Deliverable 3.2 Specification of Presentation Interfaces for the Three Scenarios

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LinkedTV

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[1] • PU = Public
• PP = Restricted to other programme participants (including the Commission Services)
• RE = Restricted to a group specified by the consortium (including the Commission Services)
• CO = Confidential, only for members of the consortium (including the Commission Services))

Table of contents

List of Figures

1 Introduction

The third work package is focused on the user interface design of the LinkedTV system. The interface design will strive to hide the complexity of the LinkedTV system operating in the background. For example, the user should be unaware of the connection between the video pixels and the concept describing them, the relation between this and a thesaurus and how these are enriched with other web-based information. At the same time, the user should be allowed access to the underlying information sources to enable them to check information sources when needed. The goal is to present the interactive elements and links in such a way that it is clear when links are accessible and what their uses are. It is important that the interface is easy to use and that it does not distract users from their goals. For example, when users do not want to receive additional information about the content of the video they are watching and just want to relax, it might be distracting and even irritating if there are links presented at various times. A metric for success for the LinkedTV interfaces is that the user should not even notice the interface and that they should be able to carry out their tasks with a minimum of effort. Another important aspect is that the interface of the LinkedTV system is aesthetically pleasing. It is known that an aesthetically pleasing interface leads to more enjoyment when interacting with television.

1.1 Purpose of deliverable 3.2

The goal of this deliverable is to propose different user interfaces for the LinkedTV system. We present different mock-ups of user interfaces with critical analyses of them.

1.2 Relation to deliverable 3.1

In deliverable 3.1 the functional requirements that satisfied user goals and needs were specified. The user goals were categorized in four different groups: Information, Communication, Manipulation and Transaction. In deliverable 3.1, we mainly focused on one of these groups, namely Information, since a central point of interest in the LinkedTV project is ensuring users easy access to additional information about items that are discussed in a programme. In deliverable 3.2 we will continue focusing on the Information category.

In this category, two user goals were described in deliverable 3.1: getting additional information and viewing related information on an item presented in the programme. Both goals include the presentation of information to the user. When getting additional information and when requesting related information, the user and/or system need to make decisions:

1. on what the information is about or to what the content needs to be related: objects, persons, places, events or abstract concepts presented in the television content
2. where the information/content comes from: e.g. Internet (Wikipedia, Europeana, etc.) programme content, providers whitelist.

For these two goals a list of functional requirements were described that were extracted from the scenarios in deliverable 3.1.

1.3 Structure of deliverable 3.2

After a literature review in section 2, we will explain these functional requirements in depth in the third section. In section 4, some user interface mock-ups will be presented and discussed by making use of the different functional requirements. After that, the mock-ups are evaluated. The last section will state some attention points and explain future plans.

1.4 History of deliverable 3.2

Table 1: History of deliverable 3.2

Date	Version	Name	Comment
20/04/2012	V0.1	Mieke Leyssen	Input to LinkedTV meeting in Mons
28/04/2012	V0.2	Mieke Leyssen	Addresses remarks from meeting in Mons
30/04/2012	V0.3	Rolf Fricke	QA
04/04/2012	V0.4	Mieke Leyssen	Final version
10/04/2012	V1.0	Martha Merzbach	Layout QA

2 User Interface Review From Literature

LinkedTV will enable users to use different links to access information about items that are represented in the programme. Here we give an overview of findings in the literature related to the user interface of hypermedia and interactive television.

Networked Hyper Quicktime (Ma, Lee, Du & McCahill, 1998) is a web-based education-on-demand system designed to deliver hypermedia annotated video. It consists of two user interfaces: an authoring tool and a player. In the player, there are two modes for receiving additional information: In the explicit mode users need to click the 'more details' button to get access to additional information. In the implicit mode, each hyperlink is fetched and displayed automatically. Here, the content of the browser is synchronized and updated automatically as the video progresses. The video and the browser are presented next to each other (see Figure 1).

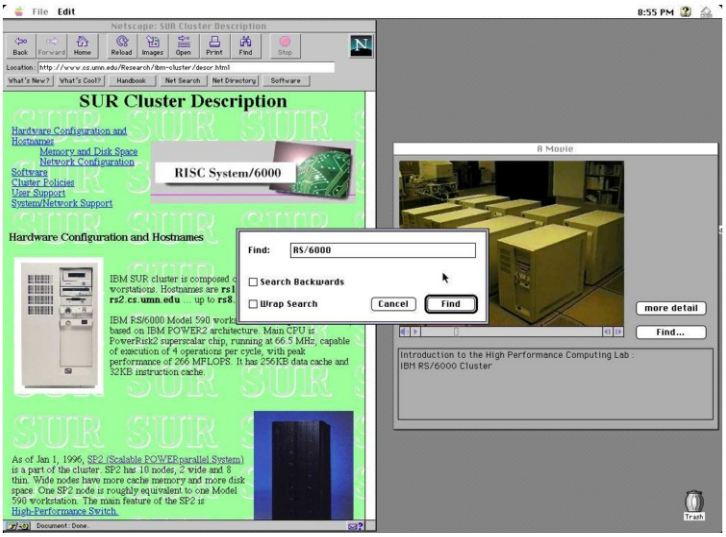

Figure 1: Printscreen of Networked Hyper Quicktime (Ma, Lee, Du & McCahill, 1998).

Instead of a button that states “more details”, it is also possible to present the links to additional information by video surrogates. Video surrogates are a better way to represent links because the surrogates give information about the link that is behind them. Ding, Marchionini & Soergel (1999) studied three types of video surrogates: visual keyframes, verbal keywords/phrases and a combination of the two. They found that words and images each provide unique information which may not be provided otherwise and that a combination of the two is favored.

Keyframes with labels to represent links are used in Hyper-Hitchcock (Girgensohn, Shipman & Wilcox, 2003; Shipman, Girgensohn & Wilcox, 2003; Girgensohn, Wilcox, Shipman & Bly, 2004; Shipman, Girgensohn & Wilcox, 2005; 2008). Hyper-Hitchcock supports authors to create detail-on-demand video by letting them combine video clips and place hyperlinks between them. When a user watches a video, the player indicates the available links by keyframes and labels on the timeline (see figure 2). When a link is currently inactive, this is indicated on the timeline by a reduced keyframe sizes with faded labels. An important finding

from the researchers was that the user interface needs to present users with an intuitive view of the hypervideo structure.

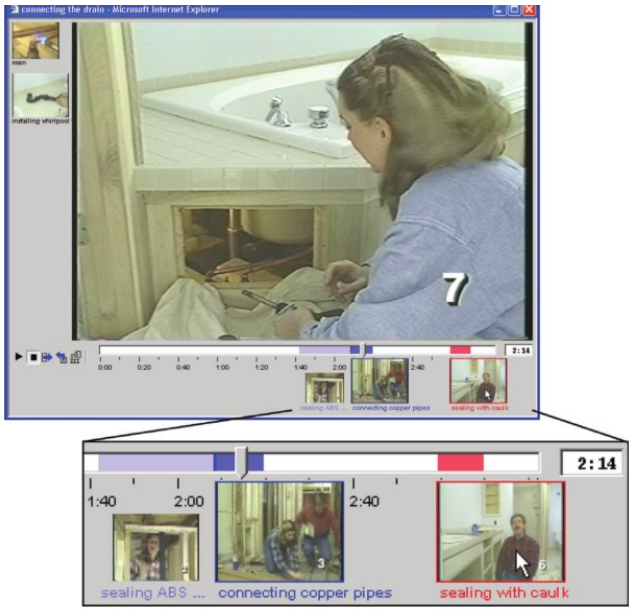

Figure 2: Printscreen of Hyper-Hitchcock (Shipman, Girgensohn & Wilcox, 2008).

Chambel and Guimaraes (2002) focus on how to provide this perception of context to users when they are navigating through different links in hypermedia. They argue that a table of content is very suitable to make the structure and content explicit and that image indexes can act as visual summaries of videos. Mills, Cohen and Wong (1992) also pay attention to the users' awareness of the hierarchical structure in their system that allows users to vary the temporal resolution of a video source.

Liestøl (1994) created a hypervideo environment in the interactive Kon-Tiki museum. In the interface, a main video frame is presented on the screen, surrounded by keyframes representing additional information about the main video (see Figure 3). Users can click on the keyframes to access the additional information, which can consist of video or text. An important finding is the importance for continuity between nodes containing different media types. The transition from dynamic (video) to static (text) is far more confusing than moving in the other direction, from text to video.

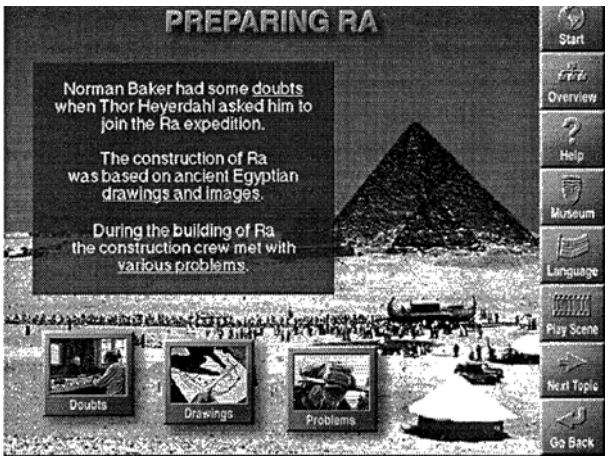

Figure 3: Printscreen of interactive Kon-Tiki museum (Liestøl, 1994).

This notion of continuity was also stressed by Sawhney, Balcom and Smith (1996; 1997) in their discussion of Hypercafe. Hypercafe is a desktop-based virtual cafe in which users can choose which conversations they want to follow. When users access different links they are moving from one scene to the other. Continuity in this sequence can be represented by navigational bridges that use visual, audio and textual techniques or by a combination of such techniques. In Hypercafe, a minimalist interface is employed by utilizing few explicit visual cues on the screen. Different link opportunities were presented by changes in the shape of the cursor, flashing frames within the video or by previews of scenes that dynamically fade-in. This minimalistic approach, results in a greater immersion of the users in the experience.

Lee et al. (2008) also state that it is important to maintain a level of simplicity as more and more functionality is provided in interactive television. In their interface, the level of interface sophistication is determined by the amount of times a particular button on the remote is pressed. The invoked interactive feature slides in from an edge of the television screen, partially covering the playback but still revealing what is behind due to the panel's semi-transparency (see Figure 4). For Lee and his colleagues, it is also important that the interactive television interface does not hinder activities at other attention levels when it was designed to target one particular level of attention. They mention that interactive television incorporates two distinct elements on its interface: video playback and interactive elements, and there is a balancing issue between the two in displaying, emphasizing and allowing switching between the two. “L-shape" layout and overlay have been suggested broadly as two main ways to arrange these two elements.

Figure 4: Printscreen of system of Lee et al. (2008).

Harrison et al. (1995) investigated how systems can support users to focus attention on a single interface object and divide attention between multiple objects. They mention three different strategies to display data on a small display:

1. a space multiplex strategy in which the screen is partitioned or tiled into a number of non-overlapping windows,

2. a time multiplex strategy in which windows lie on top of one another and only the top one is visible at any given time. A mechanism is provided to rapidly change which window is visible and
3. a depth multiplex strategy in which through the use of transparency in the windows, the contents of windows underneath is (partially) visible.

The researchers concluded that the utility of any particular interface depends on the task characteristics and goals. Low degrees of transparency enables the user to easily focus attention on the foreground. For divided attention, a high degree of transparency is desirable to support higher visibility of both layers.

3 Functional Requirements

We now discuss the functional requirements of requesting additional information that were extracted from the scenarios in deliverable 3.1. These functional requirements can be summarized in different steps that the user and the system need to carry out to satisfy the user information need.

3.1 User: Watching programme

The user watches a programme.

