From Single Screen to Dual Screen - a Design Study for a User-Controlled Hypervideo-Based Physiotherapy Training

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ABSTRACT
Hypervideo based physiotherapy trainings bear an opportunity to support patients in continuing their training after being released from a rehabilitation clinic. Many exercises require the patient to sit on the floor or a gymnastic ball, lie on a gymnastics mat, or do the exercises in other postures. Using a laptop or tablet with a stand to show the exercises is more helpful than for example just having some drawings on a leaflet. However, it may lead to incorrect execution of the exercises while maintaining eye contact with the screen or require the user to get up and select the next exercise if the devices is positioned for a better view. A dual screen application, where contents are shown on a TV screen and the flow of the video can be controlled from a mobile second device, allows patients to keep their correct posture and the same time view and select contents. In this paper we propose first studies for user interface designs for such apps. Initial paper prototypes are discussed and refined in two focus groups. The results are then presented to a broader range of users in a survey. Three prototypes for the mobile app and one prototype for the TV are identified for future user tests.

ACM Classification Keywords
H.5.2. Information Interfaces and Presentation (e.g. HCI): User Interfaces

Author Keywords
Hypervideo; Dual Screen; Navigation; Training

INTRODUCTION
During a hypervideo-based physiotherapy training, the user has to lie, sit, or stand on a gymnastics mat or training device. The correct posture during the execution of the exercises is very important to ensure the desired training and healing effect and not to strain or wrongly train certain muscles. During the training, the patient needs to be able to maintain eye contact with the screen and to interact with the video via keyboard, mouse, or touchscreen. The single screen concept described by Meixner et al. [13] uses a laptop or tablet with a stand to show the exercises as well as to control the flow of the hypervideo. In this setting it is difficult to keep a correct posture on the gymnastics mat or training device, have eye contact to the screen and position the playback device within reach for interaction at the same time. The following problems arise:

1. Positioning of the screen so that it could be easily watched during the execution of the exercises without moving the upper body or head (which can lead to a wrong execution of the exercise and a lower training effect) is difficult and sometimes not possible at all.
2. Controlling the flow of the hypervideo requires a movement towards the device, so even if the exercises were executed lying on the floor, it requires the user to get up, interact with the hypervideo and then lie down again, which may be very challenging with certain conditions.

Summarizing, in a single screen situation the playback device is either positioned well for watching the videos or for interacting with the hypervideo; both not being possible at the same time.

Dual screen applications with a TV and a touch screen for remote control offer a solution. However, up to now, the design and interaction patterns of such dual screen applications in the area of hypervideo-based physiotherapy training are not clear. Moving the main video to the TV allows a different focus and a new arrangement of the elements/components of a mobile app. Concretely, the contributions of this paper are the following: We propose interface designs for the TV screen and the mobile app. These are improved step-by-step during a design process which includes paper prototyping, focus groups with experts for hypervideo-based physiotherapy training and a survey.

This paper is structured as follows: Firstly, we give an overview of related work. Then we present context and scope of our application. The design process of the application is described thereafter. A discussion and conclusion section follows.

RELATED WORK
Related work exists in several areas, namely the areas of hypervideo, second or dual screen applications, and rehabilitation training. All areas provide insights for the implementation of

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a dual screen concept for user-controlled hypervideo-based physiotherapy training.

Hypervideo

Klynt [11], the SIVA Player [13], and the Ambulant Open SMIL Player [5] provide functions and controls relevant for the playback of hypervideo trainings. However, they are limited to single screen presentations and not capable of splitting the contents on two screens. Klynt and the Ambulant Open SMIL Player are furthermore not suited to the needs of physical trainings. Bibiloni et al. present a hypervideo platform which can be used to "represent augmented reality on Interactive TVs" [4]. Their concept of hypervideo is limited to an "interactive video stream in which the user is able to interact with the content through hyperlinks, leading to non-linear navigation, searching, sequence skipping, etc." [4]. They are "enabling a second-screen device to connect to the application in order to get the additional information in a handheld device and using the capability of HbbTV of representing the broadcast video." [4]. This work provides hints on the implementation of a mobile app with HTML5, but does not deal with the requirements of training settings.

