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Introduction

The original impetus for this article was a review of the literature addressing the topic of intellectual access to visual materials. However, while conducting the investigation it became clear that none of the authors had presented a general overview of the difficulties surrounding the topic itself. Several areas covered in detail in several separate articles are examined here, since it was felt that a higher and more holistic view of the current situation surrounding image access was needed. The painting *La trahison des images (The Treachery of Images)* by René Magritte stands as an appropriate metaphor for the state of affairs concerning intellectual access to images. While the realistic representation of the pipe is definitely a believable image, it is certainly not a pipe. Similarly, much of the research into content representation of images appears not to recognize a number of basic issues underlying the difficulty in achieving satisfactory results in this area.

One of the critical reasons for the lack of tools and techniques for access to visual materials is the low status these materials have historically held in libraries and archives.[1] Most collections of cultural materials and their visual surrogates remain, at least in part, unindexed in the basic sense. At the same time pressures to "make it all available" continue to rise at a nearly exponential rate.[2] While it sounds alarmist to state this, a comparable analogy to the print world would be to expect a book collection, indexed as it would have been in a pre-card-catalog era, to be fully accessible online within a few months.

Beyond the lack of institutional support typically seen in collections of printed matter, visual materials have not received the level of intellectual research needed to develop the theoretical bases behind their access. Several recent articles on image indexing offer a review of the relatively limited research completed on this topic to date.[3] Happily, the interest in research concerning visual materials has increased within the past few years as a result of the advances in imaging technology and the omnipresent Internet. Nearly overnight, everyone is trying to provide access to the information and images representing these objects. Several basic issues stand out as being critical obstacles to providing access to visual materials:

- A lack of agreement concerning types of information needed
- A lack of a universally applied schema
- A lack of use of standard vocabularies and classification systems
- A lack of subject indexing
- A lack of user studies

In order to provide a general overview of the topic of images and content representation, this article will investigate each of these problematic topics individually.

Types of Information

Although several studies have been conducted into the types of information or data elements needed to adequately address the discrete information concepts contained in visual materials, no consensus has been reached as to a single set of attributes.[4] Part of this difficulty is the result of the diverse nature of information needs for cultural objects and their visual surrogates. Information recorded by each institution, for each collection, for each object type, and for each object can be highly specific to that one instance. This situation of highly particular data requirements to represent the objects is amplified when the needs of potential users of this information are considered. As the studies discussed below have shown, the types of information needed by users are highly variable.

Making this a somewhat more onerous task is the fact that all of the information recorded about a particular object must be passed through a sort of sieve which displays only a specific set of information suited to the particular needs of one user group. For example, museum registrars have very different information needs (condition reports, storage location, etc.) as compared to those of scholars (exhibition history, provenance, etc.) and the general public (artist, title, items represented, etc.)

Corrine Jörgensen's research has centered on the types of information associated with user tasks such as describing, sorting, and retrieving images. The users in these studies had no subject expertise noted, nor were they skilled indexers; this has turned the results of the research toward untrained users. For example, Jörgensen's study from 1996 showed a high number of low-level indexing terms (color, shape, etc.) associated with tasks performed by subjects.[5] However, Marie R. Kennedy's study of professional image indexers found that less than 5 percent of the terms were of this nature.[6] The high number of formal element terms found by Jörgensen in her studies was similar to this author's own experience when playing the ESP Game.[7] Since the object of this game is to match the terms given to an image by an unknown and unseen partner, the words chosen tend to be obvious and simplistic. The application of such low-level terms has a limited usefulness in retrieving images in most

settings. Terms associated with cultural objects, while certainly describable in low-level vocabulary, typically provide a richer intellectual access to the materials. While one group in particular (artists and designers) might use low-level terms to fulfill some of their image needs, searches of this nature would probably be best undertaken via a content-based approach to image retrieval. Research into automated indexing of an image's formal elements has shown promise, and as concept-based image indexing is labor intensive, it seems prudent to automate indexing for those tasks it can undertake well.[8]

One last issue that needs to be mentioned here is the possible multiplicity of meaning behind each agreed-upon "attribute" of information. For example, location to Jörgensen is equated with the relationship between formal elements in a work;[9] location to a registrar would have a strong storage connotation; location to an art historian would typically be suggestive of information concerning the work's current or original location (i.e., museum or collection which houses the object). This multiplicity of meaning has only recently been recognized and addressed, most appropriately in discussions relating to schemas. This topic is therefore considered next.