3.2 User: Expression of information need

The user should be able to make clear to the system that s/he would like to receive more information about an item that is present in the programme.

3.3 System: Presentation of possible items

The system needs an overview of all the items presented in the programme and it needs to be able to verify from which items additional information can be requested. The system should be able to present those to the user to clarify from which items additional information can be requested.

3.4 User: Choice of specific information need

The user should be able to specify the item from which s/he wants to receive additional information.

3.5 System: Presentation of possible information sources

The system needs to collect different information sources. After that, the system should be able to present the different videos, texts or other information sources that the user can access to receive additional information on the item. The system should also show from which item more information was requested.

3.6 User: Selection of information source

The user should be able to select the specific source s/he wants to consult to satisfy her/his information need.

3.7 System: Presentation of information

The system needs to present the additional information by showing the information source that the user requested. Here the links to different sources should also be presented to enable the user to switch to other sources.

3.8 User: Expression of satisfied information need

When the information need from the user is satisfied, the user should be able to indicate that s/he wants to exit the additional information sources and resume the programme.

3.9 System: Returning to the programme

The programme is resumed.

4 Mock-ups

Before describing the different mock-ups in this section, we will first describe the process of how these mock-ups came to be. On the basis of the literature review, detailed in section 2, relevant user interface findings were noted and suggestions, comments and evaluations were taken into account when designing the mock-ups presented here. The steps provided by the functional requirements, section 3, were used to guide the development of the user interface mock-ups. While they are used as a basis, the structure of the different mock-ups is not exactly the same. They all include the different functional requirements, be it in a slightly different order or grouped together in a single step.

The mock-ups are based on the cultural heritage scenario[2] described in deliverable 3.1. Rita wants to learn more about the Chi Ro symbol that is present on the screen, figure 5. All the mock-ups start with this fragment and are presented by sketches.

Figure 5: Printscreen of "Tussen Kunst en Kitch" episode of 8 December 2010.

There are two different kinds of watching television: watching television in a 'lean back' way or in a 'lean forward' way. Traditionally, 'lean back' means watching a television screen while sitting on a couch. Here, the users are not actively involved in the programme they are watching. When users are watching television in a lean forward way, they are actively interacting with the programme. This was traditionally restricted to interaction with a desktop or laptop. However, the distinction between the two is getting vague since users of interactive

[2] based on the episode of 8 December 2010, see http://cultuurgids.avro.nl/front/detailtkk.html?item=8237850

television are actively involved in the programme which is presented on a television screen. It can be said that interactive television, like LinkedTV, is a mixture between 'lean back' and 'lean forward'.

In various hypermedia interfaces, the user is able to navigate between different types of media by using the mouse and clicking on an area on the screen, a hotspot, to access links (e.g. Girgensohn, Shipman & Wilcox, 2003; Liestøl, 1994; Sawhney, Balcom & Smith, 1996). However, since LinkedTV will make use of a television screen and not a desktop, we will not use a computer mouse or keyboard. CyberBELT (Bers, Elo, Lassiter & Tames, 1995) allows viewers to interact with a video by speaking, pointing and looking around. In interactive television, the regular keyboard or mouse of a PC can be replaced by a remote control. Lee et al. (2008) state, however, that there is a large difference between interaction with remote control of a TV and keyboard/mouse of a PC. In their interactive television system, frequently-used features are directly accessible via a remote control, thus reducing the menu navigation burden on the viewers. Cesar et al. (2008) use a secondary screen in an interactive television environment for selecting and previewing personal content, for showing enhanced information, to control the television content and for presentation continuity. An important feature is that private information can be displayed on the individual's secondary screen and not on the more public main screen.

Since both a secondary screen and a remote control are perceived as good interaction devices for interactive television, we discuss two different kinds of mock-ups: mock-ups that, in addition to the programme on the television screen, use a remote control and those that use a tablet as a secondary screen.

4.1 Mock-ups: Television screen with remote control

4.1.1 Television with bottom bar

User: watching programme

The user watches programme on the television screen. There is a bar at the bottom of the television screen with different keyframes representing items that are presented in the programme and from which additional information can be requested. When an item has not been presented in the programme for a while, the keyframe representing that item is removed from the list.

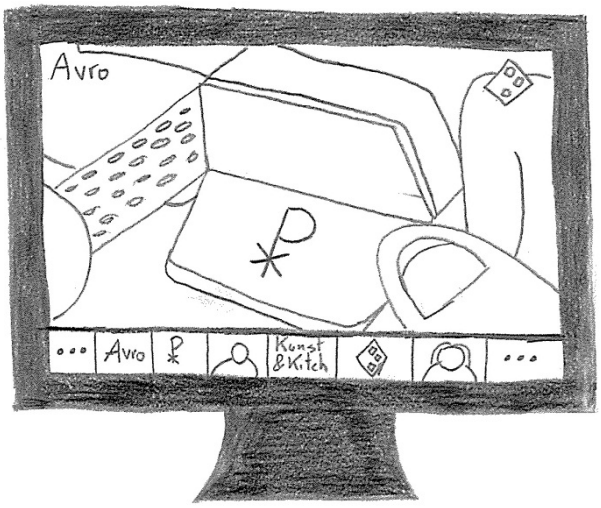

Figure 6: Sketch 1 of television with bottom bar

User: Expression and choice of specific information need

The user presses the 'additional information' button on the remote control to indicate that s/he wants to receive more information on a certain item that is presented in the bar at the bottom of the television screen. By doing so the first keyframe is highlighted. The user uses the arrow buttons on the remote control to navigate to the desired item and then presses the 'additional information' button again. From the moment that the user presses the 'additional information' button for the first time, the programme is paused.

System: Presentation of possible information sources

After the user specified the item from which additional information is requested, the system presents keyframes that represent different information sources on that specific item. The hotspots with the information sources are presented in a bar above the bar with all the hotspots of the items. In this bottom bar, the chosen item is highlighted. The paused image of the programme is still presented on the screen.

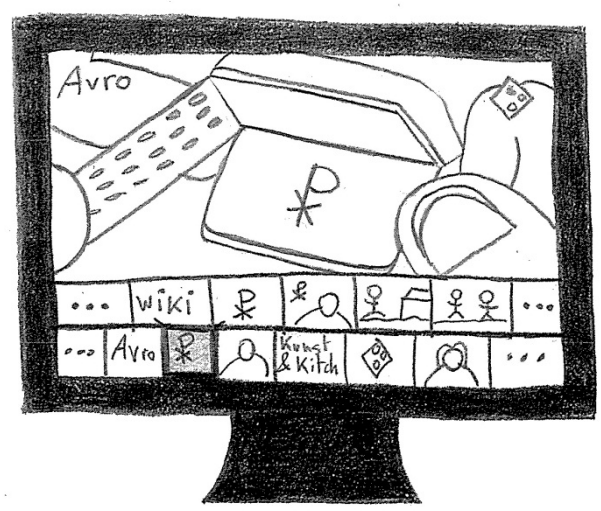

Figure 7: Sketch 2 of television with bottom bar

User: Selection of information source

The user can, again, use the arrow buttons to navigate to the desired information source in the top bar and when the user has made a decision, s/he presses the ‘additional information’ button.

System: Presentation of information

The programme is replaced by the additional information that the user requested. The two different bars are still present on the screen and users can access these bar by pressing the ‘additional information’ button and using the arrow buttons. When the additional information is a video the user can browse it by using the standard browse buttons on the remote control.

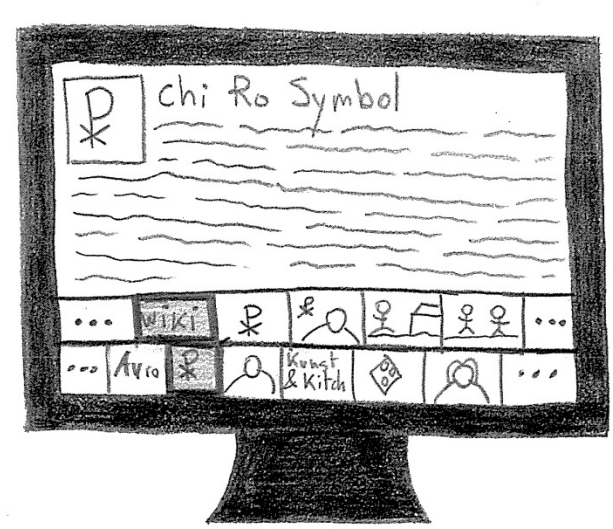

Figure 8: Sketch 3 of television with bottom bar

User: Expression of satisfied information need

When the user information need is satisfied, s/he presses the ‘back’ button on the remote control.

System: Returning to the programme

The system returns to the programme. The bottom bar with the keyframes representing the items is still presented on the screen. The bar with the keyframes representing the different information sources is no longer presented on the screen.

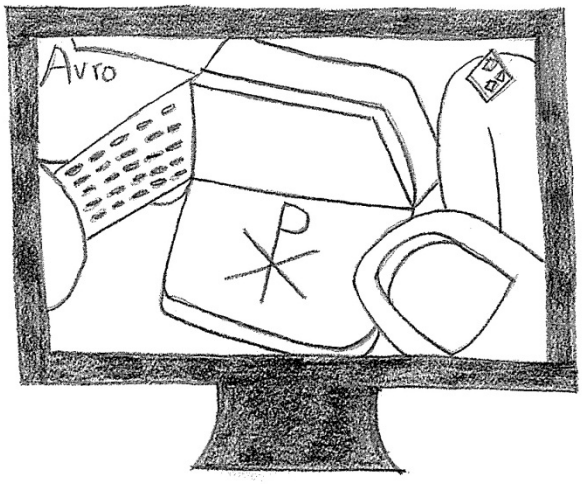

Figure 9: Sketch 4 of television with bottom bar

4.1.2 Television with right bar

User: watching programme

The user is watches a programme on the television. Apart from the programme, there is nothing else presented on the screen.

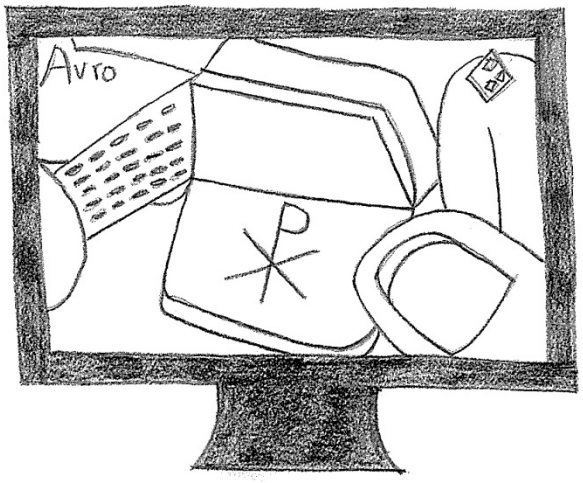

Figure 10: Sketch 1 of television with right bar

User: Expression of information need

The user presses the ‘additional information’ button on the remote control to indicate that s/he wants to receive more information on a certain item that is presented in the programme.

System: Presentation of possible items.

A bar appears at the right side of the television screen with different keyframes with labels representing items that are presented in the programme and from which additional

information can be requested. The top keyframe is highlighted. The programme continues playing. However, when the user wants the pause the programme, s/he can do so by pressing the ‘pause’ button on the remote control.

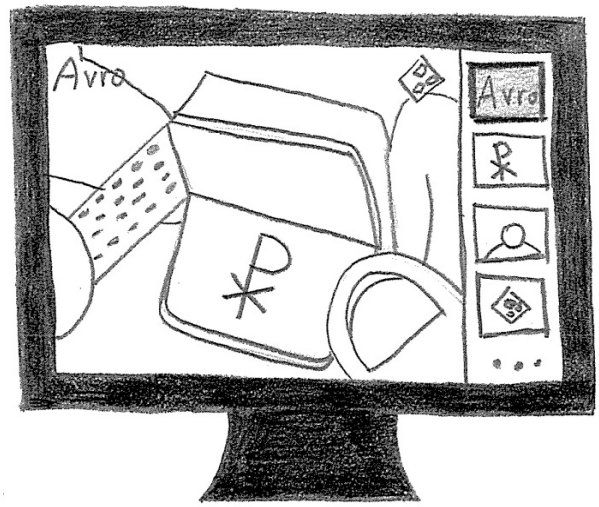

Figure 11: Sketch 2 of television with right bar

User: choice of specific information need

The user uses the arrow buttons on the remote control to navigate to the desired item and then presses the ‘additional information’ button again.