Second/Dual Screen Applications

Different studies have been made in the area of second/dual screen applications in the past few years. Many of them combine a TV screen with a second screen application showing information about contents on the first screen (TV). Cesar et al. identify "four major usages of the secondary screen in an interactive digital television environment: control, enrich, share, and transfer television content" [6]. Beeson et al. [3], Cruickshank et al. [7], and Leyssen et al. [12] describe second screen applications which can be used as remote controls. Beeson et al. [3] provide several play-lists with video streams that can also be started on the first screen via a set top box. Cruickshank et al. [7] show timelines for several TV channels which can be extended to provide information about television shows. Information about a show can be viewed on the second screen without hiding contents on the first screen. Leyssen et al. [12] describe concepts for adding additional information to certain items in the video. These can be viewed either on the main or on the second screen. All three applications use a single linear video and do not provide controls for hypervideo navigation. Leyssen et al. [12] deal with a different underlying structure of additional information, but their application provides a separation between main video controls and additional information which can be applied to our concept as well. Wald et al. [26] describe a second screen extension of an e-learning application. This application allows the viewers to add additional information and thumbnails to video fragments. Besides live synchronization, other functions which go beyond the functionality of our concept are described. However, Wald et al. [26] only describe a linear video as an underlying structure. Barkhuus et al. examine "second-screen interaction at a dance and music performance" [2]. The performance is streamed to tablets in real-time, the "video stream on the tablet is navigational and enables audience members to pan and zoom in the real-time video feed" [2]. The second screen applications described so far mainly provide additional information to a main video stream or act as some kind of remote control which allows the user to select videos, navigate in linear videos, or interact with videos (like pan and zoom). None of the applications is tailored to physical training scenarios.

The work of Fleury et al. [8] deals with the presentation of announcements on the first and/or second screen. New contents on the second screen should be announced by "very discreet prompting, e.g. an icon in the corner of the primary TV screen". Regarding the question, if the contents of the first screen should also be shown on the second screen, "participants wanted to be able to control if the show should be running on the secondary device, in sync with the content broadcast on the TV screen" [8]. Neate et al. studied second screen companion content [14]. They investigated the introduction of content on a secondary device and "how much it detracts from, or enhances, the show the user is currently engaged with". They found out that a notification by sound results in a quicker reaction than other stimuli. They furthermore recommend notifications on the main screen if companion content is available for longer than just a few seconds, so the viewer can chose when to watch the content [14].

Rehabilitation Training

Rossol et al. describe a virtual reality rehabilitation as an "effective way to supplement patient rehabilitation" [19]. They "propose a design for a flexible, low-cost rehabilitation system that uses virtual reality training and games to engage patients in effective instruction on the use of powered wheelchairs" [19]. They use Bayesian networks in their system to support a self-adjusting adaptive training. This system is implemented for the use with wheelchairs, and cannot be used for other trainings. Octavia et al. address user diversity by an adaptive rehabilitation training for multiple sclerosis patients [15]. They automatically adjust the difficulty levels of the training exercises. This results in less boredom and more challenges making the training more enjoyable and fun. However, their system requires special equipment and can only be used for the described training. In their study to enhance rehabilitation after falls at home, Uzor and Baille show that their "visualizations and games were able to overcome the major limitations of standard care, and that they were usable and acceptable to the end users" [25]. They "conclude that the visualizations and games encouraged the participants to do the exercises at the right pace". Furthermore, the users "responded that they would prefer to use the visualizations and games to the instructional booklet" after a user test. Reasons for this response were a "potential enjoyable experience offered by the games" and "advice and dynamic feedback offered by the visualizations" [25]. While [19] and [25] propose training systems and prove their usability and acceptance by the end users, none of the systems is a second screen app or uses hypervideos.