Schemas

Research on the development, use, and structure of schemas for visual materials has been undertaken by several authors.[10] Some key items for discussion were identified, and these include the variety of data elements needing to be accommodated within the schema to meet the various user needs;[11] the lack of clarification about general versus specific data elements, such as the example found in the discussion of location above;[12] and the influence of schemas on the information recorded by indexers and catalogers of images.[13]

The number of schemas that have been developed to contain information about cultural materials and their visual surrogates in the past few years is remarkable. As an example of the interest in this area, one only need visit the Getty's *Metadata Standards Crosswalks* Web site to view the diversity of schemas employed by institutions to manage information associated with cultural materials.[14] The proliferation of schemas for cultural materials is the result of the differing needs of each particular group. For example, the VRA Core was developed (and continues to be updated) to deal with access to, and management of, collections of visual surrogates of cultural objects. EAD (Encoded Archival Description) was created to handle archival materials, the CDWA (Categories for the Description of Works of Art) was developed by the Getty for the use of institutions holding cultural materials, while the Dublin Core was developed to be a highly adaptable schema easy for all to adopt.[15]

Obviously work in this direction is to be commended, since it is clearly the correct path to follow to ensure broader access to these materials. However, since many of the schemas are in a constant state of flux and new ones continue to be developed, it is easy to understand why institutions are disinclined to adopt yet another framework to hold data elements about their materials.

The increase in the number of metadata schemas, as Greenberg adroitly acknowledges in her 2001 analysis of metadata schemas for images, does not necessarily mean that any are adequately addressing the needs of the institutions attempting to index cultural materials. While Greenberg found four basic underlying classes of metadata needed to support "...the discovery, use, authentication, and administration of information objects," none of the schemas she investigated met all of these needs well.[16] This situation is partly due to the fact that schemas concerned with cultural materials are expected to contain widely disparate types of information. From technical details concerning the format of the visual surrogate, donor information, dimensions, title, and everything in between, schemas are expected to carry the entire load of information concerning these objects. When it is remembered that no agreement has been reached over what constitutes the "right" set of data elements at the object level, it is not difficult to understand why no overarching schema has been decided upon.

Standardized Vocabularies and Classification Systems

Thesauri, classification systems, and other controlled vocabularies all play an integral part in the process of providing access to information-rich resources. The control of the data values employed in the cataloging records representing these items results in more efficient retrievals.[17] While this aspect of cataloging is fundamental regardless of the format of the materials, a number of vocabularies and classification systems have been developed specifically to address the information requirements of cultural objects.

The most often utilized resources for indexing terms among institutions working with cultural objects and their visual surrogates are the *Art and Architecture Thesaurus (AAT)*, the *Thesaurus of Geographic Names*, the *Union List of Artist Names*, the *Thesaurus of Graphic Materials I and II,* and *Iconclass*. While there are specific uses for each resource, all of these items serve the broadly defined needs of catalogers working with cultural objects. The *AAT* is a hierarchical thesaurus of terms useful for indexing objects, people, artistic styles and techniques, and activities. It is an extremely broad and deep thesaurus, although its coverage of Asian materials is limited in scope, and it does not attempt to address iconography in a systematic fashion.[18] It also does not contain proper names. For these terms the *Thesaurus of Geographic Names* is used for location names, while the *Union List of Artist Names* accommodates personal names. The Library of Congress developed *Thesaurus of Graphic Materials I and II* which, while in some ways offering the same conceptual terms as *AAT,* provides a richer treatment of terms concerning two-dimensional materials and historical terms relating to printed materials in general. *Iconclass* is another useful tool employed by catalogers attempting to classify their objects' iconography. As none of the thesauri discussed are particularly strong in their support of iconographic terms and hierarchies, *Iconclass* fits this need most frequently. Like the *AAT* and the *TGM, Iconclass* has a strong focus on representing concepts about the Western world.[19]

