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This study was designed to assess whether an indexer working from automatically generated storyboard surrogates could assign subject keywords to digital video, saving significant time while sacrificing little retrievability. The researcher assigned keywords to six videos selected from the Open Video Project repository. Three were indexed after viewing the videos in full; three were indexed after viewing their storyboard surrogates. A record of time consumed was maintained. Study participants viewed all six videos in full and listed what they believed to be the main topics addressed. Participant terms were compared to the researcher-assigned keywords. Retrievability was calculated as the percentage of participant terms that matched these keywords. Overall, time consumed in indexing the three videos based on their surrogates was 82% less than the time consumed in downloading and indexing the three full videos. Results reflected only 6% less retrievability for the three videos indexed based on their surrogates.

Headings:

Indexing – Video recordings

Information Retrieval

Information Systems – Special subjects – Video recordings

Internet Video

Subject Access

Video Surrogates

THE EFFECTIVENESS OF STORYBOARD SURROGATES
IN THE SUBJECT INDEXING OF DIGITAL VIDEO

by
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Contents

Tables	ii
Introduction.....	1
Motivation for the Project	2
Methodology.....	6
Compilation of Results	
Approach 1 – Strict Agreement of Terms	13
Approach 2 – Conceptual Agreement of Terms.....	17
Analysis of Results.....	21
Time Consumed	23
Retrievability – Quantitative Analysis.....	28
Retrievability – Qualitative Analysis	32
Pair 1	33
Pair 2	36
Pair 3	41
Summary of Results	43
Conclusion.....	46
Appendices	48
Works Cited.....	57

Tables

Table 1: Videos Selected for Testing	8
Table 2: Videos Included in Study	13
Table 3: Overall Strict Agreement Match Rates	17
Table 4: Overall Conceptual Agreement Match Rates.....	21
Table 5: Time Consumed and Match Rates by Video Pairs	23
Table 6: Comparison of Total Time Consumed by Video Pairs	24
Table 7: Comparison of Indexing Time by Video Pairs	25
Table 8: Time Consumed/Segment Duration for Videos Indexed via Surrogate.....	26
Table 9: Match Rates by Video Pairs	28
Table 10: Conceptual Agreement Match Rates by Video Pairs	33
Table 11: Summary of Results – Time Saved and Retrievability Lost	44

Introduction

With the widespread growth of digital video cameras and multimedia software, editing and digitization tools, the amount of video created in or converted to digital format will quickly multiply. Through digitization and storage in video archives or repositories, countless promotional, corporate, government and educational films, documentaries, news pieces, home movies, amateur works and more can be made available to the research and educational communities, as well as to the general public. A rich source of historically and socially relevant material that has generally been difficult to obtain, video lends itself to applications for learning across all levels of formal schooling and beyond. The key to making such a store of information useful to a broader range of people lies in its accessibility.

The public is becoming increasingly familiar with the practice of natural-language searching through the Internet and electronic tools such as online library catalogs, databases, and archival finding aids. This capability has brought to light, and has increased use of, many resources that had previously been known to few beyond the scholarly and archival communities. In order to make video archives as accessible to the public, similar subject-oriented search functions must be employed. The difficulty arises with respect to the limited resources – personnel, time, money – available for viewing and assigning keywords to the volume of material currently held in or being contributed to video archives. It is the very richness of video that complicates this subject indexing process. While the full text of written material can be scanned in keyword searches, the content of video must first be translated into words before subject searches can be conducted. Likewise, the indexing of purely textual

material is facilitated by the human capacity to skim text to determine its gist; indeed, that process can even be automated through the use of software to identify words and their context. There is clearly a need for a similar shortcut to facilitate the subject indexing of digital video.

Motivation for the Project

While there exist a number of efficient methods for automatically extracting content information from textual material, this task proves much more challenging with respect to images and video. As Nanard and Nanard comment, images “do not usually embed any syntactic or semantic structures likely to be elicited by a machine for elaborating semantically rich metadata.” As such, they lament, “human interpretation of video still is the only one technique which enables precise semantic indexing at scene level” (282). Carnegie Mellon University’s Infromedia Digital Video Library Project has explored applying automatic techniques for simple image recognition – identification of certain low-level features, such as familiar objects (buildings, vehicles) and situations (position, motion, scene change, appearance of captions) – to video indexing. By extracting this information from a video’s image track and running it directly against its soundtrack and closed-caption data, some basic relationships can be identified and content-based indexing achieved (Nanard and Nanard 282; Liou et al. 258). This technique is already being used for the automatic indexing of news programs. Despite such advances, however, these methods are less promising for the broader and less-structured range of video that would be useful within the educational and scholarly communities, and to the general public. As such, more reliable subject indexing of digital video calls for human interpretation of content and context (Nanard and Nanard 282).

Liou and his coauthors agree that human operators cannot be removed from this indexing process altogether. “[A]utomatic algorithms have not yet reached a stage that can generate useful content information for reliable content-based video retrieval” (258). In considering systems for subject indexing digital video, they emphasize that it is not enough for the system to be reliable, so that users can retrieve material most relevant to their queries; it is just as important that the system be efficient. To achieve this efficiency, the system must allow the human operators to create subject indices without having to watch every video piece in its entirety (257). They propose a hybrid scheme whereby the manual indexing process would be facilitated by use of tools which could automatically segment the video based on scene changes and the like. The human operator would use as a guide the “table of contents” extracted through the automated process, and assign terminology that users can understand and on which they can query (258-265).

The need for keyword or natural-language query capability in video archives, to facilitate effective browsing and retrieval of material, is acknowledged by the Open Video Project. The Open Video Project was established at the Interaction Design Laboratory at the School of Information and Library Science at the University of North Carolina at Chapel Hill. Intended as both a shared repository of digital video and a test collection, the Open Video Project hopes to serve not only as an archive, but also as an open-source platform for the investigation of how best to “collect, organize, and store digital video so it can be efficiently found, searched, and downloaded by users with varied interests” (Geisler et al. 1). Students and teachers at all grade levels, as well as scholars and the general public, will be among the ultimate audience for video archives, which can become a rich source for lifelong learning material. For video archives to be truly useful to this wide audience, indexing methods must produce results that accommodate the types of search strategies with which the public has

become familiar. Despite the marked increase in digital video collections over the past several years, few offer interfaces that allow for such effective browsing and retrieval (Geisler et al. 8).

Considering the potential costs of downloading large digital video files from archives, it is important that users be able to preview them in order to determine whether the works might be relevant and useful. Geisler and his coauthors comment that video retrieval is more complex than searching through text files, as it must be “an iterative process that integrates querying, navigation, browsing, and selective viewing.” Essentially, “more cycles of viewing are needed to gain the gist of a video” (8). In light of this, the Open Video Project is exploring the use of a variety of video surrogates in retrieval interfaces. As substitutes for viewing an entire video, surrogates are intended to serve as the visual equivalent of abstracts or synopses of textual material, created in order to aid evaluation and retrieval. Surrogates offer a potentially efficient means of evaluating material because they take less time to examine than would the material itself. Surrogates can be truly useful, however, only if they adequately convey the gist of the material, and provide the user sufficient clues to determine whether that material might be pertinent and therefore worth retrieving. In order for it to be effective, the surrogate must accurately represent that aspect of the material in which the user is interested.

The initial audience of the Open Video Project is the research community to whom the digital video archive is made available as an open-source test collection. Accordingly, the use of video surrogates in its retrieval interface has, to date, focused on the technical aspects of video, such as visual features (color, contrast, camera motion) and audio features (amplitude, silence, speech, music), rather than the subject content of the material (Geisler et al. 9-14). Likewise, the metadata assigned to the videos has generally been limited to basic bibliographical information (title, source organization,

language, genre), structural characteristics (size, compression scheme), and terms of use. Member of the general public, however, are more likely to be interested in retrieving moving images for their subject matter, as they are with respect to still images.

A study of user requests submitted to two historical photograph archives over a four-month period showed that subject terms were reflected in these queries far more often than any other category of term. The concepts of time and place represented in the image were also widely noted, but to a far lesser extent. References to other attributes, such as genre, image creator, and physical form were significantly less frequent (Collins 45-50). Terris comments that the difficulties in indexing images of any kind are compounded by the multitude of purposes for which they may be requested. To maximize access to image collections, indexers must consider the style and focus of user queries in the context of those collections (61-2).

The present study will expand on the work of the Open Video Project, with an eye to addressing the needs of the K-12 educational community and the general public, who would be likely to search for video based on subject content rather than technical specifications. Considering the significant amount of time and expense that would be required for indexers to download and view videos in full prior to indexing them, this research focuses on the use of storyboard surrogates as tools for subject indexing digital video. In a storyboard surrogate, selected frames from a video are displayed on the computer screen as thumbnail images. Outlining the flow of the video, the frames are arranged sequentially in a grid that can be scanned across and down. Examples of storyboard surrogates from the Open Video Project are in **Appendix A** and **Appendix B**. Of primary concern is whether a human indexer working from a storyboard surrogate could assign subject keywords to a video in significantly less time than it would take to download and view the entire video, while sacrificing little in the way of retrievability.

Methodology

The Open Video Project repository contains digital moving image material available in various compression formats, including MPEG-1, MPEG-2, and MPEG-4. This material may have been either created in or converted to digital format. Using this material, researchers within the Open Video Project have been exploring various methods of video surrogate creation. It should be noted that methods of digitization, compression, and surrogate creation are beyond the scope of the research reported in this paper. While research into moving-image surrogates is underway, the Open Video Project's work to date has focused on still-image surrogates such as static storyboards developed from the key frames of a video. Surrogates created in the course of this research are made available through the Open Video Project repository. Originally, it was intended that testing for this research study would be limited to videos for which still-image, storyboard surrogates were already available. In a number of cases, however, the available surrogate proved to be only a rudimentary one created by the organization that contributed the video to the repository. In order to maintain consistency in the type of surrogate tested, it was decided that selections would not be limited to videos for which surrogates were already available. Rather, the Open Video Project staff would create new surrogates for the videos selected, using the same technology for each.