System: Presentation of possible information sources

The system presents keyframes that represent different information sources on that specific item. The keyframes that represent the information sources are represented in a bar left from the bar with all the hotspots of the items. In the right bar, the chosen item is highlighted.

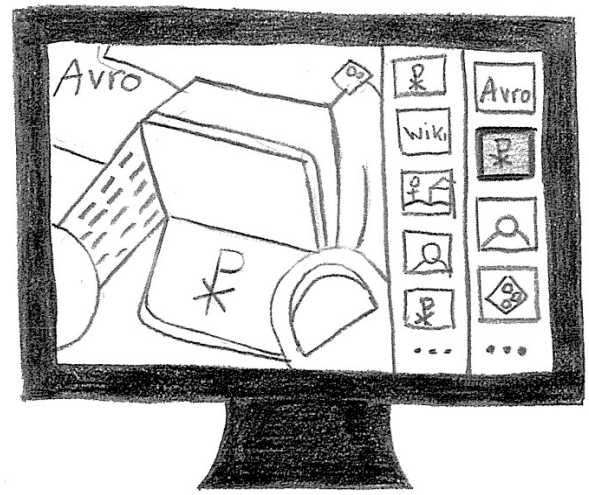

Figure 12: Sketch 3 of television with right bar

User: Selection of information source

The user can use the arrow buttons to navigate to the desired information source in the left bar. When the user has made a decision, s/he presses the ‘additional information’ button.

System: Presentation of information

Left from the two bars, the programme is still presented, but when the user selects an information source the frame on the left side of the screen is split in two: in the top frame the programme is presented and in the bottom frame the additional information is presented. When the user selected a video as additional information source, the programme is automatically paused while the other video is playing.

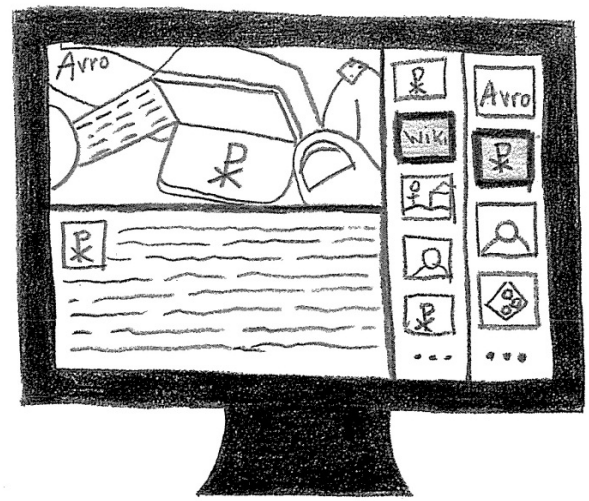

Figure 13: Sketch 4 of television with right bar

User: Expression of satisfied information need

When the user information need is satisfied, s/he presses the ‘back’ button on the remote control.

System: Returning to the programme

The programme is enlarged and now again occupies the entire frame instead of only half of it. No hotspots are indicated on the screen. The programme does not automatically resume when it was paused, the user needs to press the ‘play’ button.

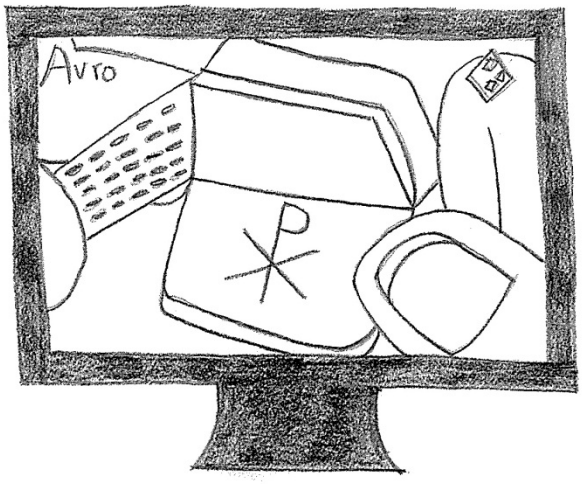

Figure 14: Sketch 5 of television with right bar

4.1.3 Television with circle

User: watching programme

The user watches a programme on the television.

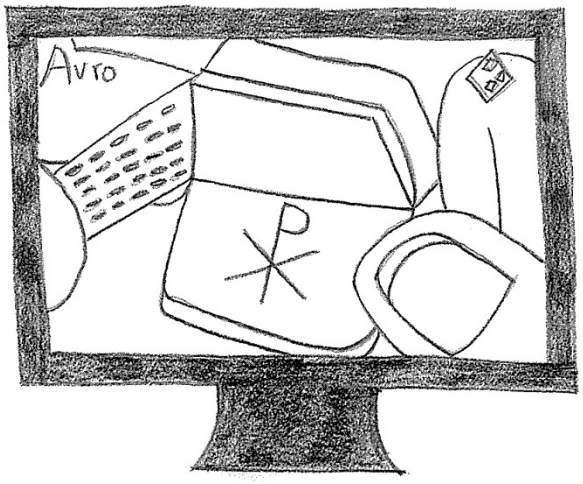

Figure 15: Sketch 1 of television with circle

User: Expression of information need

The user presses the ‘additional information’ button on the remote control to indicate that s/he wants additional information about an item that is presented in the programme.

System: Presentation of possible items

The programme is paused and the items in the programme from which additional information can be requested are indicated by transparent boxes that surround the different items. The box of one particular item is highlighted.

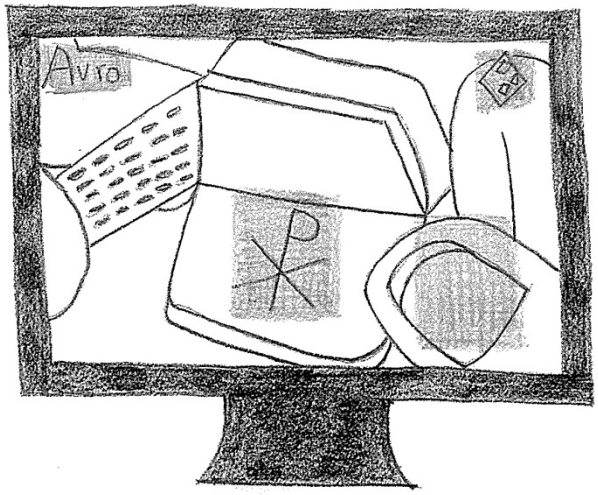

Figure 16: Sketch 2 of television with circle

User: Choice of specific information need

The user uses the arrow button to navigate around the different items. The box of the item that is currently selected is highlighted. The user selects an item by pressing the 'additional information' button on the remote control.

System: Presentation of possible information sources

The grey transparent boxes are no longer presented on the screen. Instead of the grey box around the selected item, there are different hotspots that form a circle around the item. Each of this keyframe represents a different information source which can be consulted to receive additional information. The keyframe that is at the top of the circle is highlighted.

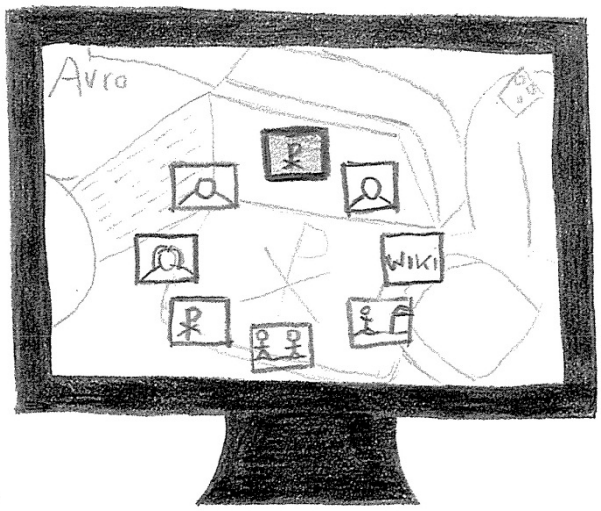

Figure 17: Sketch 3 of television with circle

User: Selection of information source

The user uses the arrow button to navigate around the different information sources. The keyframes that is currently selected is highlighted. When the user wants to consult a particular information source s/he presses the 'additional information' button.

System: Presentation of information

The circle with all the different hotspots with inside the image of the item moves to the left side of the screen. Underneath, images representing the other items from which information could be requested are listed together with their label. On the right side of the screen the requested information is presented. When the user wants to select another information source, s/he presses the 'additional information' button to visit the hotspots on the left of the screen.

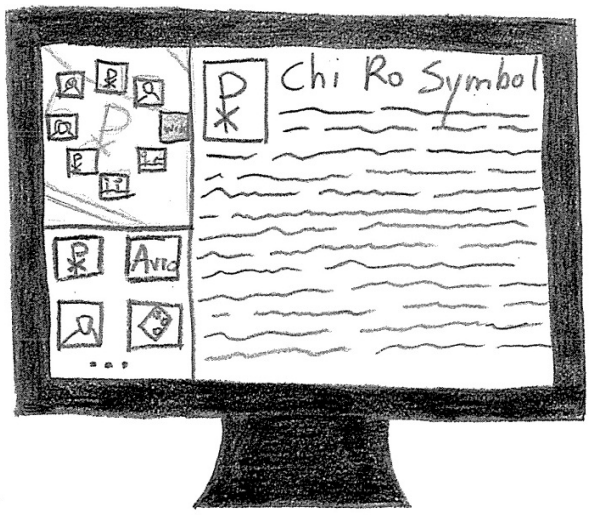

Figure 18: Sketch 4 of television with circle

User: Expression of satisfied information need

When the user information need is satisfied, s/he clicks on the 'back' button on the remote control.

System: Returning to the programme

The circle with all the different hotspots with inside the image of the item moves to the place in the screen where it was originally presented and the screen is identical to the screen that was presented before the user expressed her/his information need. The user needs to press the 'play' button to resume the programme.

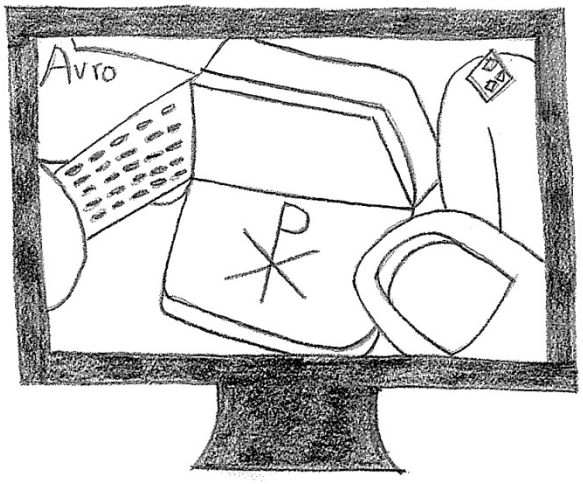

Figure 19: Sketch 5 of television with circle

4.1.4 Television with rows and columns

User: watching programme

The user watches a programme on the television.