For cataloging situations requiring a higher degree of specificity, detailed vocabularies within the specific domain under consideration need to be consulted. The bibliography provided by the J. Paul Getty Trust and the College Art Association for their *Categories for the Description of Works of Art* is a useful starting point for research into these more narrowly focused vocabularies.[20]

Although these standard vocabularies and classification systems are available for providing intellectual access to visual

information, very few institutions were found to employ them with any regularity.[21] The reasons behind this low rate of adoption are not well understood, but it is surmised that several factors are responsible. These include the limited number of staff hours devoted to the tasks involved in providing terms for object discovery, a lack of staff training in the use of these tools, the complexity of the tools, and the need for multiple vocabularies and classification systems dependent on the specific needs of the materials.

Subject Indexing

Subject indexing is the one area that nearly all researchers acknowledge as being the most difficult aspect of providing intellectual access to images. This difficulty is mainly due to the fact that, like Magritte's pipe, cultural objects and their visual surrogates have a multiplicity of subject concepts associated with them. The painting is not a pipe, as Magritte informs us with his added text *ceci n'est pas une pipe*, yet "pipe" certainly is one of the terms that an indexer would choose for the subject of this work. Visual materials are typically cataloged at both the "of" level and "about" level, and for this reason Magritte's painting could be expected to have several equally valid subjects. The painting is "of" a pipe, yet the concept Magritte expressed clearly through this work is "about" the deceiving nature of images.

Sara Shatford Layne has been the most prolific author to discuss subject access for images and other visual works; her ideas are based closely upon the work of the early twentieth-century art historian Erwin Panofsky.[22] Panofsky's thoughts about iconography published as *Studies in Iconology* suggest a tripartite division of meaning within visual works.[23] The most basic level of subject indexing is generic description; the next step is specific naming which relies on a higher level of knowledge; and finally there is an interpretive level of subject indexing which expresses concepts requiring a level of knowledge beyond merely naming specific items.

A clear example of this tripartite division of meaning can be easily discerned by contemplating a seventeenth-century Dutch still life. These paintings typically have food, tableware, shells, books, or a host of other beautifully arranged items rendered in careful detail. These terms, all generically descriptive, are the first level of meaning behind the subject's discovery. Upon further investigation, the items become specific types. Thus, food becomes oranges, plums, grapes, and trout, and the tableware is identified as a ciborium. This is the second level of subject clarification, termed identification. Finally, given background knowledge of seventeenth-century Dutch cultural beliefs, the *vanitas* theme in the work would be easily recognized. Expressing the foolishness of vanity and fleeting nature of beauty and life, the *vanitas* theme is typically seen in the depiction of less-than-fresh food, feasting insects, and in the inclusion of a human skull and/or bones. This level of meaning, which requires an intimate level of knowledge about the history and culture, is what Panofsky would term interpretive.

In addition to acknowledging and attending to this level of complexity in indexing the subject matter of a work, the needs of the particular user group must be considered. Queries in an image collection can vary from the extremely broad "I want a religious picture," to the narrowly defined request for "a depiction of an Indian immigrant family in the East End of London."

Subject indexing, to be truly effective, needs to embrace the needs of all possible users of the image. Perhaps the larger question to be asked is, can one ever predict what every potential user will request?

Unfortunately, subject access for images, which is perhaps the most interesting and potentially useful part of their content representation, tends not to be undertaken in visual resources collections due to the lack of time available for the task.[24] Generally, the more "stable" types of information are difficult enough to accomplish with any level of intellectual depth (creator, title, date, medium, location, etc.), and so intellectual access to images through subject indexing is considered a luxury in most collections.

