

Tammy L. Wells-Angerer. A Study of Retrieval Success with Original Works of Art Comparing the Subject Index Terms Provided by Experts in Art Museums With Those Provided By Novice and Intermediate Indexers. A Master's Paper for the M.S. in I.S. degree. January 2005. 68 pages. Advisor: Helen R. Tibbo.

This paper compares the retrieval success of terms for searching online art museum collections of two different origins: the use of terms that are the natural byproducts of curatorial processes and those provided by volunteer gallery teachers and students. The terms used by scholars and gallery teachers obtained the best retrieval, with approximately 15% of terms successfully retrieving the desired work. Little successful application of the terms available in the Art and Architecture Thesaurus (AAT) or of the terms used by scholars was seen in the online museum collections. Overall, the terms supplied by study participants had poor retrieval success. Application of additional index terms describing the basic elements, materials and colors featured in the works and terms from the AAT could improve retrieval.

Headings:

Art/Databases

Indexing/Pictures

Information Retrieval

Internet/Museums

**A STUDY OF RETRIEVAL SUCCESS WITH ORIGINAL WORKS OF ART
COMPARING THE SUBJECT INDEX TERMS PROVIDED BY EXPERTS IN ART
MUSEUMS WITH THOSE PROVIDED BY NOVICE AND INTERMEDIATE
INDEXERS**

by
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Introduction

It is an oft-repeated mantra that indexing visual resources is inherently more complex than indexing text-based materials. Text-based items hold within them explicit clues to their subject matter or what they are “about.” Words can describe words and aid both machine indexing systems and information professionals in describing document content to optimize for retrieval. While some visual works in archival and museum collections provide such clues, many do not. These are chiefly nonrepresentational works and some may be undecipherable to those not versed in particular cultures or fields of study.

Additionally, it is more difficult to index the digital surrogates of works in a museum collection where the distance between the object and the surrogate is less than in traditional visual resource/slide collections. This close proximity to the original work typically creates several impediments to the application of externally developed controlled vocabularies, among them, curators and scholars who use a variety of local terms in describing objects, backlogs that often lead to bare bones cataloging in order to facilitate speedier processing, and the fact that staff in museum collections management roles are often not appropriately trained for the task at hand. Additionally, there is currently little training or incentive for the curators researching and describing the works to use controlled or standardized vocabulary lists.

Given the increasing use of original works of art as source material for teaching across disciplines, it would seem logical to make those works available through a familiar access

method. Keyword and natural language searching used by online search engines such as Google, Teoma and Altavista have become familiar to most undergraduate students and general internet users such that they would appear to offer the advantages of simplicity and familiarity. This study examines the success of keyword and natural language searching for images of original works of art by answering the following questions:

1. Are the terms curators and other expert staff devise to describe the museum's works successful search terms for retrieving the works from their online image databases?
2. Are the terms college students apply to describing selected art works successful in retrieving these works from museum online image databases?
3. Are the terms museum volunteer staff students apply to describing selected art works successful in retrieving these works from museum online image databases?
4. How does the retrieval success of the three types of terms compare?
5. Do these terms map to the terms available in the *Art and Architecture Thesaurus*?

This study places participants into three indexer categories: art professionals describing the works in museum catalogues and texts; knowledgeable, but less expert volunteer gallery teachers; and novice undergraduate students. The study compares the retrieval success of two subject indexing methods for original works of art: the use of terms that are the natural byproducts of the curatorial and collections management processes and those provided by the docents and students. For the purposes of this study subject index terms are terms that are provided by the undergraduates and gallery teachers in describing

the works or those that are extracted from the scholarly texts. Art museum collections are defined as collections of original works of art that are catalogued and made available to the public via online databases accessible through the Internet. Online collection management databases are defined as databases, either commercially produced or developed in-house, for the express purpose of managing metadata about the original works of art found in the collections of museums accredited by the American Association of Museums (AAM) and made available through the Internet. Natural language queries are keyword or phrase searches developed when conducting a search for the works of art without the aid of controlled vocabularies or thesauri. College undergraduates for the purpose of this study are students enrolled in an undergraduate course of study who are taking introductory English and Art courses at The University of North Carolina at Chapel Hill and volunteer gallery teachers are trained teachers or guides affiliated with AAM accredited art museums.

Significance

As previously noted, the availability of museum collections on the Internet is placing increasing pressure on the information professionals responsible for those collections. Decreasing staff and budget resources preclude rolling out untested initiatives that are costly in both time and resources. If it is found that significant retrieval success can be obtained through the use of vocabulary that is developed as a by-product of normal workflows then this could prove to be a simpler, much more cost effective means of providing access to collections than traditional indexing. Gilchrest found that a majority of the AAM-accredited museums responding to her 2001 survey use locally-developed vocabularies but are more tentative about a full-scale deployment of AAT terms.

Depending upon whether the naturally occurring terms or those provided by the general users map directly to the AAT, this study could go a long way toward either reinforcing their decisions or providing impetus to encourage use of the AAT.

Background and Related Research

Text-Based Approaches to Image Access

One of the great challenges to institutions that preserve visual resources is the provision of systematic and consistent access to the material. The scanning, digitizing and storage of bulk quantities of visual material constitute no longer a problem from a technical point of view. However, the retrieval of information from large quantities of visual material still faces a major barrier (van den Berg).

The ubiquity of the Internet, combined with welcome interdisciplinary educational efforts, has increased demand for public access to original works of art significantly.

There is increasing public awareness, no doubt highlighted by the recent building boom in cultural institutions in the United States, of the vast collections held behind the gallery walls and in the vaults (Halperen 2001). An online user's entry access point for these collections is no longer a curator or collections manager manifest in an in-repository exhibit. Today individuals "visit" collections online, in some cases never stepping inside the museum. This requires a paradigm shift, not only in what information is provided, but also in its arrangement and accessibility for a broad audience. Visitors to museum and library websites crave enhanced access to collections and a spate of grant-funded digitization projects in the 1990s has provided online access to some of the world's cultural treasures.¹ This online presence has been a wonderful profile boost for cultural repositories, but it could be greatly facilitated by enhanced searching capabilities such as across-collection searching and thoughtful indexing.

It is arguable that images communicate more effectively than text alone because they transcend boundaries of literacy and linguistics. Shatford asserts that “all works of art are created in order to communicate, to transmit information in a broad sense; indeed, the original purpose of much of what we consider to be art *was* [emphasis in original] to transmit information . . . and its aesthetic value is a fortuitous by-product (Shatford 2001, 15).” Shatford’s assertion jibes with current art history theory that hypothesizes that there is meaning inherent to original works of art. In works that were created with functional intent, but later identified as fine art, this meaning is usually related to the original purpose—e.g., a statue of the Indian goddess *Parvati* intended to adorn a temple and communicate an aspect of the Hindu faith. Shatford, citing Ohlgren, supports this notion, noting that it is dangerous for a society to distinguish its art from its public record. “This distinction can be made, but should be followed by the realization that it is possible for the same item to be both art and record, both an aesthetic object and a source of information. Access to both the aesthetic object and the information it contains is desirable (Ibid).” The issue then becomes the development of an approach to visual art that enables an appreciation of the aesthetic and an understanding of the informational value to support users from diverse areas.