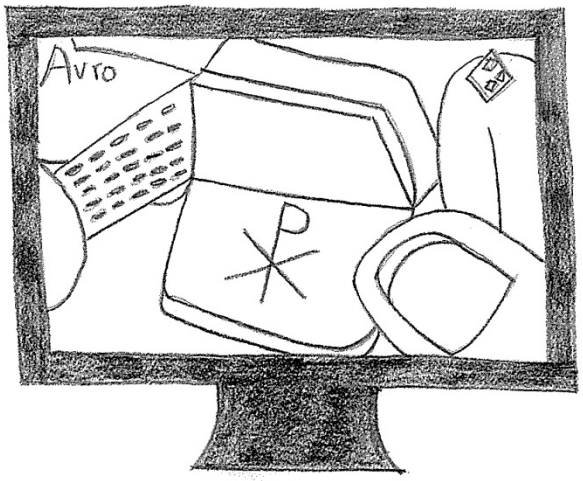

Figure 20: Sketch 1 of television with rows and columns

User: Expression of information need

The user presses the ‘additional information’ button on the remote control to indicate that s/he wants more information about an item that is presented in the programme.

System: Presentation of possible items

The programme is paused and the items in the programme from which additional information can be requested are indicated by transparent boxes that surround the different items. The box of one particular item is highlighted.

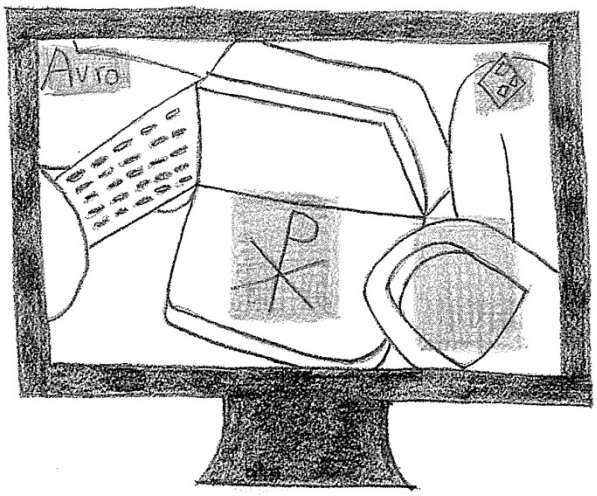

Figure 21: Sketch 2 of television with rows and columns

User: Choice of specific information need

The user uses the arrow buttons to navigate around the different items. The box of the item that is currently selected is highlighted. When the user wants to select an item s/he presses the ‘additional information’ button.

System: Presentation of possible information sources

The image of the item from which additional information is requested is presented on the left side of the screen and it is highlighted. Underneath images representing the other items from which information could be requested are listed. The remainder of the screen is filled with different keyframes that represent different information sources about the selected item.

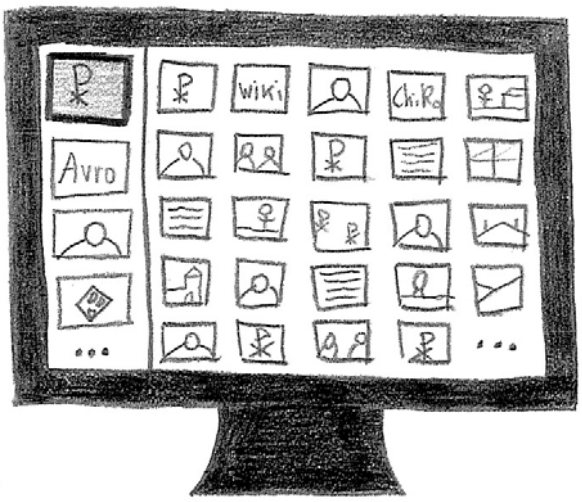

Figure 22: Sketch 3 of television with rows and columns

User: Selection of information source

The user uses the arrow button to navigate around the different information sources. The keyframe that is currently selected is highlighted. When the user wants to consult a particular information source s/he presses the ‘additional information’ button.

System: Presentation of information

The images representing the different items on the left side of the screen are still presented. On the right side of the screen the requested information is presented. When the user wants to select another information source, s/he presses the ‘additional information’ button which takes the user back to the previous screen where the different information sources were presented.

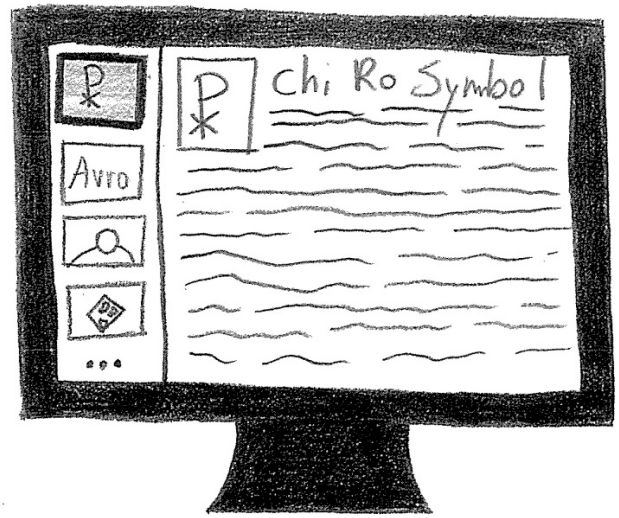

Figure 23: Sketch 4 of television with rows and columns

User: Expression of satisfied information need

When the user information need is satisfied, s/he clicks on the ‘back’ button on the remote control.

System: Returning to the programme

The programme is again present on the screen and all hotspots and images are removed. The user needs to press the ‘play’ button to resume the programme.

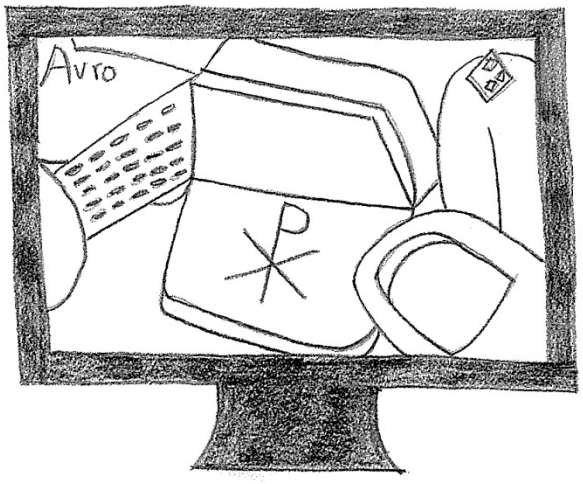

Figure 24: Sketch 5 of television with rows and columns

4.1.5 Television with rows

User: watching programme

The user watches a programme on the television.

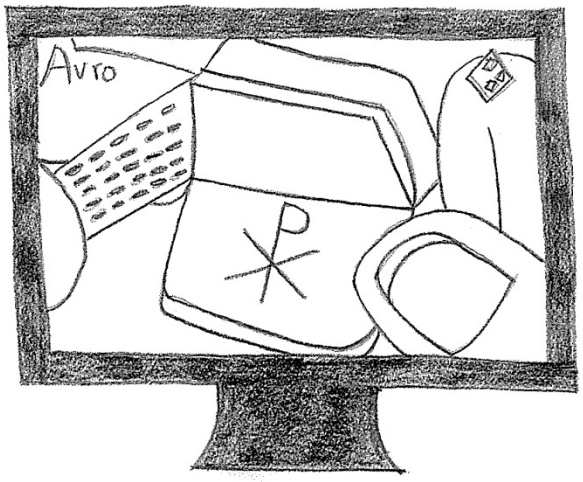

Figure 25: Sketch 1 of television with rows

User: Expression of information need

The user presses the ‘additional information’ button on the remote control to indicate that s/he wants more information about an item that is presented in the programme.

System: Presentation of possible items and information sources

On the left side of the screen a column of keyframes with labels that each represent an item from which additional information can be requested is presented. Next to each of these hotspots, a row of different information sources for these items are presented by keyframes.

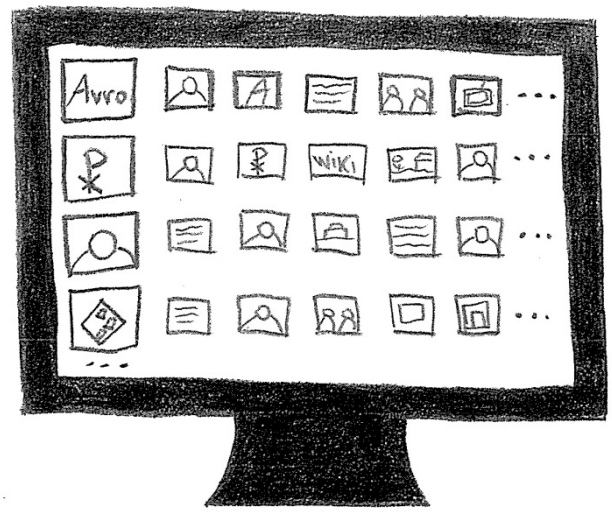

Figure 26: Sketch 2 of television with rows

User: Choice of specific information need and information source

The user can navigate through all the different hotspots to choose from which item they would like to receive more information and which information source they would like to consult. The keyframe that is currently selected is highlighted. When the user wants to consult a particular information source s/he presses the 'additional information' button.

System: Presentation of information

The keyframes representing the different items on the left side of the screen remain on the screen. On the right side of the screen the different keyframes representing the different information sources are replaced by the requested information. When the user wants to select another information source, s/he presses the 'additional information' button which takes the user back to the previous screen where the different information sources were presented.

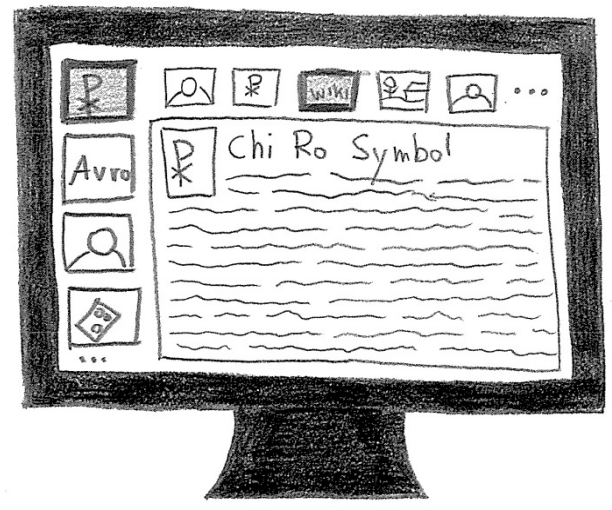

Figure 27: Sketch 3 of television with rows

User: Expression of satisfied information need

When the user information need is satisfied, s/he clicks on the ‘back’ button on the remote control.

System: Returning to the programme

The programme is again present on the screen and all hotspots and images are removed. The user needs to press the ‘play’ button to resume the programme.

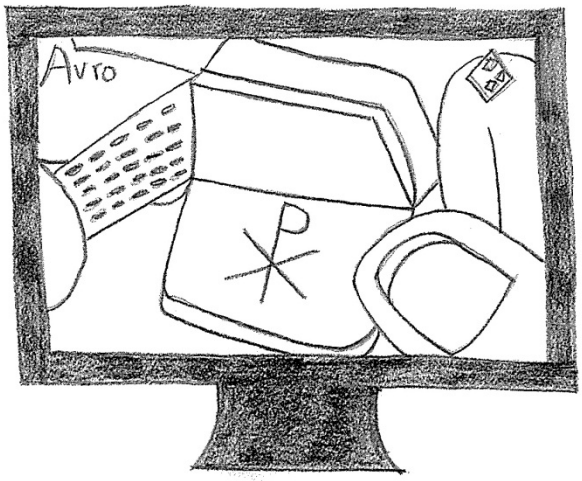

Figure 28: Sketch 4 of television with rows

4.1.6 Television with keyframes

User: watching programme

The user watches a programme on the television.