Six videos, ranging from two to seven minutes in duration, were to be selected for testing. The Open Video Project repository currently contains 1,644 video segments, many of which are available in multiple compression formats. Surrogates are created from videos in the MPEG-1 format. While videos in other formats could be converted to MPEG-1 in preparation for surrogate creation, it was decided that for the study reported in this paper, videos would be selected from those available as MPEG-1 files. Many of the video segments are sections of longer works, which have been

segmented due to practical considerations on the part of the repository. For purposes of this study, it was determined that full-length, un-segmented videos would be the most useful.

The Open Video Project's online list of videos can be searched using several criteria, one of which is duration. The 2-5 minute and 5-10 minute categories were scanned to develop a list of videos which ranged between two and seven minutes, which were not segments of longer videos, and for which MPEG-1 files were available. Since three pairs of videos were to be chosen, with videos in each pair being approximately the same length, this list was sorted by duration. With an eye to encouraging volunteer participation in the project, an effort was made to keep the total duration of the six videos to approximately thirty minutes. Two combinations of six videos, each totaling approximately thirty minutes, were chosen randomly. The remaining videos in the list served as alternates, should difficulties be encountered with any of the initial selections.

Both combinations were submitted to the Open Video Project administrator, with the videos grouped in three pairs of comparable duration. A storyboard surrogate was to be created for one video in each pair; the choice of which video was left to the individual creating the surrogate. Each surrogate was created via MERIT, a program that "automatically extracts keyframes from a video based on scene changes." According to the Open Video Project administrator, this program "looks at successive frames in the video file, and based on their color histograms, determines how much change there is from one frame to the next. When the change is over a certain threshold, MERIT concludes that there has been a scene change and extracts a keyframe from this new scene" (Geisler). These extracted keyframes are arranged in a storyboard format, with six frames per row. The small percentage of frames that appear black or blurry are manually discarded after visual review of this storyboard.

Both videos in the second pair came from the same source organization. Perhaps because of how this organization encodes their videos, the MERIT program was unable to extract keyframes from either one. A surrogate was needed for only one video in each pair. Rather than replace both videos in the second pair, one was replaced with a video of comparable duration from the list of alternates. A storyboard surrogate was created for this substitute video. The resulting combination of six videos, listed in **Table 1**, became the basis for testing.

Table 1
Videos Selected for Testing

Segment Title	Duration m:ss	MPEG-1 file size
<u>Pair 1</u>		
A Wonderful New World of Fords (1960 Ford Spot)	3:00	31.80 MB
Roads to Romance: Coral Gables	3:00	31.50 MB
<u>Pair 2</u>		
Scheduling Home Control Devices	5:55	58.20 MB
Television Remote Control (Tuner)	5:46	60.40 MB
<u>Pair 3</u>		
The Corvair in Action	6:25	67.70 MB
The Safest Place	6:23	66.80 MB

The first video in each pair was downloaded, then viewed in its entirety. After viewing each video, this researcher created original subject indexing for it. Natural-language words or phrases were assigned to describe the subject matter of the video, to ultimately facilitate retrieval of the video via concept-based searching by users. No controlled vocabulary was consulted in the selection of these words and phrases. From the beginning of the download process through the assignment of keywords, a record of time consumed was maintained. This record included the time it

took to download the video, save it onto the local network, view it, and log the words or phrases that described what this researcher understood to be its main topics. The resulting list was reviewed for clarity and modified as necessary. The end time was noted once the list of keywords was deemed complete.

For the second video in each pair, this researcher viewed its new storyboard surrogate and created original subject indexing for the video based on what was interpreted to be its main topics. Each surrogate was accessed via mouse-click from the Open Video Project website. From the mouse-click that opened the storyboard through the assignment of keywords, a record of time consumed was maintained. Again, the list of keywords was reviewed for clarity and modified as necessary. The end time was noted once this list was deemed complete. The Open Video Project database contains information on the source video for each segment, including creation date, producing organization and genre, and in many cases, keywords and a description. None of these details were viewed until after all of the videos had been indexed.

At least ten volunteers were needed to view all six videos in full, and record terms that described what they believed to be the main topic or topics of each video. Volunteers were recruited via local e-mail listservs for groups of which this researcher is a member. The only criteria were that volunteers had to be over the age of 18, and could not be enrolled in the School of Information and Library Science. Students in that program were considered likely to have been heavily exposed to issues of information accessibility and the organization of materials, as well as the extensive practice of keyword searching. Therefore, they were not, as a whole, regarded as a fair representation of the thinking and searching habits of the general public. Since this research is ultimately targeted toward making digital video more accessible to the public, it was determined that volunteers should be recruited from outside the School of Information and Library Science. A total of 13 volunteers participated in this study.

Testing took place across four separate sessions, including one pilot study with two participants and three sessions during which the remaining 11 participants were tested. All of the sessions were structured in the same manner. At the beginning of each session, the participants were asked to complete an information form indicating their age and sex, and to briefly describe or give examples of how they had used a computer to conduct searches. They were also asked to circle the number, on a scale of 1 to 5 (1 being “novice;” 5 being “expert”), reflecting how they would judge their overall level of skill with respect to conducting searches on the computer. These forms were coded **A** through **M**, but were given to the participants randomly. A sample participant information form is in **Appendix C**.

Stapled to this information form were the individual response forms that the participants were to fill out for each video. These response forms, consisting of two questions, were identical except for the title of the video listed at the top of each. A sample response form is in **Appendix D**. For each video, the participants were asked to list up to nine words or phrases describing what they believed to be its main topic or topics. They were verbally instructed that they were not limited to nine words total, and that they could list either single words or phrases of up to a few words each. They were reminded that they should not feel compelled to come up with nine words or phrases, and that they could list as few as one. It was reiterated that this was not to be an exhaustive list telling everything about the video, but rather a list indicating what they considered to be the main topic or topics of the video. The participants were instructed that they were free to write during the video, but that if they wrote any words or phrases that they later, after having seen the video in its entirety, deemed not descriptive of its main topic or topics, they were to cross those terms off their list.

The second question on each form asked participants to circle the number, on a scale of 1 to 5 (1 being “not at all;” 5 being “very”), that best reflected their familiarity

with, or knowledge about, what was covered in the video. Familiarity with keyword searching could not be assumed, so the word “keyword” was deliberately not used on the participant information and response forms, or in the verbal instructions. The word “subject” was also avoided, in order to not imply the need to use Library of Congress Subject Headings or structure responses in that format. In an effort to not bias the results, the research thesis was not divulged until the close of each session.

Testing took place in a classroom equipped with a networked projection system, through which the six videos were shown. In order to test the sound and lighting in the room, as well as to clarify the expectations regarding the questions to be completed for each video, a sample video was shown. After this sample video, the participants were asked to suggest aloud some words or phrases they might use to describe its main topic or topics. No terms were rejected; this exercise was intended merely to give the participants the opportunity to hear a range of possible terms, and to reassure them that there were no wrong answers. Furthermore, the participants were reminded that their responses were completely anonymous, and that they would not be evaluated personally.

The videos were shown in alphabetical order by title, so that no pairing would be implied. The fourth video, *Scheduling Home Control Devices*, consisted of a woman discussing her research and demonstrating three prototypes for a home automation scheduling system. The piece appeared to have been taped in an office or laboratory setting, and voices could be heard in the background. According to the two participants in the pilot study (**F** and **G**), this background noise, combined with the woman’s apparently French accent, made the video difficult to understand at times. It became easier to follow during the demonstration portion, as what the woman was saying could be derived from the context of this interaction, but overall, the participants felt that the below optimal sound quality of the video may have

compromised their understanding. Thanks to this valuable feedback, this video was replaced for the remainder of the sessions.

From the list of alternate videos, a replacement (*SearchKids: A Digital Library for Children*) was selected, downloaded and viewed in its entirety. As with the other videos, this researcher then created original subject indexing for it, while maintaining a record of time consumed throughout the process. The *SearchKids* video was selected primarily because its duration (6:00) was comparable to that of the video replaced, *Scheduling Home Control Devices* (5:55). The fact that *SearchKids* happened to fall in the same spot alphabetically as *Scheduling Home Control Devices* meant that the videos could be shown to the remaining participants in the same order, with the only variation being the replacement of this one video. Based on the results from the pilot study participants, the written and verbal instructions appeared clear, so no other adjustments were made for the rest of the sessions.

The pilot study results for *Scheduling Home Control Devices* were discarded, while the pilot study results for the other five videos were retained and combined with the results from the remaining three sessions. Consequently, the final study consisted of five videos viewed by 13 participants and one video viewed by 11 participants. Details on the six videos in the final study, including the year in which the source video was created and the time consumed in viewing and indexing each video or surrogate, are indicated in **Table 2**. Note again that for those segments indexed based on viewing the full video, time consumed includes the download time of the video.

Table 2
Videos Included in Study

<u>Segment Title</u>	<u>Segment Duration</u> m:ss	<u>Creation</u> Year	<u>Indexed by</u> full video or surrogate	<u>Time Consumed</u> mm:ss
The Corvair in Action	6:25	1960	full video	17:32
Roads to Romance: Coral Gables	3:00	1950	surrogate	1:29
The Safest Place	6:23	1935	surrogate	3:52
SearchKids: A Digital Library for Children	6:00	2001	full video	9:43
Television Remote Control (Tuner)	5:46	1961	surrogate	1:20
A Wonderful New World of Fords (1960 Ford Spot)	3:00	1960	full video	9:25

Compilation of Results

Approach 1 – Strict Agreement of Terms

The results were input into a spreadsheet. The words or phrases assigned by this researcher (“researcher-assigned terms”) were recorded in the first column. Results from the participants (“participant terms”), coded A through M, were recorded in successive columns, along with each participant’s ranking of his or her familiarity with or knowledge about what was covered in that video. A participant term was considered a “matched term” if it corresponded to a researcher-assigned term or to a term found either in the title of the video or in the name of the organization that originally produced it (referred to as the “source organization” in the Open Video Project database). This treatment is based on the assumption that videos would typically be accompanied by basic descriptive information, including but not limited to their original producer and creation date. For purposes of this analysis, it was considered that the title and source organization fields would be scanned in a keyword search. The researcher-assigned terms and the terms in the title and source organization fields will henceforth be referred to collectively as “index terms.”