Most of the research in indexing art images has been done in visual resources collections and archives where, until fairly recently, the primary users were perceived to be scholars and subject experts. Roberts notes that this is increasingly changing and that members of other academic disciplines “who once came to the slide room to find a few illustrations to liven up their lectures, are now staying to study and analyze visual images (Roberts 1988, 87).” Allmendinger found increased interest in working with and studying original works

of art, citing use of the Ackland Art Museum's collection by nineteen different academic departments at The University of North Carolina at Chapel Hill in one academic year (Allmendinger 2004). This has important implications for subject indexing and access because many of these users lack art-specific vocabulary which is indicative of the broadened user base for art museum collections.

Subject indexing, if done within museum collections at all, often falls to collections managers and curatorial staff in the absence of trained catalogers or indexers. Because the interpretation of art works is highly subjective by nature, there is little consistency in application of indexing terms or even in concepts that are covered by indexing. In museum collections where resources are limited, preservation of the objects and mounting exhibitions often take precedence over documentation and classification.

Unlike Visual Resource Collections, which are usually housed in art libraries, museums have historically had less incentive or need to index extensively or to organize their collection records for the use of those outside the scholarly community. While hiring staff with specialized professional training would almost certainly increase the usage of controlled vocabularies, this may be economically unfeasible in the short term.

Current options for indexing include the use of *controlled vocabularies*, a set list of vocabulary terms such as the Library of Congress Subject Headings, *thesauri* such as The Art and Architecture Thesaurus and *classification schemas* of which ICONCLASS is an example. According to Graham, “[a] controlled vocabulary...will incorporate a form of semantic structure which will control synonyms, distinguish homographs, and link related terms using either a hierarchical or associative relationship (Graham 2001).” The *Art and Architecture Thesaurus* is known for its hierarchical arrangement that enables

indexers to index more generally or specifically as needed. It seems though that when considering their application for subject indexing all of the aforementioned solutions function as controlled vocabularies and serve as sources of index terms. Whether controlled vocabularies, local vocabulary lists, thesauri, or classification schemas are employed, the objective is the creation of additional and appropriate access points for the users of visual resources repositories to gain entry into collections. Writing in 1974, Fox cited one of the purposes for the development of a controlled subject thesaurus for art terminology as facilitating on demand retrieval of art information by casual users and professional scholars (Fox 1974, 92). Today the use of appropriate indexing terminology is just as essential for retrieval from web and database searches.

The theoretical basis for indexing works of art is generally credited to renowned art historian Erwin Panofsky. Panofsky, working in the field of western art, defined three levels of meaning in works of art: pre-iconography, iconography, and iconology. Pre-iconography, being the most basic, is a simple description of the objects and actions in the work and is dependent on everyday experience. Indexing at the iconographic level requires “educated knowledge” or specific knowledge of a particular era or culture. The third level, iconological, requires a sophisticated level of education and interpretation. Informed by Panofsky’s work and Cutter’s *Rules for a Printed Dictionary*, Shatford defines the three phases of cataloging images as description, identifying genre or form, and defining subject—“ofness” or “aboutness.”

One of the dominant topics in the literature is the difficulty associated with determining a satisfactory level of description. There is evidence to indicate that indexing to Panofsky’s second level and Shatford’s third phase would prove valuable in providing

greater retrieval. Based upon her experience in slide libraries Torre indicates that iconographic analysis is a necessity but then states that basic indexing is unnecessary because “anyone with a basic knowledge of art history should know that Uccello’s paintings illustrate one-point perspective, Botticelli’s *Birth of Venus*, reflects Neo-Platonic philosophy, and Leonardo da Vinci used sfumato (Torre 1995, 33).” This exclusive approach of tailoring indexing to a particular user group indicates a less than ideal inclination toward broader access by diverse user groups but appears to be a commonly held sentiment. Collins points out that access to secondary subject matter is usually provided in existing catalog records (Collins 1995, 39). Both Collins and Tibbo found that basic or pre-iconographic indexing, while in limited use, would be useful for dealing with the majority of lay-user queries and it appears that combining pre-iconographic with the existing iconographic indexing would provide the most satisfactory level of access to the most users, both the novices and the more expert users that Torre is accustomed to encountering (Collins 1995, 36; Tibbo 1994, 614).

Iconographic analysis is already being done for many objects in museum collections as a natural result of curatorial practice and exhibition preparation—it then remains for institutions to establish methods to capture this valuable information and to incorporate it into the classification and indexing processes.

Wees notes that “[a]ttention is now focused on sharing images across networks, and large numbers of people outside the fields of art and archaeology are seeking access to those images”(Wees 1996, 317). In addition to improving access to the works in a particular collection, searching across collections is made possible by the use of a common vocabulary and indexing. In museum collections, the difficulties associated with

indexing are exacerbated by the fact that in-house systems are often developed by curators rather than information scientists, are often highly specialized, and fail to consider the general user. Stam, writing in 1987, considered issues surrounding the application of authority files and thesauri in art information systems. She performed *in situ* consultations with project staff responsible for describing objects and visual resources (Stam 1987, 27). She found that the “[m]ost significant external determinants [in selection of terminology] are nationalism, national language(s), levels of funding, degrees of centralization, institutional affiliation, institutional history, national style, and a desire for self-determination (Ibid, 29).” Stam suggests that the “local” nature of systems has played a fundamental role in the development of art information systems and it would seem that this serves as a fundamental impediment to universal access and searching across collections. While Stam was writing in the pre-Internet era, Gilchrest, writing in 2001, found still significant use of locally devised controlled vocabularies as compared to the use of those developed externally (Gilchrest 2001, 3).

Gilchrest surveyed a selection of art museums in 2001 to ascertain whether controlled vocabularies were being used and to what extent. She found that a promising number of institutions were using some combination of a national or internationally developed controlled vocabulary along with a locally devised list of authority terms for data entry. “The most common controlled vocabularies in use for most museum collections include Getty’s Art and Architecture Thesaurus (AAT), the Union List of Artist Names (ULAN), and The Thesaurus of Geographic Names (TGN). Non-Getty resources included the Library of Congress’ Thesaurus of Graphic Materials (LCTGM), The Revised Nomenclature for Museum Cataloging, and ICONCLASS (Ibid).” Sixty percent of the

thirty museums in Gilchrest's survey used at least one controlled vocabulary and nearly ninety percent used a locally developed list of authority terms. Graham found similar results when surveying the use of controlled vocabularies and locally developed systems in libraries and archives in the UK, however, a much lower level of adoption of AAT was seen than in Gilchrest's study which focused solely on art museums in the United States (Graham 2001, 24). Gilchrest notes that vocabularies and corresponding browser tools are being bundled together with packaged collections management databases being marketed to art museums—AAT is the most commonly bundled and its ubiquity along with the Getty reputation for scholarship seems to explain its wider adoption. The widespread implementation of networked commercial collection management databases in museums has no doubt aided in cataloging and more universal use of controlled vocabularies. While the principles of querying collection management databases that are made available on the internet are much closer to their counterparts in OPACS, the widespread usage of MARC format and other standard cataloging processes, has not yet made an appearance in museum information management. However, even its lack of universal adoption as compared with the wide-spread usage of locally developed vocabularies would seem to indicate that there is a need for information professionals to develop a means of utilizing extant descriptive resources in order to provide increased access. While the universal use of existing controlled vocabularies would prove a boon to scholarly users, it is possible that a different approach would be more beneficial to users across varied disciplines. Fidel draws the contrast between the document-oriented approach and the user-oriented approach. In the first approach, indexing focuses on the document or object as the source of meaning for indexing while the latter approach

focuses on indexing the document in ways that support how users would search for the particular document (Fidel 1994, 572). Document oriented indexing is the more typical approach in visual resources collections and museums while it appears that user-centered indexing might be a better match with the broader user base that image collections are encountering today.

