK button on the STB2 remote
- On BBCi the blue button is called “Menu”, but the STB2 remote has another button with the same name that calls up the STB OSD
- On Teletext and BBCi the blue button performs identical functions, but one calls it “Control” and the other “Menu”

**Result:**
- User making incorrect button selection and ending up somewhere unintended and confusing user mental model of interaction
- User confusion leading to inaction (and possibly time-outs – see problem 2)
- General reinforcement of concept of DTV ‘being difficult’

**Causes:**
- Most probable cause is no overall consistent approach to service and STB design – different people applying their own definitions and interpretations

**Possible fixes:**
- Have accepted definitions and meanings that are consistent across all stages of the overall DTV service provision
- Ideally these should match the user mental model of interaction closely (i.e. call things sensible names)
**Problem 3: Poor accessibility of remote control**

**Symptoms:**
User has difficulty interacting with remote control, e.g. finding and operating buttons, etc.

**Encountered:**
- Potentially every time the remote control is used

**Results:**
- User experiences difficulty accessing some or all functions of the remote control
- User frustration

**Causes:**
- Poor ergonomic design
- Low contrast on labels
- Small fonts
- Non-standard symbols
- Inadequate affordances
- Small buttons
- Need to use two hands
- etc., etc.

**Possible fixes:**
- Adoption of minimum accessibility standards and practices (e.g. following RNIB guidelines, etc.)
- Development of specifically-designed remote controls (e.g. STB3 is better than STB2 because it was designed for this use)
### Problem 4: Multiple modes

**Symptoms:**
User changes mode of STB remote control

**Encountered:**
- Often by accident
- User searching for a particular button, but does not know which
- New batteries inserted into remote control

**Results:**
- Remote control appears to stop working with the STB
- User confusion and frustration
- STB potentially returned to shop as faulty

**Causes:**
- Batteries running flat in remote control
- User not sure which button to press to achieve a particular goal

**Possible fixes:**
- Clear feedback which mode the remote control is in – e.g. a light, or slider
- Removal of mode button if redundant – e.g. for STB2
Problem 5: Use of OK/SELECT button

Symptoms:

- Highlighted item on a pop-up menu not selected
- Ditto on EPG

Encountered:

- When trying to select a channel via the EPG
- When trying to select an item from a pop-up menu when using interactive elements

Result:

- Inability to use EPG
- Inability to utilise interactive elements fully
- Reinforces concept of DTV ‘being difficult’

Causes:

- User not used to needing to do 2 clicks to complete a task when interacting with a TV
- Inconsistent language across remote controls (it is SELECT on STB1, OK on STB2)
- Inconsistent language between service and remote control (“Press SELECT to view channel” on Teletext, but OK button on STB2)
- Labelling on buttons small (STB1, STB2) and insufficient contrast (STB2)
- Button difficult to press (small and surrounded by arrow buttons)

Possible fixes:

On pop-up menus –

- Use numbers to label each item and have those numbers directly selectable (equivalent to typing in page numbers for analogue teletext)
- Example: the home page on Teletext has the common page choices identified by a number (e.g. 7 = weather) – all the users could do this, whereas virtually all had difficulty with the pop-up menus

On EPG –

- Activating dwell select (sit on it for long enough and it gets chosen) – this has the disadvantage that if a user is distracted while using the EPG they may end up on an unexpected channel
- Variant on the above – prompt the user with the equivalent of an “are you sure?” dialogue box – e.g. “Press SELECT if you wish to view this channel or ×/Ø to choose another channel”
**Problem 6: STB times out on user input**

**Symptoms:**

STB only responds to part of the input from the user

**Encountered:**

- When changing channel, ending up on C4 instead of BBC News 24 (channel 40)
- When navigating the EPG – no key press within a predetermined limit, EPG closes and reverts to original channel – often arises in conjunction with the problem with the OK/SELECT button discussed above (user gets to desired channel, thinks about what to do to select it, by the time has made decision EPG has timed out)

**Result:**

Channel changing

- Impairment of ability to change channels
- Tendency to end up on wrong channel
- Reinforces concept of DTV ‘being difficult’

EPG

- User has to re-start EPG and repeat channel search to desired channel
- Increases user frustration and/or reinforces concept of DTV ‘being difficult’

**Causes:**

Principal cause

- Time-outs almost certainly based on model of young, able-bodied user

Exacerbated by

- Checking the screen to see that the previous input has been recognised (e.g. showing “4-“ when trying to go to channel 40) – even further exacerbated if this involves a change in spectacles from reading to distance pairs
- Finding the next button to press (e.g. the ‘0’ on the STB1 remote is not in the standard position)
- Deciding on the next button to press (e.g. the OK/SELECT button – see problem 1)

**Possible fixes:**

- Extend time-out periods to allow for ‘slower’ users
- Use of warning-style dialogue boxes before dropping a user out back at the start of a process (“You have not selected an option – do you wish to do so or leave the menu?” – then press appropriate button) – problem: this may get annoying if you keep encountering it
- Use of buttons such as the “–/–” button on Sony remote controls for specifying “I am doing a two-digit input now” – problem with this: not many users understand what this button does
- Reducing the ‘exacerbating’ features – e.g. having an LCD display on the remote control show the user the input created (saves having to swap between the TV and the remote control) – ensuring ‘standardised’ layout of remote controls to reduce hunting for buttons – fixing the OK/SELECT problem discussed earlier
### Problem 7: Delay in responding to user input

#### Symptoms:
User presses a button and either nothing seems to happen or the screen goes blank

#### Encountered:
- Changing channel (black screen, no indication of which channel moved to)
- Calling up interactive elements (e.g. BBCi)
- Calling up subtitles

#### Result:
- User believing that certain functionality is not available
- User repeat pressing button (potential for ending up somewhere unexpected, damaging user mental model of interaction)
- User frustration

#### Causes:
- Download time for system to update screen

#### Possible fixes:
- Clear, unambiguous feedback from the STB that the input has been recognised – e.g. Teletext page “loading” legend (although this would be better if it was near the ‘Fastext’ colours at the bottom of the screen)
**Problem 8: Switching on subtitles via menus**

**Symptoms:**

User has difficulty switching subtitles on or off

**Encountered:**

- Switching on – when user is unable to hear the TV output (e.g. hard of hearing, or listening to something else, such as a telephone)
- Switching off – when distraction has finished, or user needs to use interactive components (e.g. BBCi)

**Result:**

- User being denied access to subtitles (main)
- Ditto BBCi (subsidiary)

**Causes:**

- Subtitles are a major feature of TVs, so users expect to be able to get to them easily – however some systems bury the option away deep in menus
- Complex menu structure and ambiguous menu names (e.g. on STB2 it is under “Set-up” – “Languages”, but very few, if any, of our users found that without guidance)
- Change in interaction between navigating and selecting items (from °/Ø to Ò/È) without guidance (e.g. when actually switching on the subtitles)
- Need to use OK/SELECT to drill down menus (see Problem 1)

**Possible fixes:**

- STB1 approach – dedicated button
- Compromise approach – high-level, unambiguous presence in menu hierarchy
- Remove clash between e.g. BBCi and subtitles
**Problem 9: Unclear set-up instructions**

<table>
<thead>
<tr>
<th>Symptoms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>User does not understand how to connect up the STB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Encountered:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• During initial installation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• User confusion</td>
</tr>
<tr>
<td>• STB not working</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Difference between instructions and actual equipment – e.g. the presence of an amplifier, or DVD player</td>
</tr>
<tr>
<td>• Connecting black cables to black sockets on a black background</td>
</tr>
<tr>
<td>• Lack of feedback that a connection is correct</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible fixes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Clear step-by-step instructions, including different equipment configurations</td>
</tr>
<tr>
<td>• Colour-coding of cables to sockets (as on PCs)</td>
</tr>
</tbody>
</table>
Problem 10: Unclear instructions for use

Symptoms:
User does not understand what to do

Encountered:
- Most frequently during ‘advanced’ use of STB, e.g. interactive elements
- Also during ‘basic’ use, e.g. activating subtitles through menus

Results:
- User confusion
- STB functionality not fully utilised

Causes:
- Mismatch between on-screen instructions and remote control layout
- Absence of instructions
- Use of unfamiliar terminology, acronyms or jargon

Possible fixes:
- Check for consistency between on-screen instructions and remote control layout
- Use of familiar language and affordances
- Better match of interaction to user mental model
Overall summary

This report has presented the results of 3 assessments – expert assessment, exclusion analysis and user observation sessions – of the accessibility and usability of 3 digital television set-top boxes. The expert assessment involved a qualitative assessment through simulation of the activities involved in installing and operating three typical STBs by two experienced assessors. The exclusion analysis focused on quantitatively evaluating the number of people who are likely to experience difficulties when interacting with the STBs. Finally, the user observation sessions involved studying 13 users interacting with two of the STBs.

Comparing STBs to analogue television

All three assessments showed that interacting with the STBs was more difficult than interacting with traditional analogue television services. Indeed, the typical digital system is likely to exclude at least twice as many users as the typical analogue system for basic operations such as channel selection. Thus the STBs are excluding potential users who at the moment are able to access and use the available television services.

The additional exclusion arose from two principal causes. First, the basic operations:

- changing channel
- changing volume
- switching on/off
- calling up subtitles

are all made fundamentally more complex by the presence of either two remote controls, or a single remote control with multiple modes of operation. Second, digital television offers increased functionality and thus places additional burdens on the user.

Looking at the basic operations, when changing channel, etc., on an analogue television, the user only has the option of using a single remote control. This limits the amount of cognitive effort required by the user, as no decision as to which remote control to use is required.

When an STB is present, the user is faced with the additional decision of which remote control to use. This presents a fundamental additional cognitive load on the user, as well as an additional motion requirement to keep swapping between the two remote controls. Some STB manufacturers have responded to this difficulty by supporting both television and STB operation into a single remote control that operates in dual modes. However, unless some kind of affordance is provided indicating which mode the remote control is in (STB or television), the user can only find out by pressing a button and then seeing and interpreting the response. If the response was not the desired one, then the user needs to undo the action, change the mode and then perform the desired action a second time.

Consequently, STBs will only cease to exclude more people than analogue televisions when their operation is completely transparent from the user’s point of view. Integrated digital televisions, for example, appear to manage to achieve this level of transparency for basic functions by using only a single remote control with minimal need for mode changes.

However, even iDTVs exclude more people than analogue televisions when considering the full range of operation. Put simply, digital television offers more functionality, and thus requires more cognitive effort to learn and operate. For example, if a user wishes to use the full functionality of DTV, then there is a greater need to be able to read the on-screen display and to swap to reading the remote control (vision demand). Similarly, the users need to be able to operate the arrow buttons and SELECT/OK, rather than just the
channel numbers. The increase in number of channels means that users have to enter more double-figure channel numbers, with the inherent time-out limitations increasing the dexterity demand still further.

Only if all of the additional functionality is as accessible and usable as interacting with an analogue television, will digital television not be more excluding than analogue. This is a tough target to aim for, but a necessary one unless it is to be accepted that not all users will have access to all of the digital services.

Summary of problems seen
Throughout this report, interaction has been considered in terms of the sensory, cognitive and motor demands placed on the users.

Common sensory problems included finding/reading buttons on the remote controls, reading on-screen text, and swapping between the two (especially for users with distance and reading glasses). These problems are made worse in comparison to analogue television because of the increased functionality leading to the need for more (and hence smaller) buttons and also increased use of on-screen text displays. Users with hearing impairments would find the subtitle button approach of STB1 very useful, but would be disadvantaged by the menu approaches of STB2 and STB3.

The most common source of motor difficulties was pressing the buttons on the remote control. Again, while this is a common task for both analogue television and the STBs, it is made more difficult for the latter by the need for more (and hence smaller) buttons and also increased levels of user interaction.

However, while there was an increase in both the vision and dexterity demands made upon the users, by far the biggest cause of exclusion noted during the user observation sessions was the cognitive demands. The inherent increase in user cognitive effort associated with having to use two remote controls (or a single remote control with multiple modes) rather than a single remote control is further exacerbated by the mismatch between the users’ mental models of the interaction and the interaction paradigms adopted. For example, users are familiar with the concept that pressing a button on a television remote control has an immediate effect on what they see on the screen. For example, pressing a channel number button causes the television to immediately tune to that channel. Thus a strong link between cause and effect is observed, and a solid user mental model of the interaction is developed.

The STBs, though, present the users with numerous new interaction paradigms, such as pop-up menus, combined with weakened cause and effect. For example, nothing happens when an item is highlighted on a pop-up menu until the OK/SELECT button is pressed (another new concept). The situation is worsened further by the seemingly arbitrary inconsistencies in language and interaction between similar purpose entities of the interface. For example, in BBCi the ‘menu’ option is called ‘menu’, whereas in Teletext it is ‘control’. On one remote control the SELECT button was called just that, whereas on the other it was denoted OK. To enter BBCi, the user has to press the RED button, while for Teletext it is the TEXT button. These inconsistencies present unnecessary usability hurdles to the users.

These differences breach one of the central tenets of usability theory, namely that of the need for consistency.

The prevalence of the cognitive difficulties encountered by users with no discernible loss of cognitive capability reinforces the estimation made during the exclusion analyses, that the levels of population exclusion predicted using the ONS data alone are demonstrably conservative.

Conclusion
The predominance of exclusion arising from the differences between the users’ mental models and the interaction paradigms within the interface affects far more users than...
those that would typically be classed as a stereotypical ‘special needs user’. This is well illustrated by the comparative lack of difficulty with the interaction experienced by the youngest participant who had the most severe vision impairment (S3) of any of the users, but who nonetheless experienced little difficulty completing the tasks, most probably because of his wide experience with high-technology products.