If a participant term was not identical to an index term, the ultimate determinant of whether that participant term was considered “matched” was this researcher’s judgment as to whether a keyword search could link that term to an index term through the underlying thesaurus, which would identify variant endings and synonyms. When terms matched exactly, the participant term was recorded in the row of the matching index term. If a participant listed a term similar to an index term, whether it be a term with a variant ending (e.g., ADVERTISEMENT and ADVERTISING) or a term deemed literally synonymous with an index term (e.g., ADVERTISEMENT and PROMOTION), the participant term was recorded in the row of the corresponding index term. If a participant listed terms that were deemed synonymous to each other (e.g., TRAVEL and VACATION), they were recorded in the same cell and therefore counted as one occurrence of the term. Participant terms that did not match any index terms and could not reasonably be considered synonymous with any index terms were listed as “unmatched terms” in the rows below the index terms. If terms from different participants matched each other or were similar to each other, in that they had variant endings or were deemed synonyms, they were recorded in the same row.

Despite repetition of identical instructions during each session, the participant results varied. Like the pilot study participants, most listed both single words and phrases of two to three words, as suggested. Participant **I** provided single terms and short phrases, but strung them together in the fashion of Library of Congress Subject Headings. (On her information sheet, participant **I** had not listed online library catalogs among the types of computer searches she had conducted, but she did mention the general “literature searches for research papers.”) The results from participants **C** and **D** consisted primarily of longer phrases and sentences that were more conceptual than descriptive in nature. Participant **J** tended to combine these two approaches. For all six videos, she provided a sentence conveying what she apparently considered to be

the primary message of the video, and for five of the videos, she also listed single words and short phrases.

This variety in participant responses is exemplified in the results for the second video, *Roads to Romance: Coral Gables*. Produced in 1950 by the Chevrolet Division of General Motors Corp., it is described in the Open Video Project repository as a “travelogue, made for theatrical showing, promoting tourism in Coral Gables, Florida. [It] shows colorful parrots, the University of Miami, and a visit to the beach.” In the video, viewers are encouraged to make the trip to Coral Gables in a Chevrolet car. A selection of participant responses for *Roads to Romance* is in **Appendix E**.

For purposes of analysis, phrases and strings of terms were divided into their individual components. These component terms were then compared to each other and to the index terms, and were recorded in the spreadsheet as matched or unmatched terms, as described above. **Appendix F** reflects the strict agreement presentation of the participant responses listed in **Appendix E**. Note that *Roads to Romance* was indexed based on viewing its storyboard surrogate (**Appendix A**).

The primary focus of this research study is the relationship between the time consumed in indexing digital video segments and the ultimate potential retrievability of those video segments. In order to calculate retrievability, a weighted count was made of matched and unmatched terms (see **Appendix G**). Rather than simply count the number of index terms that were matched by terms from one or more participants, each incident of a participant term was counted. For example, the first researcher-assigned term for *Roads to Romance* was TRAVEL. Of the five participant responses shown in **Appendix G**, four included the term TRAVEL and/or a term deemed synonymous to TRAVEL. Simply counting TRAVEL once, as an index term that was matched by one or more participants, would not reflect the high degree to which the participants thought this video was about travel. Counting all four incidents of TRAVEL

or its synonyms gives extra weight to this term relative to the total number of terms provided. The higher the weight of a term, regardless of whether it matched an index term, the more it can be considered relevant to the content of the video. By extension, and for purposes of retrievability of the video, the higher the weight of a term, the more critical it would seem for the indexing of the video to have included that term.

The weighted count of matched terms was totaled, as was the weighted count of unmatched terms. The count of matched and unmatched terms for each participant was likewise tallied. The number of matched and unmatched terms was then summed, yielding a count of total terms. The measure of retrievability for each video was considered to be the overall percentage of participant terms that matched index terms. This “match rate” was calculated, in total and for each participant, by dividing the number of matched terms by the number of total terms.

For both *Roads to Romance* and *The Safest Place*, participants supplied terms that were judged inaccurate with respect to the video. For *Roads to Romance*, participants A and I listed 1960s among their terms, as participant I also did with respect to *The Safest Place*. In both cases, this term reflects an incorrect time period, as the videos were created in 1950 and 1935, respectively. If someone were searching for a video about the 1960s, neither of these segments would be applicable. For *Roads to Romance*, participant A also included the proper name, PARADISE BEACH, while the only beach mentioned by name in the video was Crandon Beach. If someone were searching for a video about Paradise Beach, this segment would not be applicable. Therefore, in order to calculate the match rate for these two videos, the number of inaccurate terms was deducted from the count of total terms; i.e., in total and for each participant, the number of matched terms was divided by the number of total terms minus the number of inaccurate terms. The overall strict agreement match rates for all six videos are listed in **Table 3**.

Table 3
Overall Strict Agreement Match Rates

Segment Title	Strict Agreement Match Rate
A Wonderful New World of Fords (1960 Ford Spot)	84.0%
The Safest Place	69.4%
Roads to Romance: Coral Gables	65.9%
The Corvair in Action	59.6%
Television Remote Control (Tuner)	55.2%
SearchKids: A Digital Library for Children	53.5%

Participant terms were compared to each other and to the index terms based on fairly strict criteria. Participant terms were deemed “matched terms” only if they corresponded exactly to an index term, differed from an index term by no more than a variant ending, or could reasonably have been considered synonymous with an index term. This treatment of the responses was intended to reflect the typical thesaurus function underlying keyword searches and controlled vocabularies. However, the participants were asked to list words or phrases describing what they believed to be the main topic or topics of the video, and not specifically to provide terms by which they would search for the video. As such, and as suggested by the varied formats of the participant results, an alternate approach was also required – one based on conceptual rather than strict agreement of terms.

Approach 2 – Conceptual Agreement of Terms

The spreadsheet created for the strict agreement of terms approach became the basis for the conceptual agreement of terms approach as well. Again, a participant term was considered a matched term if it corresponded to any of the index terms assigned by this researcher or found in either the title of the segment or the source

organization field of its descriptive record. Recognizing the hierarchical nature of many keyword search thesauri, matches were extended to include broader participant terms that encompassed narrower researcher-assigned terms, such as U.S. and FLORIDA, respectively, in *Roads to Romance*. Rather than rely only on strict thesaurus-oriented agreement between individual terms, however, in this approach, the results for each video were evaluated for conceptual agreement within the context of that video. The original participant response forms were consulted, and phrases that had been divided into their component terms for the initial analysis were reviewed instead for their overall essence.

For example, from **Appendix E**, which lists five selected participant responses for *Roads to Romance*, come the following phrases:

Participant **D**: Drive a Chevy to have a good vacation.

Participant **I**: Advertising – Automobiles – History – U.S. – 1960s

Participant **J**: Buy a Chevy car to visit romantic Coral Gables.

Participant **I** clearly stated advertising as a main topic of the video. In the first approach, based on strict agreement of terms, neither participant **D**'s "drive a Chevy" nor participant **J**'s "buy a Chevy" could reasonably have been expected to link to the term ADVERTISING through the thesaurus underlying a keyword search function. While they express themselves differently, however, each of these participants conveys the notion of this video serving as an advertisement. Therefore, based on conceptual agreement in the context of this video, DRIVE, ADVERTISING, and BUY are considered equivalent to each other. They are still collectively considered unmatched terms, however, as no index terms reflected this advertising concept.

The fact that neither this researcher nor the participants were working from a controlled vocabulary opened the door for inconsistency of expression. It follows, then, that the conceptual approach to compiling the results would compensate not only for variations in the format of participant responses, but also for this researcher's having

assigned words or phrases that may not best convey the meaning intended. For example, one term assigned to *Roads to Romance* was ROAD TRIP. This phrase was used to convey the notion of travel by automobile, but keyword search facilities might not interpret it as such.

When the results were compiled according to the first approach, relying on the strict agreement of terms, no participant terms corresponded to ROAD TRIP. Five of the 13 total participants, however, mentioned both CAR(S) or AUTOMOBILE(S) and the notion of TRAVEL, indicating conceptual agreement with this researcher's intended meaning of ROAD TRIP. Of the five participant responses broken down strictly in **Appendix F**, three (participants **C**, **I**, and **J**) included the terms CAR(S) or AUTOMOBILE(S) – unmatched terms under the strict agreement approach – plus assorted references to traveling. Conceptually equivalent to ROAD TRIP, these terms were reclassified as matched terms under this alternate approach. It could be argued that participant **D**'s phrase, "Drive a Chevy to have a good vacation," could likewise be conceptually equated with ROAD TRIP, but based on its context, this researcher considered that phrase to be more suggestive of ADVERTISING. Care was taken to not count the same phrase as being equivalent to more than one concept. **Appendix H** reflects the conceptual agreement presentation of the participant responses listed in **Appendix E**.

As with the first approach, a weighted count was made of matched and unmatched terms (see **Appendix I**). Again, the higher the weight of a term or concept, whether matched or unmatched, the more it could be considered relevant to the content of the video. Likewise, it would seem more important for the indexing of a video to have included higher-weighted terms or concepts, versus those returned by few participants. The overall percentage of participant terms or concepts that matched index terms or concepts was considered to be the measure of retrievability for each

video. This “match rate” was calculated, in total and for each participant, by dividing the number of matched terms by the number of total terms.

In the strict agreement of terms presentation, certain inaccurate terms were noted and deducted from the count of total terms for both *Roads to Romance* and *The Safest Place*. When considered literally, these terms – 1960s, reflecting an incorrect time period for both videos, and PARADISE BEACH, reflecting an incorrect proper name for the latter, were indeed not applicable to the respective videos. However, when considered conceptually, they represent the notion that the time period of the video’s content might be of interest, as might the specific places mentioned therein. By extension, these are concepts on which one might search, and which must be addressed in the indexing of a video in order for the video to be retrieved by those searches.

Another questionable term that appeared in participant responses for several videos was HISTORY. Participant I, whose responses resembled Library of Congress Subject Headings, was the only one to mention HISTORY in reference to all of the videos other than the one produced in 2001. Participant F included HISTORY for three videos, and participant H listed HISTORIC for one. It is understandable that some participants could think of these five videos as historic from today’s perspective, but since their content was current at the time of production, the videos were not created as historical documents. As such, if they were indexed at the time of creation, they would not likely have been assigned HISTORY as a keyword. Rather than being considered inaccurate, though, the terms HISTORY and HISTORIC were regarded, like 1960s, as conceptually representing the time period of the content.

