When Thumbnails Are and Are Not Enough: Factors Behind Users' Requests for Information from a Video Digital Library

Dan Albertson
University of Alabama
dea@ua.edu

Abstract

Research questions were posed to examine users' requests for information, beyond a keyframe, and certain influences thereof when interactively retrieving video. Laboratory-style search experiments employing 28 users from the field of science education were conducted. Users were asked to attempt six pre-designed search topics. All actions of the users and topic durations were recorded, and a post-search questionnaire was used to collect data about the topics and users' experiences and impressions of the experimental system. Results showed that users regularly requested information about a clip, beyond a keyframe, while searching, not browsing, and that requests varied significantly across certain topic categories devised for this study. Users' requests for information about a clip were negatively correlated with post-search satisfaction ratings, search times, and the number of actions performed. Findings also indicated that users' requests were not associated with a search topic's representation of the experimental domain. Such findings give researchers additional insight about user interface design for video digital libraries.

Keywords: video retrieval, user interaction, user interface design, keyframes, digital libraries

Introduction

User-centered video retrieval research is significant considering the complex makeup of digital video, which lends itself to a vast range of possibilities and considerations for designing retrieval tools like user interfaces. Video's multidimensional makeup, granular structuring, effects of the "semantic gap," along with a collection's scope, envisioned users, and/or intended domain(s) can all influence designs of user interfaces and promote variations in video representations across different video retrieval systems (Albertson, 2010; Christel, 2008a; Huurnink et al., 2010). Ding et al. (1999) concluded that hybrid video representations, or video surrogates, comprising both textual and visual information, were generally more effective than textual or visual representations alone. Christel (2008b) noted the benefits of visual surrogates specifically, with regards to browsing, in that they enable users to quickly scan the collection. Amir et al. (2003) also generalized variations in the usefulness of different video components, and stated that visual information is useful for browsing while transcript (textual) data is most applicable for search. Such previous findings are significant and certainly inform the design of video retrieval systems (i.e. digital libraries) and user interfaces. However, questions remain, especially those that examine users' requests, use, and perceptions of such individual components of video in order to aid retrieval and selection.

Research Questions

Research questions were posed to better understand users' requests for information beyond a keyframe, when presented, through the user interface, as the initial representation of a video clip. The general overarching question posed as part of this analysis included:

- What factors influence users to request information from a video retrieval system beyond a keyframe; or, conversely, what are some of the circumstances where users are satisfied and confident with a keyframe alone?

Dan Albertson, D. (2013). When thumbnails are and are not enough: Factors behind users' requests for information from a video digital library. *iConference 2013 Proceedings* (pp. 662-664). doi:10.9776/13308

Other more-precise exploratory questions were developed to measure the influence of certain experimental factors on information requests by the users. The specific experimental factors examined here included some of those related to information needs and actual users. For example:

- How does the makeup of video search topics influence users' requests for additional information from a video digital library?
- Does a search topic's representativeness of a collection's domain influence users to seek more information?
- Do users who are more or less familiar with the video information being sought request more or less from the system?
- As search sessions prolong, what are the effects on users' requests for additional information about a clip and subsequently user satisfaction?

Findings from these questions, which examine user interaction and judgments, will further inform interface design for interactive video retrieval systems, such as video digital libraries.

Methodology and System

Science Education was the experimental domain (or context) used to explore these research questions. Teachers and aspiring teachers (college seniors) were recruited; a total 28 users participated in this study. Laboratory-style interactive search experiments were designed and carried out that asked each user to attempt different experimental search topics. Topics were categorized based on the number of subtopics and their incorporation of visual and/or textual needs, resulting in the following types:

- Basic: Contained one subtopic, based on either visual or textual information alone.
- Complex: Contained multiple subtopics, all of which based on textual or visual information alone.
- Combination: Contained one subtopic involving both textual and visual information.
- Combo-complex: Contained more than one subtopic involving both textual and visual information.

Two of each type of topic were created. Users completed a total of six (out of eight) experimental search topics. Individual topics were systematically ordered; each was given at each spot in the rotation an equal amount of times throughout the search experiments.

The interactive search experiments were conducted using a prototype video retrieval system designed to search and browse the NASA K–16 Science Education Programs. This collection comprises several NASA educational series, such as NASA Connect, NASA SciFiles, NASA Why?Files, and Destination Tomorrow, with production dates spanning 2000 to 2006. The experimental system, or, more specifically, its user interface, offered both visual and textual search features and various browse categories; however, for experimental purposes, a keyframe was the initial/default way of viewing results.

