Index Access Points in a Study of Intellectual Access to Digitized Art Images

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Introduction

Digitized image information is becoming an integral part of a new generation of information management systems. Many of the documents that are being converted into electronic formats contain images. Traditional retrieval and indexing methods for providing access to large text databases do not offer adequate access to the images which often accompany the text (Lunin, 1990).

Where books cite their purpose in the title, preface, or introduction, an image "makes no attempt to tell us what it is about" (Besser, 1990, p. 788). Besser also notes concern with text retrieval systems and relevancy problems of poor recall and precision: "text retrieval systems can achieve a sixty percent precision rate at best [6 out of 10 items retrieved are relevant to a user's query] but I expect much poorer performance retrieving images" (Jul, 1991, p. 17).

The differences between text and images necessitate that research in retrieval techniques for images begin with an understanding of how people search for images, how images are indexed, how images are used, and what display resolutions are needed for specific tasks.

The only study in the area of needed display resolutions is from the Getty Art History Information Program. Ester (1991) conducted a study of art historians viewing surrogate images of art objects. Art historians were asked to determine the better version from many renditions of the same image, varied in resolution and dynamic range (number of different colors). Results pinpointed a number of thresholds where people were no longer able to tell a "higher quality" image from a "lower quality" image.

The field of library and information science has acknowledged the problems of providing access to images with work in the fields of subject access and vocabulary control. Work in the areas of archival and manuscript collections and preservation has concentrated on extending MARC for subject access to visual collections (Petersen and Molholt, 1990). The *Art and Architecture Thesaurus* (AAT) project (Barnett and Petersen, 1989) is a computer-oriented thesaurus using a faceted hierarchy to develop a

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standard vocabulary in the field of Western art. An update to the AAT for use in object and image documentation is presented by Busch (1992) in *Studies in Multimedia.*

The need for terms to describe content of artworks is also being addressed by ICONCLASS, a hierarchical numeric classification scheme designed by art historians at the University of Leiden. It is used to arrange artworks through iconographical analysis. ICONCLASS indexes a full range of Western iconographic traditions through nine class divisions: religion and magic; nature; human being in general; society, civilization and culture; abstract ideas and concepts; history; Bible; literature; and classical mythology, ancient history (Walter, 1991).

Although significant research is being conducted on storage and transmission of electronic document collections over existing networks, access to the images in these collections is complicated by the immense file sizes, compression ratios needed for transmission, and lack of image retrieval terminology (Lynch, 1991). However, the major problem of intellectual access to digitized images remains largely unsolved. For the purposes of this report the term intellectual access is defined as the image searcher's ability to find and use the image that meets a stated need.

This report is part of a larger study of intellectual access to digital art images that included all aspects of search and retrieval in an art image database (Hastings, 1994). The study investigated how variations in the retrieval parameters and access points effected the queries by art historians when they conduct research using an art image database. Access points include existing information about the collection such as artist, title, provenance, and the suggestions from participants for additional access points.

Intellectual access to art images is but a small piece of the much larger problem of intellectual access to new formats of information. As more and more information becomes available in digital formats only, it is imperative that we understand how people get to, and use the information available.

Method and Design

For the purposes of this study, "intellectual access" is define d as the image searcher's ability to find and use the image that meets a stated need. A "query" consists of either a stated need or an expression of intended use. "Image" is used to represent a surrogate representation of a real painting in either digital or photographic format.

The method of presenting the expert with items related to their research is based on the work of Calvin Mooers (1959) and other early information science researchers as they began to design automated systems for the retrieval of text and bibliographic materials. Mooers used the technique of presenting research reports to the potential users of the reports and asking them how they would search for, retrieve,

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and use the reports. The technique was successful when used for unique formats and small collections or prototype design.

There are classifications of the information needs of art historians available from previous studies (Bakewell, 1988; Brilliant, 1988; Markey, 1988; Panofsky, 1962; Stam, 1984) which indicate that art historians use surrogate image formats for specific categories of study. If the categories previously defined hold true when art historians search digitized images, then it may be possible to design levels of indexing which correspond to query categories. The previous findings are considered throughout the data analysis and used to support assertions made where appropriate.

In 1985, Roberts presented a paper to the Art Libraries Section of IFLA. Her visionary proposal for an ideal network of visual resources describes the work of Aby Warburg in 1924 (Roberts, 1985). Warburg's assistant Fritz Saxl constructed a series of flat screens covered with black cloth. Photographs could be arranged and re-arranged on the screens for comparison. The ability to manipulate a large selection of photographs for the study of their similarities and differences allowed Warburg to develop a visual narrative to support his current interests and theories. The idea was so important to Warburg's work that he constructed a set of 40 screens that could hold up to one thousand photographs and took them with him when he traveled.

