A Storyboard-Based Interface for Mobile Video Browsing

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Abstract. We present an interface design for video browsing on mobile devices such as tablets that is based on storyboards and optimized with respect to content visualization and interaction design. In particular, we consider scientific results from our previous studies on mobile visualization (e.g., about optimum image sizes) and interaction (e.g., human perception and classification performance for different scrolling gestures) in order to create an interface for intuitive and efficient video content access. Our work aims at verifying if and to what degree optimized small screen designs utilizing touch screen gestures can compete with browsing methods on desktop PCs featuring significantly larger screen estate as well as more sophisticated input devices and interaction modes.

Keywords: Mobile interfaces. Mobile video browsing. Interactive multimedia.

1 Introduction

The ubiquity of handheld mobile devices such as tablets combined with the increasing popularity of mobile video playback and the possibility to access larger video archives via fast network connections results in an increasing need for better interface designs for mobile video search and browsing. Yet, interaction design for such devices – especially for rather complex tasks such as quick and efficient video browsing – is difficult for several reasons. First, the devices' form factor results in limited screen estate, which in turn limits, for example, the ability to visualize a video's content (e.g., via storyboards) and meta-information about a video (e.g., text annotations). Second, the predominant input modes for such devices, i.e., touch and tilting actions (e.g., via touch screen and accelerometers, respectively) are often lacking the flexibility and accuracy of input devices commonly used in desktop PC environments (such as keyboard and mouse). While we can therefore not expect video browsing systems on mobile devices to achieve a similar performance as interfaces optimized for desktop PCs, scientific studies (e.g., [4, 5, 6]) as well as prototypes and concrete interface designs (e.g., [1, 3]) suggest that high video browsing performance can be achieved if such a mobile system is optimized for the task at hand and considers the presumably limiting factors in the interface design.

For example, in our preceding research, we evaluated how the size of thumbnails used to represent video content influences video search performance [5, 6]. Our results indicate that surprisingly small sizes are actually sufficient in order to achieve a high search performance, thus suggesting that the small screen sizes of mobile

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devices might be much less limiting for the interface design than commonly assumed. Likewise, touch interaction has obvious disadvantages, for example, when it comes to entering content, such as typing a query on an onscreen keyboard that lacks the tactile feedback of its physical counterpart and utilizes valuable screen estate. They also often lack the accuracy of controllers or mouse interfaces in tasks that require precision and accurate placement. Yet, touch gestures have be proven to be very intuitive, efficient, and considering performance maybe even better than traditional interaction modes in situations where quick navigation of large amounts of content is required – a characteristic which can obviously be very useful for quick video browsing if related interactions and gestures are implemented appropriately. For example, in [4] we compared how a paged versus continuous navigation of storyboards via touch gestures influences video search performance, resulting in related guidelines for mobile video browsing interface design.

Encouraged by such promising results, we proposed two interface designs – one utilizing a filmstrip style visualization integrated in vertically mounted timeline sliders placed on the left and right side of the screen, and one with a storyboard design utilizing our previous related research results [4, 5, 6]. Both designs have been evaluated in a comparative study [3] illustrating their usefulness, but also demonstrating complementary strengths and weaknesses. Consequently, we propose a new interface integrating both concepts into one single design with the ability to easily switch between the two interaction modes. While our studies so far have verified the design's usability for mobile video search, it will be interesting to evaluate it in comparison to more complex desktop PC systems as part of the Video Search Showcase (VSS) 2015 event in order to gain more insight into how well mobile systems can perform compared to such traditional setups, to identify their potential and also possible boundaries. The interface that we present is based on the one for single video browsing introduced and evaluated in [3], and extended in order to also support parallel browsing in video archives of up to ten individual files, as specified in the tasks of this year's VSS competition.

2 Interface Designs

Figure 1 illustrates the storyboard-based interface design used in the comparative study in [3]. Thumbnails extracted from the video are temporally sorted and presented in a 5x5 grid layout that can extend to the top and bottom beyond the screen. Scrolling to parts of the video before or after the currently visible area is done via up and down gestures, respectively. In order to illustrate the location of the currently visible part within the whole video, a scrollbar-style icon is added to the right side of the screen.