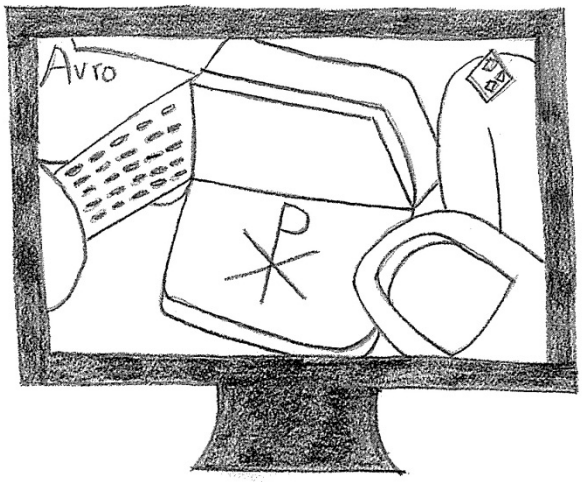

Figure 29: Sketch 1 of television with keyframes

User: Expression of information need

The user presses the ‘additional information’ button on the remote control to indicate that s/he wants more information about an item that is presented on the screen.

System: Presentation of possible items and information sources

The programme is paused and keyframes are presented in overlay on top of the items in the programme from which additional information can be requested. These keyframes represent information sources. On the right side of each keyframe there is a column with different information sources presented by keyframes.

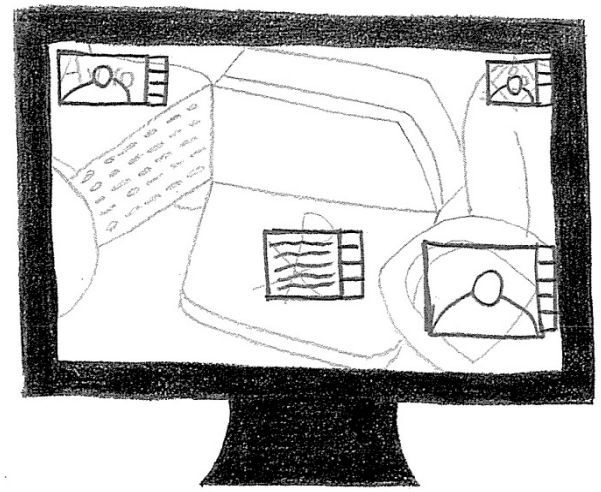

Figure 30: Sketch 2 of television with keyframes

User: Choice of information need and selection of information source

The user uses the arrow buttons on the remote control to navigate to the desired item. The keyframe of the item that is currently selected is highlighted. The user presses the ‘additional information’ button to access the additional information.

System: Presentation of information

The system zooms in on the keyframe that shows the additional information. If the additional information is a video, it automatically starts playing when it reaches its maximal size. Meanwhile, the other information sources are still present at the right side of the frame. Users can access these sources by pressing the ‘additional information’ button.

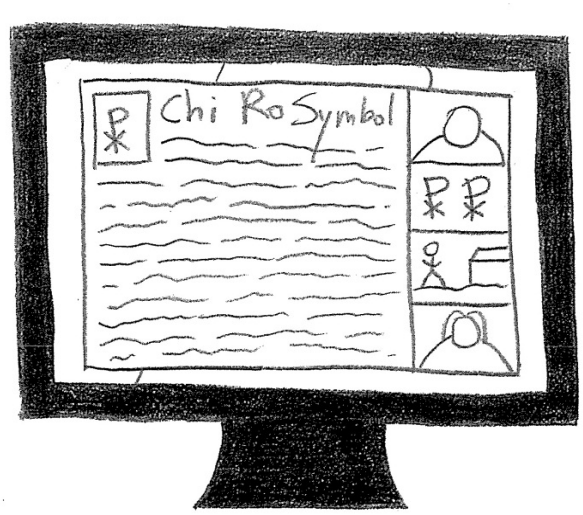

Figure 31: Sketch 3 of television with keyframes

User: Expression of satisfied information need

When the user information need is satisfied, s/he clicks on the 'back' button on the remote control.

System: Returning to the programme

The screen zooms out until the programme is again presented. While zooming out, the hotspots fade. The user needs to press the 'play' button to resume the programme.

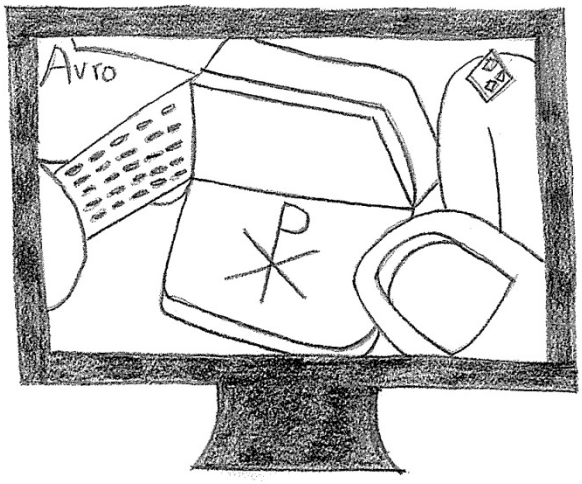

Figure 32: Sketch 4 of television with keyframes

4.1.7 Television with time-line

User: watching programme

The user watches a programme. Underneath the programme a time line is presented. On that timeline the starting point of the programme is indicated and different keyframes that represent different items from which additional information can be requested are positioned on the line. The positions of these hotspots on the timeline indicate the first time the item was presented.

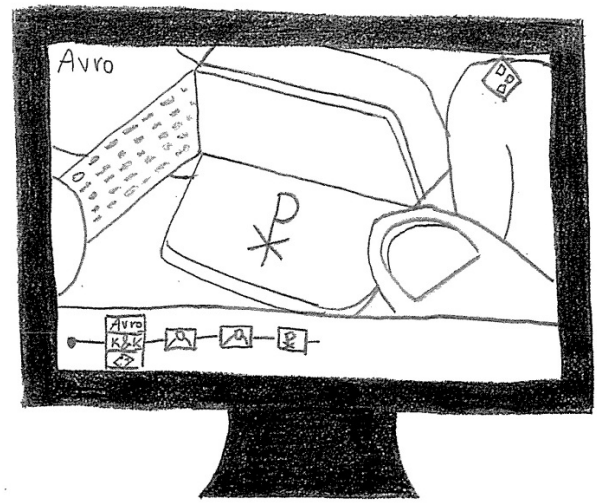

Figure 33: Sketch 1 of television with time-line

User: Expression and choice of information need

The user presses the ‘additional information’ button on the remote control to indicate that s/he wants more information about an item that is presented on the screen. By doing so, the last keyframe representing an item on the timeline is highlighted. The user uses the arrow buttons on the remote control to select the item from which s/he wants to receive more information. The user presses the ‘additional information’ button on the remote control to indicate from which item s/he would like to receive more information. From the moment that the user presses the ‘additional information’ button, the programme is paused.

System: Presentation of information

The timeline stays present on the screen and the programme is replaced by an information source that the system choose. On the timeline a highlighted keyframe that represents the current information gets attached to the keyframe that represents the item. On the right side of the screen, there is a column with keyframes that represent alternative information sources. To access these hotspots the user presses the ‘additional information’ button.

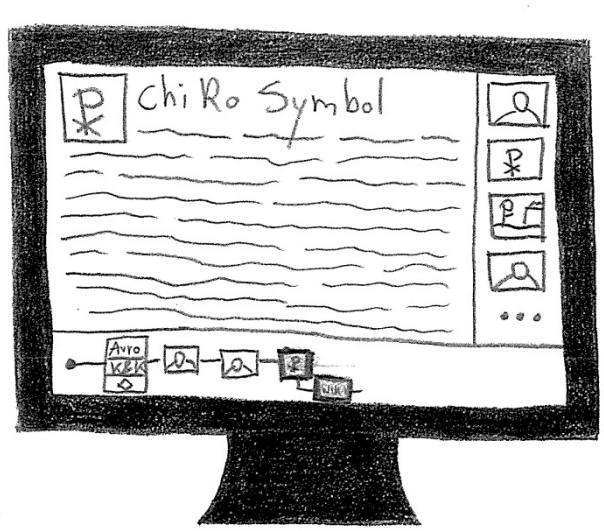

Figure 34: Sketch 2 of television with time-line

User: Expression of satisfied information need

When the user information need is satisfied, the user presses the ‘back’ button on the remote control.

System: Returning to the programme

The system returns to the initial screen which included the programme and the timeline. On the timeline the keyframes representing the information sources that the user consulted are still present. The last keyframe representing an item of the programme is highlighted. The user needs to press the ‘play’ button to resume the programme.

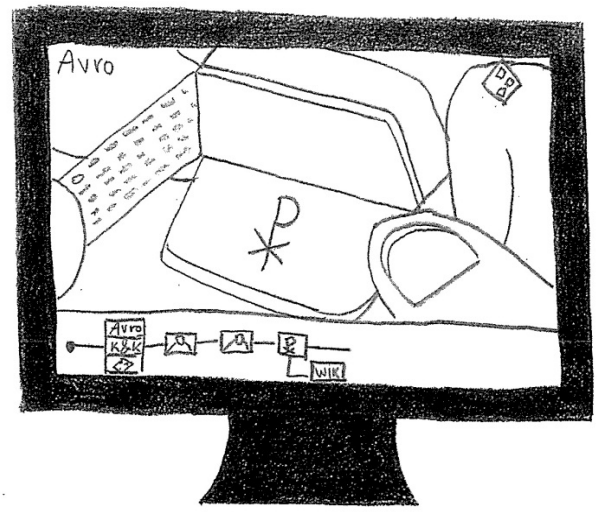

Figure 35: Sketch 3 of television with time-line

4.2 Mock-ups: Television screen with tablet as secondary screen

4.2.1 Television and tablet with right bar

User: watching programme

The user watches a programme on the television and at the same time the programme is presented on the tablet. The items in the programme from which additional information can be requested are indicated by transparent boxes that surround the different items. On the right side of the programme-frame there is also a table present which lists all the different items from which information can be requested. The list consists of keyframes representing items together with the labels of the item. Below the programme a navigation bar is presented.

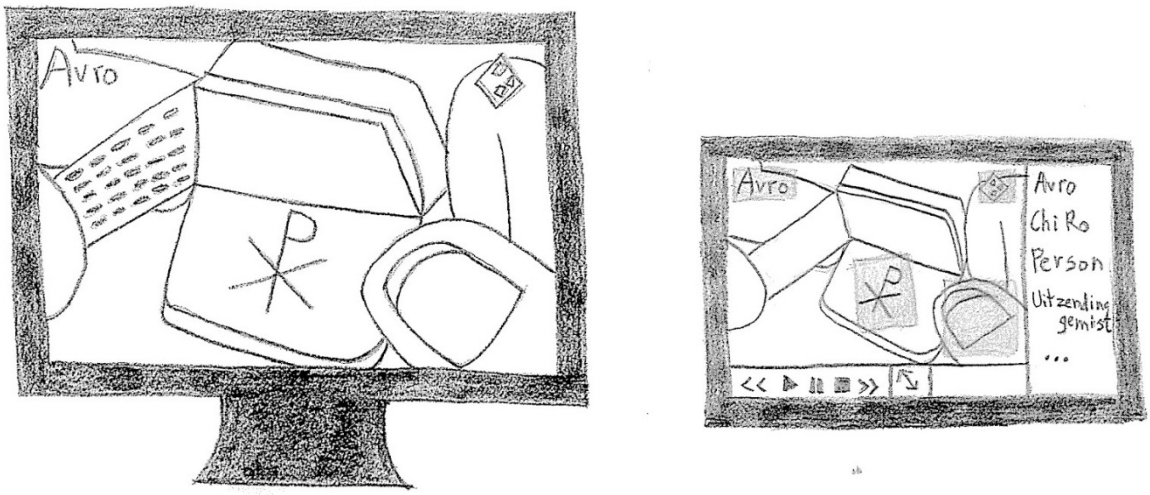

Figure 36: Sketch 1 of television and tablet with right bar

User: Expression and choice of information need

The user clicks on the grey boxes surrounding an item to indicate s/he wants additional information on that specific item. The user could also click on the corresponding hotspot on the right of the programme-frame. How the user selects which link to follow does not influence the next steps.

