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Digital Image Databases: A Study from the Undergraduate Point of View

Teresa Slobuski

This article investigates current metadata practices in art image databases. Searches were completed in the Bridgeman Education and ARTstor databases using only terms found in introductory art history texts. Details from the search results point to overall trends in the data and offer comparisons between the databases for particular search sets. The examples reveal tendencies in precision, recall, and consistency, as well as identify some particular issues that may impede successful retrieval for the novice user. A short discussion on the usability of both of the databases' interfaces offers further insight into their respective strengths and peculiarities.

Introduction

As digital images become the standard for use by professionals and students, it is important to investigate issues of representation and interface usability in image databases that are broad in both scope and content. As many institutions rely on subscription databases for access to visual resources, art librarians and visual resource professionals must take a closer look to reveal any failings or pitfalls in the current systems. Through this and future investigations, professionals will have the opportunity to establish good working practices to evaluate usability of the interface and findability¹ of the documents.

The author's research was completed initially on two subscription databases and two free databases, but this article will report only on the subscription databases: ARTstor² and Bridgeman Education.³ ARTstor and Bridgeman have rather different histories. Bridgeman Education is a relatively new pursuit of Bridgeman Art Library, which began in 1972 as a centralized source for fine art images. The library began by collecting images from institutions and individuals and acted as a liaison between the holders of image copyrights and authors and publishers who wished to use the images. By holding these images and creating licensing and reproduction contracts, Bridgeman aims to reduce some of the administrative issues involved in increasing visibility for images.⁴ Bridgeman Education uses the legacy of well-indexed metadata from its commercial collections to provide access to copyright-cleared materials to subscribing institutions.

ARTstor, however, does not have any pre-digital roots, but rather was developed by The Andrew W. Mellon Foundation to provide institutions of higher education with access to high quality digital art images. As the inevitable switch to digital loomed in the late 1990s, many visual resource collections began work on digitizing their collections. Unfortunately, digitization is beyond the abilities of many institutions because of cost and time restrictions. It became clear to the Mellon Foundation that not every institution needed to digitize its images of the *Mona Lisa* and Sistine Chapel, since digital objects can be accessed by

many people in multiple institutions simultaneously. ARTstor has partnered with many institutions and individuals to increase its collections and generally uses the metadata just as it is provided by these partners.⁵ Both ARTstor and Bridgeman require subscriptions that are based on the size of the subscribing institution's population. Therefore, the average college or university will pay for the entire student body to have access to these resources instead of only those pursuing a degree in art or art history.

Given the relatively small set on most college campuses of potential users with an advanced knowledge of art history, the ultimate goal for this study was to gain the perspective of a user with minimal knowledge of art history. To replicate the average college student's level of knowledge, all search terms were taken from three of the most widely used introductory art history textbooks—Janson, Stockstad, and Gardner⁶—and all items sought had an image in at least one of these texts. By limiting vocabulary to these terms for initial searches and then doing further searches to determine the relevant images that were available, perspective on the precision and recall afforded a user through using different terminology was gained.

Literature Review

A preliminary look at the literature on image databases shows a large range of topics covered in the last decade. A somewhat dated article by Edie Rasmussen⁷ offers an overview of the issues that continue to be discussed in literature, such as interactions between systems and users, and issues with indexing images. Some articles focus on user behaviors, but they generally use a fairly small image collection,⁸ choose faculty or other scholars for their user group,⁹ or both.¹⁰ Others examine the systems themselves and allow the usage data to offer insight.¹¹ A large number of articles, however, focus their discussion on how to create systems that will provide access to images. These include articles that review indexing practices of image representation¹² and computer systems which could provide better access.¹³ There are a few articles that report on either ARTstor or Bridgeman, but most are written from the perspective of beta

testers¹⁴ or staff members.¹⁵ No articles could be found that cover both databases. Overall, the literature appears to add more questions than provide any answers. As image representation has a shorter history of control and standards than textual materials, more research will have to be completed in all of these realms before any firm conclusions can be reached.