The original creation date is considered part of the basic descriptive information about each video, but participant terms such as 1960s and HISTORY were not compared to this date when determining matched terms. Individuals interested in videos covering a topic across time or from a particular period might search by the topic plus the term

HISTORY. This search should retrieve videos that treat the topic from a historical perspective, regardless of when they were produced. These individuals could also find valuable material by simply searching on the topic and the video production date. For purposes of this research study, to distinguish between the time period represented in the video and the production date of the video, which can differ, the creation date field was not considered in the determination of matched terms.

Ultimately, there were no “conceptually incorrect” terms, nor were any other deductions taken from total terms in the conceptual agreement approach. The overall conceptual agreement match rates for all six videos are listed in **Table 4**.

Table 4
Overall Conceptual Agreement Match Rates

Segment Title	Conceptual Agreement Match Rate
A Wonderful New World of Fords (1960 Ford Spot)	96.5%
The Safest Place	90.6%
Roads to Romance: Coral Gables	75.3%
The Corvair in Action	72.2%
SearchKids: A Digital Library for Children	65.6%
Television Remote Control (Tuner)	58.7%

Analysis of Results

This research study is focused on the subject indexing of digital video, whereby a human indexer assigns natural-language words or phrases – essentially, keywords – to describe the subject matter of a video. Subject indexing is critical to the future accessibility of digital video to the wide range of potential users throughout the K-12 educational community and the general public. As the volume of video grows within digital libraries, archives, and other repositories, the task of subject indexing the

material will become increasingly burdensome for the indexer whose only tool is the video itself. As long as it might take to view the work in its entirety, it could take even longer to download the video in preparation for viewing. Still-image video surrogates are proposed as a means by which a human indexer might be able to assess the gist of a video in order to assign to it subject-oriented keywords.

Because these storyboard surrogates can be automatically generated via sophisticated software that identifies and extracts certain frames from the video, their use could eliminate video download time. In addition, it is possible that an indexer could view the surrogate and assign keywords in less time than it would take to watch the video itself. However, this indexing would only be useful if it accurately captured the main subject matter of the video. This research study acknowledges that some loss of retrievability is inevitable no matter how sophisticated the shortcut taken by an indexer. The critical balance lies in whether an indexer working from a video surrogate can assign keywords pertinent to the video, sacrificing little in the way of retrievability, while saving enough time as to render the loss of retrievability acceptable, or even negligible, in comparison.

As such, the results of this study must be analyzed for two key elements. First is the total time consumed in indexing each video or surrogate, including downloading, accessing and viewing time, as applicable. Second is the ultimate retrievability of each video, referred to here as “match rate,” and measured by the percentage of participant terms that matched index terms. **Table 5** summarizes these results for the three pairs of videos included in this study.

Table 5
Time Consumed and Match Rates by Video Pairs

<u>Segment Title</u>	<u>V/S</u> <u>**</u>	<u>Segment</u> <u>Duration</u> <u>m:ss</u>	<u>Total Time</u> <u>Consumed</u> <u>mm:ss</u>	<u>Strict</u> <u>Agreement</u> <u>Match Rate</u>	<u>Conceptual</u> <u>Agreement</u> <u>Match Rate</u>
<u>Pair 1</u>					
A Wonderful New World of Fords (1960 Ford Spot)	V	3:00	9:25	84.0%	96.5%
Roads to Romance: Coral Gables	S	3:00	1:29	65.9%	75.3%
<u>Pair 2</u>					
SearchKids: A Digital Library for Children	V	6:00	9:43	53.5%	65.6%
Television Remote Control (Tuner)	S	5:46	1:20	55.2%	58.7%
<u>Pair 3</u>					
The Corvair in Action	V	6:25	17:32	59.6%	72.2%
The Safest Place	S	6:23	3:52	69.4%	90.6%

** Indexed based on full video (V) or surrogate (S)

Time Consumed

As indicated in **Table 5**, each pair consists of videos of comparable duration, the first of which was indexed based on viewing the full video, while the second was indexed based on its storyboard surrogate. The total time consumed for the first video in each pair includes download time. It should be noted that while the file size for *SearchKids* (90.4 MB) was considerably larger than that of both *A Wonderful New World of Fords* (31.8 MB) and *The Corvair in Action* (67.7 MB), its download time (0:58) was significantly shorter than that of the others (5:15 and 10:02, respectively). This discrepancy has to do with the location of the video files themselves. The file for *SearchKids* resides on a local server, while the files for all of the other videos selected reside on a remote server. The local access to *SearchKids* accounts for its relatively quick download time.

The comparison of total time consumed for each pair of videos is shown in **Table 6**. The total time consumed in indexing the second video based on its storyboard

surrogate is calculated as a percentage of the time consumed in indexing the first video based on viewing the full video.

Table 6
Comparison of Total Time Consumed by Video Pairs

Segment Title	V/S **	Total Time Consumed mm:ss	Total Time Consumed %
<u>Pair 1</u>			
A Wonderful New World of Fords (1960 Ford Spot)	V	9:25	
Roads to Romance: Coral Gables	S	1:29	15.8%
<u>Pair 2</u>			
SearchKids: A Digital Library for Children	V	9:43	
Television Remote Control (Tuner)	S	1:20	13.7%
<u>Pair 3</u>			
The Corvair in Action	V	17:32	
The Safest Place	S	3:52	22.1%

** Indexed based on full video (V) or surrogate (S)

This comparison shows that indexing videos based on their storyboard surrogates did indeed consume considerably less time than the process of indexing videos based on viewing the videos themselves. This held true for all three pairs, implying that time savings could be realized for videos of varying durations.

Taken in total, the three surrogates were indexed in approximately 82% less time than the three full videos. Part of the time savings was due to the download time for each full video indexed. **Table 7** separates the download time and the indexing time for each full video viewed, and shows a comparison of the indexing time for each pair of videos. The time spent indexing the second video based on its storyboard surrogate is calculated as a percentage of the time spent indexing the first video based on viewing the full video.

Table 7
Comparison of Indexing Time by Video Pairs

Segment Title	V/S **	Download Time mm:ss	Indexing Time m:ss	Indexing Time %
<u>Pair 1</u>				
A Wonderful New World of Fords (1960 Ford Spot)	V	5:15	4:10	
Roads to Romance: Coral Gables	S	--	1:29	35.6%
<u>Pair 2</u>				
SearchKids: A Digital Library for Children	V	0:58	8:45	
Television Remote Control (Tuner)	S	--	1:20	15.2%
<u>Pair 3</u>				
The Corvair in Action	V	10:02	7:30	
The Safest Place	S	--	3:52	51.6%

** Indexed based on full video (V) or surrogate (S)

The indexing time alone for the three full videos totaled 20:25, versus 6:41 for the three videos indexed based on their surrogates. As a whole, the use of video surrogates contributed to a 67% time savings during the indexing phase. Download time should be included when weighing the overall benefit of using video surrogates, but as mentioned with regard to *SearchKids*, download time is a function of not only the size of a video file, but also its server location. In this study, download time for the two full videos housed on remote servers totaled, on average, 57% of the total time consumed. In fact, the download time averaged 62% longer than the videos themselves. In contrast, the download time for *SearchKids*, housed on a local server, was only 10% of the total time consumed, and only 16% of the length of the segment. For repositories that store all of their video files on local servers, download time may likewise represent only a small fraction of the total time consumed in indexing videos. Even so, since significant time savings can be realized during the indexing phase alone, the use of video surrogates could still be advantageous.

Regarding the videos indexed based on their storyboard surrogates, indexing *Roads to Romance* and *Television Remote Control* took approximately the same amount of time, while indexing *The Safest Place* took nearly three times as long. **Table 8** shows time consumed as a percentage of segment duration for these three videos.

Table 8
Time Consumed/Segment Duration for Videos Indexed via Surrogate

Segment Title	Segment Duration m:ss	Time Consumed m:ss	Time Consumed/ Segment Duration
Roads to Romance: Coral Gables	3:00	1:29	49.4%
Television Remote Control (Tuner)	5:46	1:20	23.1%
The Safest Place	6:23	3:52	60.6%

Duration of the video segment had little bearing on the time consumed in indexing videos based on their surrogates. The speed with which *Television Remote Control* was indexed could have been attributable to several factors. This video, a promotional piece produced in 1961 by RCA Victor, touts the features of their new console television and its accompanying remote control. A voiceover explains the functions of the remote control, while a woman demonstrates its use. The storyboard for this video (**Appendix B**) contains 22 frames. Eleven frames depict the woman seated and apparently operating the remote control for the television that she seems to be modeling in four of the frames. The remaining frames focus primarily on the television itself. Due to the similarity of many of the frames, there could be little question as to the overall subject matter of the video. It is only in the voiceover that RCA Victor is mentioned and the specific television and remote control features are clarified, but the storyboard lends itself to quick interpretation of the general topic of the video.

The storyboard for *Roads to Romance* (**Appendix A**) contains ten frames. A building and a car are depicted in the first and last ones, respectively, while four frames

show what appear to be parrots, and the other four, travel scenes. The small number of frames seemed to leave little to question, and only the video itself would later clarify that the building was at the University of Miami, and that the car was a Chevrolet. The variety in the *Roads to Romance* storyboard scenes demanded slightly more time to review and interpret, versus the many similar frames in the *Television Remote Control* surrogate.

While the *Roads to Romance* video segment is just over half the length of *Television Remote Control* and has just under half the number of frames in its storyboard, the length of a storyboard created via scene change technology does not necessarily correspond to the length of the source video. *The Safest Place* was only 37 seconds, or 11%, longer than *Television Remote Control*, yet its storyboard surrogate had exactly twice as many frames. These frames tended to be much busier than those of the other two storyboards, which made it more difficult to decipher their content. The more crowded frames also tended to appear blurry, which was not an issue with the other two storyboards. In addition, there was much greater variety in the frames of the *Safest Place* surrogate. Useful text appeared in the first and last frames, but approximately ten frames showed scenes of a sailboat in rough waters, nine looked like they were in a home, and four included an airplane. The video addresses the superior safety features of the Chevrolet automobile, but no car was depicted until the 26th frame. Within the following 18 car-oriented scenes, there was a great deal of variety. These factors all contributed to the relative difficulty in piecing together a story out of this surrogate while trying to make sure that no frames were overlooked. Nonetheless, indexing based on this storyboard took almost 40% less time than simply viewing the video would have required.