Consequently, we believe that manufacturers should be encouraged to look beyond the stereotypes of young, severely, impaired people when considering who may have difficulty using their STBs and to also consider the needs of older adults and those who may not be familiar with the interaction paradigms used. There is also a clear need to standardise within those paradigms to minimise the cognitive demand placed on the users and to make interaction with the STBs as transparent as possible.

Ultimately, what is being advocated is not special purpose design for a small market sector, but rather good ‘design for all’.
Bibliography


Annex A - Exclusion analysis (theory)

Information requirements

The key requirement for assessing design exclusion is the ability to relate users to the ergonomic features of a product (Figure 8). However, the direct link (dashed line) between the two cannot be found from existing data. Consequently, based on the data available, the link is explored through two relationships: (1) product ergonomic features and user functional capabilities (sensory, cognitive and motion capabilities); and, (2) product ergonomic features and user physical attributes (anatomical dimensions such as height, reach, grip strength, etc.).

Available data

There are several sources of capability data available from government disability surveys, consumer research institutes and charities, and the like (Martin, Meltzer and Elliot, 1988; DTI 2000; RNID 2002). The most recent multiple capability data set covering the GB population (Grundy et al., 1999) is from the Disability Follow-up (DFS) to the 1996/97 Family Resources Survey. This survey specifies 13 capability scales of which 7 are particularly pertinent to product evaluation, namely:

- motion
- dexterity
- reach and stretch
- seeing
- hearing
- communication
- intellectual functioning

Each of these scales is subdivided into different levels of impairment, ranging from 0 (fully able) through 0.5 (minimal impairment) to 13 (most severe impairment). Each scale has been aligned to ensure that equal scores broadly relate to equivalent levels of capability (Martin et al., 1988), so a level 6 locomotion impairment has the same impact on quality life as a level 6 vision impairment. The full breakdowns of all seven scales are given below. A total of 7144 people were interviewed for the DFS, selected from amongst the 33897 respondents of the FRS on the basis of disability. The DFS represents a broad social and geographical coverage of Great Britain, where the data sample is fully scalable, allowing estimates of capability to be made relative to the whole population.
There are also a number of sources of ergonomic data, mainly in the form of standards. These range from the generic to the product-specific and are widely applied to workplace design, for example. As a branch of ergonomics, anthropometry deals with physical attributes (body measurements), particularly those of size, reach and strength. The Department of Trade and Industry recently up-dated a series of data sets: Childdata (Norris and Wilson, 1995), Adultdata (Peebles and Norris, 1998) and Older Adultdata (Smith, Norris and Peebles, 2000). These contain anthropometric and physical strength data for different segments of the population. However, they have been collected from many different countries and hence are difficult to correlate against the capability data gathered by the DFS or to use to draw population-specific conclusions.

**How to quantify design exclusion**

Focusing on design exclusion, a review process for inclusive design may be defined that follows a four-step approach:

1. Specify the context of use: state any assumptions regarding the environment in which the product is used and the sequence of actions encountered when using the product.

2. Assess the capability demands imposed by the product, subject to its defined context of use: determine the number of users excluded by the product (and the reasons for their exclusion) and the number of users disadvantaged, but not excluded.

3. Assess the physical attributes required by the product, subject to its defined context of use: determine the number of users excluded from using the product and the reasons for their exclusion.

4. Eliminate multiple counting: users may be excluded or disadvantaged for more than one reason. For example, someone with both poor vision and restricted movement may be identified twice as being excluded by products requiring high vision and movement capability. Consequently, such double/multiple counting of individuals’ combined/multiple capability losses needs to be corrected.

Theoretically, there will also be multiple counting when combining the results of both the functional capability and physical attribute assessments. For example, someone who is both very short and has poor vision may be excluded from using an information kiosk. However, if the data sets adopted are radically different, for example, from different countries, this can be difficult, if not impossible to correct for as there is no common ground for relating data from the one source to the other. Multiple counting from within single data sets can and should be eliminated whenever possible.

When assessing an existing product it is very important to judge its features against user capabilities. The DFS disability severity scales discussed earlier in this chapter can be adapted for such an assessment.

There are many ways of performing product assessment but for our purposes here we will discuss a very straightforward approach: expert assessment based on identifying the product capability demands and mapping those demands on to the DFS scales and underlying population data to calculate the level of exclusion. Scores are given according to the descriptions of the scale items. If there is no obvious link between the description and the user-product interaction, subjective analogy is used to infer the most appropriate score.

For example, there is no relevant description in the DFS scales of the dexterity capability required for pressing buttons on the device. Comparison is thus made based on existing descriptions. It is assumed that the required capability of squeezing water from a sponge (score 8.0) is comparable to pressing buttons, as both actions are related to the exertion of finger strength. Therefore a score is made with this reference. A rough estimation of numbers of people excluded is thus available by mapping the scale to the GB population.
However, the total exclusion will not be the sum of the seven component numbers of people excluded on the grounds of individual capabilities because of multiple counting.

A sample assessment of an audio guide system is shown in Figure 9 for the 16+ Great Britain population. The levels of user exclusion resulting from this assessment are summarised in Tables 17 and 18. Note that the motion, sensory and cognitive totals do not equate to the sum of their constituent parts, nor does the overall total correspond to the sum of its parts. This is directly due to the fact that individual users may exhibit more than one capability loss, a fact that must be accounted for when summarising the levels of exclusion.

**Product description:**

Acoustiguide 2000 wand - a device for a museum’s audio guide system

**Context of use:**

The device is in a museum for user trials. The user collects the device from the Museum’s staff and basic instructions (how to start the device and what functions are available) are given. A neck strap is already attached to the device.

**Sequence of use:**

1. put strap over head
2. find the number next to the selected object
3. key in the number
4. press the Play button
5. listen to the commentary, adjust volume or pause when necessary

<table>
<thead>
<tr>
<th>Capability</th>
<th>Score</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locomotion</td>
<td>7.5</td>
<td>This device only needs one hand for operation (NB: A user who always needs to hold on to something to keep balance will be scored 7.0)</td>
</tr>
<tr>
<td>Reach and stretch</td>
<td>8.0</td>
<td>The relevant action is hanging the device around user’s neck (the user hence should be able to put one arm up to head)</td>
</tr>
<tr>
<td>Dexterity</td>
<td>8.0</td>
<td>The dexterity demand made by the device is no more than pressing buttons that are reasonably well spaced and shaped, the device is light (260 grams) and the operation is very simple</td>
</tr>
<tr>
<td>Vision</td>
<td>4.5</td>
<td>If the user cannot see well enough to read a large print book, he/she may not see the buttons well</td>
</tr>
<tr>
<td>Hearing</td>
<td>5.5</td>
<td>The enhanced voice is comparable to a person talking in a loud voice in a quiet room</td>
</tr>
<tr>
<td>Communication</td>
<td>5.5</td>
<td>To understand the explanation of the instruction is easy, even if the user may have difficulty in understanding strangers</td>
</tr>
<tr>
<td>Intellectual</td>
<td>9.5</td>
<td>The usage of the device is intuitive and simple. It does not need much work intellectually</td>
</tr>
<tr>
<td>functioning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General comments:

On the whole, the device is easy to use. If there is a label to tell the user how to start the commentary (find the number, input the number and press Play button), the staff assistance may not be required and the communication demands will be reduced. The red ‘C’ button (function: clear) is confusing.

Duration of assessment:

30 minutes

Figure 9 – Exclusion analysis for an audio guide system
Table 17 – Levels of exclusion predicted for an audio guide system (16+ GB population)

<table>
<thead>
<tr>
<th>Disability</th>
<th>Locomotion</th>
<th>Reach and stretch</th>
<th>Dexterity</th>
<th>Vision</th>
<th>Hearing</th>
<th>Communication</th>
<th>Intellectual function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>7.5</td>
<td>8.0</td>
<td>8.0</td>
<td>4.5</td>
<td>5.5</td>
<td>5.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Exclusion</td>
<td>1 031 000</td>
<td>116 000</td>
<td>423 000</td>
<td>387 000</td>
<td>400 000</td>
<td>74 000</td>
<td>115 000</td>
</tr>
</tbody>
</table>

Table 18 – Summary of levels of exclusion predicted for an audio guide system (16+ GB population)

<table>
<thead>
<tr>
<th>Disability</th>
<th>Motion</th>
<th>Sensory</th>
<th>Cognitive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>7.5</td>
<td>8.0</td>
<td>8.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Exclusion</td>
<td>1 302 000</td>
<td>740 000</td>
<td>152 000</td>
<td>1 909 000</td>
</tr>
</tbody>
</table>

**Locomotion**

A person’s locomotion capability is derived from consideration of their walking, stair climbing, bending and balance capabilities.

<table>
<thead>
<tr>
<th>Locomotion</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1  Cannot walk at all</td>
<td>11.5</td>
</tr>
<tr>
<td>L2  Can only walk a few steps without stopping or severe discomfort/Cannot walk up and down one step</td>
<td>9.5</td>
</tr>
<tr>
<td>L3  Has fallen 12 or more times in the last year</td>
<td>7.5</td>
</tr>
<tr>
<td>L4  Always needs to hold on to something to keep balance</td>
<td>7.0</td>
</tr>
<tr>
<td>L5  Cannot walk up and down a flight of 12 stairs</td>
<td>6.5</td>
</tr>
<tr>
<td>L6  Cannot walk 50 yards without stopping or severe discomfort</td>
<td>5.5</td>
</tr>
<tr>
<td>L7  Cannot bend down far enough to touch knees and straighten up again</td>
<td>4.5</td>
</tr>
<tr>
<td>L8  Cannot bend down and pick something up from the floor and straighten up again</td>
<td>4.0</td>
</tr>
<tr>
<td>L9  Cannot walk 200 yards without stopping or severe discomfort/Can only walk up and down a flight of 12 stairs if holds on and takes a rest/Often needs to hold on to something to keep balance/Has fallen 3 or more times in the last year</td>
<td>3.0</td>
</tr>
<tr>
<td>L10 Cannot walk up and down a flight of 12 stairs if holds on (doesn't need a rest)</td>
<td>2.5</td>
</tr>
<tr>
<td>L11 Cannot bend down to sweep up something from the floor and straighten up again</td>
<td>2.0</td>
</tr>
<tr>
<td>L12 Can only walk up and down a flight of stairs if goes sideways or one step at a time</td>
<td>1.5</td>
</tr>
<tr>
<td>L13 Cannot walk 400 yards without stopping or severe discomfort</td>
<td>0.5</td>
</tr>
</tbody>
</table>
### Reach and stretch

A person’s reach and stretch capability is derived from consideration of their upper-body strength and control capabilities.

<table>
<thead>
<tr>
<th>Reaching and stretching</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS1 Cannot hold out either arm in front to shake hands</td>
<td>9.5</td>
</tr>
<tr>
<td>RS2 Cannot put either arm up to head to put a hat on</td>
<td>9.0</td>
</tr>
<tr>
<td>RS3 Cannot put either hand behind back to put jacket on or tuck shirt in</td>
<td>8.0</td>
</tr>
<tr>
<td>RS4 Cannot raise either arm above head to reach for something</td>
<td>7.0</td>
</tr>
<tr>
<td>RS5 Has difficulty holding either arm in front to shake hands with someone</td>
<td>6.5</td>
</tr>
<tr>
<td>RS6 Has difficulty putting either arm up to head to put a hat on</td>
<td>5.5</td>
</tr>
<tr>
<td>RS7 Has difficulty putting either hand behind back to put jacket on or tuck shirt in</td>
<td>4.5</td>
</tr>
<tr>
<td>RS8 Has difficulty raising either arm above head to reach for something</td>
<td>3.5</td>
</tr>
<tr>
<td>RS9 Cannot hold one arm out in front or up to head (but can with other arm)</td>
<td>2.5</td>
</tr>
<tr>
<td>RS10 Cannot put one arm behind back to put on jacket or tuck shirt in (but can with other arm)/Has difficulty putting one arm behind back to put jacket on or tuck shirt in, or putting one arm out in front or up to head (but no difficulty with other arm)</td>
<td>1.0</td>
</tr>
</tbody>
</table>
**Dexterity**

A person’s dexterity capability is derived from consideration of their picking up, carrying, holding and twisting capabilities.

<table>
<thead>
<tr>
<th>Dexterity</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Cannot pick up and hold a mug of coffee with either hand</td>
</tr>
<tr>
<td>D2</td>
<td>Cannot turn a tap or control knobs on a cooker with either hand</td>
</tr>
<tr>
<td>D3</td>
<td>Cannot pick up and carry a pint of milk or squeeze the water from a sponge with either hand</td>
</tr>
<tr>
<td>D4</td>
<td>Cannot pick up a small object such as a safety pin with either hand</td>
</tr>
<tr>
<td>D5</td>
<td>Has difficulty picking up and pouring from a full kettle or serving food from a pan using a spoon or ladle</td>
</tr>
<tr>
<td>D6</td>
<td>Has difficulty unscrewing the lid of a coffee jar or using a pen or pencil</td>
</tr>
<tr>
<td>D7</td>
<td>Cannot pick up and carry a 5lb (2.5kg) bag of potatoes with either hand</td>
</tr>
<tr>
<td>D8</td>
<td>Has difficulty wringing out light washing or using a pair of scissors</td>
</tr>
<tr>
<td>D9</td>
<td>Can pick up and hold a mug of tea or coffee with one hand but not with the other</td>
</tr>
<tr>
<td>D10</td>
<td>Can turn a tap or control knob with one hand but not with the other/Can squeeze the water from a sponge with one hand but not the other</td>
</tr>
<tr>
<td>D11</td>
<td>Can pick up a small object such as a safety pin with one hand but not with the other/Can pick up and carry a pint of milk with one hand but not the other/Has difficulty tying a bow in laces or strings</td>
</tr>
</tbody>
</table>
**Hearing capability**

A person’s hearing capability is derived from consideration of their communication and signal discernment capabilities.