Methodology

To gain maximum breadth for the study while allowing for some structure, the author separated the history of art into categories and attempted to find an artwork which fit in each intersection of the facets (Figure 1). These categories did not affect results so much as organize the data into distinct sets and prevent too much duplication in a time period or location. To be considered, the artwork had to have an image in at least one of the three introductory art history textbooks. Terms were taken from the caption for the image as well as the main body of the text describing the image. In most cases, preference was given to works that appear in more than one text. Sometimes a chosen item was not mentioned in every text because it offered an opportunity to include another culture, civilization, or style. For example, in the 3000 BCE to 1000 BCE time period, a cave painting in Algeria was chosen to represent Africa's paintings. For this time period, most of the texts focus on the art and architecture of Egypt, thus it was judged to be reasonable to dedicate sculpture, architecture, and applied arts to Egypt—but it was desirable to include at least one work from another region of Africa. Unfortunately, not every category could be filled based on these texts alone, especially for earlier time periods. Other texts were not consulted to fill in any gaps as the goal was to limit the study to resources a student would have readily available.

Time Periods	Regions	Type of Artwork
Until 3000 BCE	Mediterranean	Painting
3000 BCE–1000 BCE	Northern and Western Europe	Sculpture
1000 BCE–0	Eastern Europe (Added 500 CE)	Architecture
0–500 CE	Middle East	Applied Arts
500 CE–1000 CE	Africa	Other
1000 CE–1400 CE	Asia	
1400 CE–1500 CE	Pacific	
1500 CE–1600 CE	North America	
1600 CE–1700 CE	South America	
1700 CE–1800 CE		
1800 CE–1850 CE		
1850 CE–1900 CE		
1900 CE–1925 CE		
1925 CE–1950 CE		
1950 CE–1975 CE		
1975 CE–Present		

Figure 1: How Artworks Were Categorized.

In most instances, there was a single item sought by the search terms. In others, the description was left general enough to allow for several objects to satisfy requirements, such as cylinder seals from early Middle Eastern civilizations or Kore statues from ancient Greece. For each work, terms for the creator, title, location, and medium were identified. There is also a section called “abstract” which includes short descriptor words and alternative spellings that might be found in a short abstract or description of the piece and are not represented in the other fields (see Figure 2 for a sample of one time period). Once an artwork was identified for potential search and placed in the list, the textbook(s) in which the term was found was not recorded. Searches were formed from these term lists, and the results were reviewed to assess both precision and recall.

Initially, each term or set of terms in creator, title, and abstract was searched with no limitations to fields. In ARTstor, however, searches were limited to ARTstor collections to prevent hits from the default union searching of the Rutgers institutional collection hosted by ARTstor. Counts were kept for each search, and screenshots were taken of the first page of the search results. Results that had only a few pages were reviewed completely for both of the databases. For the searches that were generic phrases and retrieved hundreds or thousands of hits, the results were not fully assessed. To determine precision in these sets, terms were searched again in combination with a limit to date, location, medium, or another search term such as a title keyword, until a reasonable set was returned for review. ARTstor allows users to create image groups¹⁶ while Bridgeman has slideshows,¹⁷ both of which can be searched independently or amended at any time. These were especially helpful in establishing uniqueness as each search that had relevant hits would have these hits added to the image group. It was very easy to tell if two, three, or twenty hits were new. Unfortunately, for the statistical validity of the research, when a broad search is completed in ARTstor, a pop-up window lets the user know that only the first one thousand results will be shown and offers the advanced search option to increase some limits.

The data from all of these searches were handled quantitatively. Statistics on total number of hits for every search in each database were kept so that they could be compared generally within the time period as well as specifically for the object or term category. As the researcher progressed with the searches for a particular object, each relevant hit was counted and used to calculate the precision the term achieved for the object sought.¹⁸ Additional searches were sometimes completed to determine how many relevant images were in very large sets of results. It is quite probable that the margin for error increases when the search terms are broader and return more hits. For any object where there were more relevant hits than the researcher could easily remember, the relevant hits were placed into an image group or slideshow. This provided a reliable way of determining how many unique relevant hits occurred in each subsequent search for the object and ultimately the total number of images of that object in the database. Using this figure, the percent recall was determined for each search term for retrieval of the object.¹⁹ Finally, it should be noted that precision and recall in these cases refer to the particular art object that was sought, so low percentages in either category do not necessarily mean the term is used incorrectly in the irrelevant hits, but that it simply was used to describe objects other than the one in question.