System: Presentation of information and other possible information sources

The content of the frame in which the programme was presented on the tablet is replaced with the additional information from a particular source chosen by the system. On the right side of the frame the different sources that can be consulted are presented as keyframes and the frame of the source that is currently presented is highlighted. At the right side of this list, the lists of all the different items from which information can be requested is still presented. The item from which extra information is requested is highlighted. The programme on the television is not interrupted when the additional information that is requested and presented

consists of text and images, but the user has the opportunity to pause the programme by clicking the ‘pause’ button in the navigation bar on the tablet.

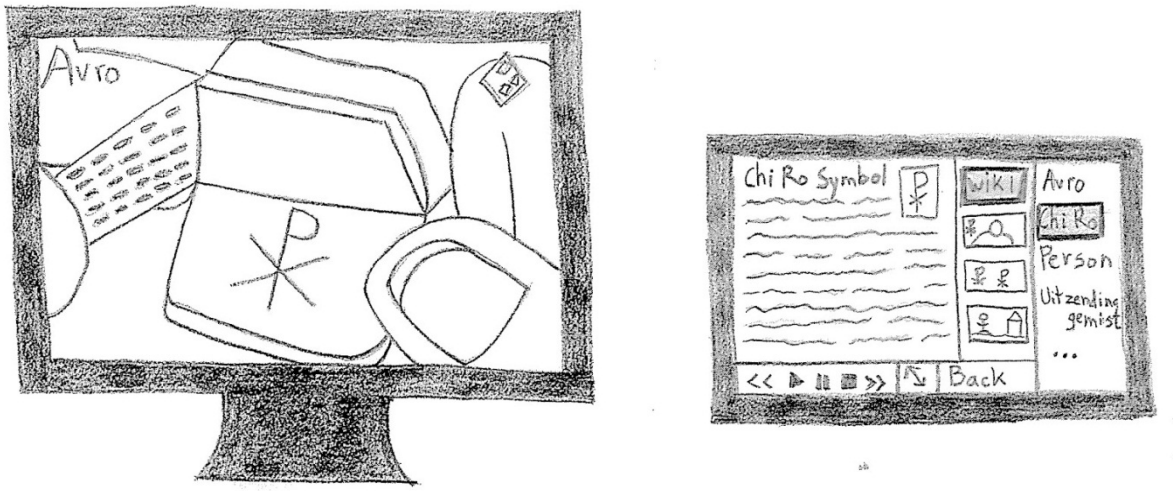

Figure 37: Sketch 2 of television and tablet with right bar

However, when the user decides to view a video, the programme on the television is automatically paused. The user can still manipulate the programme with the navigation buttons on the tablet. An extra navigation bar is also present when a video with additional information is presented on the tablet with which the user can browse through the additional information video.

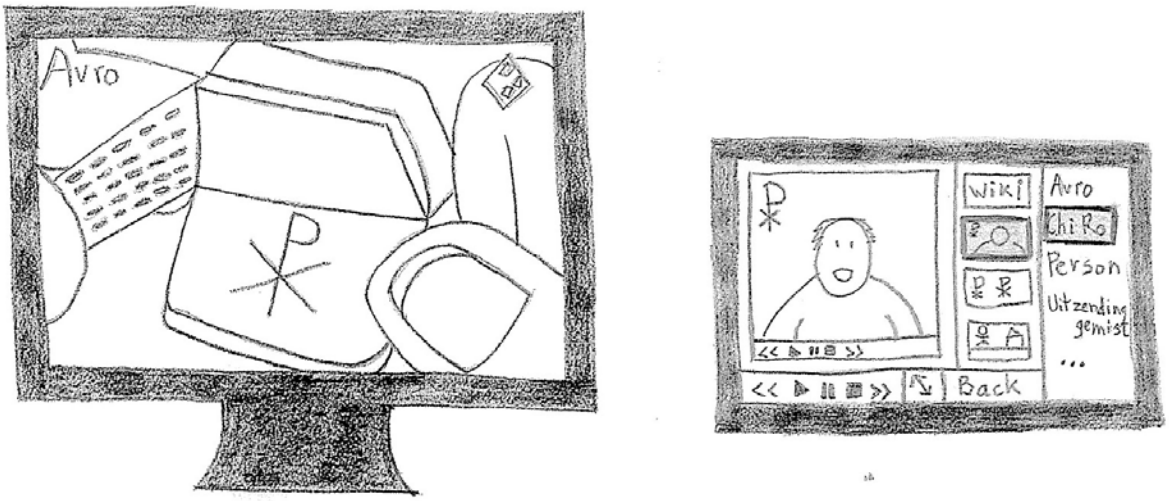

Figure 38: Sketch 3 of television and tablet with right bar

In the navigation bar the user could also select the ‘switch screen’ mode. By selecting that option, the additional information is presented on the television screen and the programme is presented on the tablet. The navigation bar and the hotspots are still present on the tablet, these are not transported to the television since the user can not click on them on the television screen.

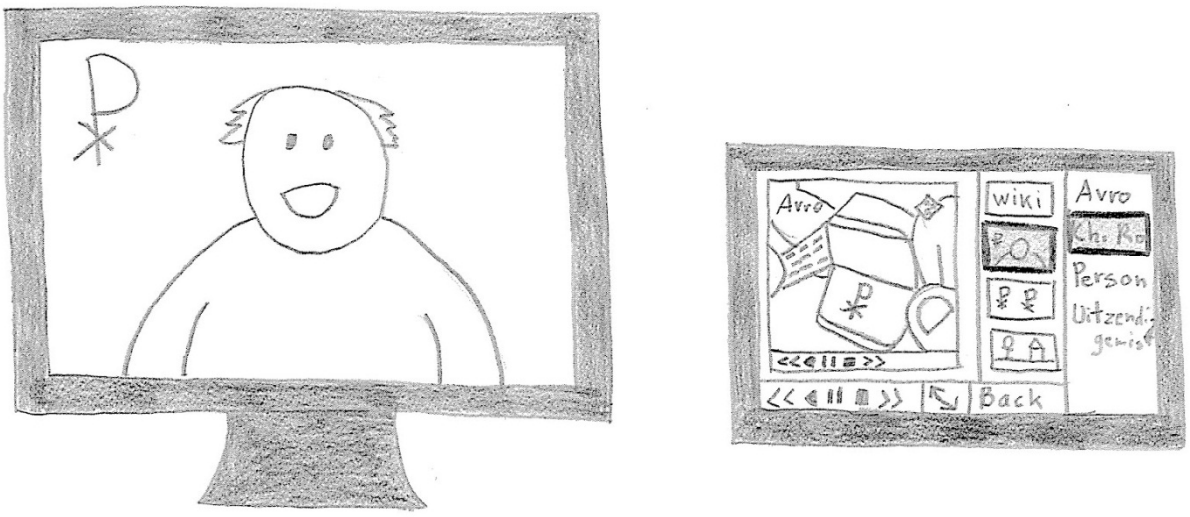

Figure 39: Sketch 4 of television and tablet with right bar

User: Expression of satisfied information need

When the user information need is satisfied, the user can return to the programme on the tablet by clicking the 'back' button in the navigation bar. However, since the programme is still presented on the television, it is not necessary to close the additional information screen on the tablet to view the programme on the television.

System: Returning to the programme

On the tablet the same screen is presented as was the case before the user expressed her/his information need. If the programme was paused on the television screen during the additional information search, the user needs to press the 'play' button in the navigation bar to resume the programme.

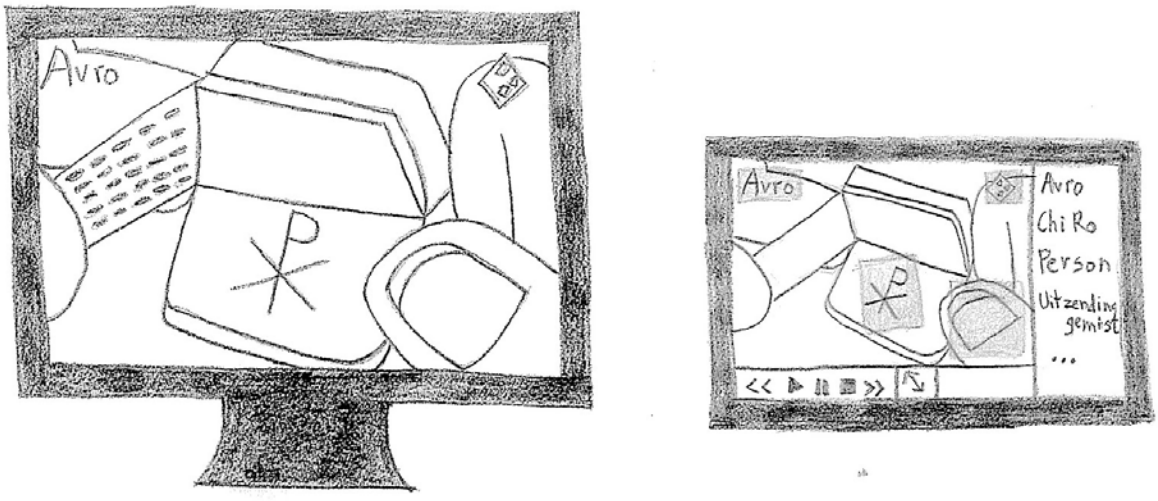

Figure 40: Sketch 5 of television and tablet with right bar

4.2.2 Television and tablet with arrow

User: watching programme

The user watches a programme on the television and at the same time the programme is presented on the tablet. There is nothing else presented on the tablet.

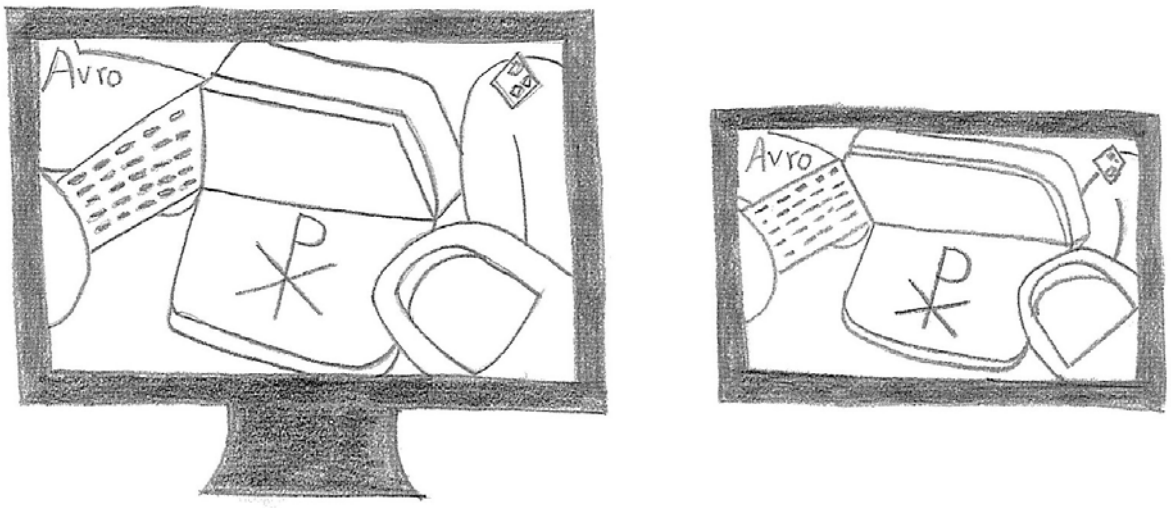

Figure 41: Sketch 1 of television and tablet with arrow

User: Expression and choice of information need

The user clicks on an item that is presented in the programme on the tablet to indicate that s/he would like to have additional information about that particular item.

System: Presentation of possible information sources

The programme is paused on the television and on the tablet. Different information sources about the item are presented by different keyframes on the tablet. The different sources are grouped together in a box with an arrow that is pointing to the item from which the user requested additional information.