Content Based Approaches to Indexing Images

The second approach to image indexing and retrieval is that of querying by image content (QBIC), also termed Content Based Image Retrieval (CBIR). This approach seeks to “index” features of an image and then permits users to search for works with the desired features. Visual feature extraction for indexing is used by a number of systems including Virage, QBIC, VisualSeek, and VideoQ (Chang 1997, 64). Because image features can be machine indexed, this method is appealing as being both more cost-effective than human indexing and algorithms can be trusted to perform consistently across images, thus avoiding the inconsistency that is often cited as a failing of human indexing. Chang notes, however, that this approach has its limitations as well, citing research that seeks to “automate the assignment of semantic labels to visual content” and specifies classes of features as depicting particular types of images, for example, particular animals or types of figures (Chang 1997. 65).

The most common feature indexed in this method is color (Zachary 2001, 840). To imagine how a query might work in a system of this type, consider a query in which the desired result is a landscape with a blue sky and green grass. The query is either input through the use of tools that enable the user to “paint” a band of blue color for sky and green for the grass or the user selects from a set of sample images and the system returns

images that most closely resemble the desired image. A prototype QBIC system sponsored by IBM is available on the Hermitage Museum's website and offers searching by color and layout.

Rui et al., developed the "Multimedia Analysis and Retrieval System" (MARS) which incorporates visual feature extraction and the retrieval techniques for non-textual materials. They cite the limitations of textual indexing of non-textual media as a primary motivation for the development of the tool. The tool utilizes color, texture and object shape to retrieve images or video with matching features. The Mars project experimented with a group of ethnographic works from the Fowler Museum of Cultural History (Rui 1999, 459).

WebSEEk, "a semiautomatic image search and cataloging engine" is an Internet search engine designed to take advantage of content-based image retrieval methods as well as the metadata and textual identifiers that accompany images on the Web. A customized ontology has been developed to aid in the retrieval process. Chang, et al. found that the WebSEEk tool had an over 90% accuracy rate in assigning images to semantic classes utilizing the combined approach (Chang 1997, 67).

The pattern-matching capability of the content-based approach is well-suited to the development of customized feature sets such as those needed in medical and law enforcement domains. However, the literature is very much undecided as to the applicability of this method for the general user or the scholar with specific needs. This method would seem to be quite promising for image searching in a scientific environment or an environment where colors and textures are of greater importance than the more "meaningful" features that depict the subject of the image, however, with the varied

content and uses of the works in museum and visual resources collections, it does not appear to be the best method for these works.

Research Studies

A number of research studies have been done on retrieval success with images as well as on user's image searching habits.

Fry performed a simple subject indexing experiment with the help of colleagues at a Visual Resources Association (VRA) meeting and found that a group of professional indexers assigned a large number of different terms for the same image (Fry 1998, 51). She noted that the group, "...when faced with a familiar image, and no rules, [generated] an impressive array of words to capture both what this image is *of* and what it is *about*." Fry also found a high level of correlation between the terms provided by the visual resources curators and the AAT. In closing, she wondered whether searching for visual images should be patterned after "successful online institutions, like Corbis, Image Bank, ArtToday, and Amazon.com, rather than from those developed for bibliographic entities and large photographic archives (Fry 1998, 52)?"

Armitage and Enser's "Analysis of User Need in Image Archives" looked at image requests at seven picture libraries in the UK and found that there are similarities in query formulation across a range of image libraries. They also determined that, based on their study, it should be possible to develop a generalized query structure for image collections. They found that for the majority of queries across most of the collections surveyed, non-unique subjects were the most prevalent—this would seem to support indexing at the very least using both authority files and more general subject terms, what Shatford would term "of" or "about" terms (Armitage, et al 1997, 287).

In another study of user queries, Collins, studied image requests at The School of Design at North Carolina State, and the North Collection at the University of North Carolina at Chapel Hill. She found that requests came from numerous sources, including scholars of art and architecture, sociologists, historians, graphic designers, picture researchers, educators, and others. She also found that the requests from a varied user base would best be served by a two-tiered indexing approach. The first tier, the primary tier, would involve indexing works by describing what an image is “of.” This approach has been utilized by two repositories seeking to provide access to users at a primary level: The Repository of Stolen Art developed by the Royal Canadian Mounted police to aid in the identification of lost or stolen cultural property and The Historic New Orleans Collection (Markey 1988, 167). The second tier of access points indicated in Collins’ study are those provided by indexing images according to what they are “about” along with indexing the expressional or emotional qualities of the images.

Goodrum and Spink examined logged image queries on the Excite search engine and found that users frequently modified their initial queries (Goodrum and Spink 2001, 303). They found that, compared with queries of other online search interfaces, web-based queries employed relatively few search terms. In this study, the average number of terms per query was 3.74. Most terms in this study were unique with the most common term occurring in less than 9% of the queries. Their table of frequently occurring terms demonstrates that terms are fairly general and, in most cases, would be considered pre-iconographical.

Hastings examined queries of Caribbean art images in the Bryan West Indies Collection at the University of Central Florida to investigate how art historians search photographic

and digital art images. She determined that there are types and levels to the historians' queries. The four query category levels are listed below:

Level One: Queries for the identification of a specific fact

Level Two: Queries about artists represented in the collection and queries that requested accompanying textual information

Level Three: Queries that required the retrieval of two or more images and may have required magnification

Level Four: Queries that related to categories of images or classification of the images and included meaning and subject.

Hastings found that art historians' queries become more complex when they are searching digital images and that some queries are unanswerable with surrogate images alone.

The literature surrounding image indexing and retrieval can be divided into three categories: the search for an acceptable level of indexing for images, technological solutions to indexing, and studies of actual users and their searching habits. Articles concerned with determining an acceptable level of indexing generally references Panofsky's classification levels and Shatford Layne's subsequent work and the debate centers on whether it is necessary to index visual materials at a basic pre-iconographical level or at the more advanced iconographical level.

Technological solutions to indexing visual materials are primarily focused on automatic indexing of pictorial elements or "features" and color or pattern matching. These methods appear to hold promise for use in medical and law-enforcement communities, however, there is little in the literature to indicate their usefulness in indexing and retrieving original works of art. It is interesting to note that IBM's QBIC project has

been piloted at the Hermitage's online site but the technology has not been applied to date to the study of art in a meaningful way.

Real world user studies in the literature focus primarily on image-seekers in archives and on the world wide web with little investigation having been done into the habits or needs of general and scholarly users searching the online resources of art museums. These studies have been useful in helping to determine that users appear to be best served by indexing images at both the pre-iconographical and iconographical levels.