The advent of image retrieval systems provides a more powerful and complex version of Warburg's screens. A visual database of images with functions for the selection and manipulation of images, in various combinations, allows the art historian to inspect, compare and contrast works of art from different periods and cultures.

Participants

The population of this study is art historians. As experts, art historians were selected in order to provide a more focused set of queries. Selection of the sample within this population was based on matched subject expertise or area of interest to the collection of Caribbean paintings, geographical logistics for completing the study, and willingness of the art historians to participate in the study.

The Collection

The paintings used for this study are part of the Bryant West Indies Collection housed in the Special Collections Department at the Main Library, University of Central Florida. In addition to the paintings, the collection contains books, serials, periodicals, and original handicrafts and artifacts from the West Indies and Caribbean area that pertain to the history, geography, economic and social life of the area. There is a special focus on Haitian art. The collection is dated from 1709 to the present.

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Procedures

In the Fall of 1993, the entire collection of paintings (66) was photographed with high resolution slide film by a professional photographer of art. The photographer used three levels of saturation and exposure for each painting. The slide film was used to produce a Kodak Photo CD at the Ross-Ehlert Photo Labs in Orlando, Florida. The Kodak Photo CD product was selected as the most efficient and inexpensive, commercially available product.

Color photographs (5"x7") were produced from the Photo CD and mounted on cardboard with Velcro strips for attaching to the Warburg screen. The black cloth covered screen (32"x34"), of the type used by Warburg in 1924, was constructed to allow the participants to arrange the photographs in sets, if they so desired.

Available catalog information about each painting from th University of Central Florida's Special Collections Department was listed in the following template on 4"x6" index cards for use with the photographs and for the digitized images in the pilot study:

CATALOG NUMBER
ARTIST
PROVENANCE
DIMENSIONS
MEDIUM
DATE AC QUIRED
DESCRIPTION / TITLE

During the pilot study, additional fields such as themes, form, style, and visual narratives were investigated for addition to the index to be used in the final investigation. After the pilot study, the template information was keyed into the Kodak Shoebox retrieval software for Kodak Photo CDs, purchased for the MacIntosh computer as the search interface to be used in the final investigation. The Kodak Shoebox software was selected for its ease of use, ability to provide search functions for text fields, and display various resolutions of the images.

Data Collection Methods

Three data collection methods are typically used in qualitative research: participant observation, interviewing, and collecting of documents. This study used participant observation, interviews, and analysis of the images.

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Participant Observation

The researcher opened each research session by reading from a script describing the project, reading a list of instructions, demonstrating how the equipment worked, what it was capable of doing, and answering any questions from the participants. Each research session, one per participant, lasted an average of two hours. Sessions began when the researcher had the computer equipment and the Warburg screen and photographs installed and set-up, ready for use. The sessions ended when each participant had completed an investigation of the collection.

Interviews

Interviews were conducted at the end of each session. Participants were asked to summarize their experience, describe what they thought of the two types of image representations and how each of these might relate to their scholarly endeavors, and explain whether they would have different queries of the collection the next time they had an opportunity to use a similar product. Open discussion was also included in the interview sessions. The interviews were recorded by video camera.

Images

The images selected and used by the participants were examined for traits that could explain certain concepts found in the analysis of data collected. For each image selected and retrieved, traits of Color, Composition, Complexity, Contrast, Perspective, Proportion, and Style were correlated to query, query category, manipulations, and access points.

Organization and Analysis of the Data

The data were analyzed in three stages. First, the preliminary data from the session transcripts, photographs and screen captures, and query statements were categorized and classified. The data were arranged in tables by query and by group of experts. Each query was matched to the image(s) used, sets of image arrangements, access points used, manipulations, and display resolutions chosen. Queries were also examined for categorical similarities and for similarities and differences between and among Group A and Group B.

The second stage of analysis was to discover patterns in both the photograph and digitized image searches. These patterns were derived from the tables produced in the first stage of data analysis. Relationships were noted for associations between query type and 1) display of the images; 2) access points or combinations of access points; 3) manipulations. The data was examined for patterns of variation.

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The third stage of analysis used the images selected and retrieved by each query to describe traits of the image itself that were similar and different. The identified traits were matched to the queries from each category.

Transcript summaries that incorporated field notes and observations plus the major points and activities of the participants were sorted into preliminary categorical sets. For verification and validation, the summaries were sent to each participant with a cover letter requesting that they review the contents and confirm that the transcript summary adequately represented what they had said and done .

Conclusions

The Recommendations category contains suggestions for additional information needed for access and/or ways to manipulate the data. The subcategories assigned by the researcher were developed as the data was analyzed.

The subcategories for Speed and Thumbnail applied to the digital images only. Ben commented that it took a long time to build an image and he questioned if a more powerful computer could retrieve images faster. Bob thought comparisons should be able to be done very quickly and hoped that the future would provide systems "with extremely high resolution, extremely quick response with the ability to project on a large screen for use in the classroom."