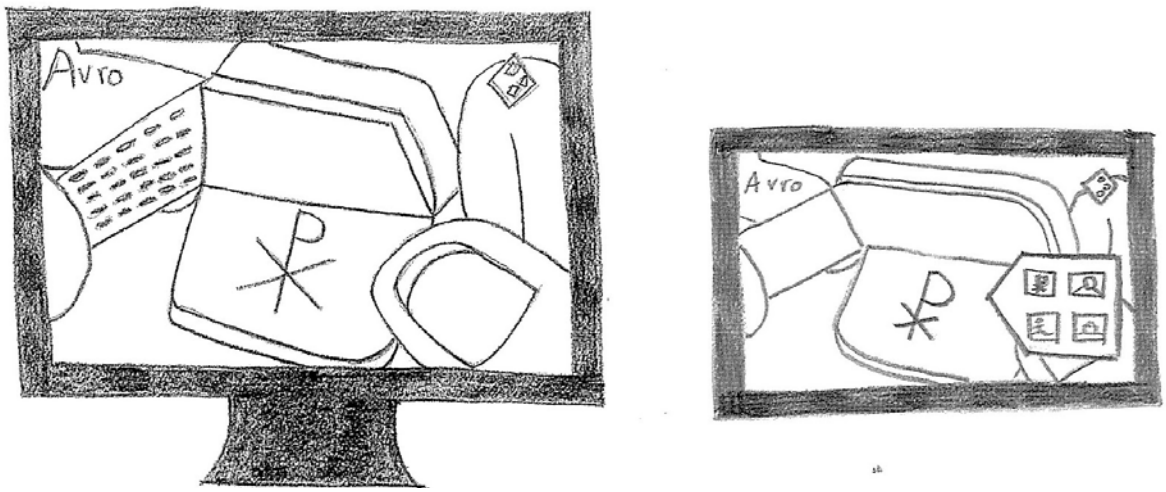

Figure 42: Sketch 2 of television and tablet with arrow

User: Selection of information source

The user clicks on the hotspot that represents the source that s/he would like to consult to get additional information about the item.

System: Presentation of information

The additional information that was requested by the user is presented on the tablet. Underneath the information the paused programme is presented as a keyframe, a 'play' icon is presented on top of the keyframe. Right from this keyframe, an image of the item and the list of different information sources on the item is presented and the source that the person is viewing at that moment is highlighted.

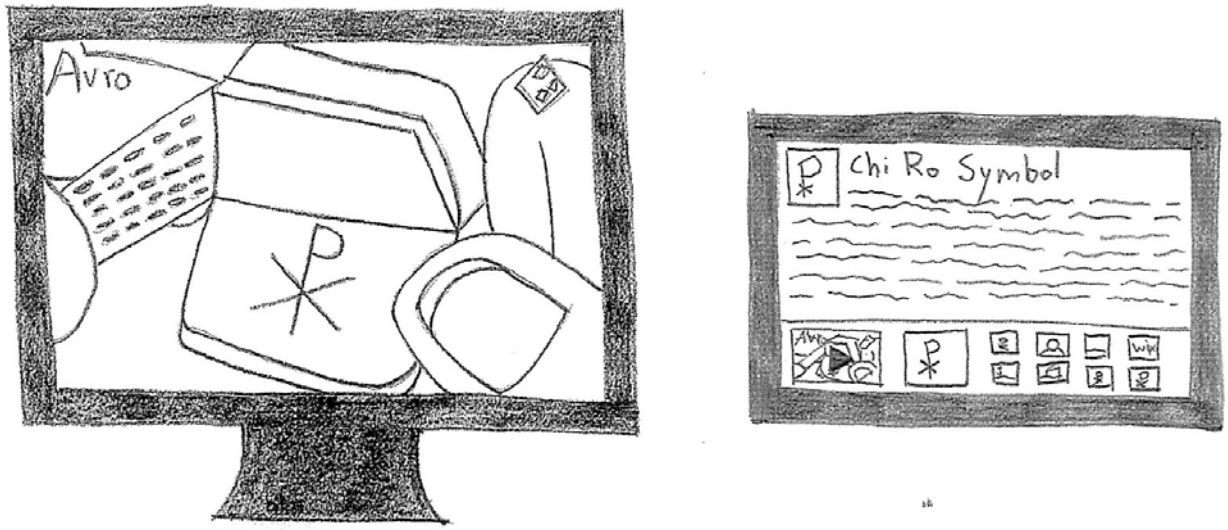

Figure 43: Sketch 3 of television and tablet with arrow

User: Expression of satisfied information need

When the user information need is satisfied, s/he clicks on the 'play' icon that is presented in the keyframe representing the programme at the bottom right of the tablet.

System: Returning to the programme

When the user clicks on the 'play' icon, the keyframe enlarges until it fills the entire tablet and the programme is resumed on the television and the tablet.

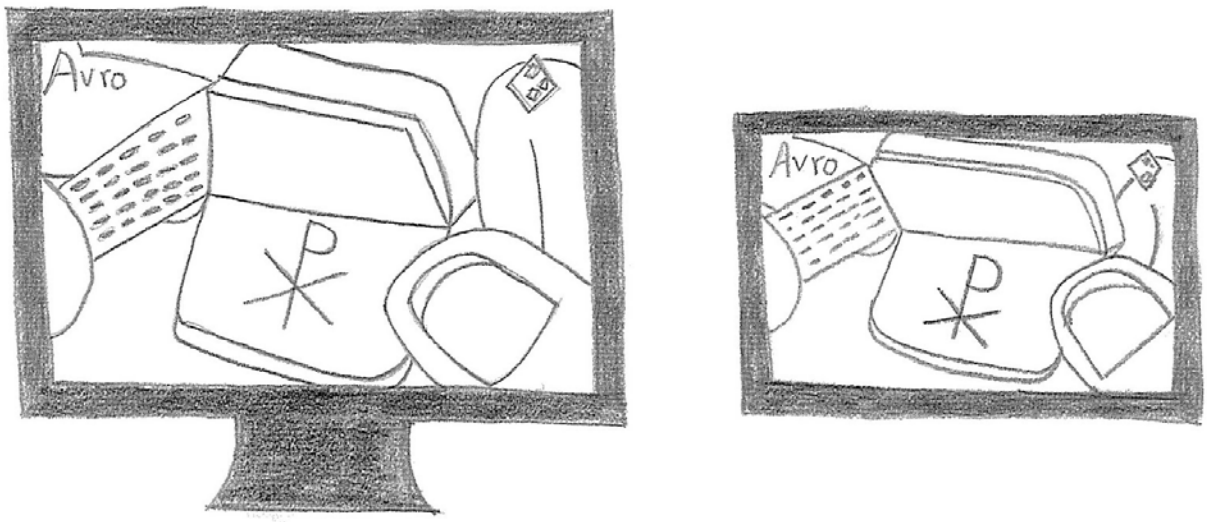

Figure 44: Sketch 4 of television and tablet with arrow

4.2.3 Television and tablet with rows

System: Presentation of possible items and information sources

User: watching programme, expression and choice of information need

The user watches a programme on the television. On the left side of the tablet is a column of keyframes with labels that each represent an item from which additional information can be requested. Next to each of these hotspots, a row of different information sources is presented by keyframes. Underneath this all, a navigation bar is presented.

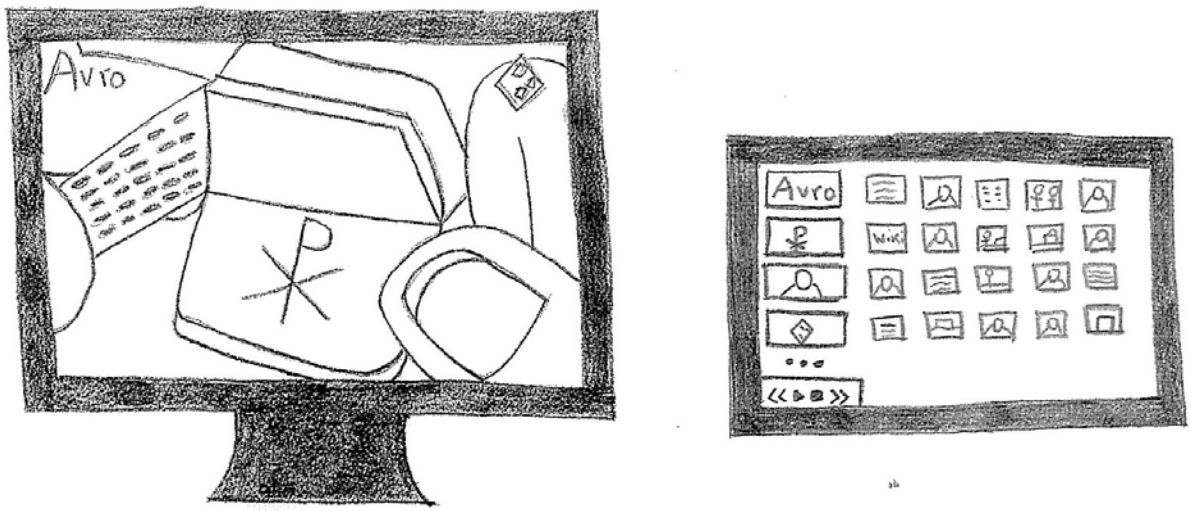

Figure 45: Sketch 1 of television and tablet with rows

User: Expression of information need and selection of information source

The user clicks on a keyframe representing an information source of a specific item to get more information about that item.

System: Presentation of information

The first row of hotspots is replaced by the row with the item that the user selected. In this first row the keyframe representing the item and the keyframe representing the information source are highlighted. The keyframes representing the other items are still presented on the left of the screen, however, the keyframes representing their information sources are replaces by a large frame that presents the additional information about the item from the source that the user requested. When the user would like other additional information, s/he can press the keyframes that represent the other information sources in the first row. During this time, the programme continues on the television screen. However, the user has the opportunity to pause the programme by clicking the 'pause' icon in the navigation bar on the tablet.

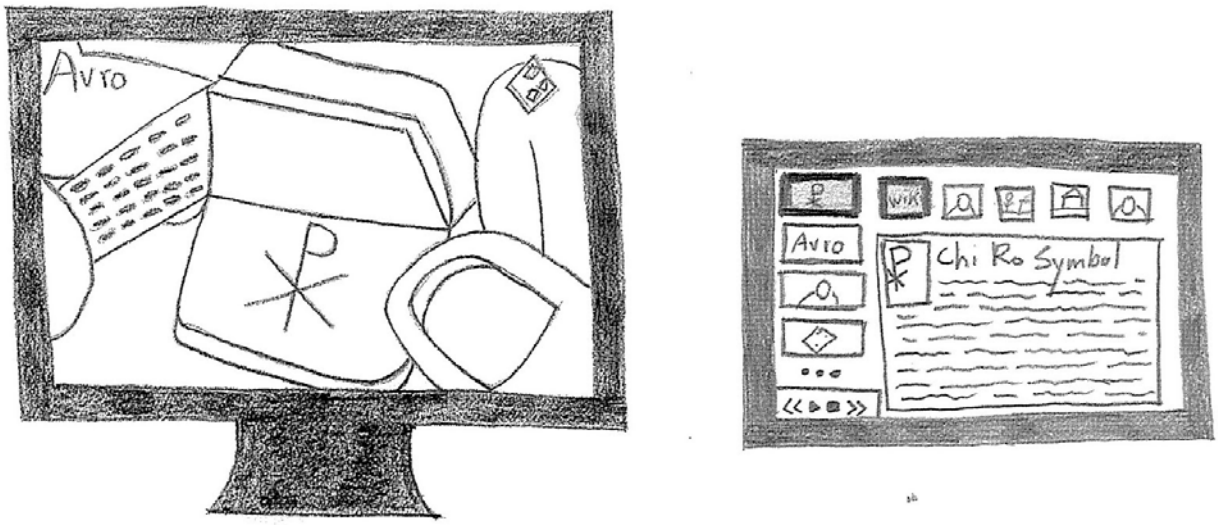

Figure 46: Sketch 2 of television and tablet with rows

When the user decides to view a video, the programme on the television is automatically paused. The user can still manipulate the programme with the navigation buttons on the tablet. An extra bar is also present when another video is presented on the tablet with which the user can browse through the additional information video.