Methodology

This study focuses on indexing and the use of controlled vocabularies in the online collections of five different AAM accredited art museums and is divided into four phases. Prior to beginning the study, an application was submitted to The University of North Carolina at Chapel Hill Academic Affairs Institutional Review Board for approval to conduct research utilizing human subjects (Appendix A). Images of ten original works of art were selected from the collections of five museums. The works were selected based upon their availability in the online collection interfaces of their home institutions and the fact that they had been previously published with a detailed description in a museum collection or exhibition catalogue. Only two-dimensional works were selected because it was thought that they would be best represented by a single image. The works in the study were created between the 16th and 20th centuries, included both western and non-western works, and represented a variety of media (See Appendix B for images of art works).

In phase one, subject and descriptive terms, the by-products of the curatorial process present in museum collection and exhibition catalogue entries, were extracted and

compiled into a term list for each work. In most cases, these catalogues were published by the same institutions where the works are found. These terms were selected from the catalogue entries based upon frequency, uniqueness and descriptiveness. It is important to note that text provided in image captions was omitted from the list because it was felt that these terms would provide the most obvious access points and would most certainly skew in favor of their retrieval success since the undergraduates and gallery teachers approached the study with little or no prior knowledge of the works. This list was later used to test whether the vocabulary used by the scholars was incorporated into the object records available online and to compare the effectiveness of the terms used by the “expert indexers” with those provided by the students and gallery teachers.

In phase two, two groups of ten students and ten gallery teachers were selected for the study. A convenience sample of undergraduate students currently enrolled at The University of North Carolina at Chapel Hill, based upon their response to a call for participation, was drawn from introductory English and Art classes because it is expected that they have a similar degree of basic art knowledge and searching skill. Students were recruited through a message sent to existing faculty-maintained and departmental email listservs in order to maintain their privacy. A second group of participants, volunteer gallery teachers, were drawn from two local AAM accredited institutions. The gallery teachers were contacted through an email sent to volunteer coordinators at the Ackland Art Museum and the North Carolina Museum of Art and were selected for participation based upon the speed of their responses. Each participant was asked to commit approximately thirty minutes to the study and was offered her choice of a \$10 gift certificate from a local bookstore or coffee shop as compensation for their participation.

The author met with participants at their choice of a local library, coffee shop or one of the two museums. For the most part, the meetings were one on one, however, for convenience, one group of five docents at the Ackland chose to complete the survey together. Participants were provided with a consent form that included a brief description of the study and were asked to give their verbal consent to participation. They were then asked to complete a short questionnaire indicating their level of education and familiarity with art. No names or other personally identifiable information was collected at this or any time during the study. Each participant was then presented with a set of ten full-color images of original works of art from the online collections of five United States museums and instructed to provide index terms, either single terms or phrases, of their own choosing that they would expect to retrieve the work in an online or database search (Appendix C). Participants were given no instruction regarding the number of terms that they should provide or preferencing a recommended “type” of terms. They were reassured that there were no correct or incorrect terms and that the online interfaces and museums were being tested, not the participants. Once all participants had completed their packets, the terms that they provided were entered into a spreadsheet ordered by art work and participant.

In phase three, the author conducted searches against the online collection interface of the institution to which each work belonged to determine the success of each term supplied by the students and gallery teachers. The terms supplied by individual participants were stored and tracked separately so that total term counts and averages could be calculated within the groups, and queries were conducted upon all of the unique terms provided. For example, the term “bird” was used in a search query only once and the retrieval

performance noted, regardless of the number of participants providing that term for a given art work. Terms were defined as either individual terms or phrases. Several of the participants placed their index terms in quotation marks or added question marks, presumably to indicate their level of confidence with the term, these quotation and question marks were removed from terms when queries were conducted.

Success of each term was determined by whether the desired object was retrieved, regardless of the total number of records returned. In many cases, the author reviewed several thousand works retrieved in order to determine whether a term performed successfully. This was, thankfully, aided by effective image browsing provided by most of the interfaces. Undoubtedly the participants would have had better success at narrowing their searches if they had been querying the interfaces directly, rather than providing terms for later searching. Most of the interfaces provided for multi-term searching, however, to ascertain the success of each term in locating a given object, the author queried each term individually which led to large result sets. This was particularly true when period/era and media-related terms were queried.

Where possible, the terms were entered as “advanced” keyword searches which queried all fields simultaneously. This functionality was supported in four of the interfaces searched: The University of Michigan Museum of Art, The Fine Arts Museums of San Francisco (www.thinker.org) and the Albright-Knox Art Gallery. The remaining interface, The National Gallery of Art (Washington), required that a field be selected and queries were entered into the “Artist’s last name”, “keywords in title”, “style” and “media” fields. A subject search was also available on the National Gallery site with a

set of terms provided for selection, however, these subjects did not match those terms provided by study participants so this field was not queried.

The interfaces queried all provided for searching of the basic object information: maker, title, time period/era and medium, however, they differed in the formats provided.

The process was repeated with the terms extracted from the expert texts. A comparison was then made between the success rates of the students and gallery teachers relative to that of the terms derived from the expert texts.

A fourth phase of the study considered how closely the natural language terms provided by the students and gallery teachers and those selected from the scholarly texts map over to those of the AAT. This is significant because it will determine whether the participants are searching with essentially the same set of slightly modified terms and whether the degree of similarity is sufficient to preclude the need for the usage of multiple indexing methods vocabularies.

Evaluation

The undergraduate participants in the study were evenly divided down gender lines and according to their classification as members of an English or Art Class. There was no significant difference in the retrieval success based either on gender or course of study.

Two of the ten students had taken no formal art courses—either fine art or art history—a fact that may account for slightly more “of” terms being provided by those participants.

The gallery teachers were slightly less balanced on gender lines with 70% being women.

At the same time, all of the gallery teachers had at least a bachelor’s degree, 80% had obtained some type of graduate degree, and an additional 10% had done some graduate

study. Essentially this group, by virtue of their extensive educational backgrounds and training as gallery teachers, had achieved at least “demi-expert” status where the description of art is concerned (Appendix D).

Based upon queries conducted against the interfaces of the selected museum collections, the terms extracted from scholarly texts had a retrieval success rate of 16% with 24 out of 147 selected terms retrieving the desired work. The gallery teachers had the next best performance with 12% of their unique terms or 42 of 363 terms retrieving the work.

Interestingly, the undergraduates had the least success with only 5% of the unique terms provided, or 22 out of 475 terms, retrieving the work, while they provided by far the most unique terms. There does not appear to be a clear explanation for the significantly larger proportion of terms provided by the undergraduates. All participants were given the same instructions to provide as many or as few terms as they felt necessary. It is possible that they had less comfort with describing works of art and supplied more terms in the hopes of including the “correct” terms. All participants took approximately thirty minutes to complete the study. The results indicate that the terms provided by scholars were only slightly more successful than those of their non-expert counterparts. A two sample test of statistical significance was run in the STATA software application using the *prtesti* function and the results indicated that there was statistical significance in the difference when comparing the retrieval results for the undergraduates and gallery teachers as well as between the undergraduates and scholarly texts. The test indicated that there was no statistically significant difference between the retrieval success seen by the gallery teachers and that seen by the scholarly texts. Across all queries, a dismal 9% of the unique terms provided retrieved the desired work. Two of the works in this study

were returned by three or fewer queries provided by all groups. In these cases a test query was conducted to confirm that the work was indeed available in the database and that it could be retrieved. All works in the study were retrievable by artist name or exact title match.