Spina et al. describe a "training system based on a smartphone that integrates in clinical routines and serves as a tool for therapist and patient" [21]. The smartphone is strapped to the joint that is moved and only the "build-in inertial sensors were used to monitor exercise execution and providing acoustic feedback on exercise performance and exercise errors" [21]. It can be operated in teach-mode to generate an exercise model, and train-mode that provides feedback to the user. The system gives no visual feedback. The patient needs to know how to execute the exercises and only gets feedback whether they are performed correctly. The movement of whole body parts is needed for the system to work properly. Exercises where only single muscles are tensed or relaxed do not result in feedback from this system. Tang et al. propose a similar system which can also correct motion sequences, but instead of a smartphone strapped to a joint, several cameras are used. The prototype "guides people through pre-recorded physiotherapy exercises using real-time visual guides and multi-camera views" [23]. Thereby, aspects of corrective guidance are addressed. The exercises are visualized by geometrical shapes in the different available camera views. This system requires the installation of cameras to provide enough data for motion correction and guidance. Like in the system described by Spina et al., whole body parts need to be moved for the system to work properly.

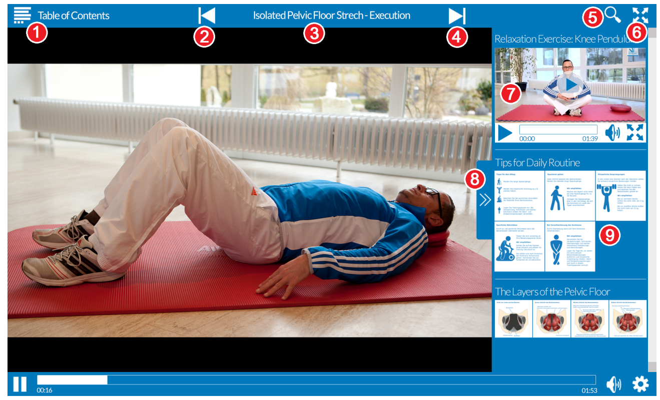

Figure 1. Screenshot of the single screen player as described by Meixner et al. [13, 24]

CONTEXT AND SCOPE

The two most important concepts of hypervideos are a non-linear structure of scenes and annotations that are associated to the video scenes. The interlinking of scenes results in a graph structure. This graph structure allows the viewers to select an individual path through the hypervideo. They can repeat video scenes or skip information that is already known. Furthermore, each scene may be enhanced with additional information which can be invoked by the viewer if desired. Depending on the type of additional information (image, text, audio, video, links), different interactions are possible.

The playback of such videos requires special players which are capable of providing navigational elements like selection panels for follow-up scenes, a table of contents, or a search function. Furthermore, areas for displaying additional information are necessary. Figure 1 shows an example user interface of a hypervideo player as described by Tonndorf et al. [24]. The user interface provides navigational elements at the top in addition to standard controls in the bottom pane below the video. Navigational elements include an entry point to the table of contents (1), a button to jump to the previous scene (2), the title of the currently displayed scene (3), a button to jump to the next scene (or to a selection panel) (4), a search button (5), and a button for the full-screen mode (6). A foldout panel on the right shows additional information (8). In the example in Figure 1, an additional video (7) and two image galleries (9) are provided. The additional video provides standard controls and can be displayed in full-screen mode. The image galleries can also be viewed in full-screen mode with one enlarged image at a time, and an overview of the other images.

The videos used for the hypervideo-based physiotherapy training usually have a theoretical/introductory and a practical part (as described by Tonndorf et al. [24]). Information about the disease as well as important and generally applicable information for the execution of the exercises are provided in the theoretical/introductory part. The practical part provides different training programs for beginners and more advanced participants. These trainings consist of video sequences which explain the proper execution of the exercises. An introduction and a participation video exist for each exercise. The viewer can decide if she/he wants to repeat the exercise after a set of executions or proceed with the next exercise. Thus, the training can be adjusted to the individual fitness and training progress. For all video sequences of the theoretical as well as the practical part, additional information like schematic drawings, optional relaxation exercises, and further reading materials is provided. The videos are furthermore provided together with a table of contents and a search function to jump directly to a certain part of the training.