<table>
<thead>
<tr>
<th>Hearing</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Cannot hear sounds at all</td>
</tr>
<tr>
<td>H2</td>
<td>Cannot follow a TV programme with the volume turned up</td>
</tr>
<tr>
<td>H3</td>
<td>Has difficulty hearing someone talking in a loud voice in a quiet room</td>
</tr>
<tr>
<td>H4</td>
<td>Cannot hear a doorbell, alarm clock or telephone bell</td>
</tr>
<tr>
<td>H5</td>
<td>Cannot use the telephone</td>
</tr>
<tr>
<td>H6</td>
<td>Cannot follow a TV programme at a volume others find acceptable</td>
</tr>
<tr>
<td>H7</td>
<td>Difficulty hearing someone talking in a normal voice in a quiet room</td>
</tr>
<tr>
<td>H8</td>
<td>Difficulty following a conversation against background noise</td>
</tr>
</tbody>
</table>
**Vision capability**

A person’s vision capability is derived from consideration of their recognition and reading capabilities.

<table>
<thead>
<tr>
<th>Seeing</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 Cannot tell by the light where the windows are</td>
<td>12.0</td>
</tr>
<tr>
<td>S2 Cannot see the shapes of furniture in a room</td>
<td>11.0</td>
</tr>
<tr>
<td>S3 Cannot see well enough to recognise a friend if close to his/her face</td>
<td>10.0</td>
</tr>
<tr>
<td>S4 Cannot see well enough to recognise a friend who is an arm’s length away</td>
<td>8.0</td>
</tr>
<tr>
<td>S5 Cannot see well enough to read a newspaper headline</td>
<td>5.5</td>
</tr>
<tr>
<td>S6 Cannot see well enough to read a large print book</td>
<td>5.0</td>
</tr>
<tr>
<td>S7 Cannot see well enough to recognise a friend across a room</td>
<td>4.5</td>
</tr>
<tr>
<td>S8 Cannot see well enough to recognise a friend across a road</td>
<td>1.5</td>
</tr>
<tr>
<td>S9 Has difficulty seeing to read ordinary newspaper print</td>
<td>0.5</td>
</tr>
</tbody>
</table>
**Communication capability**

A person’s communication capability is derived from consideration of their interpersonal understanding capabilities.

<table>
<thead>
<tr>
<th>Communication</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 Is impossible for people who know him/her well to understand/Finds it</td>
<td>12.0</td>
</tr>
<tr>
<td>impossible to understand people who know him/her well</td>
<td></td>
</tr>
<tr>
<td>C2 Is impossible for strangers to understand/Is very difficult for people who</td>
<td>8.5</td>
</tr>
<tr>
<td>know him/her well to understand/Finds it impossible to understand strangers/Finds it very difficult to understand people who know him/her well</td>
<td></td>
</tr>
<tr>
<td>C3 Is very difficult for strangers to understand/Is quite difficult for people who know him/her well to understand/Finds it very difficult to understand strangers/Finds it quite difficult to understand people who know him/her well</td>
<td>5.5</td>
</tr>
<tr>
<td>C4 Is quite difficult for strangers to understand/Finds it quite difficult to understand strangers</td>
<td>2.0</td>
</tr>
<tr>
<td>C5 Other people have some difficulty understanding him/her/Has some difficulty understanding what other people say or what they mean</td>
<td>1.0</td>
</tr>
</tbody>
</table>
### Intellectual capability

A person’s intellectual function is derived from consideration of a number of capabilities including, for example, reading, writing and counting.

<table>
<thead>
<tr>
<th>Intellectual functioning</th>
<th>Sum</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (sum) of problems from the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1 Often forgets what was supposed to be doing in the middle of something</td>
<td>10</td>
<td>12.0</td>
</tr>
<tr>
<td>I2 Often loses track of what is being said in the middle of a conversation</td>
<td>9</td>
<td>10.5</td>
</tr>
<tr>
<td>I3 Thoughts tend to be muddled or slow</td>
<td>8</td>
<td>9.5</td>
</tr>
<tr>
<td>I4 Often gets confused about what time of day it is</td>
<td>7</td>
<td>8.0</td>
</tr>
<tr>
<td>I5 Cannot watch a half hour TV programme all the way through and tell someone what it was about</td>
<td>6</td>
<td>7.0</td>
</tr>
<tr>
<td>I6 Cannot remember and pass on a message correctly</td>
<td>5</td>
<td>6.0</td>
</tr>
<tr>
<td>I7 Often forgets to turn things off such as fires, cookers or taps</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>I8 Often forgets the name of people in the family or friends seen regularly</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>I9 Cannot read a short article in newspaper</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>I10 Cannot write a short letter to someone without help</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>I11 Cannot count well enough to handle money</td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>
### Annex B - Exclusion analysis (data)

<table>
<thead>
<tr>
<th>No.</th>
<th>locomotion</th>
<th>reach &amp; stretch</th>
<th>dexterity</th>
<th>seeing</th>
<th>hearing</th>
<th>communication int. functioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>0.5</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>5b</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>0.5</td>
<td>n/a</td>
<td>2.0</td>
</tr>
<tr>
<td>5c</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>5d</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>6a</td>
<td>1.5</td>
<td>1.0</td>
<td>2.0</td>
<td>0.5</td>
<td>6.0</td>
<td>n/a</td>
</tr>
<tr>
<td>6b</td>
<td>1.5</td>
<td>1.0</td>
<td>2.0</td>
<td>4.5</td>
<td>6.0</td>
<td>n/a</td>
</tr>
<tr>
<td>6c</td>
<td>1.5</td>
<td>1.0</td>
<td>2.0</td>
<td>4.5</td>
<td>6.0</td>
<td>n/a</td>
</tr>
<tr>
<td>7a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>7b</td>
<td>7.0</td>
<td>5.5</td>
<td>4.0</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>8</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>9a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>0.5</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>9b</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>11.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>9c</td>
<td>n/a</td>
<td>n/a</td>
<td>6.5</td>
<td>11.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>9d</td>
<td>n/a</td>
<td>n/a</td>
<td>4.0</td>
<td>8.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>9e</td>
<td>n/a</td>
<td>n/a</td>
<td>6.3</td>
<td>8.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>10a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>0.5</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>10b</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>11a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>0.5</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>11b</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>11c</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>11d</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>11e</td>
<td>n/a</td>
<td>n/a</td>
<td>5.5</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>12a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.0</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>12b</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>5.0</td>
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</table>
Annex C - User observations (protocol)

Opening questions

Preamble

“Welcome to the trials of 2 new digital television set-top box receivers. We will shortly ask you to go through to the room where the equipment is set-up, but first we need to ask a few questions about you and your attitudes to technology.”

“You see, the Government, broadcasters and other stakeholders want to stop television signals being broadcast as they are at present and replace them with a new type of digital signal. However, take-up of the new digital television receivers by certain sectors of the population is slow and we need to find out whether it is because the technology is poorly designed, or whether there are other factors affecting the take-up.”

“The aim of today is to try to find out how well designed the set-top boxes are. The results will be passed on to the Department of Trade and Industry and will be used to help make future generations of STBs easier to use for everyone. This is your opportunity to make a difference and influence government policy in this area.”

“You will probably be told this several times today, but please remember that it is the receivers that we are testing today, NOT YOU. Whatever happens during the course of using the STBs, please remember that there is no wrong answer or action. Every time something seems unclear, it is the fault of the equipment, not you. We know that the equipment has problems, we want to find out how many problems and what they are.”

Getting to know the user

“One of the first things we need to do is to find out some more information about you. Please be assured that ALL information gathered during the course of today will be treated in the strictest of confidence and will be fully anonymised.”

“Before we start though, are you happy with everything so far? If so, we need you to sign a statement that you are happy to participate in this session.” [Hand disclaimer to user]

“As you will see, when you go into the room with the television, we’ve got a number of cameras set up in there. They are not there so we can sell the videos at a later stage! They are there so that we can analyse anything that we might miss during the course of this session”

“Also, we would like to occasionally take photos during the course of this session. These photos will not be used for commercial gain, but for illustrative purposes in the final reports to the DTI and in subsequent academic papers. Is it OK with you for us to take photos during the session?”

“If so, I am afraid that we are legally obliged to ask you to sign a release form allowing us to take photos of you and to use them for the purposes I’ve described. Here is the release form. IF you are happy with the form, please could you sign it here.”

“Before we begin with the questions, I would like to remind you that you do not have to answer any questions that you do not wish to.”
Protocol

The questions
“First of all, please could you tell me how you would like to be addressed, today?
Are you comfortable with [e.g. John]?”

“Which of the following age ranges do you fit into?” (or - “How old are you?”)
50-54 55-59 60-64 65-69 70-74 75-79 80-84 85+

“Do you have a job at present? If not, have you had a job in the past?”
YES, AT PRESENT / YES, IN PAST / NO, NEVER

“If so, what kind of jobs (do you/did you) do?”

“What is your highest level of education?”
School (Grammar or Secondary Modern) 6th Form University

“How frequently do you read newspapers? Which one do you read most often?”

Capability profile
[Use separate tables – focus on Dexterity, Vision and Hearing in particular.]

Attitudes to televisions
“Since we are here to look at digital television, we would like to know a bit about
your attitudes towards television. First off, easy question, do you watch television?
If so, how many hours a day do you watch it, on average?”
less than an hour 1 to 2 hours 2 to 4 hours more than 4 hours

“Do you own your own television?”
YES/NO

“If not, whose television do you watch?”

“Is it a wide-screen television?”
YES/NO

“Does it have a remote control?”
YES/NO

“What are you favourite channels and programmes?”

VIDEO RECORDERS
“Do you own or have regular access to a video recorder?”
YES OWN/ YES OTHERS / NO

“Do you use it for playing back pre-recorded tapes (such as those bought in a
shop)?”

“Do you use it for recording programmes?”

“If so, do you just press RECORD, or do you programme the video to record at
particular times?”

“If so, do you set the timer using a code, or by setting the start and stop times?”
Protocol

**TELETEXT**

*Do you ever use Teletext?*

YES/NO

*If so, do you use it regularly and what for?*

*Are you happy with your current television/channels/services?*

YES/NO

Comments:

*If you could, what would you like to change about the current channels and services?*

**LOOKING TO THE FUTURE**

*How long have you had your current television and are you aiming to replace it at some point in the future?*

How long? Replace: YES/NO

*If so, when?*

*Have you heard about digital television before being invited to take part today?*

YES/NO

*If so, how did you hear about it?*

*Are you aware that between 2006 and 2010 the current method of broadcasting programmes will be switched off and that after that date only digital services will be broadcast? [This means that most current televisions will not be able receive the signal and will need a set-top box to work]*

YES/NO

*What are your thoughts about that?*

**OWNING A DIGITAL TELEVISION**

*Do you own your own digital television system?*

YES / NO

IF YES (IF NO, see next page):

*Is it an integrated digital television set or a set-top box?*

IDTV / STB

*What make is it?* [e.g. SONY, JVC, etc.]

*Why did you upgrade to digital television?*

*How did you decide which system to buy?*

*Did you install the system yourself, or did you get someone else to install it for you?*
“Was the installation easy or were there any problems during the installation?”

“Are you happy with it and do you prefer it to analogue?”

“What do you like about it and what do you not like?”
LIKE
DISLIKE

IF NO (does not own a digital television)

“What are your thoughts on digital television from what you know about it?”

“Have you thought about buying a digital television or digital set-top box?”
YES/NO

“Do you know if your aerial can receive digital signals?”
YES, I KNOW / NO, I DON’T
YES, IT CAN / NO, IT CANNOT

Attitudes to other technologies
“Do you own a mobile telephone?”
YES/NO

If yes, “How did you decide which one to buy?”
LIKE
DISLIKE

“What do you like and dislike about it?”

“Do you own or have access to a computer?”
YES, OWN / YES, HAVE ACCESS TO / NO, NEITHER

If yes, “What do you use it for?”

“Do you ever surf the Web?” [Internet]
YES OFTEN / YES SOMETIMES / NO NOT AT ALL

If yes, “What information are you normally looking for?”

“What is your favourite ‘high-tech’ product and why?”

“What is your least favourite ‘high-tech’ product and why?”
Protocol

Equipment trial

Analogue Television

0 – Familiarisation
“Before we start, I know that this is not your usual television. Please take just a few moments to familiarise yourself with the remote control.”

“Is the layout clear?”

“Before we start, how would you normally find out what programmes are on?

1 – Switch on the television
Pointers: Remote control used? Time taken? How easy?
Notes:

2a – Change channel to ITV
Done using CH+/- or by typing in number?
Notes:

2b – Channel hopping
Done using CH+/- or by typing in number?
Notes:

3 – Change volume
Notes:

4 – Teletext – find local weather and then TV programmes
Done using page numbers, CH+/-, Fastext buttons?
Notes:

5 – Subtitles – switch on/off
[p.888]
Page number known? Method of finding out page number? Navigation method
Notes:

6 – Switch off
Notes:

Round up questions
“How did that compare to using your usual television?”

“Was there anything that you found particularly challenging or difficult?”

“Are you ready to start the next part of the session?”
Protocol

STB 1

Preamble – deciding which one to buy

“Now imagine you are in an electrical retailer’s shop, such as … or … . You are
talking to the shop assistant and he says that they have 2 STBs in stock. They are
these ones [place packaging on table]. Which one of the two would you be tempted
to buy and why?”

“What questions might you ask of the shop assistant before making your
decision?”

“This is what the two boxes look like out of the packaging. Now, which one of the
two would you buy, and why?”

Installation

“Would you be inclined to attempt to install this STB if you had bought it or would
you rather get it installed professionally or by a friend or relative?”

“Here are the instructions for installing the STB. How easy do you think this STB
would be to connect up?”

“Would you like to have a go at connecting it up now?” [Note – optional activity]

If yes – do it.