An average number of terms provided per-participant as well as per-participant group was also calculated. The average number of terms per work provided by the undergraduates was 5.3, 4.3 for the gallery teachers and 4.9 for the scholarly texts, however the figure for the scholarly texts is based upon term extraction and not indicative of any choice or action on the part of the scholars. This is slightly higher than the average of 3.74 terms per query seen by Goodrum and Spink in their evaluation of online searching and nearly identical to the 4.87 seen by Choi and Rasmussen (Goodrum and Spink 201, 304; Choi and Rasmussen 2003, 505). Shatford divides subject index terms into “of” and “about” terms. Using her model, 34% of terms supplied by undergrads and 18% of those provided by the gallery teachers fall into the “of” category and describe at a very basic level what was depicted in the image. For example, Paulus Moreelse’s *Death of Lucretia* was indexed with the terms “woman, knife and bed” which required only that the viewer look at the work and describe what they saw rather than that they knew the story of Lucretia’s rape and subsequent suicide. Interestingly most of the participants recognized or intuited that the Moreelse image depicted a death or suicide and provided index terms to that effect yet the work had very poor retrieval success. Turner found similarly that the majority of non-expert users asked to index provided pre-iconographical index terms for works (Turner 1995, 9) As discussed above, this type of indexing directly corresponds to Shatford’s “of” category and Panofsky’s first level of

description: pre-iconography. The remaining terms provided in this study require some level of knowledge or understanding of art and the culture in which they were created and fall into Panofsky's iconographical or iconological categories. It is interesting to note that the "of" terms provided by the undergrads and gallery teachers had little retrieval success. The terms with the most retrieval success were those that demonstrated a more sophisticated understanding of the artist materials, genre, era or iconography represented. These were also the terms with the greatest likelihood of mapping over to the Art and Architecture Thesaurus.

The undergraduates and gallery teachers were slightly more likely to use multi-word phrases than single terms in their searches: 51% and 55% of the terms respectively were multi-word phrases. Because the author selected the terms from the expert texts, it is not useful to draw a comparison of the single terms versus multi-word phrases used for those searches. The multi-word phrases that comprised slightly more than half of all terms provided little or no retrieval success. These phrases which included as many as eight words, seem to correspond to the 3.74 terms per query that were seen by Goodrum and Spink in their study of online image queries against the Excite search engine (Goodrum and Spink 2001, 304).

One objective of this study was to assess the level of overlap between the terms extracted from the scholarly texts and those provided by the undergraduates and gallery teachers with those offered in the AAT. About one quarter of the terms provided by the undergrads and gallery teachers map directly over to those available in the Art and Architecture Thesaurus—these are primarily the media, genre, and period/era-related terms and were those that made up the bulk of the undergrads' retrieval success. Forty-

four percent of the terms extracted from the scholarly texts directly mapped to the AAT. This is very significant in that it indicates that the collections queried in this study are either not employing AAT terms in their records available online or that they are not doing so in a method that best serves their users. It was not possible to determine from the interfaces whether AAT terms were in use. The terms that did not map over would be best described as “of” terms—those that describe in the simplest terms what is depicted in the work and those that described a feeling or emotion. An oft-repeated complaint is that the AAT does not support non-western art well—this was found to be the case with the Japanese four-panel painting in this study as well.

The poor retrieval success seen across the three groups is quite surprising. This supports the conclusion that the museum collections queried are neither incorporating the vocabulary used by scholars to describe the works in their collections in their indexing efforts, nor are they indexing effectively with AAT terms.

Limitations

The greatest limitation of this study was the sample size, both in the number of works selected and the number of participants. It might also be more telling to study “real world searches” in which the participants have a stake in the search. This could be achieved by utilizing the search logs of selected interfaces or by working directly with users conducting searches in resource or reference rooms of museums. An additional limitation of the study is the variability in the underlying design and function of the museum collection management interfaces. Several of the interfaces queried offered term

lists that could have aided some of the participants in developing more successful queries if they had been querying the interfaces directly.

Conclusions

Overall, this study demonstrated that online museum collections in their current incarnation fail users. The retrieval rates seen for the participants were exceedingly poor, even the terms extracted from scholarly texts that were published in conjunction with museum exhibitions or as a catalogue to the collection of a particular institution retrieved the desired work less than 20% of the time.

It appears that to achieve the best retrieval success with existing search engines for online museum collections, users should provide single word queries featuring the artist name, medium or format. This assumes a great deal of prior knowledge on the part of the user and, particularly with medium and format related terms, will most likely produce large result sets. This method of searching also appears to run counter to the way that the participants instinctively described the works given that roughly half of them provided multi-word phrases as search terms. Alternatively, if one were to take a user-centered approach to the problem, in order to offer better searching and retrieval to existing art museum users, those developing and populating online museum collection interfaces should continue to index at the iconographical level and to provide access through era and media-related terms but they should also index at the very basic “of” or pre-iconographical level. Were this to model applied, the retrieval success for the gallery teachers would nearly double to 30% and that for the undergrads would increase by nearly eight times to 39%. At less than 50% in either case even this model requires

additional research and continued measures for improvement. This study does demonstrate that providing indexing at these levels could be achieved without significant expense as many institutions currently benefit from access to volunteer gallery teachers such as those participating in this study. An example of such a project was conducted in the mid-1990s the Legion of Honor Museum of the Fine Arts Museums of San Francisco conducted a cataloging project in conjunction with a rehousing, barcoding and photography project. Over the course of a couple of years at least four volunteers, both gallery teachers and others, were given instructions to write clearly and use their own basic terms to describe works. Ultimately, 37,712 works were given basic subject indexing and the project, part of the underlying indexing that powers the “www.thinker.org” search engine for the collections of the Fine Arts Museums of San Francisco has received resounding praise (Grinols, 2004). Indexing with the terms extracted from the scholarly texts could also be done without extraordinary expense given that many of the source texts used for this study were those published by or with the cooperation of the institutions holding the works or art. While, the most resource-intensive option, effectively adding AAT terms would further increase retrieval success since 44% of the terms extracted from the scholarly texts directly mapped to the AAT terms.

The two works in this study with the best retrieval results were the abstract and the non-western work. The reason for this is not clear, however one hypothesis is that the indexing that is done for these types of works is more the “of” sort either because the iconography of the works is less familiar to the indexers or less established. The works that had the least retrieval success were those that required iconographic knowledge—

usually background in a particular myth or story or additional knowledge of the movement to which the artist or the work belonged. It appears that, of all of the museum collections queried, The Metropolitan Museum of Art, incorporated the most terms from the scholarly text into the record for Kano Sansetsu's *The Old Plum*, a set of sliding panel doors from the 17th century.

Studying user queries in photographic archives, Collins recommended indexing the expressional or emotional qualities of the images, this might prove useful for the queries in this study as well given that 5.3% of terms provided by the undergraduates and 1.4% of those provided by the gallery teachers described the "feeling or emotional" qualities of the works (Appendix D). While a small number of terms provided by both groups included simple descriptions of the colors present in the works, there is little evidence to suggest that the incorporation of QBIC technology into the interfaces would significantly improve access for these user groups.

