Improving the Video Timeline for Educational Video Content

Christopher Brooks
Department of Computer Science
University of Saskatchewan
110 Science Place
Saskatoon, SK, S7N 5C9
cab938@mail.usask.ca

Carl Gutwin
Department of Computer Science
University of Saskatchewan
110 Science Place
Saskatoon, SK, S7N 5C9
gutwin@cs.usask.ca

Scott Bateman
Department of Computer Science
University of Saskatchewan
110 Science Place
Saskatoon, SK, S7N 5C9
scott.bateman@usask.ca

Jim Greer
Department of Computer Science
University of Saskatchewan
110 Science Place
Saskatoon, SK, S7N 5C9
greer@cs.usask.ca

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Abstract
In the age of social media and user generated content, the traditional timeline metaphor used in video navigation doesn't provide adequate support for educational users. To remedy this, we have designed a replacement for the video scrubber widget called *Video Drops*, which represents video as a set of connected raindrop-like graphics which show both usage information and user-contributed video discussion. Pedagogically, this design is informed by social constructivism theories which suggest that discussion between students is a valuable act in learning.

Keywords
Video, course casting, lecture recording, multimedia, timeline, scrubber, social media, education

ACM Classification Keywords
H.5.1 Multimedia Information Systems, H.5.2 User Interfaces, K.3.m Miscellaneous.

Introduction
Video recording of lecture content in higher education has been happening for more than 40 years. The availability of inexpensive, scalable, and automated lecture capture and web production systems such as

Echo360[1], Accordant[2], and Opencast[3], have caused a resurgence in both the number and scope of institutions capturing, streaming, and distributing video lectures for students. These technologies enable universities to put online, for blended or distance delivery, full videos of class interactions as soon as a lecture has taken place. At the same time, the Web 2.0 principles of interactivity and user generated content have continued to proliferate throughout the web. Education learning environments are no special case, and learners now expect to be able to contribute to discussions, articles, and other learning artefacts provided to them.

However, educational video in particular has not caught up with the social media abilities used on the broader web. Unlike streaming media for entertainment, one of the principal purposes of online educational video is to allow students to reflect and critically examine the content being presented. Social constructivist theories of learning [1] suggest that knowledge is generated through interaction with other students, instructors, and domain experts. Thus, showing and enabling this interaction is important for enhancing student learning. However, most course-casting tools provide little to no ability for students to interact with one another while watching recorded content. Any online interactions that might happen (e.g. messages posted to a message board) happen outside of the video playback environment, and are thus decontextualised from the primary artifact being used for learning.

[1] http://www.echo360.com/

[2] http://www.accordent.com/

[3] http://www.opencastproject.org/

Video Timelines

The video scrubber widget (figure 1) is ubiquitous in both video playback and editing systems. It shows time as linear construct starting at the left hand side and ending on the right hand side. It usually contains a single navigational element, the playhead, which identifies the current scene being displayed. Dragging this playhead along the timeline enables the viewer to seek through the video.

figure 1: A video scrubber widget from the YouTube social media website. The playhead is shown as a small target to the left, and controls for playing and pausing the video are available, along with information about the total length of the video in minutes.

While the majority of video playback systems on the web limit the timeline widget to the above functions, a few have begun to include embellishments along the timeline. One such interesting example of this is a promotional video create by Adobe Systems Inc. for the movie Avatar (figure 2). This system includes temporally-relevant secondary video content as embellishments along the timeline. When the rectangular playhead encounters these markers the video pauses and a small navigational overlay indicates that the user can switch videos to learn more about the object on the screen. If selected, a secondary video is shown with a traditional (embellishment-free) timeline.

Even with embellishments, video scrubbers fail to invite or contextualize user generated content. The increase in the number of consumer electronic devices with embedded cameras, such as cell phones, media players, and laptops, suggests that video-based user

generated content will continue to grow. Allowing users to leave video questions or bring related video into the system while watching a lecture would be difficult to do with current scrubbers, and interrupting playback with popups (such as those used in the Avatar interface) is likely to frustrate users.

figure 2: The Avatar promotional video. The bottom of the video shows a traditional video scrubber widget with markers indicating secondary videos. Overlays, shown on the aircraft as a target, become available when the playhead reaches the timeline markers. Another navigational element is shown above the top of the video showing a list of all secondary videos available.