	Mediterranean	NW Europe	East Europe	Middle East
Painting				
Creator		Jean Pucelle		
Title	Christ in Majesty	Book of Hours of Jeanne d'Evreux	Lamentation over the Dead Christ	The Vladimir Madonna
Location	Catalonia, Spain	Paris, France	Nerezi, Macedonia	Byzantium
Abstract	Santa Maria de Mur, apse, Romanesque,	grisaille, Hours of the Virgin, Joys and Sorrows of the Virgin, Saint Louis, bas-de-page	St. Pantaleimon, Yugoslavia	devotional icon, Christ, Virgin, Russia, Moscow
Medium				painted wood
Sculpture				
Creator	Nicola Pisano			
Title	Pulpit of Baptistery	Roettgen Pieta		
Location	Pisa, Italy	Germany		
Abstract	Gothic, Corinthian capitals, trefoil arches	Madonna, Virgin, dead Christ, Mother of God, Vesperbild		
Medium	marble	painted wood		
Architecture				
Creator				Trdat
Title	Palace of the Lions	Chartres Cathedral	Cathedral of Santa Sophia	Cathedral of Ani
Location	Alhambra, Granada, Spain	Chartres, France	Kiev, Ukraine	Armenia
Abstract	Muqarnas dome, mirador, Hall of the Abencerrajes, squinches, stucco Iberian, court	Notre-Dame, Gothic, spires, flying buttress, nave, Royal Portal	Grand Prince Yaroslav, domes, Pantokrator	Arpa river, Akhurian river, gmbet, dome, vault of heaven
Medium	stone, plaster			

Figure 2: Sample from Term Lists, Section from 1000 CE–1400 CE.

Search Results

Since it was not possible to have perfect data on precision and relevancy for all of the terms in both of the databases, it is difficult to come to any firm conclusions on the outcome of these tests. Furthermore, since the data were so expansive, it is impossible to display them all in this article; however, samples of sections of the data are given below. Generally, in all of the time periods, ARTstor had by far the highest number of hits. Bridgeman, however, made a strong showing for a significant number of the works and at times seems to have had more relevant results than ARTstor. One category in which Bridgeman was particularly strong was in terms pulled from the abstracts. For example, in the "Until 3000 BCE" time period, searches were completed for the term *hounds* and *hound* while looking for a painted beaker. Bridgeman had 594 and 649 hits respectively compared to ARTstor's 220 and 116 hits. Though a very small portion of these were relevant in the search for the beaker, this example displays Bridgeman's emphasis on helping users find the content of an image rather than a particular image. Though many more images in ARTstor are likely to have hounds, these may be deemed inconsequential by most metadata creators. For Bridgeman, however, authors or publishers may be looking for

a pastoral image which contains some hounds, in which case Bridgeman's goal is to allow access through such a search feature, thereby increasing the user's likelihood of finding an appropriate image in its library. Though Bridgeman's educational database is run separately from its commercial database, the shared metadata between the two provides higher consistency throughout the collection.

Though ARTstor far outnumbers Bridgeman in pure number of hits in most categories, further exploration of its relevancy revealed several areas where the numbers may have been higher, but results were easier to manage in Bridgeman. A search for Chartres Cathedral in both databases shows that ARTstor has over 1,000 images while Bridgeman has 222. While most are relevant in both databases, it is not until the fifth page of ARTstor results that one encounters a photograph of the exterior. Bridgeman's first page of results has several exterior shots, though the results default to show more results per page. However, ARTstor's pure number of results cannot be undervalued. Although results in the thousands may be daunting to someone simply looking for one exterior shot, any student researching the Notre Dame Cathedral at Chartres would be thrilled to have access to a large variety of views of the building as well as detailed shots of most, if not all, of the stained glass work.