Retrievability – Quantitative Analysis

The effectiveness of video surrogates in subject indexing digital video cannot be measured by time savings alone. A critical component of the analysis is the assessment of the potential retrievability of videos indexed via their surrogates, versus that of videos indexed upon viewing them in full. **Table 9** recaps the match rates for each video, as calculated under both the strict and conceptual agreement of terms approaches.

Table 9
Match Rates by Video Pairs

<u>Segment Title</u>	<u>V/S</u> <u>**</u>	<u>Segment</u> <u>Duration</u> <u>m:ss</u>	<u>Strict</u> <u>Agreement</u> <u>Match Rate</u>	<u>Conceptual</u> <u>Agreement</u> <u>Match Rate</u>
<u>Pair 1</u>				
A Wonderful New World of Fords (1960 Ford Spot)	V	3:00	84.0%	96.5%
Roads to Romance: Coral Gables	S	3:00	65.9%	75.3%
<u>Pair 2</u>				
SearchKids: A Digital Library for Children	V	6:00	53.5%	65.6%
Television Remote Control (Tuner)	S	5:46	55.2%	58.7%
<u>Pair 3</u>				
The Corvair in Action	V	6:25	59.6%	72.2%
The Safest Place	S	6:23	69.4%	90.6%

** Indexed based on full video (**V**) or surrogate (**S**)

Due to the variations among participant responses, with some consisting of abstract rather than descriptive phrases, it is understandable that the match rates under the conceptual agreement of terms approach would be higher than those under the strict agreement approach. The diversity of participant responses reflects how differently people express themselves on a regular basis. Keyword searching often involves finding more than one needs, or finding unrelated material that uses one's search terms in an unexpected manner. Both scenarios may require a searcher to review and revise his terms in an effort to refine his results. While there can be such

drawbacks whenever searchers are not given a prescribed list of terms from which to choose, there are significant advantages to being able to conduct natural-language searches, without having to be familiar with or limited to a controlled vocabulary.

A robust thesaurus underlying the keyword search facility can add value to the search process by leading the individual to additional or alternative terms that may help to narrow or redirect his inquiry. Although this researcher acknowledges that a strong thesaurus is critical to the usefulness of any search tool, the construction of such thesauri is beyond the scope of this study. Neither this researcher nor the study participants worked from a controlled vocabulary, and the participants were asked not to supply search terms, but to simply state what they believed to be the main topics of each video. For those reasons, it was determined that the conceptual agreement of terms approach would be most relevant for purposes of this analysis. Regardless of the variations in their terminology or phrasing, the degree to which the participants conceptually agreed on the topics of a video should reflect the relevance of those topics to the video. The higher the rate of agreement on a topic, the more important it would be for the indexing to include references to that topic. The conceptual agreement match rate will, therefore, be used as the primary measure of retrievability for each video.

The participants' background information – their age range and sex, their judgment of their overall level of skill with respect to conducting searches on the computer, and their assessment of their familiarity with or knowledge about what was covered in each video – were analyzed in SPSS. Figures by participant and overall averages were compared to both the strict and conceptual match rates for each video. The only statistically significant correlations noted were between the strict and conceptual match rates for four of the videos, as might be expected. Since the overall conceptual match rate for each video is greater than its strict match rate, this finding

indicates that, for the most part, the participants' conceptual agreement with the index terms seems to increase over their strict agreement at a comparable rate. This supports the notion that a variety of words and phrases can be used to convey similar ideas, but that conceptual agreement is generally rooted in some common terminology.

Consequently, high conceptual agreement would not be expected among participants who started out with low strict agreement match rates.

This relationship for the video *A Wonderful New World of Fords* reflected some correlation, but not at the statistically significant level. Skewing the results for this video was the response of participant **D**, who listed two longer and somewhat abstract phrases to describe the video. When these phrases were broken down and their specific terms analyzed in the strict agreement approach, participant **D**'s match rate was 50%. When these phrases were regrouped along conceptual lines, her match rate doubled to 100%. This increase was in sharp contrast to the overall average increase of only 12 percentage points. When participant **D**'s results are removed from the dataset, the correlation between strict and conceptual match rates for *A Wonderful New World of Fords* becomes statistically significant.

Surprisingly, the relationship between strict and conceptual match rates for *Roads to Romance* reflected almost no correlation at all. Review of the results indicated that they were skewed significantly by the response of participant **C**, and to a lesser degree, by that of participant **A**. The case of participant **C** is similar to that of participant **D** in the previous example. When his somewhat abstract phrases (listed in **Appendix E**) were broken down and their specific terms analyzed in the strict agreement approach (see **Appendix F**), participant **C**'s match rate was only 25%. When these terms were rearranged conceptually (see **Appendix G**), his match rate increased to 100%. If participant **C**'s results are omitted, the relationship between strict and

conceptual match rates for this video reflects some correlation, but not at the statistically significant level.

Participant A's strict agreement match rate was 66.7%, after the deduction of two incorrect terms – 1960s, the incorrect time period, and PARADISE BEACH, an incorrect proper name – from his total of eight terms. As previously discussed, these terms were included in the number of total terms under the conceptual agreement of terms approach. Since neither concept – the time period of the video's content and the specific beach depicted therein – was among the index terms, both of these participant terms remained unmatched. With no change in his number of matched terms under the conceptual approach, participant A's match rate decreased to only 50%. The sharp increase in participant C's match rate and the decrease in participant A's match rate contrasted with the average increase of nine percentage points. If the results from both participants C and A are omitted from the dataset, the correlation between strict and conceptual match rates for *Roads to Romance* becomes statistically significant.

For the video *The Corvair in Action*, there was also a statistically significant relationship between sex and familiarity with or knowledge of what was covered in the video, with males indicating higher familiarity than females. Still, the males' higher familiarity ratings did not translate into higher match rates for this video. It was expected that participants who judged their overall searching skill to be high might have better strict agreement match rates, but no such correlation was noted. In fact, for some videos, both those indexed based on their surrogate and those indexed based on viewing the full video, there was a slight negative correlation between these factors. It was also expected that those who expressed greater familiarity with or knowledge of what was covered in a video might have higher match rates under both approaches. Again, no such correlation was noted, and there were slight negative correlations between these data for some videos, indexed based on either the surrogate or the full

video. For the most part, the correlations between familiarity rating and conceptual match rate did tend to be somewhat better than those between familiarity rating and strict match rate, but there were no strong relationships with respect to either.

Because no statistically significant relationships were noted between the participants' background information and their match rates, it can be surmised that the match rate results achieved in this study were not unduly influenced by outside factors. This means that similar results could be expected no matter the sex or adult age range of the participants, and regardless of their assessment of their searching skills. Likewise, since the participants' familiarity with the content of these videos had no significant bearing on their match rates under either the strict agreement or conceptual agreement approach, similar results might be expected irrespective of the subject matter of the videos. Based on these results, the pool of participants is considered to be fairly representative of the general public. Since this research study was based on a small sample of videos and a small group of participants, and given that there were no strong quantitative relationships between the data regarding either the videos indexed based on their surrogates or the videos indexed based on viewing them in full, qualitative analysis of the match rates of video pairs was deemed more constructive.

Retrievability – Qualitative Analysis

For purposes of this research study, it was determined that the conceptual agreement of terms approach would be more informative than the strict agreement of terms approach, and that the conceptual agreement match rate should be used as the primary measure of retrievability for each video. Therefore, qualitative analysis of paired videos will be limited to their conceptual agreement match rates, which will henceforth be referred to strictly as “match rates.” **Table 10** lists match rates by video

pairs, along with the duration of each segment and the average familiarity rating noted by the participants.

Table 10
Conceptual Agreement Match Rates by Video Pairs

Segment Title	V/S **	Segment Duration m:ss	Average Familiarity/ Knowledge	Conceptual Agreement Match Rate
<u>Pair 1</u>				
A Wonderful New World of Fords (1960 Ford Spot)	V	3:00	3.1	96.5%
Roads to Romance: Coral Gables	S	3:00	2.7	75.3%
<u>Pair 2</u>				
SearchKids: A Digital Library for Children	V	6:00	2.5	65.6%
Television Remote Control (Tuner)	S	5:46	3.7	58.7%
<u>Pair 3</u>				
The Corvair in Action	V	6:25	2.8	72.2%
The Safest Place	S	6:23	3.5	90.6%

** Indexed based on full video (V) or surrogate (S)

Pair 1

The shortest videos tested were the 3:00 works in Pair 1. It is acknowledged that the shorter the video, the less time there would be to save, such that retrievability might be the key factor in judging the effectiveness of surrogates used in indexing shorter videos. *A Wonderful New World of Fords (1960 Ford Spot)*, indexed based on viewing the full video, earned a 96.5% match rate, versus a 75.3% match rate for *Roads to Romance: Coral Gables*, indexed via its surrogate.

A Wonderful New World of Fords, produced in 1960 by the Ford Motor Company, is described in the Open Video Project repository as a “Ford commercial linking new compact cars to futurism and the space frontier.” Ironically, neither this researcher nor any of the 13 participants noted the concepts of space or futurism among their terms, nor did anyone mention COMPACT cars specifically. Nonetheless, all

seven researcher-assigned terms, plus four additional terms found in the title (WONDERFUL, NEW, WORLD, and SPOT) were conceptually matched 83 times out of 86 participant terms. The only unmatched participant terms were two participants' references to the music or jingle in the video and participant I's mention of U.S. with respect to automobile history. This could not be considered a broader term as previously defined. All 13 participants matched the researcher-assigned term FORD, while 11 matched 1960, and nine matched each CARS/AUTOMOBILES, ADVERTISEMENT, and either the proper names of the three models depicted in the video or the term MODELS.