In several cases, it was apparent that stemming and synonyms, both fairly common in current search engine technology, were not utilized as part of the search engine's operations. For example, the singular term "peacock" was provided by five participants for a painting whose title is "Peacocks" and the work was not returned. In several other queries for the same painting, the correct form of the term "peacocks" was provided as part of a phrase but the interface utilized only exact text matching and these queries also failed to return the correct work. It was clear that most of the interfaces were engineered for exact string matching which hindered those users providing only part of a title or included the correct title as part of combination of terms.

While it is true that Art museums have come late to the realization that the principles of information science could be utilized with their collections, the Getty Art History Information Project (AHIP) group that met in the mid 1990s identified many of the central issues in information standardization for museum collections that are still relevant today. As Gilchrest noted in 2001, the situation has improved somewhat in the last decade and controlled vocabularies, either developed in-house, or by external sources are being adopted. This study demonstrates that there is still an extensive amount of work to be done if museums are truly seeking to provide access to their collections in the online environment.

Future Research

While examining the terminology that general undergraduate users and the more advanced gallery teachers use when describing original works of art, this study did not provide a clear view of their searching habits when approaching online museum databases. It would be interesting to work with real world users and their queries of these databases in order to better understand the length and number of real queries provided for such works as well as how users modify those queries and browse result sets.

Notes

1 Most of the world's major cultural institutions have exerted extensive online presences: The Louvre <<http://www.louvre.fr/>>; The National Gallery of Art, Washington <<http://www.nga.gov/>>; Smithsonian American Art Museum <<http://www.nmaa.si.edu/>>; The Tate Gallery <<http://www.tate.org.uk/home/default.htm>>; The British Museum <<http://www.thebritishmuseum.ac.uk/>>; The Metropolitan Museum of Art <<http://www.metmuseum.org/>> (10 December 2003)

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Appendices

- A. Institutional Review Board Application
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Appendix A
Institutional Review Board Application

Tammy Wells-Angerer
Academic Affairs Institutional Review Board Application
October 14, 2004
Abstract

This study seeks to answer the question: Are the experts in art museums accredited by the American Association of Museums (AAM) associating subject index terms with the works in their art museum collections available online that provide better retrieval success than natural language queries supplied by college undergraduates and volunteer gallery teachers performing known-item searches? The study will compare the retrieval success of two subject indexing methods for original works of art: the use of terms that are the natural byproducts of the curatorial and collections management processes and those provided by the volunteer teachers and students.

Tammy Wells-Angerer
Academic Affairs Institutional Review Board Application
October 14, 2004

1. Project Description:

(a) Purpose, hypothesis, or research questions

This study seeks to answer the question: Are the experts in art museums associating index terms with the works in their collections that provide better retrieval success than natural language terms supplied by college undergraduates and volunteer gallery teachers performing known-item searches? Given the increasing use of works of art as source material for teaching across disciplines, it would seem logical to make those works available through a familiar access method. Keyword and natural language searching used by online search engines such as Google, Teoma and Altavista have become familiar to most undergraduate students and general internet users and would appear to offer the advantage of simplicity. Participants will either select index terms from a list provided or will supply their own. The effectiveness of the terms assigned will then be compared to determine which method is more successful.

(b) Procedures

This study will work with the art objects selected from the online collections of five different AAM accredited art museums. Naturally occurring subject terms, by-products of the curatorial process present in labels, online descriptions and catalogue entries, will be extracted from the records and compiled into a term list. This list will later be used to assess the effectiveness of the “expert indexers.” A convenience sample of undergraduate students, based upon their response for participation will be drawn from introductory English and Art classes because it is expected that they will have a similar degree of basic art knowledge and searching skill. A second group of participants, volunteer gallery teachers, will be drawn from local AAM accredited institutions. Participants will be asked to complete a short questionnaire indicating their level of familiarity with art (Appendix A). Two groups of at least ten students and ten gallery teachers will be selected for the study. The participants will be presented with ten images of original works of art and instructed to provide index terms of their own choosing (Appendix C). The author will then conduct a search against the online collection interface of the institution to which the work belongs to determine the success of each term. The process will be repeated with the gallery teachers. Success will be determined by whether the desired object is returned within the first set of results returned. A comparison will then be made between the success rates of the students and gallery teachers relative to that of the terms derived from the expert texts. Each participant will be expected to commit approximately thirty minutes to the study and will receive a \$10 gift certificate from a local bookstore or coffee shop as compensation for their participation.

2. Participants

(a) All participants will be over the age of 18, of either sex and will number approximately 20.

(b) Half of the participants will be selected from undergraduate English and Art Department classes at The University of North Carolina at Chapel Hill. The other half will be selected from volunteer gallery teachers at the Ackland Art Museum, Duke University Museum of Art, North Carolina Museum of Art and the Weatherspoon Art Museum, all AAM accredited art museums in central North Carolina.

(c) An email will be sent to the course listservs to which the participants are subscribed and participants will be accepted for the study in the order that they respond to the email.

(d) Participants will be compensated with a \$10 gift certificate to their choice of a local bookstore or coffee shop.

3. Are participants at risk?

No, this project poses no risk to the participants.

4. Describe steps to minimize risk (if 3 is answered “Yes”)

5. Are illegal activities involved? If so, describe.

No illegal activities are involved in this project.

6. Is deception involved? If so, describe.

No deception is involved in this project.

7. What are the anticipated benefits to participants and/or society? (Optional unless 3 is answered “Yes”)

8. How will prior consent be obtained?

Consent will be obtained from participants verbally and implicitly (See the attached consent form, Appendix B).

9. Describe security procedures for privacy and confidentiality.

In the study, participants will be asked to provide no identifying information apart from that provided on the initial questionnaire. Any information collected for the purposes of scheduling will be kept confidential and not incorporated into the final documentation.



THE UNIVERSITY OF NORTH CAROLINA

AT

CHAPEL HILL

School of Information and Library Science
Phone# (919) 962-8068
Fax# (919) 962-8071
Student Research Project

The University of North Carolina at Chapel Hill
CB# 3360, 212 Manning Hall
Chapel Hill, N.C. 27599-3360

Invitation to Participate in a Research Study

I am a Master's Student in the School of Information and Library Science at the University of North Carolina at Chapel Hill and would like to solicit your voluntary participation in the following research study: **"A Study of Retrieval Success with Original Works of Art Comparing the Subject Index Terms provided by Experts in Art Museums with Those Provided By Novice and Intermediate Indexers."** Participation is expected to take approximately thirty minutes, and participants will be compensated with their choice of a \$10 gift certificate to The Bull's Head Bookshop or a local coffee shop of their choosing.

Please read the attached consent form and contact Tammy Wells-Angerer at wellsang@email.unc.edu or 919-843-3685 if you have any questions or would like to volunteer.

Thank you for your time.

Sincerely,

Tammy Wells-Angerer



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AT
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A Study of Retrieval Success with Original Works of Art Comparing the Subject Index Terms provided by Experts in Art Museums with Those Provided By Novice and Intermediate Indexers

Consent Form

This is an invitation to participate in a research study that is being conducted as part of the research for a Master's paper in the School of Information and Library Science at The University of North Carolina at Chapel Hill. Participation in this study is voluntary and you are free to withdraw your participation at any time.