User Studies

A limited number of user studies of visual materials have been conducted to date that appear to offer conflicting results.[25] Their contradictory outcomes are discussed by Hsin-Liang Chen. The situation may be the result of the various user groups under investigation in these studies.[26] For example, Armitage and Enser's study included seven very different image libraries, and so it covered widely different image user groups (academics, generalists, news personnel, civic planners, etc.), while Chen's study focused on undergraduate students' use of images to support their art history research. The results in Armitage and Enser's study would support this hypothesis. The queries by library could vary quite dramatically due to the library's specific focus. For example, the Witt Library, which serves primarily art historians, saw nearly 11 percent of its user queries based on creator name, while only three other libraries had any of these types of requests, and all of these were less than 3 percent.[27]

In general, individuals searching for images will utilize "object" terms more frequently than any other, and these searches can be formulated as a general request or a specific example. Choi and Rasmussen's 2003 study of researchers performing searches of American history-related materials found over 60 percent of the items searched to be general object requests, while slightly over 25 percent of the requests were for specific items. Armitage and Enser, in their 1997 study, found that specific geographic location formed a large percentage of image requests as well. This finding was supported by Chen's study, as his subjects utilized location terms much more frequently than had been anticipated. Chen surmised that his study's results were influenced by the topic being investigated by the subjects, since they were art history students studying medieval architecture.[28] Further results by Chen suggested that low-level terms were used infrequently, and this situation was repeated in the 2004 study by Hollink et al. This team of researchers found that only 12 percent of the terms were related to color, shape, composition, and texture.[29] Samantha Hastings's study is interesting for its unusual focus on the visual aspects of the search system. Although she looked at the terms used to perform queries, she found that some retrieval tasks were more efficiently accomplished by the visual materials presented through the images themselves.[30]

Tammy Wells-Angerer's recent study of user image queries of online museum collections offers rather grim statistics on successful retrieval rates. She found that even the users with the highest level of knowledge about the objects in the collections (scholars and museum staff) had retrieval success rates of only

approximately 15 percent.[31] She posits that the poor retrieval results may be due in part to the lack of *AAT* terms within the object records of these museums. Karen Markey's study of interindexer consistency levels among indexers working with visual materials also found a low percentage of agreement of terms.[32] The findings of Wells-Angerer and Markey, separated in time by over twenty years and nearly a galaxy away from each other in terms of image cataloging tools and technology, would suggest that indexing of visual materials has not advanced over the course of the intervening years. Happily, there are indications that when trained image indexers are asked to perform this work, the results are far more encouraging.

Eileen Fry's experiment with image indexers at a conference meeting in 1998 showed that these individuals were quite adept at describing visual concepts, and in fact there was a high percentage of *AAT* terms applied (without the use of the resource).[33] One of the basic issues behind image indexing research is that many studies have been undertaken with subjects who are ill equipped to perform the work. This very basic fact has gone unrecognized, and many authors continue to use Markey's study as proof that image indexing will produce low returns for the effort. This is remarkable considering Markey noted that "[t]he use of inexperienced indexers and non-subject specialists in this study may have diminished interindexer consistency scores."[34] The idea that images would require no skill to index is surprising, since their language is every bit as rich and complex as written or verbal communication.

Conclusion

As many collections of visual materials remain far behind their printed counterparts in terms of automated access, it is a major undertaking to bring these materials into the online environment. The increasing interest in cultural objects and visual studies witnessed recently, coupled with the technology to provide access to these materials over the Internet, has furnished the impetus for many institutions to provide deeper descriptive information for these types of items. It is hoped that the discussion above has presented a more complete overview of the current state of affairs surrounding content representation of images. One crucial step in the process of providing access to these materials is discovering the obstacles encountered in the processes of image cataloging. While there are a number of challenging aspects to be found when working with visual materials, these objects hold a wealth of information that justifies the additional effort needed to make them accessible.