Figure 2 shows the aforementioned filmstrip style visualization which appears when the vertically timeline slider on the right side of the screen is used. Compared to the traditionally used horizontal orientation of such a slider, the vertical placements on the left and right side of the screen enables easier access and operation when holding the device with two hands during interaction (cf. illustration on the left side of the figure), a design decision that was also utilized in the interface design presented in

[2]. In our case, the slider on the left side of the screen covers the whole content of the video, enabling quick access to a certain part of it if and only if the related position is mapped on the (rather short) slider timeline representing the whole length of the video. For longer videos, the slider bar on the right can be used, which illustrates only a fraction of the whole file thus enabling browsing at a finer granularity level.

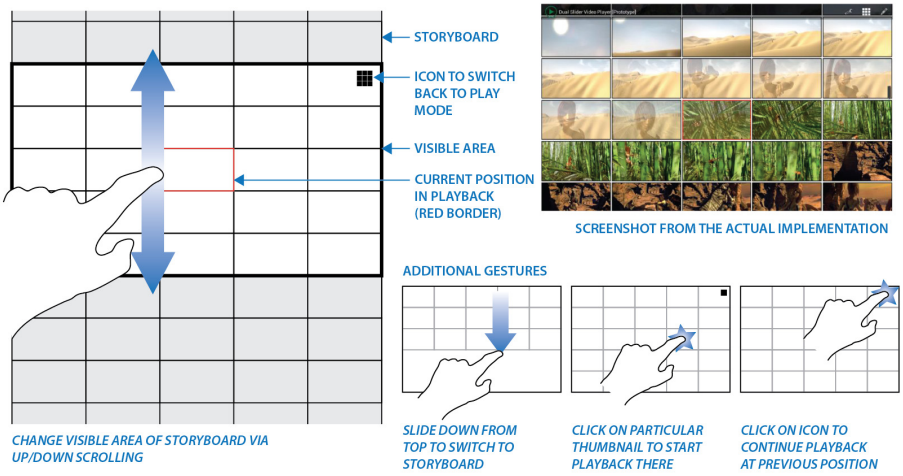

Fig. 1. Storyboard design implementation (from [3])

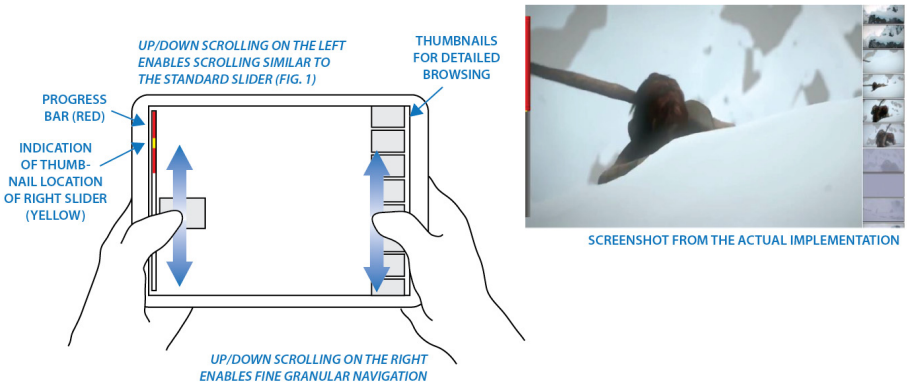

Fig. 2. Enhanced slider interface implementation (from [3])