The target group of our software are cancer patients who had surgery after a prostate-cancer diagnosis. The age group that usually gets this type of cancer is 45 years and above. This leads to a further challenge for hypervideo-based physiotherapy trainings, because this user group has a mixed level of technical experience in the usage of touch screens and apps on smartphones. Furthermore, first problems with eyesight appear. This has to be taken into account when designing the user interface to control the hypervideo and leads to the following questions:

- Which control elements are necessary to be able to control an individual training in a way that does not interrupt the training more than necessary?
- How should the multimedia elements of the training be split up between TV and touch screen?
- What are requirements for a mobile app which is capable of controlling the TV screen in an individual training?
- How should elements and function-buttons on a mobile app be arranged?

INTERFACE DESIGN

We designed the user interface of the mobile app in an iterative process. The goal was to provide all necessary buttons in an easy to use screen layout. We iterated the design of the mobile app concept in the following three steps which resulted in three prototypes which were then implemented:

1. **Initial high-fidelity paper prototypes** with screen designs guided by related work, existing apps, and requirements of hypervideos.
2. Pluralistic Walk-through [17, p. 514] in **1st and 2nd focus group meeting** (2nd focus group meeting with refined and improved high-fidelity paper prototypes).

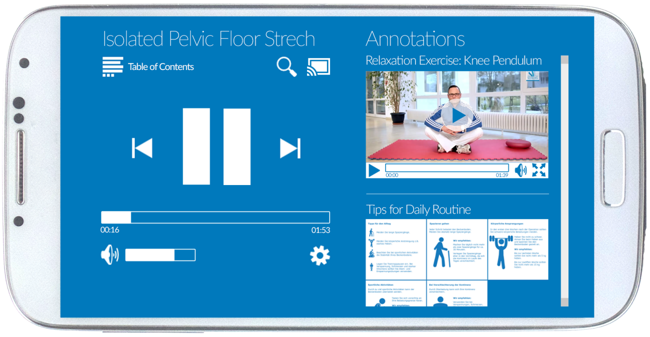

Figure 2. Variation of the original player without the media preview and large control buttons.

Figure 3. Split screen for video and additional information.

3. A **survey** with selected high-fidelity paper prototypes.

Initial High-fidelity Paper Prototypes

For the creation of the high-fidelity paper prototypes [20], we analyzed related work to derive already evaluated usage concepts. We also studied existing Chromecast apps with a focus on video, like LocalCast for Chromecast/DLNA [16]. In addition, we applied the Google Chromecast user experience guidelines [10] and results of previous tests from our lab. Furthermore, physiotherapists gave advice for the creation of the initial high-fidelity paper prototypes. Based on the hypervideo player described in [13], we created four screen dummy variants for the TV and the touch screen (TS) respectively:

- **TV1 (baseline)**: The original player used in our first study (Figure 1). All control elements and a sidebar for additional information are shown. Although this variant is contradictory to [10], because the guidelines state that no control buttons should be displayed on the TV screen, we kept it for completeness.
- **TV2**: TV1 without control elements to comply with the guidelines in [10]. The TV screen still contains the additional information, the progress bar and the title of the currently displayed scene.
- **TV3**: TV2 without additional information. Only the video (centered), the progress bar (bottom) and the title of the current scene (top) are displayed.
- **TV4**: Solely the video is shown, “standard TV watching”.

Each of the touch screen variants (TS1-TS4) as described in Table 1 was designed in four different forms: landscape and portrait mode for smartphone, and landscape and portrait mode for tablet. The video view on the touch screen was assumed to be synchronized with the video on the TV screen.