Term	Bridgeman	ARTstor
Ashurbanipal Hunting Lions	8	1
relief	4,718	1,000
dying lion	10	7
Audience Hall of Darius and Xerxes	10	5
Audience Hall of Darius	15	6
apadana	47	120
columns	1,953	1,000
palace	4,801	1,000
painted beaker	7	21
ibex	73	75
hounds	594	220
hound	649	166
Chartres Cathedral	218	1,000
Notre-Dame	704	1,000
Notre-Dame and Chartres	7	290
gothic	4,617	1,000
gothic and Chartres	172	751
spires	155	234
flying buttress	70	21
nave	460	1,000
nave and Chartres	4	292
Royal Portal	22	55

Figure 3: Example of Raw Hit Totals for Several Works in Various Time Periods.

Lack of consistency between the databases helps crystallize the notion that more work must be done if these art images resources are to be used by students. The inconsistency, however, may be as much a product of the nature of art history as it is a lack of regularity in cataloging. When seeking a relief sculpture titled in the texts *Ashurbanipal Hunting Lions*, Bridgeman came up with eight results that were all relevant, while ARTstor only had one. On the other hand, a search for the same object using the descriptive phrase *dying lion* came up with three relevant results in ARTstor and none for Bridgeman.

Handling Large Result Sets

Large result sets and ambiguous terms caused issues for many searches in both databases. Some examples can be found when searches for images of the Jean de Chelles rose window in the north transept from the Cathedral of Notre-Dame in Paris are considered. In ARTstor, these searches were difficult to manage because not only were there large numbers of results, many of which were not useful for information about the cathedral, but most of the images of the rose window in ARTstor did not have the term *rose window* in the description. A significant number of

images resulting from searches on *Notre-Dame* and *Paris* were in fact images of people in and around the Cathedral, rather than views which offered any information about the building itself. The search beginning with *Notre-Dame* led to using the following to find relevant hits: “*Notre dame and paris and (cathedral or cathedrale) not (franck or louis),*” limited to the date range of “1000–1400 CE” and the classifications of architecture and city planning or decorative arts, utilitarian objects, or interior design. This string returned 263 results to review for the rose window, including twenty-three QuickTime 360° views, many of which had to be opened in order to determine whether the window could be seen. Ultimately, twenty-five of these results were found to have a view of a rose window, but only five of those are images of the north transept window created by Jean de Chelles. The artist's name, however, was attached to many images of the other rose window from the south transept, which was created years later. In Bridgeman, *rose* and *window* are indexed terms, and using those with *Notre Dame* and *Paris* in the regular search allowed a much more manageable result list of forty. Even so, Jean de Chelles does not appear on any of the results, so users who did not already know either that the window was in the north transept or what it looked like or depicted would not be able to narrow these down with much success.

Term	Total Results	Relevant Results	Precision	Unique Results	Recall Compared to Total Records Found
Chartres Cathedral	1,000	1,000	100.00%	1,000	79.43%
Notre-Dame	1,000	290	29.00%	0	23.03%
Notre-Dame and Chartres	290	290	100.00%	60	23.03%
gothic	1,000	748	74.80%	0	59.41%
gothic and Chartres	751	748	99.60%	19	59.41%
spires	234	9	3.85%	0	0.71%
flying buttress	21	1	4.76%	0	0.08%
nave	1,000	292	29.20%	0	23.19%
nave and Chartres	292	292	100.00%	180	23.19%
Royal Portal	55	31	56.36%	0	2.46%
Total				1,259	
Jean de Chelles	26	26	100.00%	1	20.00%
rose window	386	2	0.52%	0	40.00%
rose window and Paris	66	2	3.03%	2	40.00%

Notre-Dame	1,000	5	0.50%	0	100.00%
Notre-Dame and Paris	589	5	0.85%	2	100.00%
gothic	1,000	0	0.00%	0	0.00%
gothic and Paris and Notre-Dame	197	0	0.00%	0	0.00%
Total				5	
Audience Hall of Darius and Xerxes	5	5	100.00%	5	3.55%
Audience Hall of Darius	6	6	100.00%	1	4.26%
apadana	120	116	96.67%	110	82.27%
columns	1,000	23	2.30%	17	16.31%
palace	1,000	65	6.50%	8	46.10%
Total				141	

Figure 4: Example of ARTstor's Precision and Recall Results.