In a comparative study using tasks slightly modified to the ones utilized in previous Video Browser Showdown competitions [7], both interfaces demonstrated their usability and power for video search (for detailed results we refer to [3]). Yet, both designs also revealed limitations and disadvantages – some of them opposed to each other. For example, the sliders obviously offer a faster access to searched locations if and only if those are directly accessible, whereas the storyboard design often

outperforms the slider interface when a more sophisticated inspection of the presented content is needed. Consequently, we propose a design that seamlessly integrates both interfaces, as illustrated in Figure 3, which we will present in the 2015 edition of the Video Search Showcase. Using gestures, users can easily activate either of the two scrolling modes (i.e., storyboard and filmstrip view) and switch between them. In particular, the storyboard view is activated by moving the thumbs of both hands slightly to the center of the screen, resembling an intuitive "zoom out" effect commonly used on tablets, for example, for maps where a comparable pinch-to-zoom gesture is also used to gain a higher-level overview of larger portions of the data. Clicking on a thumbnail in the storyboard activates playback mode again, where users can activate the filmstrip slider by simply clicking on the screen.

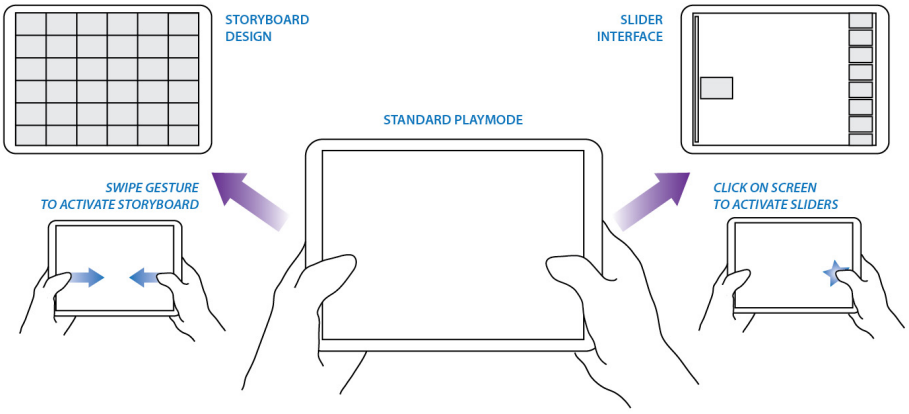

Fig. 3. Proposed design, seamlessly integrating both interaction concepts (from [3])

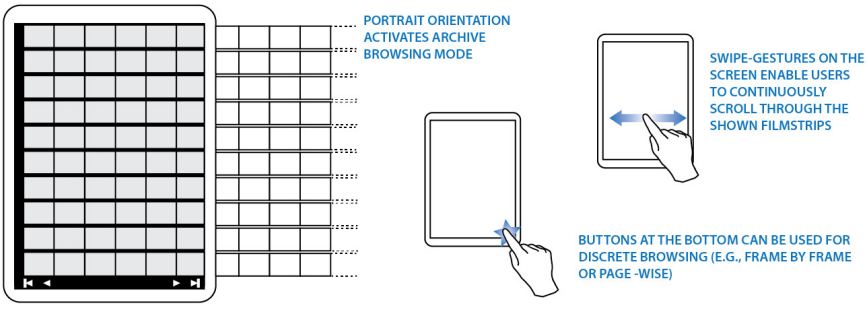

Fig. 4. Browsing video archives (ten videos in parallel) in portrait mode

Our studies confirm that this design enables quick and efficient video browsing within *one* video file and is thus well suited for tasks such as the Known Item Search (KIS) in single video files that was part of the Video Search Showcase in previous years. In order to deal with this year's tasks, which require search in ten videos from a larger archive, we propose the design illustrated in Figure 4. Turning the device from

landscape to portrait mode activates video archive browsing, i.e., the simultaneous navigation within ten video files shown as filmstrips. Navigating the content is done either by a simple left-right swiping gesture on the screen or by using buttons on the bottom of the display that result in a discrete motion. Both interactions enable a simultaneous movement of all filmstrips, so users can visually browse and inspect the content of all videos by just using these simple gestures. While our initial tests confirm that people are indeed able to simultaneously browse all videos with this approach, it should be noted that for larger archives than the ten videos used in this year's Video Browser Showdown obviously some sort of pre-filtering (e.g., via querying that creates a ranked list of video search results) is required, and part of our future research.

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