Video Drops

To more deeply support critical inquiry in lecture recording systems, we are developing a system we call *Video Drops*. In this system, the timeline widget is replaced with one that explicitly shows the contextual relationships between videos using spatial characteristics. Our design (figure 3), was created with the following principles in mind:

- New video content should be contextually associated to the video that prompted the creation of that content
- Interactions of users with content should be explicitly shown
- Awareness of where a user is in video and how to navigate to an associated video should be clear
- Secondary video content should be opportunistic and focused (e.g. threaded conversation systems instead of flat ones) and thus a recursive model should be used

While not strictly required, we can think of a course using a lecture capture system as having two kinds of video. The first, the principal video, is a set of classroom or studio-based lectures that make up the course, while the second supplementary videos may be student questions, discussions, or instructor clarifications. Instead of a straight line, we represent time using curves, where the beginning of the curve is attached to the position in the principle video where the question or discussion began. A reply to a discussion creates a new line segment that is appended to this curve, and the curve ends where it originated giving it a raindrop-like shape. Questions or comments made about a supplemental video form the creation of their own raindrop. Thus we can represent a discussion tree in a compact amount of space, and a learner can move playback directly to any point in a video with a single click. By closing drops and having them return to where they start, we can offer an intuitive and uninterrupted playback experience, where a playhead marker can simply traverse the edges of the drops that a learner may wish to view.

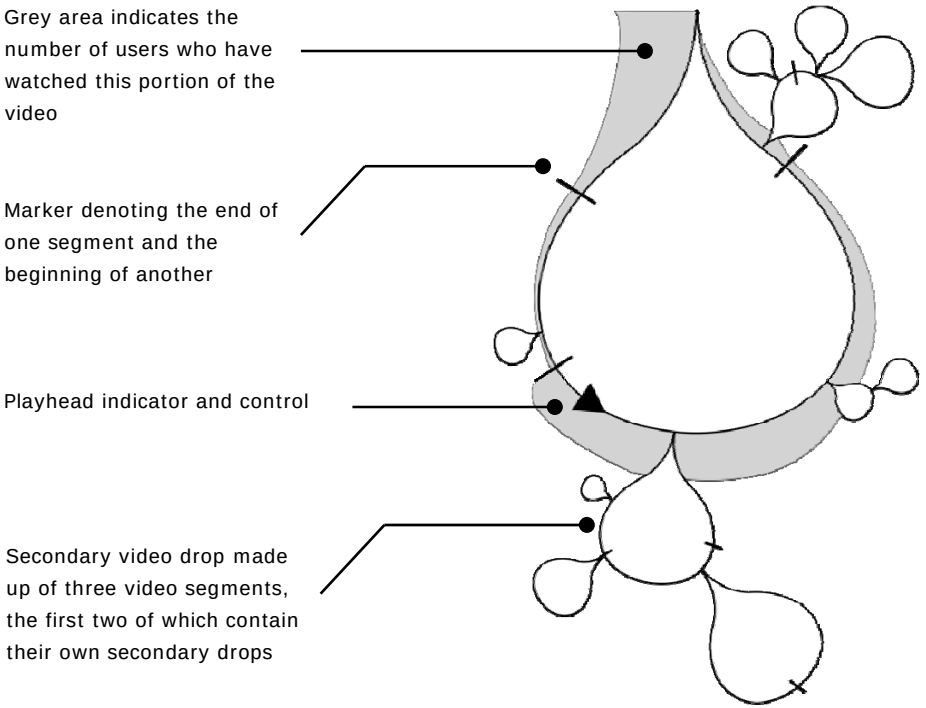

figure 3: An example navigational video drop. The main video track has four segments, denoted by the bars along the outline of the largest drop. The grey area to the outside of the drop represents the number of users who have viewed a given video segment. In this example there were many views at the beginning of the first video, the second video has very few views, and the third video starts with a lot of viewership which declines over the length of the video. Smaller drops represent user generated video content. Following a message board metaphor, these drops may be questions or clarifications about the main video tracks. These drops are also segmented based upon length, and replies to these videos continue to generate more attached drops. The playhead representing the current playback position is shown with an arrow on the main video track.

Depending on the amount of space available, the video drop representation can either be rendered linearly, where a given length of line represents a certain amount of time of video, or non-linear, where some aspects of the video (e.g. the lecture) may be given more prominence.

Conclusions

Video scrubbers are effective widgets to control playback and seeking within a single video. In the case of multiple, contextually-linked videos, the scrubber does not provide adequate information for users to both understand and control flow throughout videos by itself. While embellishments may provide some ability to overcome these issues, we believe a rethinking of the timeline as the mechanism of representation for video is warranted. This is especial true in the case of educational video, which is quickly growing in response to affordable and scalable lecture broadcasting technologies.

Citations

[1] Vygotsky, L.S. (1978). Mind and society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.