Results That Were Related, but Irrelevant

As mentioned above, most of the search results of a large set would often be in some way related to the object sought, but many images frequently offered little to no information about the actual artwork. For example, a search for Angkor Wat, a temple complex in Cambodia, returns 692 hits in ARTstor. Many of these hits, rather than containing architectural information, are images of statues removed from the site, images taken near the site, or images of people on the site. Though many of these images have artistic value in their own right, a fairly large number seem not to be of architectural significance. When all of the pages of results were examined, only 404 images were marked as potentially having significance for someone interested in the architecture of Angkor Wat. Some users may find more or fewer images to be useful because some of the images included in this set are more focused on a person, but overall still offer something of interest to the architectural scholar, such as a sense of scale. On the other hand, some images not included were close-up shots of relief sculpture cut into the walls. Though it may be argued that these are a key component of the architecture of Angkor Wat, they give no sense of scale or space, which are important elements of architectural study. Bridgeman's results for Angkor Wat are much smaller, only thirty-seven, but they suffer from similar problems such as an image of a monk walking near the complex, statues from Angkor Wat, and a clothing advertisement with Angkor Wat featured in the background.

Working with Differences in Metadata and Terminology

As mentioned in the introduction, ARTstor has a largely hands-off approach to the metadata provided by institutions for their images. This can lead to some difficulty in searches because there is little evidence that there is any form of vocabulary control. Looking at the example of Notre-Dame in Paris, a search had to use both *cathedral* and *cathedrale* because many of the images labeled *cathedrale* would not come up in a search using *cathedral*. This example shows that not only does ARTstor not have connections between related terms, but also it does not automatically complete root searches or truncation. In the help files, it does offer characters that can be used to complete such searches,²⁰ but the help button is off to the side and separated from other menus and may be easily overlooked by a user. Furthermore, there are not always connections between works that are clearly the same but have slightly different spellings. This can be seen in the ARTstor results for the *Book of Hours of Jeanne d'Evreux*, which has thirty-eight results, and the *Book of Hours of Jeanne d'Evreaux*, which has forty-seven. Bridgeman does not suffer from such problems as universally as does ARTstor, but it still has room for improvement. To return to the *cathedrale* example, 193 of the 227 results from a *cathedrale* search do also have the term *cathedral* in their records. In most cases one of the spellings is found in either the title or location field, while the other is found in the description; whether including both spellings is purposefully done or not remains unclear.

Beyond some of the specific examples described, evaluating the data for precision and recall reveals something about the trends in searching in image databases. Overall, the highest precision and recall for each work was most often achieved by means of a title search. Nevertheless, this was by no means the rule throughout all the time periods and locations. In the time period 1000 BCE–0, abstract terms were tied with title string searches for recall. There were a few works where this was particularly true. The Audience Hall of Darius, in the ancient city of Persepolis, had less than 5 percent recall in ARTstor searches for the work with and without the addition of Xerxes, his queen's name. Bridgeman had recall of 7.09 percent with Xerxes included and 10.64 percent recall without her name. However, searching for the Persian word for audience hall, *apadana*, returned not only the hits found in the title searches, but also many more unique hits, 110 in ARTstor and thirty-four in Bridgeman. Though this was certainly the most significant number of unique hits found this way, given the limited scope of the research and the increasing number of non-expert searchers, the fact that a significant number of images of an important work were located only by using this specialist term is troubling (Figure 4).

Usability

Although usability was not the initial focus in this research, completing such a large number of searches in a relatively short period did reveal a fair amount of information about the databases. When the bulk of the research was originally completed, Bridgeman displayed the complete search strings with the results. ARTstor would display the terms that were searched, but if limiters were used it merely stated "[Multiple search criteria specified]." In August 2010, however, Bridgeman unveiled a new website with many improvements to the advanced search functions, and it unfortunately no longer includes the full string.

This is disturbing because it can make it difficult for users who are completing a complicated search task to remember their trail. Furthermore, Bridgeman's new system does not retain search histories so that a user can go back through the searches, nor can the user click the back button to review previous searches. ARTstor's interface, on the other hand, allows both of these, so if a user gets off track it is easy to return to previous searches.