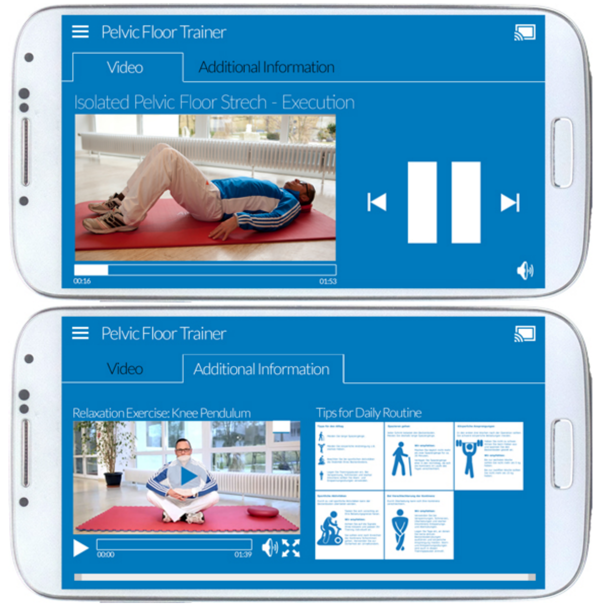

Figure 4. Tab concept: video tab with video view and controls (top) and additional information tab (bottom)

1st Focus Group Meeting

The initial high-fidelity paper prototypes described in the previous section, TV1-TV4 and TS1-TS4 were refined and optimized with a focus group.

Participants

Participants were five experts ($N = 5$) who had knowledge in hypervideo design and dual screen concepts. All of them use smartphones and tablets in daily live. The five experts were from different disciplines: two media and communication scientists, a web developer, a programmer, and a legal expert. At least three of them had experience in experiments with the target user group and participated as observers in usability studies with the target user group in the past. The experts furthermore had knowledge from a 1-year user study with the target user group using a single screen application. The analyzed user comments from the previous study were taken into account. Furthermore, physiotherapists had provided questions and hints that should be kept in mind by the focus group during their meetings. Already known issues and difficulties in the usage of training apps were discussed and the results integrated into the paper prototypes. Having prostate cancer patients in the focus groups was desirable, but finding a patient with sufficient knowledge about hypervideo and dual screen concepts was not possible at that time.

Procedure/Data Collection

The first focus group meeting [18], was carried out as a Pluralistic Walkthrough [17, p. 514] with more open discussions in the group. Each participant got her/his own printout of all high-fidelity paper prototypes of the mobile app described in Section ’Initial High-fidelity Paper Prototypes’. The TV prototypes were shown in a presentation on a large monitor.

Table 1. Prototypes and their usage in the different steps of the user-centered design process

Name	Description	Used in				
		initial prototype	1st exp. meeting	2nd exp. meeting	survey	user test
TS1	The original player described in [13] extended by a concept for portrait mode. (baseline) (Figure 1)	✓	✓			
TS2	TS1 without a video view. The focus lies on displaying additional information. (Figure 2)	✓	✓			
TS3	Both, a video view and additional information are shown. A split screen is used in landscape mode. Two tabs are used in portrait mode.	✓	✓			
TS4	Video and additional information are arranged like in TS3. The video view is substituted by large centered video controls.	✓	✓			
TS5	***"Split view"*** uses a split of the area into two halves, one half shows the video view and the video controls, the other contains the additional information. Each part has a different background color. (Figure 3)			✓	✓	✓
TS6	***"Tab concept"*** with a player view combined with large buttons and a separation between video and additional information by two tabs. (Figure 4)			✓	✓	✓
TS7	***"Drawer concept"*** with different background colors for the video view/large video controls and the additional information. (Figure 5)			✓	✓	✓
TS8	TS7 without the video preview. (Figure 6)			✓		
TS_TOC	Panel with the table of contents and controls that are not necessary for primary navigation. (Figure 7 (left))			✓	✓	✓
TS_CB	Control buttons to select the next scene. (Figure 7 (right))			✓	✓	✓

The following questions were given to the participants to start and guide the discussion: Is the allocation of contents between TV and touch screen useful? Is the arrangement of the elements within a screen appropriate? Are all necessary control elements available or is anything missing? Is the realization of the selection panels for choosing the next scene clear? Which variant (possibly with modifications) seems to be the most practical?