Comments and recommendations regarding the thumbnail images and size in general included:

1. With this [the computer] looking at smaller is bigger. You don't have to walk away to gain perspective, you can just make the image smaller on the screen.
2. Size of the thumbnails is not a problem but more difficult when images are dense or complex.
3. Thumbnails do not have adequate resolution but they suffice for study purposes. Bernice: Put title, artist and date in a caption by the thumbnail.
4. Need higher resolution for the thumbnails to at least see what the activity is but the size is not a problem because you can enlarge it if it interests you.
5. When you look at an image in such a small size, students memorize broad shapes and don't really look for details, or deal with iconography, technique and so on.

The subcategories of Category, Color, Display, Resolution, and Text applied to photographs and digital images. Comments for Color, Display, and Resolution for the photographs were complimentary

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for both formats. The Color of the photographs was thought to be very high quality and the Warburg screen for displaying the photos received rave reviews. Ann thought the resolution of the photographs was excellent and Betty thought that computer resolution that equaled the photographs would be good.

Recommendations for Color and Display in the digital images included:

1. When you see six images at once, first your eye is drawn by color, then by bigger images like the red house.
2. The color is very different from the photographs, this is softer, grayer.
3. The color is beautiful, definitely need color. Maybe for sculptures you could get away with black and white.
4. This doesn't give you surface detail and texture or stylistic brush strokes.
5. This is much better than slides. With slides it depends on who took the picture, lens, age of slide, etc.
6. It would be important to be able to project these images on a large screen.

Resolution for the digital images was a major topic in the recommendation category. The majority of the recommendations were for better resolution. Betty said the resolution was better than what she got with a slide taped to the light. Bob thought the resolution was good until "you get down into pixels and then it's annoying — slides don't have pixels." Abby also thought that the resolution was poor when using the zoom function.

Recommendations for Category and Text are combined for the photographs and digital images because comments for the photographs in this case also apply to the digital images. The Text subcategory contains recommendations for additions or deletions to the textual information. The following fields were identified for addition to the text fields that were provided from the catalog cards of the paintings:

Date paintings were painted [date acquired was p rovided]
Gallery where purchased
Location of the o riginal
Keywords
School of painting the artist is f rom
Interviews with artists

Recommendations regarding categories for subject indexing of the collection included the use of the following subject categories to improve access to the collection:

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Haitian symbologies
Voodoo
Work, Play, Home, Spiritual, Para dise
Social Construct and Folk Tales
Landscapes, S eascapes, Still-life, Portrait
Ritual
Village sc enes, Cultural Scenes
Decorative
Historical Even ts and Holidays

Other suggestions for indexing included high versus low contrast, color and pattern, and scanning of artist's signatures for an access/retrieval point.

Table 1 lists the major components of intellectual access identified in the analysis of the data by Level of Query Complexity. Level One represents the least complex query level and level Four represents the most complex. The table explains how the discovered concepts depend on complexity of the query and are linked to access points, computer manipulations, and traits of the image.

LEVELS OF COMPLEXITY	QUERIES	ACCESS POINTS	COMPUTER MANIPULATIONS
Level 1: Least Complex	Includes identifica tion queries for Who, Where, When	Includes Text Fields and Image in general	Use of Search, Sort, and Display
Level 2: Complex	For queries of the type, "What Are?"— req uires sorting of the text info in the answer set	Includes Sorted Text Information and Images	Use of Search, Select, Sort, Display, and Enlarge
Level 3: More Complex	Includes queries o f Style,Subject, How, and ID of objects or activities	Includes Style, Keywords, and Complex Images	Use of Compare,Enlarge, Mark, Resolution, and Style
Level 4: Most Complex	Includes queries for Meaning, Subject, and Why	Includes Style and Subject	Use of Style & Subject Searches plus access to full-text secondary subject resources

Table 1. Major Components of Intellectual Access to Digitized Art Images

Research Questions

The major question posited by this study was: **Do the art historian's queries have a relationship to the access points used by them for retrieval of the needed image?** Yes, a relationship was identified. Categories of queries were found to use different levels of access points and computer

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manipulations. The relationship is meaningful in the consideration of information need and the design of image databases.

1. Are there identifiable categories of queries by art historians searching photographic art images and digitized art images? The study found that there are categories of queries by art historians. The categories are supported by previous research in the information needs of art historians. The major classes of queries, in order of frequency are Identification, Subject, Text, Style, Artist, Category, Compare and Color. By level of query complexity, classes of queries for Identification are primarily Level One; Text and Artist are Level Two; Color, Compare, Subject, and Style were found to be Level Three in complexity; and Category or search for meaning was Level Four.