If not, “What is making you hesitant or uncertain about installing it?”

“What additional information would you like to help persuade you to have a go at
installing it?”

Switch on and tune-in

“Here are the remote controls for the STB and the television. Please switch both of
them on.”

“Do you think that you are watching digital television or the usual analogue
service?”

“Well done. You are now watching digital television.”

Changing channels and volume

“Before I explain about how digital television is different from the traditional
television channels, would you like to change the channel to [BBC1 or ITV]?”

“That’s good. Now, how about changing the volume of the television?” – NOTE –
effect of 2 remotes

“OK – one of the benefits of digital television is that they are able to transmit more
channels. One of those is BBC News 24. Please see if you can find BBC News
24.” NOTE – channel 40

“Well done. Digital broadcast also enables you to receive radio programmes
through your television aerial. Please see if you can find BBC Radio 4.” NOTE –
prompt to use OSD menu guide – channel 74

“Would you like to explore the channels that are available.”

“Do any of the channels seem interesting?”

“Finally, please go back to ITV.”
Protocol

**Teletext**
“What I would now like you to do is to call up Teletext. Would you do that now please?”

“The text button doesn’t seem to work, does it? Teletext has its own dedicated channel on digital TV. You need to change to channel 9.”

“OK. Now we are on the right channel, How do you think you can call up Teletext now?”

“That’s good. Now, as we did earlier, can you find the local weather forecast?”

“And how about the TV programme guide?”

“Does this content seem to be of interest? Would you like to explore the pages? Is there something in particular that you think you might like to find out about?”

“And to finish off, would you like to return back to ITV?”

**Subtitles**
“We’ve almost finished with this STB. We’ve only got two more things to do. The first is, would you like to call up subtitles for this programme?”

“OK – the page 888 solution doesn’t work here. We need to find another way. Are there any keys on the remote control that you think you need to press to activate the subtitles? NOTE – menu, language, etc.

“Would you now please turn them off?”

**Interactive content**
“Final bit with this box. Would you please change channel to BBC1?”

“Although digital television does not offer Teletext on the channels, it offer ‘interactive content’ instead. Look at the remote control and see if you can figure out how to call up the interactive content.”

“Well done. Now once again, please see if you can find the local weather forecast.”

“And once again, how about the TV programme guide?”

“Very final steps. Would you please exit the interactive elements and switch off both the television and the STB?”

**Wrap-up**
“Well done. So what did you think of that?”

“How did that compare to using your usual television?”

“Was there anything that you found particularly challenging or difficult?”

“Are you ready to start the next part of the session?”
Protocol

**STB 2**

*Preamble – deciding which one to buy*

“So now we have the second of the 2 boxes…”

**Installation**

“Would you be inclined to attempt to install this STB if you had bought it or would you rather get it installed professionally or by a friend or relative?”

“Here are the instructions for installing the STB. How easy do you think this STB would be to connect up?”

“Would you like to have a go at connecting it up now?” [Note – optional activity]

If yes – do it.

If not, “What is making you hesitant or uncertain about installing it?”

“What additional information would you like to help persuade you to have a go at installing it?”

“Here are the remote controls for the STB and the television. Please switch both of them on.”

“Do you think that you are watching digital television or the usual analogue service?”

“Well done. You are now watching digital television.”

**Changing channels and volume**

“Before I explain about how digital television is different from the traditional televisions channels, would you like to change the channel to [BBC1 or ITV]?”

“That’s good. Now, how about changing the volume of the television?” – NOTE – effect of 2 remotes

“OK – one of the benefits of digital television is that they are able to transmit more channels. One of those is BBC News 24. Please see if you can find BBC News 24.” NOTE – channel 40

“Well done. Digital broadcast also enables you to receive radio programmes through your television aerial. Please see if you can find BBC Radio 4.” NOTE – prompt to use OSD menu guide – channel 74

“Would you like to explore the channels that are available.”

“Do any of the channels seem interesting?”

“Finally, please go back to ITV.”
Protocol

Teletext
“What I would now like you to do is to call up Teletext. Would you do that now please?”

“The text button doesn’t seem to work, does it? Teletext has its own dedicated channel on digital TV. You need to change to channel 9.”

“OK. Now we are on the right channel, How do you think you can call up Teletext now?”

“That’s good. Now, as we did earlier, can you find the local weather forecast?”

“And how about the TV programme guide?”

“Does this content seem to be of interest? Would you like to explore the pages? Is there

“And to finish off, would you like to return back to ITV?”

Subtitles
“We’ve almost finished with this STB. We’ve only got two more things to do. The first is, would you like to call up subtitles for this programme?”

“OK – the page 888 solution doesn’t work here. We need to find another way. Are there any keys on the remote control that you think you need to press to activate the subtitles?” NOTE – menu, language, etc.

“Would you now please turn them off?”

Interactive content
“Final bit with this box. Would you please change channel to BBC1?”

“Although digital television does not offer Teletext on the channels, it offer ‘interactive content’ instead. Look at the remote control and see if you can figure out how to call up the interactive content.”

“Well done. Now once again, please see if you can find the local weather forecast.”

“And once again, how about the TV programme guide?”

“Very final steps. Would you please exit the interactive elements and switch off both the television and the STB?”

Wrap-up
“Well done. So what did you think of that?”

“How did that compare to using the previous STB?”

“Was there anything that you found particularly challenging or difficult?”

“We would just like to ask you a few more questions about your thoughts regarding the equipment that you have used today. Please follow me and I will take you back to [x] for the final debrief.”
Protocol

Closing questions

SERVICE
“Having used the set-top boxes, what are your first thoughts?”

“Was digital television what you expected it to be?”

“Have you changed your opinion about adopting digital television?”

“What did you like about the digital television service?” [Note – the programmes, etc., not the STB]

“What did you dislike about the service?”

“How did you feel about the number of channels?”

TOO MANY / TOO FEW / ABOUT RIGHT

“What about receiving radio programmes through your television? What did you think about that?”

SWITCH OVER
“As we mentioned earlier, some time between 2006 and 2010 you will have to use either a set-top box or by an integrated digital television to watch television. Having used a set-top box, what are your thoughts about this?”

“How much warning do you think people should be given before the existing television service is switched off?”
[i.e. time before signal switched off, e.g. 6 months?]

“How much help and advice should be provided?”

“Who should provide that help and advice?”
[e.g. shops, broadcasters, government]

“And who do you think should pay for the provision of that help and advice?”
[e.g. shops, broadcasters, taxpayers, consumers]

THE SET-TOP BOXES
“What about the set-top boxes? Did you find them easy to use?”

“How much of the 2 boxes did you find easier to use and why?”

“Which one of the 2 would you buy?”

“STB2 is £120 and STB1 is £100. Would that affect your decision?”

“What do you think about having to use an additional remote control?”

“How many remote controls do you have at home at the moment?”

“Here is an attempt to combine the digital STB remote with a TV one. What do you think of that remote control?”
[Note – give SKY remote control to user]

“How useful was the on-screen programme guide?”
FINAL THOUGHTS

“Having used the boxes, are there any final thoughts that you would like to pass on to the government about digital television?”

“What do you think is the most important benefit about digital television?”

“What do you think is its biggest weakness?”

“Finally, if we have any further questions about your session today, would it be OK for us to contact you?”
### Annex D - User observations (data)

#### Master sheet

<table>
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<tr>
<th>Complete?</th>
<th>User</th>
<th>Date</th>
<th>Where</th>
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Note on following pages:

- BLOCK capitals represent button names. The only exception is OK, which refers to both the button and “fine”
- “In double quotes” are things the user said (direct quotes)
- ‘In single quotes’ are on-screen instructions
- OK refers to the OK button, Ok means no problems observed
### User 1

**Capability profile**

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<td>Dexterity</td>
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<tr>
<td>Seeing</td>
<td>n/a</td>
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<td>Hearing</td>
<td>H8</td>
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<tr>
<td>Communication</td>
<td>C4</td>
</tr>
<tr>
<td>Intellectual Function</td>
<td>IF5</td>
</tr>
</tbody>
</table>

[Uses walking stick, slight tremor and hence hand-eye co-ordination difficulties]

**Personal profile**

- **Age**: 85
- **Job**: Academic
- **Reads newspaper?**: Yes
- **Watches**: <1 hour
- **Own (rented) TV, R/C, not w/screen, 5 years old, no idea when replacing it**: Likes – BBC2, University Challenge
- **Own (rented) VCR, used for playing tapes, not recording**: Teletext – does not use it
- **Does not particularly like current programme choice – “lousy programmes”**: Switch over – hopes for improvement (in programme choice) and flexibility
- **Is aerial OK for DTV?**: No, it is not
- **Owns mobile phone?**: Yes (it was a present)
- **Owns 2 PCs, used for Word, Access, e-mail and Internet – surfs everyday, looking for answers to crossword clues**: Favourite hi-tech product – computer – move away from handwriting
- **Least favourite – plastic bags – pollution**

**Equipment trial**

**Analogue TV**

- 0 – purpose of Fastext buttons not clear, otherwise Ok – gets programme info from TV guide in newspaper
- 1 (Switch on) – used TELETEXT CLEAR button – worked, though!
- 2a (Change to ITV) – used no. 3
- 2b (Channel hopping) – use nos.
- 3 (Change volume) – Ok
- 4 (Teletext) – tried BLUE, needed help to find TELETEXT button (NB on c4) – used nos. to navigate – went to index on 103 – told to go to 150 (to save time) – in TV guide used GREEN twice to get to BBC 2 programmes
- 5 (Subtitles) – told 888 – tried pressing GREEN to clear – told which button to use
- 6 (Exit) – pause, then correct button

**User Comments:**

Very similar to own TV in terms of ease of use – teletext unfamiliar, but not overly difficult

**STB2**

**PREAMBLE**

Which STB to buy? – STB1 clearer to read – STB2 harder to read and more technically complex

**Questions of shop assistant?** – price, guarantee, returns policy, service policy (whether at home or take it somewhere), current used and hence electricity consumption

Out of box – STB1 still

**INSTALLATION**

Self-install? – no – get it done professionally

Ease of installation – should be Ok from instructions

Have a go? – yes – difficulty connecting SCART and power cables

**SWITCH ON**

Switching on TV Ok – STB t/c difficulty finding POWER

Thought watching ??? – not obvious, one way or another
CHANGING CHANNELS AND VOLUME
Change channels – tried TV r/c first – then STB one
Changing volume – looked on STB r/c – could not find it – told to use TV r/c Going to channel 40 – typed in ‘26’ [aiming for 24?] – found ‘blue bar’ (describing channel) helpful – told 40
Going to 74 – prompted to use EPG – took a little while to find GUIDE button – used TEXT and called up BBCi – shown GUIDE button – used PR +/- Ok after prompt, but difficulty swapping to ÷/Ø – told to use OK (could not read it)
Channels of interest – “not really”
Not of interest –
Difficulty between no. push and channel change annoying
TELETEXT
Finding – told 9, used no.
Calling up – done
Finding weather – 7 + 5
Finding prog guide – long pause – pressed TEXT and thrown out – went into EPG – went back into Teletext – could not make the connection that BLUE = ‘control’ = ‘menu’
Exploring – pressed GREEN, not BLUE when prompted [colour blind?] – confused by screen menu – would prefer bigger buttons
Getting out of Teletext – pressed TV button – r/c stuck in TV mode – STB rebooted, but needed STB button pressing to ‘reactivate’ r/c
SUBTITLES
Had to be told to find MENU – took a while – through to subtitles page Ok – difficulty knowing how to switch on – difficulty controlling ÷/Ø, kept overshooting – difficulty exiting menu – told QUIT – difficulty finding QUIT
INTERACTIVE CONTENT
Calling up – told RED
Navigating – called up ‘menu’ Ok – difficulty with arrow keys again – navigated to targets Ok
Switching off – tried QUIT, told POWER
WRAP-UP
User comments:
Steep learning curve – should be better with familiarity – would take notes to help repeat steps – unfamiliar in comparison with own TV – r/c Ok, but additional DVD controls confusing

STB1
INSTALLATION
Instructions better than for STB2
SWITCH ON
Done
CHANGING CHANNELS AND VOLUME
Change channels – used TV r/c first – then Ok
Ch 40 – timed out to C4 – ended up trying PR – re-tried 40 and got there
Ch 74 via EPG – used BBCi instead – ‘what’s on’ – came out and in to EPG – typed 74 – went there
TELETEXT
Finding – told 9
Calling up – TEXT pressed Ok
Finding weather – 7 + 5
Finding prog guide – used ‘back’ and then 3
Difficulty remembering how to get out – used POWER
SUBTITLES
Finding – took a while to find SUBTITLES button, but easy to do once there
INTERACTIVE CONTENT
Calling up – told RED
Navigating – BLUE = ‘menu’ much clearer than = ‘control’ for Teletext – once in, scrolling etc. more straightforward than Teletext
WRAP-UP
User comments:
Much easier, possibly because of experience – r/c definitely easier than STB2 one
User 2

Capability profile

Locomotion – n/a
Reach and stretch – n/a
Dexterity – n/a
Seeing – n/a
Hearing – H8
Communication – n/a
Intellectual Function – n/a
[note – often forgets things, loses track in conversations, difficulty hearing]

Personal profile

Age – 82
Job – Yes – civil service
Watches – 1 to 2 hours
Own TV (6 years), w/screen, not sure when will replace
Likes – BBC1 & 2, history/drama – does not like gameshows
Own VCR, used for recording and playback – uses both codes and timer for recording
Teletext – seldom uses it, for weather when does
Switch over – knew about it, but not when – unsure whether her health will render the issue
important for her [NB – joke?!]
Is aerial OK for DTV? – does not know
Owns mobile phone? – no
Owns PC – no