Notes

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4. For discussions of image attributes see John Attig, Ann Copeland, and Michael Pelikan, "Context and Meaning: The Challenges of Metadata for a Digital Image Library Within the University," *College and Research Libraries* 65, no. 3 (2004): 251-61; Corrine Jörgensen, "Indexing Images: Testing an Image Description Template," *American Society for Information Science 1996 Annual Conference Proceedings,* http://www.asis.org/annual-96/ElectronicProceedings/jorgensen.html (accessed May 3, 2007); Corrine Jörgensen, "Attributes of Images in Describing Tasks," *Information Processing & Management* 34, no. 2/3 (1998): 161-74; Corrine Jörgensen, "Access to Pictorial Material: A Review of Current Research and Future Prospects," *Computers and the Humanities* 33 (1999): 293-318; Corrine Jörgensen, "An Analysis of Selected Classification Systems in Relation to Image Attributes Named by Naïve Users," *Annual Review of OCLC Research 1999,* http://digitalarchive.oclc.org/da/ViewObject.jsp?objid=0000003507 (accessed May 3, 2007); Sara Shatford Layne, "Some Issues in the Indexing of Images," *Journal of the American Society for Information Science* 45, no. 8 (1994): 583-88.

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7. To play the ESP Game visit: http://www.espgame.org. For more information about the game, see Luis von Ahn and Laura Dibbish, "Labeling Images with a Computer Game," *Conference on Human Factors in Computing Systems: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, April 24-29, 2004, Vienna, Austria* (New York: Association for Computing Machinery, 2004), 319-26.

8. Peter Enser, "Visual Image Retrieval: Seeking the Alliance of Concept-Based and Content-Based Paradigms," *Journal of Information Science* 26, no. 4 (2000): 199, 202-204; Kennedy, "Informing Content- and Concept-Based Image Indexing and Retrieval Through a Study of Image Description," 1-5; and Christopher Town and David Sinclair, "Language-Based Querying of Image Collections on the Basis of an Extensible Ontology," *Image and Vision Computing* 22 (2004): 251-67.

9. Jörgensen, "Attributes of Images in Describing Tasks," 169.

10. Of particular use to this topic are Attig, Copeland, and Pelikan, "Context and Meaning;" Jane Greenberg, "A Quantitative Categorical Analysis of Metadata Elements in Image-Applicable Metadata Schemas," *Journal of the American Society for Information Science and Technology* 52, no. 11 (2001): 917-24; Patricia Harpring, "The Role of Metadata Standards in Mapping Art Information: The Visual Resources Perspective," *Art Documentation* 27, no. 4 (2000): 71-76; Patricia Harpring, Mary S. Woodley, Anne J. Gilliland, and Murtha Baca, "Metadata Standards Crosswalks," *Introduction to Metadata:*

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12. Attig, Copeland, and Pelikan, "Context and Meaning," 255-56; Harpring, "The Role of Metadata Standards in Mapping Art Information," 73-74.

13. Jörgensen, Jaimes, Benitez, and Chang, "A Conceptual Framework and Empirical Research for Classifying Visual Descriptors," 941.

14. Harpring, Woodley, Gilliland, and Baca, "Metadata Standards Crosswalks."

15. Greenberg, "A Quantitative Categorical Analysis of Metadata Elements in Image-Applicable Metadata Schemas," 918-19; Harpring, "The Role of Metadata Standards in Mapping Art Information," 74.

16. Greenberg, "A Quantitative Categorical Analysis of Metadata Elements in Image-Applicable Metadata Schemas," 917, 921-22.

17. Linda McRae, Elisa Lanzi, and Murtha Baca, *Project Proposal for Guide to Good Practice: Cataloging Standards for Describing Cultural Objects and Images*, 2001, http://www.diglib.org/standards/vrawork.htm. Although not specifically addressing the efficiency of retrievals, an interesting early discussion of the creation of subject thesauri useful to cultural objects can be found in Thomas H. Ohlgren, "Subject Indexing of Visual Resources: A Survey," *Visual Resources* 1, no. 1 (1981): 67-73.

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27. Armitage and Enser, "Analysis of User Need in Image Archives," 289.

28. Chen, "An Analysis of Image Queries in the Field of Art History," 266.

29. Hollink, Schreiber, Wielinga, and Worring, "Classification of User Image Descriptions," 619.

30. Hastings, "Evaluation of Image Retrieval Systems: Role of User Feedback," 438, 448-51.

31. 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," 29.

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