This video garnered the highest match rate, but as indicated in **Table 10**, this high match rate did not correspond with the highest familiarity rating. The familiarity rating for this video averaged 3.1. Individual participant ratings ranged across the spectrum, with one participant circling 1 and one selecting 5. The exceedingly high match rate could be attributable to the fact that the video was a straightforward promotional piece and the researcher-assigned terms were simple. Although this video is over forty years old, today's public is generally familiar with car advertisements. Ford is a recognizable manufacturer, and one of the cars featured – the Thunderbird – is still in Ford's product line. Several participants alluded to difficulty in answering the question regarding their familiarity with or knowledge of what was covered in the videos. The lack of correlation between match rate and familiarity rating could have to do with the nonspecific nature of that question.

For *Roads to Romance*, indexed based on its surrogate (**Appendix A**), all seven researcher-assigned terms, plus two additional terms found in the title (ROMANCE and ROADS), and CHEVROLET, found in the source organization field, were conceptually matched 61 times out of 81 participant terms. Four participants included a reference to the UNIVERSITY OF MIAMI, depicted in the video as one of the possible destinations in the Coral Gables area. In fact, the building shown in the first frame of the storyboard

surrogate is at the University of Miami. From the context of the rest of the frames, this researcher mistakenly considered that building to be a hotel or resort. Clearly, there is little, if any, chance an indexer would have accurately identified that building in the storyboard and assigned UNIVERSITY OF MIAMI as a keyword without reference to the audio track. Participant terms included three other references to specific locations in the video, which were unmatched by researcher-assigned terms. It seems reasonable to conclude that the use of storyboard surrogates could prove problematic in identifying specific people and places, except for the very recognizable, and proper names in general.

It is interesting to note that while four participants mentioned the University of Miami, two others did so but later crossed off the phrase before submitting their results. This implies that these two participants decided that the university was not among the main topics of the video, although they had identified the concept as present. Based on this researcher's viewing of the full video, UNIVERSITY OF MIAMI would indeed be a pertinent descriptor. Furthermore, members of the general public or K-12 educational community could realistically be interested in finding early footage of locations such as this.

The match rate for *Roads to Romance* was affected most by there being no reference to ADVERTISING among the researcher-assigned terms; eight participants mentioned this concept. Every participant also mentioned CHEVROLET or CHEVY. Had "source organization" not been considered one of the fields that would be scanned in a keyword search, these 13 terms would have gone unmatched, and the conceptual match rate for this video would have decreased from 75.3% to 59.3%. However, both concepts would have been addressed had the title frame of *Roads to Romance*, or any frames with text, been included in its storyboard surrogate.

Roads to Romance had two title frames, neither of which was represented in its surrogate. The first title frame read, “Chevrolet presents *Roads to Romance*.” Based on the phrase “Chevrolet presents,” this researcher would have assigned both CHEVROLET and ADVERTISEMENT as descriptors. (Similarly, the title frame for the Pair 3 video, *The Safest Place*, read “Chevrolet presents *The Safest Place*.” This title frame was included in the surrogate for *The Safest Place*, which prompted this researcher to record both CHEVROLET and ADVERTISEMENT as descriptors for that video.) Had these terms been recorded for *Roads to Romance*, the match rate for this video would have been 85.2% rather than 75.3%. When compared to the 96.5% match rate for its pair member video, *A Wonderful New World of Fords*, the 85.2% match rate would have represented a difference of only 11.3 percentage points, rather than 21.2.

One participant noted BISCAYNE BAY among her terms. The second title frame in *Roads to Romance* read, “Coral Gables Florida – Sunland on Biscayne Bay.” Had this frame been reflected in the storyboard surrogate, BISCAYNE BAY might also have been included among the researcher-assigned terms. This example suggests that storyboard surrogates might be most useful, for both indexing and browsing purposes, if they consistently included title frames, and ideally, any text frames.

Pair 2

The Pair 2 titles had the lowest retrievability rates of all three pairs. *SearchKids: A Digital Library for Children*, indexed based on viewing the full video, earned a 65.6% match rate, versus a 58.7% match rate for *Television Remote Control (Tuner)*, indexed via its surrogate. Although the raw scores are lower, the difference between the two rates is only 6.9 percentage points. This supports the hypothesis that the difference in potential retrievability between the two indexing methods could be relatively insignificant.

SearchKids, produced in 2001 by the Human-Computer Interaction Lab at the University of Maryland, presents results of research sponsored by the lab. Its description in the Open Video Project repository reads:

An interdisciplinary, intergenerational team developed SearchKids, a zoomable digital library that contains multimedia information about animals. Our digital library supports collaboration by enabling several children to navigate the same information on the same computer at the same time. The design process as well as the technology is presented.

As might be expected due to its more technical nature, this title earned the lowest overall familiarity rating, 2.5. Of the 11 participants who viewed *SearchKids*, four circled a familiarity rating of 1 and another four circled 4. Interestingly, and reinforcing the lack of correlation between familiarity and retrievability, participants who indicated a familiarity level of 4 had an average match rate of 60%, while those who indicated a familiarity level of 1 averaged a 70% match rate.

Of the 13 index terms, including the title term, SEARCHKIDS, eight were conceptually matched 42 times out of 64 participant terms. The five researcher-assigned terms that were not listed by any participants included the names of two organizations featured in the video. HUMAN-COMPUTER INTERACTION LAB (HCIL) was the producer of the video and the setting for much of its action. HCIL partnered with YORKTOWN ELEMENTARY SCHOOL to create the SearchKids digital library, and the school was also the setting for some of the testing depicted in the video. No participants mentioned either of these institutions. Other terms not mentioned by any participants were INTERFACE, EFFICIENCY (specifically, SEARCH EFFICIENCY), and ZOOMABLE. This researcher was especially doubtful that ZOOMABLE would be noted by any participants, but the term was included as a keyword because it was mentioned frequently in the video. In retrospect, INTERFACE and EFFICIENCY may have been included as keywords because of this researcher's familiarity with these concepts in terms of online searching, but the terms may not be widely used among the general public.

At first glance, this example might seem to reflect a propensity to over-index upon viewing a video in full. The notable gaps in the indexing bring that into question, however. Six participants mentioned COMPUTER, PROGRAM, or ONLINE, five noted RESEARCH/DEVELOPMENT, and four listed EDUCATION. Three participants referred to the GRAPHIC nature of the SearchKids digital library, and three alluded to PROMOTION of the product. This researcher considered that last reference attributable, in part, to the fact that the other five videos shown were promotional in nature. The remainder of the unmatched terms seemed reasonable for *SearchKids*. While participant familiarity was not a good predictor of match rate, the discrepancy between researcher-assigned terms and participant terms for this video might have been a function, instead, of this researcher's knowledge of the topic.

The unmatched participant terms tended to be straightforward, as in the case of COMPUTER and EDUCATION, while the researcher-assigned terms INTERFACE and EFFICIENCY may reflect some assumptions grounded in this researcher's familiarity with digital libraries. For example, where digital libraries are concerned, COMPUTER would be taken for granted, as to a lesser degree, might EDUCATION. RESEARCH/DEVELOPMENT could likewise be assumed to be components of DESIGN, a researcher-assigned term which was matched by only two participants. The index terms that were matched most often were the simpler ones – SEARCH and ANIMALS, each listed by five participants – and those included in the video title – DIGITAL LIBRARY and CHILDREN, listed by nine and ten participants, respectively. It is worth noting that the two participants who did not list the obvious DIGITAL LIBRARY among their search terms were participants C and D, both of whose responses consisted primarily of longer phrases that were more conceptual than descriptive in nature.

Overall, the results for *SearchKids* reinforce the need for a strong keyword search facility to be supported by a robust thesaurus that highlights broader, narrower,

and related terms. In addition, the discrepancy between researcher-assigned terms and participant terms should serve as a reminder that within the indexing function, the potential audience for the material must be considered. While the research reported in this paper is ultimately focused on facilitating the public's access to moving image material, this researcher's exposure to the topic of digital libraries in the context of graduate study may have led to the assignment of some keywords that were inadvertently directed more toward the research community. Attempts to accommodate both ends of this spectrum may indeed lead to over-indexing and, therefore, to potential noise within keyword search results. This may be an inevitable cost of trying to maximize access for a broad range of potential users, a subject worthy of further research employing a greater number and wider variety of videos and participants.

Television Remote Control, produced in 1961 by RCA Victor, earned the highest overall familiarity rating (3.7), but the lowest match rate of all six titles tested. Its description in the Open Video Project repository reads simply, "early technology to enable the channel-surfer." In the video, a voiceover explains the features of the new RCA Victor console television and its accompanying remote control, while a woman demonstrates their use. Four of the six researcher-assigned terms, plus TUNER, found in the title, and RCA VICTOR, the source organization, were conceptually matched 37 times out of 63 participant terms. Had "source organization" not been considered one of the fields that would be scanned in a keyword search, the seven participant mentions of RCA VICTOR would have gone unmatched, and the conceptual match rate for *Television Remote Control* would have decreased from 58.7% to 47.6%. Two participants mentioned INSTRUCTIONS and "HOW TO," matching researcher-assigned terms, but credit for the match rate is due primarily to the 25 incidents of TELEVISION and REMOTE CONTROL among the participant terms. These terms would have been matched by the keyword

search's inclusion of the title field. They were also specifically included as keywords because it appeared from the surrogate (**Appendix B**) that little else was covered in the video. This researcher also included as keywords both FUNCTION and OPERATION with respect to the remote control, but no participants listed these or similar terms.

Even after viewing the video in full, this researcher questioned whether *Television Remote Control* was an advertisement. It should be noted that it was not described as one in the repository. The participants' interpretation of the video as an ADVERTISEMENT was clear, however, as nine of 13 noted the term in their responses. Five participants also specified that this was a COLOR television, and six used a variety of terms to make reference to this being a display of NEW TECHNOLOGY. Unlike in the case of *Roads to Romance*, no title or text appeared anywhere in *Television Remote Control*. Thus, this surrogate could not have been supplemented by the addition of any such frames. Perhaps the woman's appearing to model the television should have implied the promotional aspect of the piece, but this researcher simply did not pick up that notion. Since the storyboard and the whole video were primarily sepia-toned, it might have been difficult to discern that a color television was being depicted. Inferring from the images themselves the sense of this being a recent invention or new technology would likewise have been problematic.