Equipment trial

Analogue TV
0 – would normally use Radio Times – no comment on r/c layout, but recognised POWER
immediately
1 (Switch on) – tried POWER, told channel no.
2a (Change to ITV) – used no. button
2b (Channel hopping) – used nos.
3 (Change volume) – Ok, button +/- markings on VOL. not clear
4 (Teletext) – on to BBC – called up Teletext Ok – straight to weather by nos. – does not use
Teletext to find TV programmes, but still able to find it
5 (Subtitles) – Told 888, nos.
6 (Exit) – done
User Comments:
Much the same as own TV – slightly bigger r/c than own – nothing particularly difficult

STB1

PREAMBLE
Which STB to buy? – STB1 – box easier to read
Questions of shop assistant? – his opinion – what features, etc.
Out of box – no opinion – STB2 one has more buttons [but not clear if this is a good or bad thing]
INSTALLATION
Self-install? – no – get professional, even if has to pay
Ease of installation – looks Ok
Have a go? – no
SWITCH ON
Ok – thought watching digital – “picture looks better”
CHANGING CHANNELS AND VOLUME
Change channels – no. with correct r/c
Changing volume – done
Going to channel 40 – timed out to C4 – got there on 3rd attempt
Going to 74 – prompted to use EPG – difficulty mapping arrow keys to jumps – timed out again
Channels of interest – none, really
TELETEXT
Finding – told 9
Calling up – done without prompting
Finding weather – 7 + 5
Finding prog guide – initially no idea – after prompting to persevere found BLUE ‘control’ button
   – used TEXT to get out without prompt
SUBTITLES
Could not initially find SUBTITLE button, but once found straightforward – also liked new style
   subtitles (easier to read than analogue ones)
INTERACTIVE CONTENT
Calling up – no idea – told RED [NB – keeps forgetting SELECT, also button very small]
Navigating to weather – got temporarily lost – ended up in Scotland – could not connect on-
screen right with right arrow
WRAP-UP
User comments:
R/c too small, SELECT in particular, battery cover Ok, much the same as own TV, greater
button spacing on own r/c – would be better when accustomed to it

STB2
INSTALLATION
Harder to install than STB1 on initial skin of instructions
SWITCH ON
Could not find POWER – told – confused by DVD controls
CHANGING CHANNELS AND VOLUME
Change channels – Used nos. – did not find ‘blue bar’ useful
Ch 40 – straight there
Ch 74 via EPG – prompted to use EPG – not clear how to navigate it (confused between PR
   and Ø) – done with instruction – OK button not clear and problematic
TELETEXT
Finding – told 9
Calling up – pressed POWER to enter Teletext [obvious problem – turned box off]
Finding weather – 7 + 5
Finding prog guide – BLUE (‘control’) – Ok, but hesitant on SELECT (‘OK’ on this r/c)
Used TEXT to get out
SUBTITLES
Finding – no idea how
Told MENU, guessed ‘set-up’, told ‘languages’ (thought ‘TV set-up on 2nd level)
Could not see how to exit menu, told
INTERACTIVE CONTENT
Calling up – difficulty calling up BBCi (subtitles still on) [problem] – told RED
Navigating to weather – saw ‘menu’ on screen and pressed MENU [wrong] – not sure how to
   scroll between pages
Navigating to TV guide – difficulty over which MENU/’menu’
Pressed RED to exit [correct], but chosen by mistake
SWITCH OFF
Done
WRAP-UP
User comments:
Buttons too small, always having to change hands – STB1 easier – just easier to reach, less
hand-swapping – tendency to catch ‘other’ buttons if not careful – battery cover too stiff
to open

Digital Television for All – Appendix E
John Clarkson & Simeon Keates
User 3

Capability profile

Locomotion – L5
Reach and stretch – RS4
Dexterity – D5
Seeing – S9
Hearing – n/a
Communication – n/a
Intellectual Function – IF7

Personal profile

Age – 65-69
Job – Yes – making TVs
Reads newspaper? – Yes, Mirror
Watches – 2 to 4 hours
Own TV, no R/C, 15yrs old, not w/screen, replace when broken
Likes – history, animal and archaeology programmes
Owns VCR, husband does recording
Teletext – No
Switch over – “If it’s going to happen, then it’s going to happen. Cannot halt progress.”
Is aerial OK for DTV? – Don’t know
Doesn’t like the idea of too many channels – “By the time you get through 30 channels you’ve missed what you wanted to watch.”
Owns mobile phone? – No, but husband does – user doesn’t know how to use it, though
Likes – emergency use
Dislikes – no excuse not to answer
Owns PC – no, but one in son’s room – have tried to learn it, but gave up – memory not very good and so forgot from one lesson to another
Favourite hi-tech product – cordless phone – mobility
Least favourite – computers – “nemesis” – nothing’s sacred, lack of privacy

Equipment trial

Analogue TV

0 – R/C layout clear – teletext, vol, ch controls unfamiliar, though – would normally use newspaper TV guide to find out what’s on
1 (Switch on) – Done
2a (Change to ITV) – by no.
2b (Channel hopping) – by nos.
3 (Change volume) – done, guessed which, but Ok
4 (Teletext) – not on own television – unfamiliar – misread index initially, but figured it out and got to 400 typing nos. (for weather) – for TV guide went via sport pages – associated nos. to left of item on menu, not right, but got there in the end – [picked up the idea of interaction quickly]
5 (Subtitles) – told to go to p. 888 – by nos.
6 (Exit) – told which button, but would have guessed Teletext button again – switched off Ok

User Comments:
“Pretty easy, really” – buttons well spaced – good sized r/c to hold – no particular problems (apart from unfamiliarity with new buttons)

Observer’s comments:
Not bad for someone who does not ordinarily use an R/C for controlling the TV

STB1

PREAMBLE
Which STB to buy? – STB1 – box is clearer and easier to read
Questions of shop assistant? – ease of use – how many channels
Out of box – STB1, still – had heard of STB2 make, but not enough to persuade to buy it

INSTALLATION
Self-install? – no – get son to do it, or shop if free
Ease of installation – instructions Ok once read, not familiar with SCART, though
Have a go? – yes – installation procedure followed, Ok, but connections weak and loose
   [physical difficulties with connecting, not cognitive ones] – “won’t let me blow anything up, will you?”
SWITCH ON
Thought watching analogue
CHANGING CHANNELS AND VOLUME
Change channels – used nos.
Changing volume – wanted to use DTV remote
Going to channel 40 – confusion between which r/c to use – wanted to go to channel 24
   [confused by name ‘BBC News 24’] – called up EPG – needed help to use arrows and SELECT
Going to 74 – used nos., but kept timing out
Channels of interest – UK History
Not of interest – Holiday/fashion channels
TELETEXT
First response to use TV r/c
Navigation skipped – signal too weak
SUBTITLES
Found button Ok
Turned off Ok, but first tried CANCEL, told to use SUBTITLE button again
INTERACTIVE CONTENT
Calling up – Told to use RED button
Navigating – kept forgetting SELECT button – pop-up navigation not clear – user tried following on-screen instructions – found Weather page – skipped TV guide – switched off Ok
WRAP-UP
User comments:
“It’s not that bad” – r/c Ok – buttons clear – SELECT button harder, but Ok – “once you know what to do, it’s Ok. It’s easier than I expected.”

STB2
INSTALLATION
Instructions much worse than STB1
SWITCH ON
R/c control not as clear – “Don’t like it” – wanted to use TV button to switch on [NB – potential problem here with dual mode problem]
CHANGING CHANNELS AND VOLUME
Change channels – used nos.
Volume – skipped
Ch 40 – “no idea” how to get to BBC News 24 – tried arrow keys – told ‘40’ – used nos.
Ch 74 via EPG – used arrow keys to navigate EPG after prompt – told PR to speed up process [would not have guessed] – difficulty positioning highlight bar on target channel – difficulty remembering and pressing OK button – “that is dreadful”
TELETEXT
Finding – told to go to ch 9
Calling up – focussed on finding button on r/c, missed on-screen instructions – told ‘TEXT’
Finding weather – Ok [note – nos. on left for new Teletext, on right for analogue Teletext]
Finding prog guide – told to use BLUE and then how to navigate list [no feel at all for content structure and layout] – ‘jump’ and ‘control’ names misleading [on toolbar]
SUBTITLES
Finding – no idea – told MENU – guessed ‘set-up’ from options – told ‘languages’ for next level – would not have guessed – switching on subtitles took a long while to find ð/ö and kept overshooting – long time to find QUIT
INTERACTIVE CONTENT
Skipped because of time constraints
SWITCH OFF
Confusion because TV reverts to analogue
WRAP-UP
User comments:
STB1 much better – easier to read – STB2 not as clear – have to use 2 hands to operate – MUTE button unclear – STB2 battery cover too stiff, STB1 one Ok
User 4

Capability profile

Locomotion – L1
Reach and stretch – n/a
Dexterity – n/a
Seeing – S9 – needs reading specs
Hearing – n/a
Communication – n/a
Intellectual Function – n/a

Personal profile

Age – 80-84
Job – Yes – nursing sister
Reads newspaper? – Yes, everyday, Independent
Watches – > 4 hrs per day
Own TV, has R/C, not w/screen, had 8 years, will keep until it breaks
Likes – BBC1 and Ch4, but not vulgarity, enjoys series
Does not own VCR
Teletext – Yes – for news and what’s on – uses every day
Switch over – feels she’s too old to be bothered about it – wants to be able to choose whether
Is aerial OK for DTV? – don’t know
Owens mobile phone? – No [answered yes, but probably meant cordless phone]
Likes – useful
Dislikes – hard to hold to ear
Owens PC – no, “house is a computer-free zone”
Favourite hi-tech product – television – “it is company” [note lives on her own]
Least favourite – ‘loud’ music centres

Equipment trial

Analogue TV

0 – layout Ok – would normally use teletext to find out what’s on and then take notes
1 (Switch on) – done – told no. button
2a (Change to ITV) – done by no.
2b (Channel hopping) – by nos.
3 (Change volume) – done – straightforward
4 (Teletext) – found TELETEXT button Ok – difficulty reading list on screen [turns out she’d
forgotten her distance glasses] – then to p. 402 – “is Cambridge a UK city?” – straight to
631 by nos. for programme guide
5 (Subtitles) – told p. 888
6 (Exit) – used power on/off to exit teletext [note – facetious]
User Comments:
R/C very clear – comfortable size – buttons good

Observer’s comments:
No real difficulties observed

STB2

PREAMBLE

Which STB to buy? – STB2 – seems simpler and closer to NTL digital box [note – she did not
admit to owning DTV earlier…]
Questions of shop assistant? – would follow advice of son...
Out of box – STB2 again – still seems plain and simple
INSTALLATION
Self-install? – no – get it done professionally (even if have to pay) – or get son to do it
Ease of installation –
Have a go? – instructions too complicated – pay someone to do it
“R/C looks very pretty” quite good shape for holding
SWITCH ON
Tried using STB and TV buttons to switch on [potential mode problems] – found POWER button
Thought watching digital

**CHANGING CHANNELS AND VOLUME**

Change channels –
Changing volume –
Going to channel 40 – had to be told ‘40’ – used nos. to get there
Going to 74 – prompted to use EPG – told to use PR – could not figure out to swap to arrow
  keys

Channels of interest – UK History, QVC for “window-shopping”
Not of interest – Parliament

**TELETEXT**
Finding – had to be told ch. 9
Calling up – Done
Finding weather – ended up coming out of Teletext (ch. 6) – re-entered Teletext – found
  weather Ok
Finding prog guide – had to be told BLUE and then how to navigate – thought ‘user guide’ was
  ‘TV guide’ [change of language confusing]

**SUBTITLES**
Had to be told MENU, guessed ‘set-up’ Ok, but not ‘languages’ nor ↓/↑ - told arrow keys, but
  ↓/↑ too sensitive – QUIT button found (for leaving menu), but TV mode button had been
  pressed, so did not work

**INTERACTIVE CONTENT**
Calling up – had to be told RED
Navigating (weather) – went to ‘help’ – eventually found way through – had difficulty with
  Ω / Ø, kept overshooting
Navigating (TV guide) – thought it would be under ‘entertainment’

**WRAP-UP**
User comments:
With the R/C being white it was not clear to see the buttons, etc. Colours indistinct
STB1

INSTALLATION
Instructions more readable than for the STB2, but still not inclined to install by self
“get a little man in”

SWITCH ON
Switched on with no prompt
Green bulb on front of STB a bit faint – hard to tell when on
Guessed watching DIGITAL

CHANGING CHANNELS AND VOLUME
Change channels – used no. 3 to get straight to ITV
Volume – wanted to change using DTV remote (✓/✓), told to use TV one – swapped to TV r/c
and then tried using PR – then confused
Ch 40 – timed out trying to type ‘4 + 0’ – difficulty finding ‘0’ [note – non-standard layout –
also user can see the writing on this r/c] – 3rd attempt successful – “can see the writing on
this one”
Ch 74 via EPG – called up EPG after prompt (tried INFO first) – typed in ‘74’ – then timed out –
re-entered, told SELECT, could not find it, told where on r/c – user expressed preference for
single arrow key set

TELETEXT
Finding – straight to ch 9
Calling up – done, after prompt
Finding weather – 7 + 5
Finding prog guide – prompted ‘colour’, found BLUE – pressed Ø instead of ‘Ø’ [note –
common problem trying to figure out which arrow key translates to which direction on the
screen] – told SELECT – got out of EPG with prompting

SUBTITLES
Finding – straight to button
This r/c “more like NTL”

INTERACTIVE CONTENT
Calling up – told RED
Navigating to weather – found BLUE (wanted to try ‘HELP’) – [note – help seems like a double-
edge sword – when it’s offered the users seem to view it as a catch-all] – pressed SELECT
too early and ended up in ‘news’ – had to be told YELLOW to get back, then to ‘weather’ –
had to be told SELECT
Navigating to prog guide – ‘what’s on’ not a clear name