Please read the following study description and, if you agree to participate, please indicate your consent to take part in the study by stating "I Agree."

Tammy Wells-Angerer, M.S.I.S. Candidate, is the Principal Investigator on this project and can be reached at 919-843-2685, wellsang@email.unc.edu and Helen R. Tibbo, Ph.D., School of Information and Library Science at The University of North Carolina at Chapel Hill is the Faculty Advisor, 919-962-8063, tibbo@ils.unc.edu.

This study seeks to answer the question: Are the experts in art museums accredited by the American Association of Museums (AAM) using vocabulary terms to describe the works in their collections that provide better retrieval success than terms supplied by college undergraduates and volunteer gallery teachers for the same works?

Approximately ten undergraduate students and ten volunteer gallery teachers will be provided with images of original works of art and will be asked to come up with their own search terms for the works. Participants will be selected based upon their email or telephone response to the invitation to participate.

This study should take approximately thirty minutes to complete. At the end of the study each participant will be offered a \$10 gift card from their choice of The Bull's Head Bookshop or Starbucks.

The names and contact information of all participants will remain confidential and will not be incorporated into any written documentation.

If you have any further questions about this study, please contact Tammy Wells-Angerer, Principal Investigator, at 843-2685, wellsang@email.unc.edu, or Helen Tibbo, Ph.D., Faculty Advisor, 962-8063, tibbo@ils.unc.edu.

The Behavioral Institutional Review Board (Behavioral IRB) of the University of North Carolina at Chapel Hill has approved this study. If you have any questions about your rights as a research participant in this study, please contact the Behavioral IRB at 919-962-7761 or at aa-irb@unc.edu.

Questionnaire

Please circle or list your responses to each of the following questions.

Gender: Male female

Please indicate your current level of education:

High School Some College Baccalaureate Degree
Some Graduate School Graduate Degree

Please select the group that best describes you:

Member of an English class Member of an Art class Volunteer Gallery Teacher

How many courses have you had in art?

None _____
Secondary School (number): _____
Undergraduate (number): _____
Graduate (number): _____

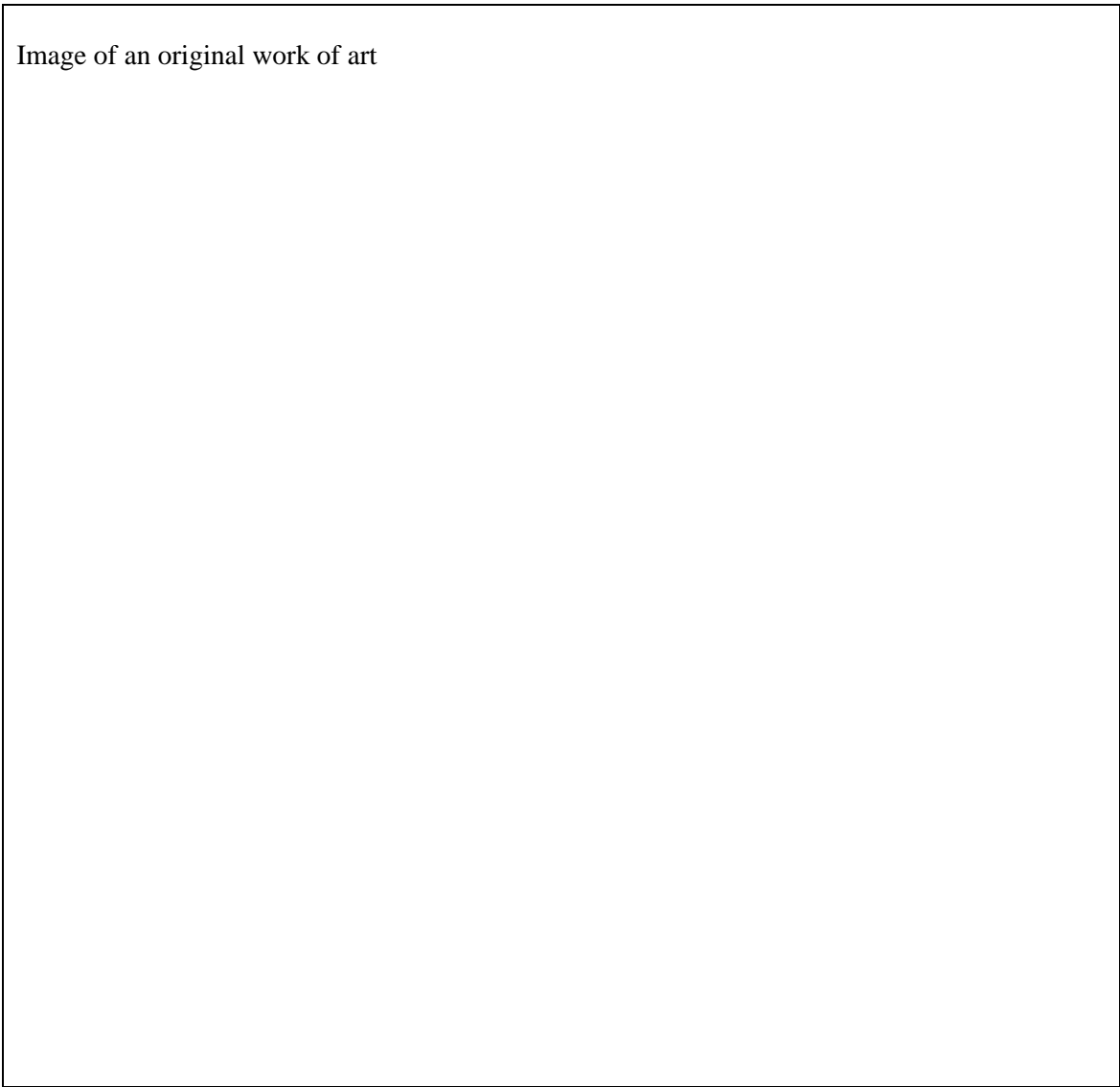
Image Identification Worksheet

A Study of Retrieval Success with Original Works of Art Comparing the Subject Index Terms provided by Experts in Art Museums With Those Provided By Novice and Intermediate Indexers

Image Identification

Please consider the artwork shown below and provide up to five terms that you would expect to retrieve that work.