User: Expression of satisfied information need

The user can return to the screen that was presented on the tablet before additional information was requested by pressing the 'back' button in the navigation bar. Another possibility is clicking on one of the keyframes that represent the items from which additional information can be requested. However, since the programme is still presented on the television, it is not necessary to close the additional information screen on the tablet to view the programme on the television.

System: Returning to the programme

When the user clicks on the ‘back’ button or on a keyframe representing an item, the initial screen is presented on the tablet. If the programme was paused by the user, s/he presses the ‘play’ button in the navigation bar to resume the programme.

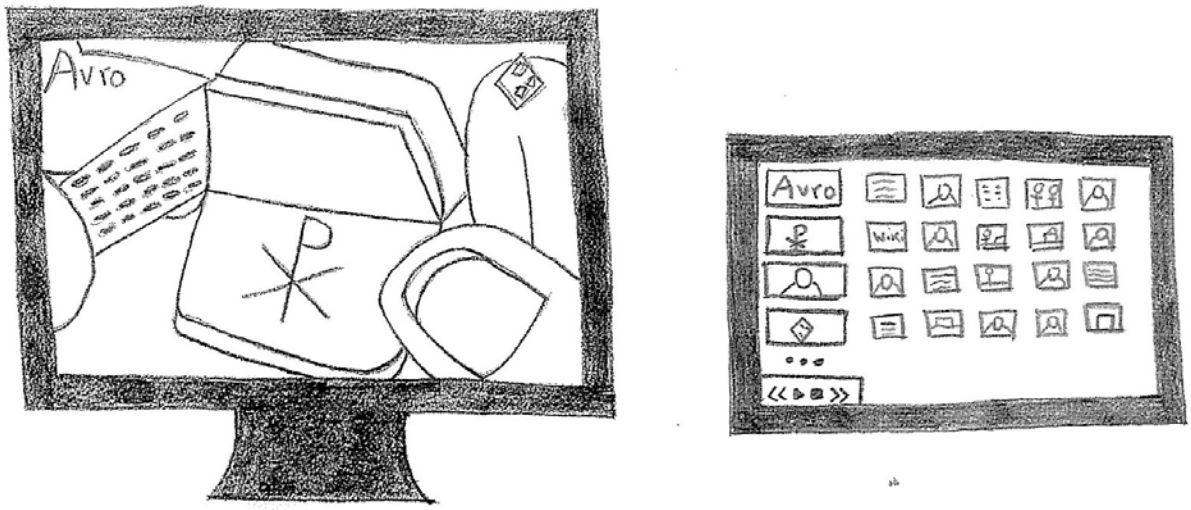

Figure 47: Sketch 3 of television and tablet with rows

5 Discussion of Mock-ups

In this section, we discuss features of the different mock-ups and their importance in the user-interface of the LinkedTV system.

Devices

One difference between the mock-ups was already mentioned above: one group of mock-ups makes use of a television screen and a remote control while the other group makes use of a television screen and a tablet. The ease of use of a remote control is an advantage, since only a limited set of buttons need to be used and the buttons can be clearly labeled (e.g. 'additional information' and 'back'). However, selecting an item on the screen when there are several items present can be clumsy. Another advantage of using a remote control is that this device is less expensive than a tablet. Forcing all users to purchase an expensive device is not ideal and for that reason it seems like it is less interesting to use a tablet. However, it is expected that the number of people owning a tablet will rise the next couple of years. An advantage of using a tablet is that when the additional information is requested and presented on the tablet, it is possible to keep presenting the programme on the screen. This enables other users to keep enjoying the programme while someone is requesting the additional information. Another feature of a tablet is that private information can be viewed only by the tablet's user.

Selection of item

In all mock-ups the user has the opportunity to specify from which item additional information is desired. How the user selects the item varies between mock-ups. Two different groups of mock-ups can be distinguished: mock-ups in which the items are presented in a list and mock-ups in which the user selects the items directly from the programme. The mock-ups that make use of a list of items are 'Television with bottom bar', 'Television with right bar', 'Television with rows', 'Television with time-line' and 'Television and tablet with rows'. The mock-ups in which the user needs to indicate in the programme from which item s/he would like to receive additional information are 'Television with circle', 'Television with rows and columns', 'Television with keyframes' and 'Television and tablet with arrow'. The advantage of not presenting the items in a list, but rather let the user indicate their request in the programme screen, is that it is very intuitive: the user sees the item in the programme and clicks or selects that particular item. A disadvantage of this approach is that additional information can only be requested from items that are visually present on the screen. It is very plausible that the user wants more information about a topic that is discussed in the programme, but not presented on the screen. This issue is dealt with in the mock-ups that make use of a list, since items or topics that appear in the list are not restricted to items that are visible in the programme. There is one mock-up that combines both approaches, namely 'Television and tablet with left bar'. Combining the approaches benefits from both advantages. However, the same information is presented multiple times and this may confuse or bother the user.

Selection of information source

In some mock-ups ('Television with bottom bar', 'Television with right bar', 'Television with circle', 'Television with rows and columns', 'Television with rows', 'Television and tablet with arrow' and 'Television with rows') the system presents an overview of several information sources before presenting the additional information. This enables the user to specify which information source s/he would like to consult. In three mock-ups, namely 'Television with keyframes', 'Television with time-line' and 'Television and tablet with right bar' the system presents one information source when the user has selected the item about which additional information is requested. When this additional information is presented, a list of alternative information sources is presented to the user and s/he can easily switch to a different information source. In this case the system needs a sufficiently accurate idea about the information source that is most interesting for the user. When the system first presents an information source that the user does not prefer, the user loses time and might even get frustrated. In the LinkedTV project, WP4 is responsible for personalizing the information sources and thus selecting the information sources that are most interesting for the user. In general, mentioning the source of the information allows the user to make a decision about the trustworthiness of the information. But the cost of presenting the sources is that it requires screen space and it can distract the user from the actual additional information.

Overview of items

When the user is looking at additional information on a certain item, in most mock-ups, the other items from which additional information can be requested are still presented. This enables the user to easily switch to another item when desired. It also gives the user an overview of available information and some structure. There are two mock-ups in which this overview is not presented: "Television with keyframes" and "Television with arrow". In these cases, the user needs to go back to the programme in order to select a different item.

Overview of information sources

In almost all mock-ups, an overview of information sources is presented when the users are consulting one particular information source of one item. This overview enables them to easily switch from one information source to another when they want more information than presented in one information source. The only mock-up in which this feature was not included is "Television with rows and columns". In this mock-up, the user first needs to revisit the overview of all information sources about one item, before consulting an alternative information source. An advantage of this mock-up is that there are a lot of information sources presented and the user can choose from all of these sources. Presenting too many information sources, however, can also be disadvantageous, because it leads to information overload. The personalized selection of information sources made by WP4 of the LinkedTV project will address this issue.

Pausing the programme

In the mock-ups "Television with bottom bar", "Television with circle", "Television with keyframes", "Television with time-line", "Television with rows and columns" and "Television with rows" the programme is immediately paused when the user presses the 'additional

information' button. In the two last mock-ups, the programme is not presented on the screen after pressing the 'additional information' button. An advantage of pausing the programme while the user selects the item about which s/he would like to receive additional information, is that they don't need to divide their attention between making the selection and the programme. However, the flow and ease of the programme can be disrupted when there is an abrupt interruption. This disadvantage is not present in the mock-up "Television with right bar" since the programme continues playing while the user selects the additional information. When presenting the additional information, the screen is split into two different parts: one frame presents the information and the other the programme. The programme is paused when the requested additional information source is a video. This is also the case for "Television and tablet with right bar" and "Television and tablet with rows" in which the programme on the television is not paused unless the requested additional information source is a video. However, the user can pause or resume the programme by the buttons on the navigation bar on the tablet. In the "Television and tablet with arrow" mock-up, the programme is paused on both the television and the tablet as soon as the user clicks on the tablet to indicate that s/he would like to receive additional information about an item.

Returning to the programme

In all mock-ups that include a television and a remote control, a 'back' button is used to let the user indicate that her/his information need is satisfied. On selecting this, the system returns to the point in the programme where the user left so that s/he does not miss anything. Making use of a 'back' button is intuitive and does not result in confusion as to what will happen when the button is used, since the button itself describes the action. The mock-ups "Television and tablet with right bar" and "Television and tablet with rows" also make use of such a button, which is presented in the navigation bar on the tablet. However, it is in these mock-ups not necessary for the user to select 'back', since during the quest for additional information, the programme is still presented on the television screen. Therefore, the user can just press 'play' in the navigation bar on the tablet in order for them to resume the programme. When the programme was not paused, there is of course no need to resume the programme. The mock-up "Television and tablet with arrows" makes use of a different navigation tool. During the presentation of additional information, a keyframe representing the programme is presented in the bottom left of the tablet. In this keyframe a "play" icon is presented. The user needs to click this keyframe in order to resume the broadcast on both the television and the tablet.

6 Conclusion

The mock-ups that are described in this deliverable were created as a starting point for discussion in the LinkedTV project. The mock-ups were designed without taking into account the technical difficulties. For this reason, not all features that are discussed in the mock-ups can be realized in the user interface of the LinkedTV system. The mock-ups were presented to the work package responsible for the realization of the LinkedTV platform and they pointed out some challenging aspects of the proposed user interfaces. In the upcoming months, the mock-ups will be redesigned in such a way that all features can be implemented by the LinkedTV platform.

For all the mock-ups described in this deliverable, the user goal was to receive additional information about a certain topic. The user interface when the user requests related information can be very similar to the interfaces we just described. The user could select an item from which related information is desired and then select an information source. The difference between additional information and related information would lie in the content of the information sources.

The additional or related information sources that the system presents to the user should be selected in such a way that they are most interesting for the user. WP4 of the LinkedTV project deals with this personalization of the information sources.

In the mock-ups, the interaction took place by making use of a remote control or a tablet. It is also possible to use other devices for the same purpose. One device that would be suited for the interaction is a smartphone. When this device is used, the user interface design of the tablet cannot be copied, since the screen of a smartphone is significantly smaller than the screen of a tablet. In this case, the keyframes, buttons and labels should be resized and repositioned. Other ways of interaction could also be used. It is, for example, already possible to use movement to control and interact with the Xbox 360 by using the Kinect device[3]. The wii remote control[4] is also a nice example of using movement to interact with content. It is not possible to predict the technology that will come to us in the immediate future. We assume that several devices will enable the interaction with a television, ranging from a simple, standard remote control to a sophisticated tablet.

In the future, user tests will be carried out to test the proposed mock-ups. By carrying out the user tests we want to verify whether the system can meet the user needs in such a way that the user is satisfied with the ease of use and the overall interaction with the system. Also the cognitive load on the users will be investigated when interacting with the LinkedTV user interfaces. More basic features that will be tested are the ease of switching from one additional information source to another and switching from information about one item to

[3] www.xbox.com/en-GB/kinect

[4] www.wii.com

requesting information about another item. It is also important to verify whether users can easily access the information when using a limited number of buttons on the remote control and whether the user can keep an overview of the things s/he requested and whether s/he is able to reconstruct the structure of the information.

The next deliverable (D3.3 in month 12) will also focus on LinkedTV user interfaces sketches. In that deliverable, the mock-ups that are presented in this deliverable will be redesigned with attention for the technical restrictions and the results from the user tests. In addition to the adjustments of the current mock-ups, new user interface designs will also be proposed.

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