SWITCH OFF
Done

WRAP-UP
User comments:
Quite enjoyed it – preferred STB1 to STB2 – STB1 more comfortable – STB1 battery cover Ok,
STB2 not
User 5

Capability profile

Locomotion – n/a
Reach and stretch – RS8
Dexterity – n/a
Seeing – n/a
Hearing – H7
Communication – n/a
Intellectual Function – IF2

Personal profile

Age – 69
Job – Yes - clergyman
Reads newspaper? – Daily Telegraph
Watches – 1 to 2 hours
Own TV, R/C, not w/screen, replace when broken
Likes – BBC1, BBC2, ITV, historical, drama, soaps
Owns VCR, used primarily for recording
Teletext – yes – for weather, TV guide, travel
Switch over – “government always changes their ideas”
Is aerial OK for DTV? – yes
Has STB (Panasonic) – difficulties with instructions, aerial, connecting to video
Owns mobile phone? – yes
Likes – emergency access, house-hunting
Dislikes –
Favourite hi-tech product – computer – communication
Least favourite – telephone system – not working properly

Equipment trial

Analogue TV
0 – finds programmes using Daily Telegraph supplement, unless digital only, when uses EPG – r/c too large
1 (Switch on) – POWER button – told CH
2a (Change to ITV) – used PR, hardly ever uses nos.
2b (Channel hopping) – PR button
3 (Change volume) – done – button sensitive
4 (Teletext) – TELETEXT button Ok – r/c sensitive again – used PR to change pages
(experienced user) – found weather – for TV guide came out of teletext, back in and through p 100
5 (Subtitles) – knew 888 and cleared Ok
6 (Exit) – POWER

User Comments:
Too many buttons on own remote (only uses 6 of them) – button sensitivity on this r/c – VOL + /– not clearly visible – dot for blind users too low

STB2

PREAMBLE
Which STB to buy? – STB2 – more info on box, seems more useful – STB2 seems to offer more channels (no BBC ones marked on STB1 packaging) – “probably because of name”
Questions of shop assistant? – how easy to connect to other TV bits – ease of set-up and use
Out of box – STB1 (STB2 “very Germanic”)

INSTALLATION
Self-install? – Yes
Ease of installation – ‘Quick set-up’ instructions clear – main instructions too complex for need – “one set-up is not what I’ve got, though” [does not address user’s own situation at home]
Have a go? – Yes – some difficulty finding slots, but generally Ok

SWITCH ON
R/c over-fussy – grey on grey not clear – no need for “video” buttons [Note – actually DVD ones]

POWER straight away
Thought watching digital – much clearer than analogue

CHANGING CHANNELS AND VOLUME
Change channels – tried MENU for GUIDE – used PR again
Going to channel 40 – called up EPG – used Ø/× – told PR – knew to press OK button, but did not recognise it – great difficulty opening battery cover – would not have chosen this STB if had seen r/c first
Going to 74 – done
Channels of interest – News 24, children’s channels, UK History, C5 [difficult to receive through analogue in Cambridge]
Not of interest – radio, travel, shopping, ‘music’

TELETEXT
Finding – went to 9 Ok
Calling up – text
Finding weather – 7 – ‘19’ [note – temp in Cambridge that day]- then 5
Finding prog guide – went ‘back’ then 3 – where ‘next’ seems illogical – ‘control’ guessed Ok, but commented ‘control’ not a good name – also ‘back’ not clear where to – note: overshot occasionally when scrolling in menus
Used PR to get out of Teletext

SUBTITLES
Would have guessed STB button – told MENU – guessed ‘set-up’, but not ‘languages – figured out Ø/× and how to quit

INTERACTIVE CONTENT
Calling up – told RED
Navigating to weather – got to weather, but almost pressed wrong MENU button
Navigating to TV prog guide – found after exiting and re-entering
Tried using QUIT to switch off the STB [should be POWER]

WRAP-UP
User comments:
Layout of r/c too fiddly – no need for “video” (sic) controls [meant DVD] – PR feature good on EPG – prefers Fastext buttons at bottom of r/c and also remove unnecessary buttons – fonts starting to get too small to read on r/c
STB1

INSTALLATION
Lack of 2nd SCART connector a problem
Straightforward installation, though – STB1 easier to do, but both Ok

SWITCH ON
Done (green light not very bright) – much clearer r/c than STB2, especially the arrows – much
closer to own r/c – bit tight on spacing, though – also uses upper case lettering, but finds
lower case easier to read

CHANGING CHANNELS AND VOLUME
Change channels – not immediately clear how to channel hop (no PR)
Volume – guessed × ÷ to change (changed channel instead)
Ch 40 – went to EPG – then straight to 40 – SELECT button too small
Ch 74 via EPG – preferred PR feature on STB2 – choosing EPG, GUIDE: red or button below,
not clear on r/c – would like more info on screen
Distinction between radio and TV on EPG poor – switched back from 9 to World Service for no
obvious reason

TELETEXT
Finding – reminded 9
Calling up – straight in – confused by ‘loading’ time though
Navigating – Ok, good control – difficulty getting out, though – no instructions on how to do
this – went out through ‘TV navigator’

SUBTITLES
Finding – Straight to button

INTERACTIVE CONTENT
Calling up – Ok
Navigating – Ok

SWITCH OFF

WRAP-UP
User comments:
Much clearer than STB2 (“much clearer”, “much simpler”)– difficult getting out of Teletext –
unexplained buttons (e.g. SWAP, WIDE) – much easier having single set of arrow keys –
preferred in conjunction with ‘favourites’ programming option
Observer’s comments:
Had no idea of system view – does not appreciate difference between STB content and channel
content
**User 6**

**Capability profile**

<table>
<thead>
<tr>
<th>Category</th>
<th>Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locomotion</td>
<td>n/a</td>
</tr>
<tr>
<td>Reach and stretch</td>
<td>n/a</td>
</tr>
<tr>
<td>Dexterity</td>
<td>n/a</td>
</tr>
<tr>
<td>Seeing</td>
<td>n/a</td>
</tr>
<tr>
<td>Hearing</td>
<td>n/a</td>
</tr>
<tr>
<td>Communication</td>
<td>n/a</td>
</tr>
<tr>
<td>Intellectual Function</td>
<td>IF2</td>
</tr>
</tbody>
</table>

**Personal profile**

- **Age**: 62
- **Job**: deputy head teacher
- **Reads newspaper?**: local newspaper
- **Watches**: 1 to 2 hours
- **Own TV, R/C, not w/screen, replace in 5 years with plasma screen**
- **Likes**: documentaries, historical, tennis, news
- **Owns VCR, primarily for recording (husband does it)**
- **Teletext**: yes – tennis, weather, news
- **Switch over**: good thing
- **Is aerial OK for DTV?**: yes
- **Owns STB, installed by shop**
- **Likes quality of picture, dislikes not being able to watch in the bedroom**
- **Owns mobile phone?**: yes
- **Likes**: simple, wonderful, personal security
- **Dislikes**: 
- **Owns PC**: yes – data handling, e-mail, etc. web-surfing for family history, etc., Encarta
- **Favourite hi-tech product**: television and VCR
- **Least favourite**: computer – too complex

**Equipment trial**

**Analogue TV**

- **0 – r/c too long – would use Radio Times or EPG**
- **1 (Switch on)** – POWER no – used PR +/-, Ok
- **2a (Change to ITV)** – no.
- **2b (Channel hopping)** – nos.
- **3 (Change volume)** – done
- **4 (Teletext)** – (r/c buttons too small) – 400 to 402 by nos. – 600 by nos.
- **5 (Subtitles)** – p.100 to 888 – Ok
- **6 (Exit)** – Ok

**User Comments:**

- Very similar to own – orientation of PR and VOL different (vertical not horizontal) – buttons smaller than own r/c, but r/c bigger in size

**STB1**

**PREAMBLE**

Which STB to buy? – STB2 (brand) – but if not brand, then STB1 – STB2 seems to do more and also says ‘easy to use’ (liked this phrase)

Questions of shop assistant? – channels, reception, picture quality, installation, after-sales service

Out of box – STB1 – more rounded

**INSTALLATION**

- Self-install? – no – get husband to do it, or else shop
- Ease of installation – automatically assumed it is going to be difficult – understood most of the instructions, but not the technical info (e.g. what is a SCART cable?)

Have a go? – yes – done – difficulty knowing which end of UHF cable to connect to TV / STB

[Note – connection to VCR a functionality issue for this user, as for user 5]

**SWITCH ON**
R/c similar in size to one at home, but black instead of white
Thought watching digital – liked better picture quality

CHANGING CHANNELS AND VOLUME
Change channels – done - no.

Changing volume – wanted to use $\Delta$/$\nabla$ first, then $\approx$/$\approx$, then realised TV r/c – kept mistaking + for – on VOL [use of arrow buttons causing difficulty]
Going to channel 40 – hunted for it – told 40 – timed out onto C4 – got it 2nd time
Going to 74 – prompted to use EPG – called up Ok – not clear how to navigate and especially how to use SELECT – also thought that press and hold would work, rather than having to v/v/v/v/...
Channels of interest – News channels, UK History, Cbeebies (for grandchildren), travel guides
Not of interest – shopping

TELETEXT
Finding – told 9 – did not know (despite owning an STB)
Calling up – tried analogue r/c and then RED to get in
Finding weather – not clear which way $\Delta$/$\nabla$ goes in 1/3 to 3/3 etc. – guessed BLUE after prompting – “like a computer” – through BLUE then 5
Finding prog guide – done – through BLUE
Having problem with using 2 r/cs – would like step-by-step guide
Getting out of Teletext difficult – went to 9, YELLOW to get to TV (wrong) – pressed analogue TEXT CLEAR button – ended up in analogue TV – confused about how to get back – got back (after prompting) – no idea how to exit – used POWER

SUBTITLES
Did not spot subtitles button initially, wanted to try GUIDE – “too much grey on r/c, but lovely to handle, though” – buttons a but small, but easier than the (Sony) TV one – SUBTITLE operation Ok once button found

INTERACTIVE CONTENT
Calling up – told RED
Navigating to weather – straight to ‘menu’ – down to ‘weather’ – prompted to SELECT – wanted to press 2 to get to p. 2 of 5 – thought page would update itself (and scroll through) – used $\Delta$/$\nabla$ Ok
Navigating to TV guide – done
Used RED to get out of BBCi (after pause)

WRAP-UP
User comments:
Would like just 1 r/c to deal with – given practice would be Ok – would like to see different colours used for different bits of the r/c – eye drawn to Fastext buttons, but they are not the most important – r/c nice weight but would prefer bigger buttons
**STB2**

Words too small on r/c – not as clear as STB1 – unsure about DVD buttons on r/c  

**INSTALLATION**  
No comparison with STB1 – put off by diagram – no diagram of the bits – “looks like something from school”

**SWITCH ON**  
Found POWER Ok  

**CHANGING CHANNELS AND VOLUME**  
Change channels – used no. – thought pause a bit long before channel appearing  
Ch 40 – nos. – timed out  
Ch 74 via EPG – prompted to use EPG – STB1 EPG preferred – TV picture in top corner  
“irritating” – used #/8 to change – keeps going wrong way – told PR, but preferred just one way of doing it – could not read ‘OK’ on r/c

**TELETEXT**  
Finding – told 9  
Calling up – done  
Finding weather – done  
Finding prog guide – done  

**SUBTITLES**  
Finding – told MENU – guessed ‘service list’ (not ‘set-up’) – unsure between ‘language’ and ‘TV set-up’ – guessed into ‘languages’ – not sure how to switch subtitles on – prompted – not sure how to exit, saw QUIT on screen and thought it was selectable (on-screen) – finally found on r/c – user commented that it was on the ‘wrong’ side of r/c

**INTERACTIVE CONTENT**  
Calling up – as for STB1  
Navigating – as for STB1  

**SWITCH OFF**  
Done  

**WRAP-UP**  
User comments:  
Preferred STB1, clearer – OK button very poor, too difficult to read – nicer button action, though – r/c too heavy, but nice size – found getting out of Teletext too difficult – STB1 battery cover Ok, STB2 too stiff to open
User 7

Capability profile

Locomotion – n/a
Reach and stretch – n/a
Dexterity – n/a
Seeing – n/a
Hearing – H7
Communication – n/a
Intellectual Function – n/a

Personal profile

Age – 61
Job – deputy head teacher
Reads newspaper? – Times, Sunday Times, Daily Mail
Watches – >4 hours
Own TV (rented), R/C, w/screen, replace every 2/3 years
Has Sky – professionally installed
Likes – arts, news, shopping, sports, movies
Owns VCR + DVD, records lots of things
Teletext – yes – TV programme guide, travel, weather, subtitles
Switch over – bit soon, doesn’t think people should be forced to change
Is aerial OK for DTV? – n/a
Owns mobile phone? – yes
Likes – instant response of buttons
Dislikes – continual need to charge
Owns PC – yes – frequent web-surfing (shopping), research
Favourite hi-tech product – television
Least favourite – n/a

Equipment trial

Analogue TV

0 – thought layout too simple – “does it do everything?” – likes all-in-one r/cs – bit big
Uses Culture and Radio Times to find programmes, then TV
1 (Switch on) – wanted to use POWER, told 1
2a (Change to ITV) – by no.
2b (Channel hopping) – by nos.
3 (Change volume) – done
4 (Teletext) – done – by nos. and Fastext buttons
5 (Subtitles) – straight to 888 and cleared Ok
6 (Exit) – done
User Comments:
Sony r/c much simpler than own (also has VCR controls) – too much blank area at base – too chunky – prefer colour PR buttons