2. Do changes develop in the queries of art historians as they search photographic images and as they search digital images and accompanying text information? The nature of the queries for the digital images changed more frequently during the sessions when increased computer manipulations were available. Queries were found to change in levels of complexity, when the art historians used digital images but not when they searched the photographs. The changes in queries were related to computer manipulation functions.

3. Are there identifiable queries or categories of queries from the art historian which cannot be met by the retrieval of surrogate images in an art image database? Queries from Level Four that sought to determine the meaning of a painting could not be answered from the digital images or from the available textual information. The queries would require secondary subject resources. For example, access may be to full-text historical or biographical works to answer a class of queries within the Level Four category.

4. Are there identifiable characteristics of the images that can be described by level of complexity? The study found that by comparing query to image retrieved, there was a subset of images that were related in complexity to the queries for style.

Implications for Datatbase Design

The purpose of this study was to investigate how art historians search photographic and digital art images. The findings support previously identified categories of information needs of art historians and support concerns from image database developers (Besser, 1990). The identification of query categories that relate to access points both used and suggested, and selected computer manipulations can help image database designers isolate what functions may be needed to answer classes of queries.

Evidence of a high degree of image complexity retrieved by particular query types has implications for database design and suggests a need for additional research focused on the analysis of image traits.

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In Level Three, the indication of a relationship between query and image complexity is shown in the number of complex images retrieved for queries of style. The method used for image analysis was successful with this set of digital images and may also work for other types of images.

References

Bakewell, E.; Beeman, W.; and Reese, C. (1988). *Object, Image, Inquiry: The Art Historian at Work*. Santa Monica, CA: Getty Art History Information Program.

Barnett, Patricia J. and Petersen, Toni. (1989). Subject analysis and AAT/MARC implementation. *Art Documentation*, 8, 171-182.

Besser, Howard. (1990). Visual access to visual images: the UC Berkeley image database project. *Library Trends*, 38, 787-798.

Besser, Howard. (1991a). Imaging: Fine Arts. *Journal of the American Society for Information Science*, 42, 589-596.

Brilliant, Richard. (1988). How an art historian connects art objects and information. *Library Trends*, 37, 120-129.

Busch, Joseph A. (1992). Overview of art information endeavors. *Bulletin of the American Society for Information Science*, 18, 8-13.

Enser, P.G.B. (1993). Query analysis in a visual information retrieval context. *J Document & Text Management*, 1, 25-52.

Ester, Michael (1991). Image quality and viewer perception. *Visual Resources*, 7,327-352.

Greenhalgh, Michael. (1982). New technologies for data and image storage and their application to the history of art. *Art Libraries Journal*, 7, 67-81.

Gruba, Egon G. and Lincoln, Yvonna S. (1989). *Fourth Generation Evaluation*, Newbury Park, CA: Sage.

Hastings, Samantha K. (1994) *An Exploratory Study of Intellectual Access to Digitized Art Images*. Ph.D. Dissertation, Florida State University, Tallahassee, FL.

Jul, Erik. (1991). Howard Besser explores the development of image databases. *OCLC Newsletter*, March/April, 16-17.

Kuhthau, Carol C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science*, 42, 361-371.

Lunin, Lois. (1987). Electronic image information. In M. E. Williams, (Ed.), *Annual Review of Information Science and Technology* (Vol. 22, pp. 179-224).

Holland: Elsevier.Lunin, Lois. (1990). An overview of electronic image information. *Optical Information Systems*, May/June, 114-130.

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Lynch, Clifford A. (1991). The technologies of electronic imaging. *Journal of the American Society for Information Science*, 42, 578-585.

Markey, Karen. (1986). *Subject Access to Visual Resources Collections*. Westport, CT: Greenwood Press.

Markey, Karen. (1988). Access to iconographical research collections. *Library Trends*, 37, 154-174.

Molhot, Pat. and Petersen, Toni. (1990). *Beyond the Book: Extending MARC for Subject Access to Non-traditional Materials*.Boston, MA: G.K. Hall.

Mooers, Calvin. (1959). *Information Retrieval Selection Study*. Cambridge, MA: Zator.

Panofsky, Erwin. (1962). *Studies in the Visual Arts*, New York: Oxford University Press, 1939; reprint ed., New York: Harper & Row.

Patton, Michael Quinn. (1990). *Qualitative Evaluation and Research Methods*. 2nd ed. Newbury Park, CA: Sage.

Roberts, Helene E. (1985). Visual resources: proposals for an ideal network. *Art Libraries Journal*, 10, 32-41.

Stam, Deirdre C. (1984). How art historians look for information. *Art Documentation*, 3, 117-119.

Stam, Deirdre C. and Giral Angela. (1988). Linking art objects and art information: introduction. *Library Trends*, 37, 117-119, (Theme Issue).

Walter, Nadine. (1991). Computerization in research in the visual arts. *Art Documentation*, 10, 3-12.

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