Based on the participant responses, then, the core topics of *Television Remote Control* were addressed in the indexing, but the full perspective of the video was not. This failure to convey the tone or character of a work could be expected as a weakness of storyboard surrogates, and could render completely ineffective their use with respect to abstract works. Again, further research with a wider variety of videos may offer an opportunity to qualitatively consider the tradeoff between this potential shortcoming and the time savings afforded by video surrogates.

Pair 3

Results for the Pair 3 videos were perhaps the most surprising. *The Safest Place*, indexed via its surrogate, earned a conceptual match rate of 90.6%, which was 18.4 percentage points higher than the 72.2% match rate of *The Corvair in Action*, indexed based on viewing the full video. When compounded by the fact that it took over four times as long to download, view and index *The Corvair in Action*, the use of video surrogates indeed seems promising. It should be noted that this anomaly was evident even under the strict agreement of terms approach, where the match rate for *The Safest Place* exceeded that of *The Corvair in Action* by 9.8 percentage points.

The Corvair in Action, produced in 1960 by the Chevrolet Division of General Motors Corp., is described in the Open Video Project repository as a “promotional film for the controversial Chevrolet Corvair.” All seven researcher-assigned terms were conceptually matched 57 times out of 79 participant terms. The match rate for this video was affected most by there being no reference to time period among the researcher-assigned terms; ten participants mentioned either 1960, 1960s, or HISTORY. The time period covered in *The Corvair in Action* could be correctly inferred from the production date of the video, but since that relationship cannot always be assumed, the creation date field was not considered one that would be scanned in a keyword search. Failure to note the year of the Corvair depicted in the video was likely the result of researcher oversight. Had the time period been reflected in the researcher-assigned terms, the match rate for this video would have risen to 84.8%.

It seems that a difference in perspective, rather than researcher error, accounted for the other main discrepancy between researcher-assigned terms and participant terms. Seven participants referred to the concept of TESTING in *The Corvair in Action*. The video depicted the Corvair in a variety of situations, some clearly engineered for promotional purposes. Rather than consider the general testing aspect of these scenes,

however, this researcher noted terms related to the results of that testing, namely the SAFETY FEATURES and superior ROAD HANDLING of this compact car. The discrepancies between researcher-assigned terms and participant terms can ultimately be viewed much like the inconsistencies among the participants themselves. No matter the medium, the same content can be interpreted somewhat differently by any number of people. The key remains that the core topics of this video, as determined by the degree to which participants conceptually agreed on them, were reflected in the researcher-assigned terms.

The same is true for *The Safest Place*, a work whose indexing was based on its storyboard surrogate. This video, produced in 1935 by the Chevrolet Division of General Motors Corp., is described in the Open Video Project repository as “how the automobile is the safest place a person can be.” In it, the dangers of boats and airplanes and even the home are compared to the relative safety of the Chevrolet automobile, referred to as a “living room on wheels.” Of the 12 researcher-assigned terms, ten were conceptually matched 58 times out of 64 participant terms. The two researcher-assigned terms not mentioned by any participants were admittedly vague references to LAND and WATER safety. Each of the six unmatched participant terms was listed only once. The lack of agreement among participants regarding these terms implied that the terms had little significance to the video as a whole. While *The Safest Place* enjoyed a high overall familiarity rating, it was yet another example of how this participant assessment proved a poor predictor of match rate. Indeed, the lowest participant match rate, 66.7%, was calculated for the one individual who indicated a familiarity of 5.

The variety and number of frames in the storyboard surrogate for *The Safest Place* led to this researcher spending significantly more time indexing it than was spent indexing the other two surrogates. It is possible that the process of piecing together a

story from 44 frames resulted in more attention being paid to each individual frame. The researcher-assigned terms were not finalized until after several close reviews of the entire sequence of frames in the storyboard surrogate. This type of effort was not undertaken with the surrogate for *Television Remote Control* because there was so much similarity between the scenes it depicted. For the most part, these frames simply alternated between the remote control and the television itself (see **Appendix B**). Likewise, with the ten frames of the *Roads to Romance* storyboard surrogate (**Appendix A**), a quick and incomplete determination of the video's content was made largely because there were fewer frames to interpret.

Simply requiring more frames in each storyboard surrogate is clearly not the answer, however. That would not have changed the indexing for *Television Remote Control*, for example. The MERIT keyframe extraction technology, based on scene changes, is still being tested. As research into this and other related technologies continues, the resulting improvements in the video surrogates created will undoubtedly make them more useful for manually subject indexing digital video. Alternate methods of surrogate presentation, such as slide shows that would allow for the individual frames to be larger, can also be applied to this purpose.

Summary of Results

Motivating this research study was the theory that a human indexer could use an automatically generated storyboard surrogate to assign subject-oriented keywords to a video, saving significant time while sacrificing relatively little in the way of retrievability. The results of this study are summarized in **Table 11**.

Table 11
Summary of Results
Time Saved and Retrievability Lost

Segment Title	V/S **	Time Consumed mm:ss	Time Saved %	Conceptual Agreement Match Rate	Retrievability (Lost) Gained
<u>Pair 1</u>					
A Wonderful New World of Fords (1960 Ford Spot)	V	9:25		96.5%	
Roads to Romance: Coral Gables	S	1:29	84%	75.3%	(22%)
<u>Pair 2</u>					
SearchKids: A Digital Library for Children	V	9:43		65.6%	
Television Remote Control (Tuner)	S	1:20	86%	58.7%	(11%)
<u>Pair 3</u>					
The Corvair in Action	V	17:32		72.2%	
The Safest Place	S	3:52	78%	90.6%	26%
Overall Average			82%		(6%)

** Indexed based on full video (V) or surrogate (S)

The “Time Saved %” column indicates that for each pair of videos, the time consumed in subject indexing the video based on its surrogate was 84%, 86%, and 78% less, respectively, than the time consumed in indexing the full video in that pair. In the aggregate, the time consumed in indexing the three videos based on their surrogates was 82% less than the time consumed in indexing the three full videos.

For Pair 1, the match rate of the video indexed via its surrogate was 78% of the match rate of the title indexed upon viewing the video in full. The resulting 22% relative loss in retrievability is reflected in the “Retrievability (Lost) Gained” column. For the Pair 2 titles, the relative loss in retrievability was 11%. Due to the anomaly in the Pair 3 data, the use of the surrogate there resulted in a 26% relative gain in retrievability. To calculate an overall match rate for the three videos indexed via their surrogates, their collective matched and unmatched terms were counted, then added together to arrive at a collective total number of terms. The collective matched terms sum was divided by the collective total number of terms, yielding the overall match

rate. The overall match rate for the other three titles, indexed based on viewing the videos in full, was calculated in the same manner. A comparison of these two overall match rates indicates only a 6% net relative loss in retrievability for the videos indexed based on their storyboard surrogates.

Analysis of the results for the individual videos gives rise to suggestions for further study and for improvements in storyboard surrogates. The results also reveal some potential shortcomings of relying on surrogates in the subject indexing of digital video. For a digital video repository employing video surrogates as an indexing tool, there is likely to be a tradeoff between the time consumed to make material accessible and the ultimate retrievability of that material. The promising results of this research study indicate that it would be worth pursuing the topic further by exploring a variety of video surrogates and assessing which types of surrogates lend themselves best to human interpretation for subject indexing purposes. A larger study, utilizing a more diverse range of videos, would also be useful for evaluating how effectively surrogates might convey different subject material.

For the study reported in this paper, this researcher viewed each video or surrogate and assigned keywords to describe its subject content. Rather than rely on this one interpretation as the basis for testing, it would be worthwhile to conduct a two-phase study in which various experienced indexers viewed each video or surrogate and assigned the keywords. In phase one of the study, the indexers' results could be evaluated against each other. In phase two of the study, participants representing the general public could view each video in full and describe what they believe to be its main topics. In order to gauge the potential retrievability of each video, the participant results could then be compared to the terms assigned by the multiple indexers. In addition, future studies on this topic could benefit from having more participants and from specifically requesting those participants to provide terms by which they might

search for a particular video. Results in this stricter format, versus the variety of participant responses in the study reported in this paper, could be analyzed more objectively within the structure of an existing keyword search thesaurus.

Considering the growth in digital libraries and the otherwise increasing availability of digital video, it appears that shortcuts will have to be taken in order to create access to this body of material in a timely manner. In determining what types of shortcuts should be employed, video repositories must consider their potential audience, and the possible uses to which that audience will put the available video segments. If the general public and the K-12 educational community are targeted as potential users, the repository must allow for subject access to its holdings. In order to make more of this material, created in or retrospectively converted to digital format, available and accessible on a regular basis, indexers should not have to rely only on downloading and viewing full videos in order to assign keywords. Video surrogates may offer a means of creating valuable subject access to moving image material, while limiting the amount of time indexers need to invest in each work.

Conclusion

Digital video has potential value in countless settings, and particularly in the educational and scholarly communities, where it can be a source of historical and social treasures. In the digital library, in the physical classroom, and via distance education programs, digital video can be used to further learning and research. This wide application of video resources adds value to, and justifies support of, digital archives. However, the application and usefulness of digital video cannot be assured without efficient and reliable subject access to this important material. Because of the complexity of video content, human expertise is required to create subject indexing, but the proliferation of digital video and the potential for tremendous growth in video

archiving demands that limited human, financial, and time resources be maximized. This research study indicates that the use of video surrogates could prove an efficient means of accomplishing both.