STB1

PREAMBLE
Which STB to buy? – STB1 looks nicer – blue on blue text gets lost a bit (STB2)
Questions of shop assistant? – How easy to use – how to hook up to VCR – recording and viewing different channels, supports VideoPlus
Out of box – STB1 more subtle, doesn’t dominate (unlike STB2)
INSTALLATION
Self-install? – prefer professional, but not if charged
Ease of installation – doesn’t like picture instructions generally
Have a go? – yes – no real difficulty
SWITCH ON
Likes r/c – nice shape and size – layout clear – likes mute position – green light not very clear on STB
Thought watching digital
CHANGING CHANNELS AND VOLUME
Change channels – by no.
Changing volume – done – “bit of a bind, especially for speed” (e.g. recording)
Going to channel 40 – tried INFO first – found EPG - Ø/Ø Ok – finding channel a bind – EPG
timed out too quickly
Going to 74 – nos. – timed out – 3rd attempt
Channels of interest – News, auction, radio, Travelshop, UK History
Not of interest –
TELETEXT
Finding – prompted 9
Calling up – wanted to use Ø/Ø
Finding weather – 7 then 5, but not clear TV responding to 7
Finding prog guide – figured out BLUE – “Select” better name for control – BACK, guessed to
weather, actually to HOME, then from there by no.
Difficulty getting out – tried through Navigator – didn’t respond – told Text – exited – then
pressed Text again and re-entered
SUBTITLES
Found button Ok
Turned off Ok
INTERACTIVE CONTENT
Calling up – thought GUIDE – told RED
Navigating to weather – no problems, but Ø/Ø problematic (confusion between up and down)
WRAP-UP
User comments:
Didn’t like using 2 r/cs – liked Teletext layout, but not glitches – misses nos. for access and
index – prefers Sky r/c, but occasionally gets confused between modes – had to phone up
to find out how to use EPG – finds ’Teletext’ on Sky difficult, but this one was better

STB2
INSTALLATION
Instructions “fairly clear” – ‘RF’ uncertain – Quick start doesn’t show how to connect phonos –
Full guide text too small
SWITCH ON
“Snazzy” r/c – shape not as good – looks confusing – may need to read book – poor contrast –
doesn’t like DVD controls, would prefer VCR
Switch on – wanted to try TV, then POWER [didn’t work – wrong mode] – tried STB [still not
work] – then POWER [worked, but by luck]
CHANGING CHANNELS AND VOLUME
Change channels –
Volume –
Ch 40 –
Ch 40 via EPG – couldn’t find GUIDE – “should be coloured“ – prefers this EPG – not clear how
to PG UP/DN – ended up on 45 – tried to get back, ended up on BBCi channel – couldn’t
get out – PG UP/DN overly sensitive (kept overshooting)
TELETEXT
Skipped (time)
SUBTITLES (switching off in this case)
[Note: kept being confused between TV and STB modes]
Finding – tried TEXT, then TV, QUIT, dismissed MENU – told MENU – guessed SET-UP – “not
Languages” – told – tried QUIT [came out of menu] – back in- tried OK – couldn’t find Ø/Ø
INTERACTIVE CONTENT
Skipped (time)
SWITCH OFF
WRAP-UP
User comments:
Nice r/c, but kept finding use confusing – prefer 10 progs on EPG, not 5 – channel info not
needed – battery cover confusing and difficult
Observer’s comments:
Lots of mental model problems, even though experience DTV-er
User 8

Capability profile

Locomotion – n/a
Reach and stretch – n/a
Dexterity – n/a
Seeing – n/a
Hearing – n/a
Communication – n/a
Intellectual Function – n/a

Personal profile

Age – 65-69
Job – Computer manager
Reads newspaper? – Times
Watches – 1 to 2 hours
Own TV, R/C, 1 yr old, w/screen, iDTV
Likes – BBC, history, factual
Owns VCR and DVD - recording
Teletext – yes – news, weather, sports results
Switch over – not particularly interested, but concerned about 2nd TVs
Is aerial OK for DTV? – yes
Owns iDTV – likes bigger, clearer picture – dislikes page freezes, little difference in programming, time to load text
Owns mobile phone? – yes
Likes – efficiency, messages
Dislikes – cumbersome, poor reception
Owns PC – yes – accounting, Word, e-mail – surfs web occasionally for medical info and travel
Favourite hi-tech product –
Least favourite – mobile telephone

Equipment trial

Analogue TV
0 – find progs through Radio Times or analogue teletext – r/c/ too big – numeric buttons Ok
1 (Switch on) – POWER – told 1
2a (Change to ITV) – no.
2b (Channel hopping) – nos.
3 (Change volume) – done – likes VOL button
4 (Teletext) – called up Ok, straight to 402 and 601 by nos.
5 (Subtitles) – straight to 888, told CLEAR, wanted to use TEXT again
6 (Exit) – done
User Comments:
Big r/c – cumbersome – too few functions – would use reverse – too heavy

STB2

PREAMBLE
Which STB to buy? – STB1, nicer presentation and box shape – STB2 appear to do offer more, but too much information on box
Questions of shop assistant? – what advantages over each other – e.g. ease of use, connectability, quality
Out of box – STB1, still – STB2 plain
INSTALLATION
Self-install? – no – shop (insist on free installation)
Ease of installation – instructions seem Ok
Have a go? – yes – some problems (UHF wrong way round, TV not same as diagram)
SWITCH ON
Lighter, more tactile r/c than Sony one – pause then POWER – needed 2 hands
Thought watching digital
CHANGING CHANNELS AND VOLUME
Change channels – by no.
Changing volume – first DTV, then TV r/c
Going to channel 40 – needed glasses to read r/c – knew 40, timed out to C4 – got there 3rd attempt

Going to 74 – wanted to press MENU, told GUIDE – pressed PR, forgot 9/0 for in page changes – couldn’t read OK
Channels of interest – 1, 2, 4, 5, History
Not of interest – shopping, travel, pop music
TELETEXT
Finding – told 9
Calling up – TEXT
Finding weather – 7 then 19 [temp] then 5
Finding prog guide – guessed BLUE = menu, got there through pop-up – wanted to use QUIT to exit – told TEXT, then 1

SUBTITLES
INTERACTIVE CONTENT
Calling up – told and pressed RED
Navigating – Ok, kept overshooting with 9/0
Wanted to use QUIT to exit (like Teletext) – told RED

WRAP-UP
User comments:
Better than own TV – seems to offer more functionality [later discovered own TV did most of this] – buttons too sensitive – r/c nice weight – difficult to find what’s what on r/c

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STB1

INSTALLATION
R/c better than STB2 – buttons better size and clearer
Instructions better than STB2 – clearer and step-by-step – pictures useful
SWITCH ON
Done

CHANGING CHANNELS AND VOLUME
Change channels – no.
Ch 40 – EPG – pressed SELECT Ok
TELETEXT
Finding – remembered 9
Calling up – TEXT
Finding weather – 7 + 5
Finding prog guide – skipped
TEXT out
SUBTITLES
Finding – spotted button – liked it
INTERACTIVE CONTENT
Calling up – forgot RED
Navigating – used RED to get out Ok
SWITCH OFF
Done
WRAP-UP
User comments:
Preferred STB1 – buttons better size, shape – subtitle button good – as many functions as STB2?
User 9

Capability profile

Locomotion – L1
Reach and stretch – RS9
Dexterity – D5
Seeing – n/a
Hearing – n/a
Communication – n/a
Intellectual Function – n/a

[qquite severely impaired, use of only 1 hand (other severe arthritis), needs 2 pairs of glasses]

Personal profile

Age – 60
Job – assistant curator
Reads newspaper? – Times
Watches – 2 to 4+ hours
Own TV, R/C, not w/screen
Likes – STB3 News, sports, detective
Owns VCR, for playback, not recording
Teletext – yes - occasionally
Switch over – wait until free from the government – won’t buy the box now [note – but has
access to some Sky channels already through analogue cable]
Is aerial OK for DTV? – don’t know
Owns mobile phone? – yes
Likes – use in bed, calling carer, emergencies
Dislikes – expensive
Owns PC – yes – Internet access, e-mails, writing
Favourite hi-tech product – computer – use it to keep in touch with people
Least favourite – n/a

Equipment trial

Analogue TV

0 – r/c layout clear – uses Culture
1 (Switch on) – wanted to use POWER
2a (Change to ITV) – no. 3
2b (Channel hopping) – would normally use EPG on cable
3 (Change volume) – done
4 (Teletext) – told TEXT (on ITV) – told Index – couldn’t see weather – told 150 – difficulty
pressing nos. – used nos. to navigate – difficulty reading – prefers Fastext
5 (Subtitles) – told 888 and CLEAR
6 (Exit) – done
User Comments:
R/c too big – difficulty with left-handed use and pressing buttons that are too close together

STB1

PREAMBLE
Which STB to buy? – neither – government going to give them out for free – if had to, then
STB1
Questions of shop assistant? – could I watch Satellite? Freeview?
Out of box – STB1
INSTALLATION
Self-install? – no – would pay shop
Ease of installation – instructions look like they provide good explanation – likes diagrams –
should be straightforward to connect
Have a go? – no (one-handed wheelchair user)
SWITCH ON
TV r/c Ok – DTV r/c, difficulty finding POWER
Thought watching ??? – not clear
CHANGING CHANNELS AND VOLUME
Change channels – no. 3 (difficulty reading r/c w/o reading glasses, but only use of 1 hand)
Changing volume – prefers single r/c – likes STB1 r/c size, but nos. too small
Going to channel 40 – timed out [tendency to press + check + find + press + check]
Going to 74 – prompted EPG – told GUIDE, v, SELECT
Channels of interest – News, UK History
Not of interest – shopping, holidays
TELETEXT
Finding – told 9
Calling up – pressed BLUE [couldn’t read instructions?]
Finding weather – straight to BLUE and to weather
Finding prog guide – tried BACK, ended up still in weather – then BACK to main index, overshot
– iteration – eventually 3 after prompt
Told TEXT to exit
SUBTITLES
Found button Ok [NB swapping glasses]
INTERACTIVE CONTENT
Calling up – told RED
Navigating to weather – straight to BLUE – navigation and SELECT Ok [note tried 2 to get to
page 2 of 5, instead of v]
Navigating to TV guide – straight to BLUE and ‘what’s on’
WRAP-UP
User comments:
Own TV r/c a bit smaller than Sony and buttons & nos. bigger
Observer’s comments:
Difficulty in trade-off of r/c – wants big buttons, but small r/c

STB2
INSTALLATION
STB2 instructions “a nightmare” – STB1 ones clearer
SWITCH ON
R/c looks a bit clearer – would use reading glasses to memorise
Switched on Ok
CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Volume – wanted to use DTV
Ch 40 – done – learned to be quick
Ch 74 via EPG – difficulty with glasses – prefers this EPG (colour scheme and thumbnail
picture) – liked PR – couldn’t find OK, though – told
TELETEXT
Finding – told 9
Calling up – couldn’t find TEXT, rest skipped
SUBTITLES
Finding – told MENU – didn’t like GUIDE and MENU names – guessed ‘Service list’ and
‘Languages’ – navigation Ok – told OK, though – switching on, told $\Rightarrow$/ (but didn’t ‘get’
$\Rightarrow$/) – found QUIT to get out
Switched everything off when asked to switch off subtitles...
INTERACTIVE CONTENT
Skipped
SWITCH OFF
Done
WRAP-UP
User comments:
Nos. a bit clearer on white r/c, but preferred STB1 one (bit clearer what to do)
User 10

Capability profile

Locomotion – n/a
Reach and stretch – n/a
Dexterity – n/a
Seeing – n/a
Hearing – n/a
Communication – n/a
Intellectual Function – n/a

[Note – only 1 eye]

Personal profile

Age – 70-74
Job – nurse
Reads newspaper? – Daily Mail
Watches – 2 to 4 hrs
Own TV, R/C, w/screen
Likes – BBC1, ITV, soaps
Owns VCR, recording and playback
Teletext – no
Switch over – not happy about it – may not be here to worry about it
Is aerial OK for DTV? – no, it cannot
Owns mobile phone? – yes
Likes – emergencies, ease of use
Dislikes – n/a
Owns PC – no – use electronic word processor
Favourite hi-tech product – nothing in particular – not technically-minded – “I like practical things”
Least favourite –

Equipment trial

Analogue TV

0 – r/c/ same size as own – clear layout – uses Mail on Saturday guide
1 (Switch on) – told 1 – didn’t work first time – done by observer
2a (Change to ITV) – no. 3
2b (Channel hopping) – go to ‘Guide’
3 (Change volume) – done
4 (Teletext) – difficulty pressing TEXT – had to use nail to push in
5 (Subtitles) – told 888
6 (Exit) – done

User Comments:
Home one easier to operate and slightly easier to read – prefers simplicity

STB2

PREAMBLE
Which STB to buy? – STB2 very similar in appearance to own VCR – STB1 looks completely new and unfamiliar
Questions of shop assistant? – Cost – functionality – would go to local shop (tried and trusted)
Out of box – STB2 still – “good make”

INSTALLATION
Self-install? – no – shop or son-in-law
Ease of installation – Instructions Ok
Have a go? – no

SWITCH ON
R/c frightening/overwhelming – needs learning – requires too much dexterity – would like bigger r/c

Switching on – TV on by observer [POWER problematic – hand shielding r/c IR port]
Thought watching ??? – couldn’t see any difference

CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Changing volume – 2 r/cs “too complicated”
Going to channel 40 – straight there (40)
Going to 74 – prompted EPG – Told PR and ÷/Ø – guessed OK (didn’t see it)
Channels of interest – UK History, BBC Parliament
Not of interest – shopping, news
TELETEXT
Finding – told 9
Calling up – wanted to use Fastext colours – didn’t see “Press Text” instruction – told
Finding weather – 7 – then wanted 18, but realised 5 [real difficulty pressing buttons]
on screen but OK on r/c
SUBTITLES
Told MENU – guessed ‘service list’ and either ‘technical info’ or ‘TV set-up’ – told ÷/Ø - got
QUIT
INTERACTIVE CONTENT
Calling up – told RED [confusion between ‘menu’/MENU buttons]
Navigating to weather – done – [Ø and OK too close]
Exiting – wanted to QUIT or BLUE – told RED [despite on-screen instructions]
WRAP-UP
User comments:
Frightening – didn’t like it – too confusing – no time to spend learning it