Analysis and Results

The focus group meeting revealed the following findings regarding the TV screen: A mirroring of the touch screen to the TV screen (TS1 and TV1) is not considered useful, because many unnecessary elements are displayed on the TV screen where no interaction with the contents can be carried out. Instead of showing the additional information on the TV screen, their availability in a scene should be announced to encourage the user to take a look at them on the touch screen. With respect to the announcement of additional information, no consensus could be found, so these questions were addressed in our survey (see Section 'Survey').

Regarding the touch screen, the experts specified that at least a small video view and the timeline are necessary for orientation and to jump forward and backward without looking back and forth between the devices. The control elements should be enlarged compared to the version described in [13] to make them easier to touch. The table of contents and the search function should be aggregated on an option panel which can be folded out from the left. Scroll bars (if necessary) should only be available for one direction (left-right OR top-bottom). The experts agreed that a clear demarcation (by background color or otherwise) between video control and additional information is necessary. Therefore, three options were considered useful: a *tab concept* with a separation of video controls and additional information, a *split view* where video and additional information are always visible, and a *"drawer" concept* as seen in the Spotify app [22]. The latter adapts the screen space to the currently focused elements, video controls or additional information, but does not hide one area completely.

The findings of the first focus group meeting were integrated into the existing high-fidelity paper prototypes. Furthermore, new high-fidelity paper prototypes were created for new concepts not incorporated in the first high-fidelity prototypes. This led to the new variants TS5-TS8 as described in Table 1.

The prototypes of the first focus group meeting also did not provide concepts for the table of contents and the selection panel for the follow up scene at a fork in the video flow. Accordingly, the two high-fidelity prototypes TS_TOC and TS_CB as

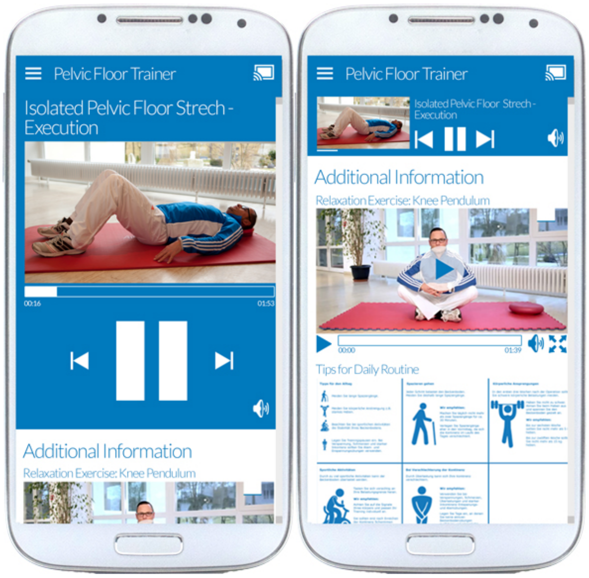

Figure 5. "Drawer" concept: video part with video view and controls (left) and additional information part (right)

Figure 6. "Drawer" concept without a media preview and large control buttons.

described in Table 1 were added for discussion in the second focus group meeting.

Variant TS1 was kept as a reference, TS2-TS4 had the same concepts as in the first draft but with a clearer appearance. They were improved with the findings from the first focus group meeting. For example, the buttons not necessary for primary navigation and the table of contents were grouped into a panel.