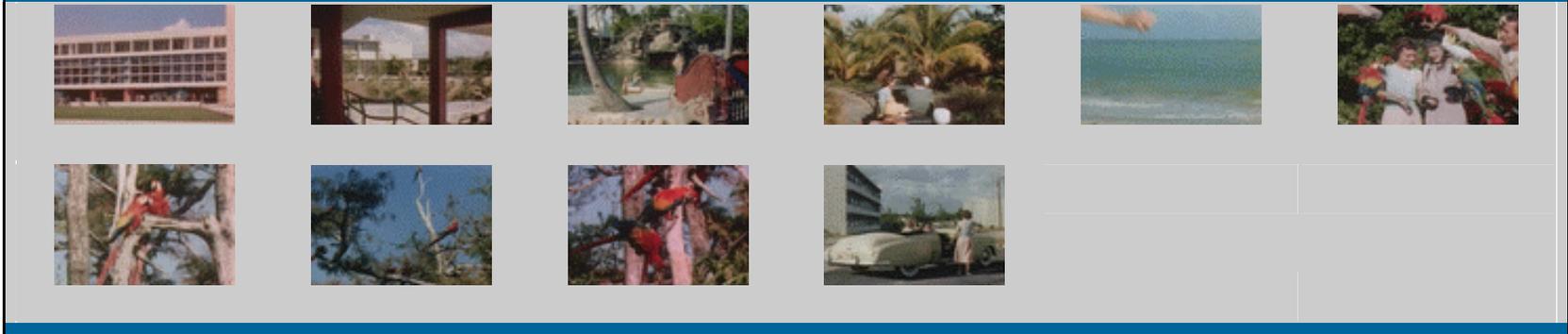
Automatic indexing tools are currently available for identifying technical aspects of video that may be the focus of the research community. Subject indexing, however, must allow for the natural-language and keyword searching capabilities of the general public. Because of the volume of video being digitized and made publicly available, indexing this material would be literally impossible without shortcuts to this end. It appears that indexing based on video surrogates, rather than on viewing videos in full, may be one promising approach.

Finding an effective subject indexing method for digital video may not only prompt retrospective indexing projects, but may also motivate additional work in this field. More widespread and more effective subject access to digital video adds value to the archives that hold them, and will undoubtedly result in their increased use. Applications for video content in and beyond the digital library, research and educational communities will steadily be realized. Effective indexing techniques cultivated in the digital video arena may also improve Internet search engines, as well as access to electronic resources and still images. By identifying methods of facilitating that access, we can effectively serve the lifelong learners of tomorrow.

Appendix A

Storyboard Surrogate for *Roads to Romance: Coral Gables*

Preview of Digitized Segment "Roads to Romance: Coral Gables"



<http://www.open-video.org/preview.php?seg_id=4250>

Appendix B

Storyboard Surrogate for *Television Remote Control (Tuner)*

Preview of Digitized Segment "Television Remote Control (Tuner)"



<http://www.open-video.org/preview.php?seg_id=4370>

Appendix C

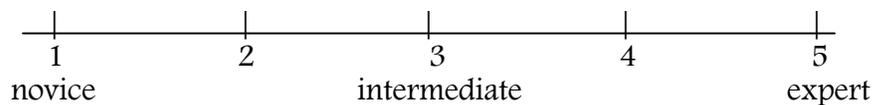
Participant Information Form

Age _____

Sex _____

Please describe, in a sentence or two, how you have used a computer to conduct searches, whether for school, home, or professional use (i.e., types of searches, examples of things you have searched for, applications in which you have conducted searches).

On a scale of 1 to 5 (1 being novice; 5 being expert), circle one number to indicate how you would judge your level of skill with respect to conducting searches on the computer.

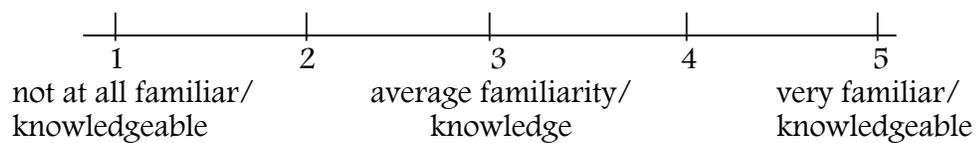


Appendix D
Sample Response Form

VIDEO TITLE: *Roads to Romance: Coral Gables*

1) Please list up to 9 words or phrases describing what you believe to be the main topic or topics of this video.

2) On a scale of 1 to 5 (1 being not at all, 5 being very), circle the number that best reflects your familiarity with or knowledge about what was covered in this video.



Appendix E

Selected Participant Responses for *Roads to Romance: Coral Gables*

Participant C

See the land in your Chevy.
Freedom to roam with your car

Participant D

Attractions of Coral Gables area
Drive a Chevy to have a good vacation.

Participant F (representative of most responses)

Coral Gables
University of Miami
Travel & vacation
Chevrolet
Florida

Participant I

Travel videos – U.S. – Florida
Tourism – History – U.S. – Florida – 1960s
Advertising – Automobiles – History – U.S. – 1960s
Chevrolet

Participant J

University
Beaches
Birds
Chevy cars
Buy a Chevy car to visit romantic Coral Gables.

Appendix F
 Strict Agreement Presentation of
 Selected Participant Responses for *Roads to Romance*, as listed in Appendix E

	Participant C	Participant D	Participant F	Participant I	Participant J
INDEX TERMS					
<u>researcher-assigned terms</u>					
travel		vacation	travel & vacation	travel; tourism	visit
Coral Gables		Coral Gables	Coral Gables		Coral Gables
Florida			Florida	Florida	
road trip					
sights		attractions			
beach					beaches
parrots					
<u>terms in title</u>					
romance					romantic
<u>source organization</u>					
Chevrolet Division, General Motors Corp.	Chevy	Chevy	Chevrolet	Chevrolet	Chevy
UNMATCHED TERMS:	see the land				
	freedom to roam				
	car			automobiles	cars
		drive			
			University of Miami		university
				U.S.	
				history	
				1960s	
				advertising	
					birds
					buy

Appendix G

Calculation of Strict Agreement Match Rate, Based on Selected Participant Responses for *Roads to Romance*, as listed in Appendix F

	Weighted Count	Participant C	Participant D	Participant F	Participant I	Participant J
INDEX TERMS						
<u>researcher-assigned terms</u>						
travel	4		vacation	travel & vacation	travel; tourism	visit
Coral Gables	3		Coral Gables	Coral Gables		Coral Gables
Florida	2			Florida	Florida	
road trip	0					
sights	1		attractions			
beach	1					beaches
parrots	0					
<u>terms in title</u>						
romance	1					romantic
<u>source organization</u>						
Chevrolet Division, General Motors Corp.	5	Chevy	Chevy	Chevrolet	Chevrolet	Chevy
Sum - Matched Terms	17	1	4	4	3	5
UNMATCHED TERMS:	1	see the land				
	1	freedom to roam				
	3	car			automobiles	cars
	1		drive			
	2			University of Miami		university
	1				U.S.	
	1				history	
	1				1960s *	
	1				advertising	
	1					birds
	1					buy
Sum - Unmatched Terms	14	3	1	1	5	4
Total Terms	31	4	5	5	8	9
Inaccuracies (*)	1				1	
Total Terms Less Inaccuracies	30	4	5	5	7	9
Match Rate **	56.7%	25.0%	80.0%	80.0%	42.9%	55.6%

Notes:

* This date reflects an incorrect time period, as this video was created in 1950. If someone were searching for a video about the 1960s, this segment would not be applicable. The inaccurate term was deducted from the total number of terms in order to calculate the “Match Rate” for this video – the percentage of participant terms that matched index terms.

** This table includes only 5 of 13 participant responses; this overall Match Rate of 56.7% does not equal the figure calculated based on all responses. See **Table 3** for the Overall Strict Agreement Match Rates.

Appendix H
Conceptual Agreement Presentation of
Selected Participant Responses for *Roads to Romance*, as listed in Appendix E

	Participant C	Participant D	Participant F	Participant I	Participant J
INDEX TERMS					
<u>researcher-assigned terms</u>					
travel		vacation	travel & vacation	travel; tourism	visit
Coral Gables		Coral Gables	Coral Gables		Coral Gables
Florida			Florida	Florida; (BT) U.S.	
road trip	freedom to roam with your car			automobiles	cars
sights	see the land	attractions			
beach					beaches
parrots					(BT) birds
<u>terms in title</u>					
romance					romantic
<u>source organization</u>					
Chevrolet Division, General Motors Corp.	Chevy	Chevy	Chevrolet	Chevrolet	Chevy
UNMATCHED TERMS:		drive (a Chevy) *		advertising	buy (a Chevy car) *
			University of Miami		university
				history; 1960s	

Notes:

(BT) refers to “broader term.” Recognizing the hierarchical nature of many keyword search thesauri, broader participant terms that encompassed narrower researcher-assigned terms were considered “matched terms” in this presentation.

* The term CHEVY is not counted twice in this presentation. It is shown parenthetically here to indicate the context of the participant’s original response.

Appendix I

Calculation of Conceptual Agreement Match Rate, Based on Selected Participant Responses for *Roads to Romance*, as listed in Appendix H

	Weighted Count	Participant C	Participant D	Participant F	Participant I	Participant J
INDEX TERMS						
<u>researcher-assigned terms</u>						
travel	4		vacation	travel & vacation	travel; tourism	visit
Coral Gables	3		Coral Gables	Coral Gables		Coral Gables
Florida	2			Florida	Florida; (BT) U.S.	
road trip	3	freedom to roam with your car			automobiles	cars
sights	2	see the land	attractions			
beach	1					beaches
parrots	1					(BT) birds
<u>terms in title</u>						
romance	1					romantic
<u>source organization</u>						
Chevrolet Division, General Motors Corp.	5	Chevy	Chevy	Chevrolet	Chevrolet	Chevy
Sum - Matched Terms	22	3	4	4	4	7
UNMATCHED TERMS:	3		drive (a Chevy)		advertising	buy (a Chevy car)
	2			University of Miami		university
	1				history; 1960s *	
Sum - Unmatched Terms	6	0	1	1	2	2
Total Terms	28	3	5	5	6	9
Match Rate **	78.6%	100.0%	80.0%	80.0%	66.7%	77.8%

Notes:

* The term 1960s is based on the participant's misinterpretation of the time period of this video. While inaccurate with respect to the content of the video, this term and the term HISTORY reflect the notion that the time period covered in the video could be of interest. As such, from the perspective of conceptual agreement, these terms are equivalent.

** This table includes only 5 of 13 participant responses; this overall Match Rate of 78.6% does not equal the figure calculated based on all responses. See **Table 4** for the Overall Conceptual Agreement Match Rates

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