Image of an original work of art



Search terms:

Appendix B
Illustrations





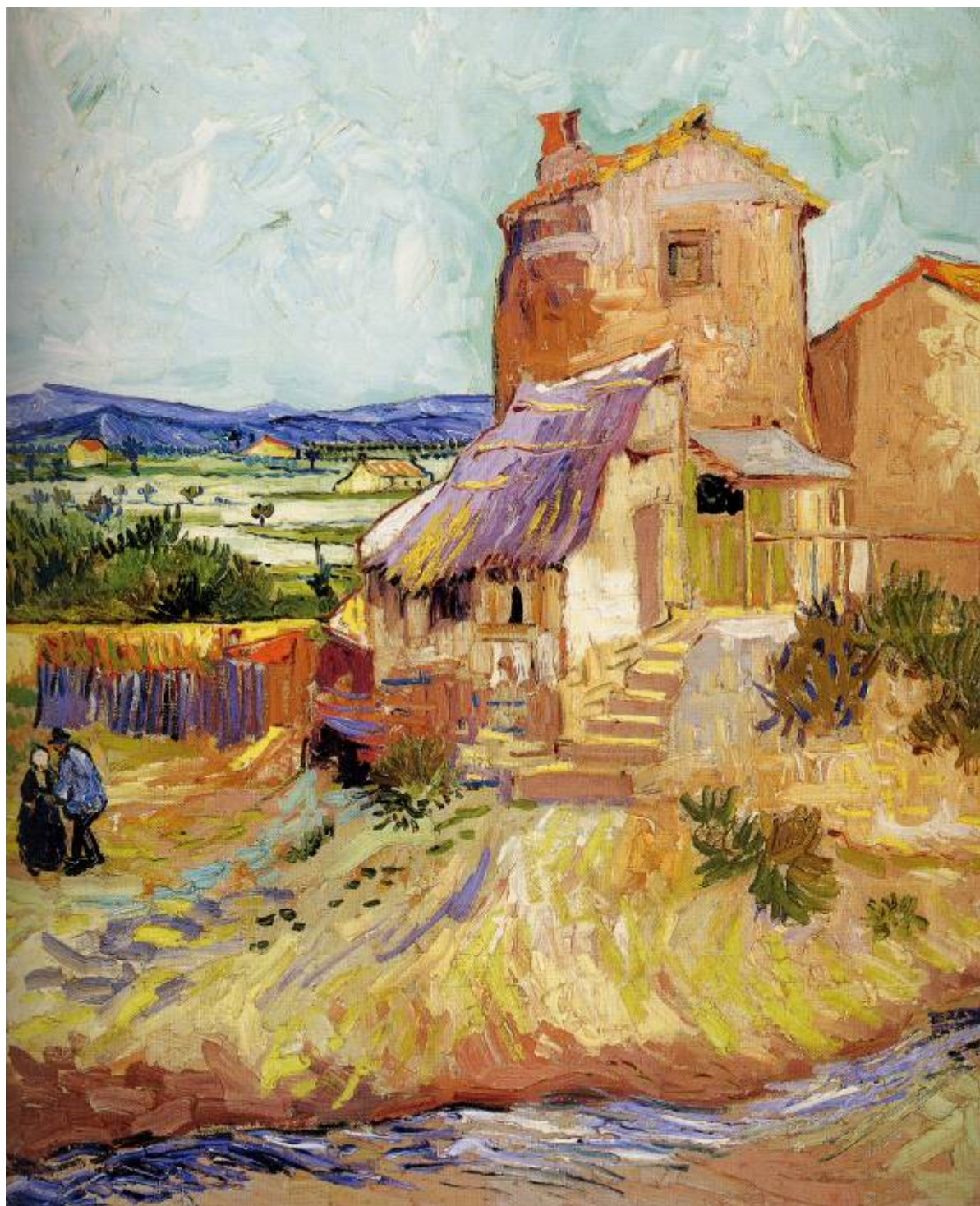
















Appendix C
List of Museum Collections Queried

Albright-Knox Art Gallery, Buffalo, NY
<http://www.albrightknox.org>

Fine Arts Museums of San Francisco, CA
<http://www.thinker.org>

The Metropolitan Museum of Art, New York, NY
<http://www.metmuseum.org>

National Gallery of Art, Washington, DC
<http://www.nga.gov>

University of Michigan Museum of Art, Ann Arbor, MI
<http://www.umma.umich.edu>

Appendix D
Tables

Table 1. Types of Terms*

	Period/Era	Nationality/Place	Medium/Format	Artist	Style	Feeling/Emotion	Single term	Phrase
Undergraduates	4.60%	7.80%	7.20%	1.30%	6.50%	5.30%	48.60%	51.40%
Gallery Teachers	11.60%	8%	14.60%	3.30%	13.80%	1.40%	45.20%	54.80%

*Note that some terms are counted in more than one category type.

Table 2. Demographics

Undergraduates										
ID#	UG01	UG02	UG03	UG04	UG05	UG06	UG07	UG08	UG09	UG10
GENDER	f	m	f	f	f	m	m	f	m	m
EDUCATION	some college	some college	some college	some college	some college	some college	some college	some college	some college	some college
GROUP	english	english/art	english	art	english	art	english	english	art	english
NOART*	1									1
SECONDARY*		1	1	1	3-4 per year	1	4	2		
UNDERGRAD*		1	1	15	1	3			1	
GRADUATE*										
Gallery Teachers										
ID#	GT01	GT02	GT03	GT04	GT05	GT06	GT07	GT08	GT09	GT10
GENDER	f	F	m	m	f	f	m	f	f	f
EDUCATION	some grad	graduate degree	bac degree	graduate degree	graduate degree	graduate degree	graduate degree	graduate degree	graduate degree	
GROUP	gallery teacher	gallery teacher	gallery teacher	gallery teacher	gallery teacher	gallery teacher	gallery teacher	gallery teacher	gallery teacher	gallery teacher
NOART*			X (many painting classes, no formal courses)	X			X (extensive reading and gallery museum visits)			
SECONDARY*	1									
UNDERGRAD*	4				many	1		BA Art History + 4 classes	2 (16 years as a docent)	40?
GRADUATE*	1	1						MA Cultural Studies		18

* Number of art courses

Table 3. Successful Terms*

	Image1	Image2	Image3	Image4	Image5	Image6	Image7	Image8	Image9	Image10
Undergraduates										
	painting		oil painting	drawing	abstract	Baroque		Van Gogh		four
	20th century art				modern art	painting		Dutch		Chinese
					abstract painting					tree and rocks
					French					panel
					paint					gold
					color					tree
Gallery Teachers										
	twentieth century		genre painting	engraving	abstract	Seventeenth century		Van Gogh		Chinese
	European		painting	Italian	color	16-17 th century		19th century		tree
	girl		comedia del arte		music	Rembrandt		impressionist painting		blossoms
	Modigliani		Eighteenth century		abstraction	Baroque		Vincent Van Gogh		painting
	oil painting		oil painting		oil painting	oil painting		late 19th century		Asian Art
	painting		Watteau		painting	Rembrandt portraits				Asian
			French artists in 18th century							
	contemporary modern					17 th century				gold

* each cell represents a unique term

Table 3. Successful Terms (ctd.)*

Scholars										
	girl		Italian	Venus	abstract	Lucretia	Lucretia	Old Mill	chateau	four
				Mars	tower		death	Arles		sliding
				putti	disc					fusuma
					sun					Tensho-in
										painting

* each cell represents a unique term

Table 4. Average Unique Terms Provided

Undergraduate Students											
	Image1	Image2	Image3	Image4	Image5	Image6	Image7	Image8	Image9	Image10	
By image	5.2	5.5	4.7	5.7	4.4	4.3	5.9	7.4	5.9	5.2	
										average terms:	5.32
Gallery Teachers											
	Image1	Image2	Image3	Image4	Image5	Image6	Image7	Image8	Image9	Image10	
By image	4.1	4.7	4.6	4.2	4.5	4.0	4.0	4.0	4.0	4.8	
										average terms:	4.29