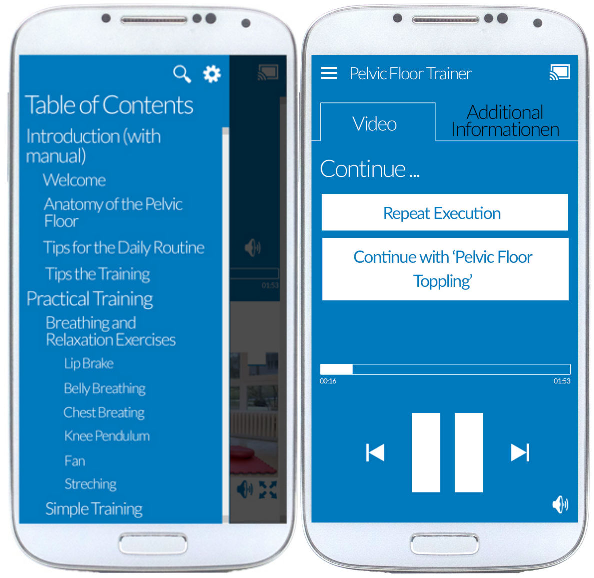

Figure 7. Table of contents and search panel (left) and screen with control buttons (right)

2nd Focus Group Meeting

Open questions from the first focus group meeting were discussed in a second session. All former findings were integrated into the high-fidelity paper prototypes for further analysis.

Participants

A second session with the same participants using the same methodology as in the first meeting was conducted to find a smaller set of high-fidelity prototypes that could be presented to a larger group of people in a survey.

Procedure/Data Collection

The improved and new high-fidelity paper prototypes described in the previous section (TS1-TS8, TS_TOC, and TS_CB) were handed out to the participants. This time only the smartphone versions were used, because the tablet versions did not lead to any additional findings in the first focus group meeting. Besides, presentation on smartphones tends to be harder due to their smaller screen size. Each prototype TS1-TS8 was discussed separately and either valued as unsuitable or put aside for further discussion. Furthermore, prototypes TS_TOC and TS_CB were verified to be consistent with the rest of the application and provide all necessary functions. Points to discuss were identified.

Analysis and Results

Three screen concepts for the display of control elements and additional information (TS5 (Figure 3), TS6 (Figure 4), and TS7 (Figure 5)), as well as two other screens (selection of next scene (TS_CB (Figure 7, right)), table of contents(TS_TOC) (Figure 7, left)) were selected by the group for further evaluation and the high-fidelity paper prototypes were adapted to the results of the discussion. Some functions provided in the single screen player were considered not necessary (like additional information displayed as overlay on the main video, hotspots). Buttons for selecting the next scene should be positioned in the video control part. No separate volume control is needed for additional information videos. A search form should be available in the table of contents to allow fast access to the search function.

Figures 3-7 show the resulting high-fidelity prototypes chosen by the focus group, namely TS5, TS6, TS7, TS_TOC, and TS_CB. Although the TV screen (TV3) was the declared preference for the TV screen, the experts were indecisive whether additional information on the TV might be useful. This question was also covered by our survey.

Survey

In order to get the opinion of a wider range of users with different knowledge levels in the usage of smartphones and in the execution of physiotherapy trainings, we conducted a survey with 164 participants. Our survey consisted of six parts. The first part contained questions about the device usage (which devices are used?), the transition of content to the TV, and an active participation in TV shows. The second part evaluated the usage of devices (how are they used?), the comprehensibility of certain button designs, as well as standard interactions performed in commonly used apps. The third part asked questions about the importance of showing contents on the TV screen. The fourth part contained questions on when and how to watch additional information. Part five examined the user friendliness, the appropriateness of button sizes, the arrangement of buttons, the separation of video and additional information, and the obviousness of additional information for the variants evaluated as usable in the second focus group meeting. Thereby, animated high-fidelity paper prototypes were used for the tab and the “drawer” concept. The questions in the survey were asked for each variant, and both, landscape and portrait mode. To be able to verify the answers, an additional question about the overall preferred variant was asked. The sixth part of the survey included more common questions about the table of contents and the privacy statement.

Participants

The survey was answered by 164 participants (121 male, 41 female, 2 NA). They were between 17 and 78 years old (M = 34.28, SD = 17.46). The educational background was mixed and included all levels of education. All but one participants had at least a school graduation, 66 of them had a university degree, and 31 had completed a vocational training.