STB1
INSTALLATION
Buttons clearer than STB2, but still too small
STB1 instructions “seem more complex”
SWITCH ON
Done
CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Ch 40 – timed out – 3rd time using both hands
Ch 74 via EPG – told GUIDE, pressed RED – told ÷/Ø, otherwise navigation Ok – SELECT too
small
TELETEXT
Finding – told 9
Calling up – told TEXT – found button Ok
Finding weather – skipped
Finding prog guide – skipped
SUBTITLES
Finding – Ok
INTERACTIVE CONTENT
Calling up – skipped
SWITCH OFF
WRAP-UP
User comments:
Much better than STB2, clearer, etc. – but still buttons are too small
User 11

Capability profile

Locomotion – n/a
Reach and stretch – RS5
Dexterity – D5
Seeing – S9
Hearing – H8
Communication – n/a
Intellectual Function – n/a

Personal profile

Age – 70-74
Job – nursery nurse
Reads newspaper? – no
Watches – >4 hours [doesn’t always watch it – has it on]
Own TV, R/C, not w/screen
Likes – ITV, BBC1, wildlife, archaeology, soaps, etc.
Owns VCR, playback and recording
Teletext – no – doesn’t have it
Switch over – have to do what you have to do – “if I’m still here”
Is aerial OK for DTV? – doesn’t know
Owns mobile phone? – no
Owns PC – no
Favourite hi-tech product – just TV and VCR
Least favourite – “cannot think of one”

Equipment trial

Analogue TV

0 – normally use Radio Times
1 (Switch on) – done
2a (Change to ITV) – no. 3 [difficulty pressing button and getting push recognised – r/c angle too high]
2b (Channel hopping) – nos.
3 (Change volume) – done
4 (Teletext) – told TEXT – found 400 – never used teletext before, but know what it is there for
5 (Subtitles) – Told 888 - done
6 (Exit) – done (red power switch on own r/c)
User Comments:
About the same as own r/c – bigger than own one – no real preference between the 2 – quite good button spacing – sometimes gets wrong button on own r/c

STB2

PREAMBLE
Which STB to buy? – STB2 – brand
Questions of shop assistant? – not sure – is it easy to use – what would they recommend – which is better value
Out of box – STB1 aesthetically – shape
INSTALLATION
Self-install? – no – shop, even if charged
Ease of installation – should be Ok
Have a go? – No
SWITCH ON
TV switched on Ok, but r/c still pointing high – would prefer STB r/c POWER to say ON/OFF or something similar
Thought watching digital – picture bit clearer
CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Changing volume – done – but wanted to use DTV r/c
Going to channel 40 – done (without time-out)
Going to 74 – prompted EPG – told GUIDE – no idea how to navigate at all – difficulty even when told
Channels of interest – news, shopping, food, history
Not of interest – Parliament, pop music – travel shops

TELETEXT
Finding – told 9
Calling up – TEXT
Finding weather – 7 + 5
Finding prog guide – menu difficult to understand, but not to navigate

SUBTITLES
told ⊗/⊘ - told QUIT – shown QUIT – “subtitles clearer” – turned off by facilitator

INTERACTIVE CONTENT
Calling up – told RED
Navigating – Pressed MENU [mix-up with BLUE] – told ⊗/⊘
Wanted to press TV to get out of BBCi [mode problem again]

WRAP-UP
User comments:
Need more practice – r/c quite easy to use, despite buttons being close together – shouldn’t bee difficult “once you get to know it”

STB1
INSTALLATION
STB2 instructions look easier – STB1 seems more complicated – pictures don’t help

SWITCH ON
Done – easier than STB2

CHANGING CHANNELS AND VOLUME
Change channels – no.
Ch 40 – nos. – no time-out
Ch 74 via EPG – prompted GUIDE – EPG timed out – told SELECT
[OK on STB2 has different function to OK on own VCR r/c]

TELETEXT
Finding – told 9
Calling up – TEXT Ok
Finding weather – 7 + 5
Finding prog guide – pressed GUIDE and came out of Teletext – but then back in after EPG time-out

SUBTITLES
Finding – wanted to use GUIDE or SELECT – SUBTITLE pointed out – used Ok

INTERACTIVE CONTENT
Calling up – told RED
Navigating to weather – skipped
Navigating to TV guide – guessed BLUE and ‘what’s on’ – reminded SELECT, reminded ⊗/⊘

SWITCH OFF
Done

WRAP-UP
User comments:
STB1 better than STB2 – would buy it – nothing too difficult once you get to know it – felt getting a better feel and understanding
User 12

Capability profile

Locomotion – L1
Reach and stretch – n/a
Dexterity – n/a
Seeing – S9
Hearing – n/a
Communication – n/a
Intellectual Function – IF 5

Personal profile

Age – 70-74
Job – electronics
Reads newspaper? – no [eyes not so good]
Watches – >4 hours
Own TV, R/C, not w/screen
Likes – nature, Countdown, soaps, Proms, news
No VCR
Teletext – yes – news, weather
Switch over – “if it has to come, it has to come. We cannot change that – have no choice in the matter”
Is aerial OK for DTV? – don’t know
Owns mobile phone? – yes
Likes – can be passed to her
Dislikes – buttons too close together (uses a pen or pencil to push numbers)
Owns PC – no
Favourite hi-tech product – doesn’t have one
Least favourite – doesn’t have one

Equipment trial

Analogue TV

0 – r/c buttons clear, but “too flat” – gets prog info through teletext
1 [Switch on] – done [buttons difficult to press]
2a (Change to ITV) – no. 3
2b (Channel hopping) – nos.
3 (Change volume) – done, but slowly
[moved closer to screen – wearing reading glasses only – own r/c has controls at the bottom (easier to handle) – r/c too long]
4 (Teletext) – TEXT Ok – found 400
5 (Subtitles) – told 888 – done
6 (Exit) – done
User Comments:
Prefer own because r/c too long

STB2

PREAMBLE
Which STB to buy? – STB2 – brand
Questions of shop assistant? – not sure because doesn’t know enough about them
Out of box – STB2 – looks more elegant

INSTALLATION
Self-install? – no – shop
Ease of installation – wouldn’t even countenance it
Have a go? – no

SWITCH ON
R/c looks clear except for blue print [DVD controls]
Thought watching ??? – didn’t know

CHANGING CHANNELS AND VOLUME
Change channels – no. 3 – [kept wanting to type in 113]
Changing volume – done
Going to channel 40 – timed out – gave up
Going to 74 – prompted to use EPG – difficulty reading it and navigating [wrong glasses]
Channels of interest – radio, news, concert music
Not of interest – holiday, shopping, pop music
TELETEXT
Finding – told 9
Calling up – told TEXT [could not read it]
Finding weather – [me reading out screen display] – went to press 7, ended up in News
[pressed wrong button]
Finding prog guide – done by observer
SUBTITLES
Told MENU – guessed ‘set-up’ – told ‘Languages’ – problems with overshoot – used to just
using Fastext keys
INTERACTIVE CONTENT
Calling up – told RED – RED very difficult to press
Navigating – no recognition of OK, either location or purpose
WRAP-UP
User comments:
“New bit” just that bit more complicated – liked r/c, but fingers need to get used to it – raised
buttons good – outweighs small size

STB1
INSTALLATION
R/c clearer – likes it better – buttons better, easier to press
SWITCH ON
Done
CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Ch 40 – timed out
Ch 74 via EPG – prompted GUIDE, found GUIDE button – very difficult to use, kept timing
out
TELETEXT
Skipped (user tired)
SUBTITLES
Finding – told SUBTITLES – use Ok
INTERACTIVE CONTENT
Skipped (user tired)
SWITCH OFF
Tried to switch off using CANCEL
WRAP-UP
User comments:
R/c mush easier to understand – buttons easier to press – shape helps – “I would have been
lost without having used Teletext before”
User 13

Capability profile

Locomotion – n/a
Reach and stretch – n/a
Dexterity – n/a
Seeing – S3
Hearing – n/a
Communication – n/a
Intellectual Function – n/a

Personal profile

Age – 24
Job – PhD student
Reads newspaper? – no – goes to news web-sites instead
Watches – <1 hour
Doesn’t own TV, watches family’s, R/C, not w/screen
Likes – news, classical music, Star Trek
Doesn’t own VCR (parents’), playback only
Teletext – yes – if internet down – for new, weather, programme schedules
Switch over – everyone will need to get new equipment – better quality of picture – more
concerned about digital radio (world-wide access)
Is aerial OK for DTV? – don’t know
Owns mobile phone? – no – doesn’t like small buttons
Owns PC – yes, uses it for “everything”
Favourite hi-tech product – big monitor, Linux stuff, Psion Revo (PDA)
Least favourite – MS Windows – difficult to do anything out of the ordinary

Equipment trial

Analogue TV
0 – r/c a bit big – could have better spaced buttons – contract pretty good, no tactile mark on 5
1 (Switch on) – wanted POWER – told ‘#’
2a (Change to ITV) – no. 3
2b (Channel hopping) – nos.
3 (Change volume) – done
4 (Teletext) – found TEXT – found 400 to 406 to 402, no problem – very close to screen (12")
– went to 600 from memory
5 (Subtitles) – straight to 888 – prefers white on black and stationary text (not appearing word
by word as on a live broadcast) – cleared Ok
6 (Exit) –
User Comments:
R/c but less responsive than parents’, otherwise about the same – would like bigger nos. and
better action

STB2

PREAMBLE
Which STB to buy? – STB2 – but very similar and random choice
Questions of shop assistant? – compatibility: TV, receiving signal, aerial – would it work – any
other bits needed – is this everything (cables, etc.)
Out of box – STB2 – has power button and control buttons on set
INSTALLATION
R/c incredibly small buttons – poor labelling – “only get it if really desperate” – “not good for
quick access, for example if someone rings doorbell” – would have chosen differently if
seen earlier
Self-install? – yes (everyone else in family is technophobic)
Ease of installation – minuscule print on warnings, bad – instructions in sans serif, good
Have a go? – no
SWITCH ON
Switched on Ok - thought watching DTV – better quality image
CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Changing volume – TV r/c – no problem Going to channel 40 – no time-out [user “used to time-outs”] – ch 40 is actually 040, but first 0 is not recognised

Going to 74 – prompted to use EPG – [needs to use magnifier to read] – went to MENU
[because list of choices] and ‘service list’ [in danger of reprogramming STB] – told GUIDE – EPG seemed to crash on data channel 51 – used ò/ò, then OK

Channels of interest – radio, 24hr news, UK History
Not of interest – travel shops, pop music, CBBC, shopping
[Note – problem pointing r/c at STB when that close]

TELETEXT
Finding – told 9 – went straight there
Calling up – done – wants black background, not white – bright colour too strong when very close, hurts eyes – no obvious mechanism for changing brightness, TV set-up menu doesn’t seem to affect DTV channels
Finding weather – 7 + 5 – font size too small on screen, despite lots of empty space – more care needed with colours and contrast – would ideally like to be able to customise colours
Finding prog guide – tried BACK, then YELLOW, then BLUE [final one correct] – ò/ò navigation
Ok in menus, but tried PR to go to 2 of 3 and ended up in different channel – wanted to find a “what’s on now and next” page

Used PR to get out of Teletext – ignored “Press select…” instruction on screen

SUBTITLES
Guessed ‘menu’, but then guessed ‘Service list’ – eventually iterated to ‘set-up’ – guessed ‘TV set-up’, iterated to ‘Languages’ – got ò/ò Ok – wanted OK to get out, found QUIT – “this is incredibly awkward” – slightly easier subtitles to read than 888, despite being smaller

INTERACTIVE CONTENT
Calling up – told RED – “how am I supposed to know that?” – didn’t realise 2 column display – likes black background, but grey text too dark
Navigating – no problem – found BLUE – used TEXT to exit (remembered from opening dialogue)

WRAP-UP
User comments:
R/c could be better – it’s Ok, but not for use in a hurry, (e.g. in front of family) – buttons not as bad as first impression, but not easy – would have liked tutorial – finding GUIDE was unnecessarily difficult – red from top and came across MENU first, so had to explore that before getting down to GUIDE
STB1

INSTALLATION
R/c more contrast than STB2 – immediately spotted subtitle button – no. buttons too small –
“why don’t they [the designers] fill the available space?”
Instructions – “this is complicated”– “all pictures, no text” first impression – changed opinion on
reading it- print smaller, “but better” – would like enlarged version

SWITCH ON
Done

CHANGING CHANNELS AND VOLUME
Change channels – no. 3
Ch 40 – straight to 40, no time-out – 0 operated Ok on the r/c – no tactile mark on 5, “but not
so important because layout is clear”
Ch 74 via EPG – EPG slightly easier to read, but time-out fierce – prefer without picture in
background – used SELECT Ok – found that \(\Rightarrow/\Rightarrow\) = PG UP/DN

TELETEXT
Finding – remembered 9
Calling up – TEXT – ‘loading’ warning inadequate
Finding weather – 7 + 5
Used EPG to get out

SUBTITLES
Finding – found button – no problems

INTERACTIVE CONTENT
Calling up – Told RED
“Either too dark or too bright – you cannot win”
Navigating – skipped

SWITCH OFF
Done

WRAP-UP
User comments:
Apart from the number buttons being a bit fiddly, a lot of things better than the STB2
Battery cover – STB1 – “oh that wasn’t too bad” – STB2 – “oh dear, oh dear”