A questionnaire was given after each search, which asked users to rate their familiarity with the search topic, the representativeness of the experimental topics with "real" search topics from Science Education, topic difficulty, and satisfaction with the user interface and search results. The lead researcher on this study monitored the search experiments and manually recorded all actions performed by each user and search times. The number of times each interface feature was used was tallied, and Web logs helped validate observations. Different quantitative analyses, including mean analysis, Pearson's correlation, and ANOVA tests, were conducted.

Findings

Results showed that users' requests for additional information about a clip, beyond a keyframe, were significantly correlated ($r=.407$, $p < 0.01$, $N=112$) with keyword searches, in positive manner, but not video browsing; that is, as the number of keyword searches increased, so did users' requests, and vice versa. This finding was reasonable, as keyword searches would likely be utilized more for semantic needs; therefore, users would want to assess where and how their search query corresponded to a video clip. Video browsing, on the other hand, is steered by access point; therefore, selecting a title, for example, combined with a keyframe may have been sufficient to indicate suitability of the returned clips. These findings give researchers insight about the design of user interfaces for new collections based on how they envision users accessing items.

Users' requests for further information were shown to vary according to the different categories of search topics. A one-way ANOVA of the topic groupings yielded significant differences, $F(3, 164) = 2.883$, $p < 0.05$. Significant differences from an LSD post hoc analysis, also at $p < 0.05$, occurred between basic topics and both complex and combo-complex types of topics at ($M = -1.524$, 95% CI [-2.75 -.30]) and ($M = -1.571$, 95% CI [-2.80 -.35]), respectively. To generalize this finding, users requested more from the system about a clip for topics asking for multiple sources of information, but not for topics requesting both visual and semantic (textual) information as part of one topic. Significance of incorporating additional metadata in video search results to support users with more detailed needs is verified, but not necessarily for supporting users, such as general audiences, with predominately shorter basic needs.

A topic's resemblance of the experimental domain did not produce significant associations with users' requests for additional information. This finding suggested that such requests were more global of an interaction. However, further influences of the domain can be indirectly assessed by evaluating results in conjunction with knowledgeable users' familiarity with the experimental search topics. Higher familiarity with these topics led to fewer information requests about a clip; that is, the more science educators knew what they were looking for, the less they examned video clips, as indicated by a significant negative correlation at ($r=-.224$, $p < 0.01$, $N=168$). This finding suggests possible variations in user interactions according to collection type or scope, in terms of what type of additional information is being requested to support information needs of knowledgeable users.

Users' requests for additional information about a video clip were also found to be positively correlated with the overall number of user actions ($r=.602$, $p < 0.01$, $N=168$), search time ($r=.484$, $p < 0.01$, $N=168$), and perceived topic difficulty ($r=.364$, $p < 0.01$, $N=168$). These findings demonstrated that the more time users spent attempting search topics, the more information they requested from the system's database. This outcome is also supportive of the findings uncovered for a previous (second) research question, in that as needs increase in the amount of required information, so do users' requests. With regards to addressing user satisfaction, or how added interactivity of the user impacted their perceptions, findings suggested that as user satisfaction increased, users' requests decreased, and vice versa. Negative correlations at $p < 0.01$ were discovered between users' requests for more information and both user satisfaction with the user interface and search results ($r=-.301$ and $r=-.369$, $p < 0.01$, $N=168$). This finding was intriguing in that users were more satisfied when they had ultimately retrieved less information from the collection for verifying a given topic was complete. Additional time having to explore the actual contents of individual video clips reduced satisfaction among users.

References

Albertson, D. (2010). Influences of users' familiarity with visual search topics on interactive video digital libraries. Journal of the American Society for Information Science and Technology, 61(12), 2490-2502.

Amir, A., Srinivasan, S., & Efrat, A. (2003). Search the audio, browse the video - A generic paradigm for video collections. Eurasip Journal on Applied Signal Processing, 2003 (2), 209-222.

Christel, M.G. (2008a). Supporting video library exploratory search: When storyboards are not enough. Proceedings of the CIVR, Niagara Falls, Ontario, July 7-9, 2008, (pp. 447-456). New York: ACM.

Christel, M.G. (2008b). Amplifying video information-seeking success through rich, exploratory interfaces. In: Tsihrintzis, G., Virvou, M., Howlett, R., & Jain, L. (Eds.) New directions in intelligent interactive multimedia, Vol. 142 (pp.21-30.). Berlin and Heidelberg: Springer.

Ding, W., Marchionini, G, & Soergel, D. (1999). Multimodal surrogates for video browsing. Proceedings of the fourth ACM conference on digital libraries, Berkeley, CA, August 11-13, (pp .85–93). New York: ACM.

Huurnink, B., Hollink, L., van den Heuvel, W., & de Rijke, M. (2010). Search behavior of media professionals at an audiovisual archive: A transaction log analysis. Journal of the American Society for Information Science and Technology 61(6), 1180–1197.