Recruitment/Data Collection

The participants were recruited through members of the project via social media and email. Furthermore, patients at the rehabilitation clinic and participants of former tests were asked to participate.

Analysis and Results

The survey tried to find a preference for one of the prototypes. Therefore, each variant (see Figures 3 to 5) was presented to the participants in portrait and landscape mode. The tab concept was preferred by most of the participants (portrait mode: 93 participants, landscape mode: 92 participants). The split screen and the “drawer” concept were preferred by about the same number of participants in portrait mode (split screen: 34 participants, “drawer” concept: 38 participants). A preference for the split screen can be recognized in landscape mode (49 participants) compared to the “drawer” concept (24 participants).

In addition to a preference for one version, the survey revealed the following findings for the prototypes for the user test:

- Getting information on a secondary device is the most frequent way of interaction with content on a TV screen.
- A one handed usage of the secondary device with a thumb is desired (esp. for smartphones).
- The stand of the cover is used rarely, therefore, no preference of landscape mode for tablets can be derived.
- The volume on the TV screen should be controlled by the hardware volume buttons on the secondary device.
- Turning off the screen of the secondary device after a time of inactivity is considered important.
- Buttons for settings and table of contents need a separation.
- Buttons for screen transfer and navigation in the video structure (jump for-/backward between videos) are clear.
- It should be possible to pause and start the video by touching the video area or with a button below the video
- Showing the title of the current video in the header, the timeline in the footer, and an as large as possible display of the video are considered important for the TV screen.
- No clear statement can be made regarding the display of additional information on the right side of the TV or the indication of new additional information on the TV screen.
- Additional information is mainly watched at the end of a scene and should be shown enlarged on the TV screen.
- The button sizes of all prototypes are sufficient.
- The arrangement of elements and the separation of video and additional information is considered best for the tab concept.
- Different ways to close the table of contents are desired.
- The imprint and data privacy statement should be placed at the end of the table of contents.

The tab concept was evaluated best, the split screen was preferred by a smaller number of participants. The dynamic view of the “drawer” concept, however, is hard to show in a survey despite the usage of animations. Furthermore it is not very well known from desktop computers. Accordingly, we decided to implement all three variants for a user test in future work. Our prototypical mobile application will use three hardware components: a standard TV with an HDMI connector, a Chromecast [9] and an Android smartphone. The Chromecast supports the transmission of HTML5 contents and enables us to display media on the TV. Furthermore, we use PhoneGap [1] to create the prototypical apps from the player implemented in HTML5, CSS3, and JavaScript.

DISCUSSION AND CONCLUSIONS

This paper proposes a screen designs for a dual screen concept for a user-controlled hypervideo-based physiotherapy training. We introduce designs for both parts, the TV screen and the mobile second screen app. Smaller devices like smart watches were not considered in this work. Our design process consisted of several steps. The initial high-fidelity paper prototypes were created in the beginning to have a basis for discussion in the focus group meetings. While it was not possible to recruit experts from the target user group, we had experts in the meeting that did user tests and long term studies with the target user group before and knew their behavior as well as potential issues. We tried to get a wider opinion on an improved subset of the initial prototypes using a survey with 164 participants. The survey revealed that a one handed usage of the secondary device with a thumb is desired (esp. for smartphones) and the volume on the TV screen should be controlled by the hardware volume buttons on the secondary device. Furthermore, it should be possible to pause and start the video by touching the video area or with a button below the video. On the TV screen, the title of the current video should be shown in the header and the timeline in the footer. An as large as possible display of the video is considered important. Additional information is mainly watched at the end of a scene and should be shown enlarged on the TV screen. The tab concept was considered best regarding the arrangement of elements and the separation of video and additional information. In addition to the focus groups and the survey, we are going to test three selected prototypes from the survey in a user study with patients of a rehabilitation clinic to identify usability problems during a training session where the user has to do the exercises in different positions.

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