The databases also have a great variation in the number of advanced search options. One area that was vastly improved in Bridgeman's August 2010 release is the advanced search capability (Figure 5). Previously, besides use of Boolean strings, a user could restrict the results only by form, which could be done by checking off the desired boxes, such as "black & white" and "illustrations." Now, using the advanced search function, one can limit terms to artist, nationality, title, century, ID number, location, description, medium, or classification fields as well as completing a keyword search. One caveat, however, is that the advanced search does not make it explicit that the keyword search in the advanced search is an "or" search as opposed to an "and" search as it is in the simple search interface. Using the search terms *rose window notre dame paris* in the simple keyword search had forty results. When the same term string was searched using the advanced search interface in the keyword field, there were 15,658 total hits. Though it is very obvious with such an example of the problems of this function, certain types of searches have a more subtle effect. For example, the location field defaults to an "or" search as well. Therefore, simply typing *Paris* in the location field results in a narrower search than *Paris, France* as the latter returns hits of all of the results with Paris or France in the location. This seems counterintuitive to the reasons behind using an advanced search and may prove highly frustrating to the inexperienced searcher.

ARTstor offers a more complex advanced search (Figure 6). One may limit the search by geography, classification, or collection by checking the appropriate selections as well as limit by a time-period range. Strings of terms, however, may be limited to only the creator or title fields. This choice may be a reflection of the variety of sources of metadata in ARTstor. The same object might have the search term in the culture field, description field, title, or subject depending upon the institution that gave ARTstor the record, so if a user makes the assumption that subjects are uniform throughout the database, he or she may have great difficulty finding the image desired.

In the Methodology section of this article, the use of ARTstor's image groups and Bridgeman's slideshows to assist in the research process was discussed. Though the reason for their use was perhaps different than either organization intended during development, by repeatedly using these tools a great deal of their functionality was revealed. When logged into either

Figure 5: Bridgeman Education Advanced Search.

Figure 6: ARTstor Advanced Search.

site, a user has the ability to create as many image sets or slideshows as desired. Bridgeman defaults to allowing the slideshow to be seen by all members of the institution, and the users can manually limit access after creation. ARTstor allows only users with instructor rights the ability to share image groups with other users. In Bridgeman's interface, one begins with an empty slideshow and can add images without going into a slideshow-specific window. The images are automatically saved for thirty days, then will be deleted unless a user titles the slideshow. To create a new slideshow the user simply presses a button to get a clean slate and can do this without giving the previous slideshow a title; the latter still will remain available for the thirty-day period. To add images to a previous slideshow the user must reopen it. In contrast, to add images to a set, ARTstor opens a dialog box that allows the user to either create a new set or add to any of his or her earlier sets. Thus, a user may work on multiple sets without needing to reselect a new one each time, but this does not allow a user to add a selected group to different sets simultaneously. The interface Bridgeman uses for editing a slideshow is in a pop-up window and seemed generally slow with the occasional glitch. It does not remove duplicate images, so if a user mistakenly adds an image multiple times, each one needs to be opened in the interface to delete duplicates. This could be useful if the user wants to show multiple views of the same object, i.e., zoomed into a specific area, but it could be irritating when completing multiple searches to create the slideshow as one may forget what has been added already. Though adding images to a group in ARTstor initially occurs in a pop-up screen, actual editing occurs in a window very similar to the results pages. Unlike Bridgeman, ARTstor does automatically remove duplicates of the same image. If the user wants to add a different view of the image, he or she does it through zooming in on the image record and adding that view, rather than through the image group interface as in Bridgeman.

Conclusions

Though the searching has ended for this project, there is still much investigation of these resources that needs to be done. In the six months from the initial research to the writing of this article, both databases improved their interfaces and increased their collections. Regardless of these advances, neither of these systems is perfect, nor do they necessarily suit the needs of the entire student body in any institution. As illustrated by many of

the examples, the average undergraduate student may require help from professionals for either searching skills or subject knowledge. By using these databases more frequently themselves, art librarians and visual resource professionals have the ability to position themselves as experts, not just for the faculty member who is finally ready to give up analog slides but for the entire student population as well.

Although it is easy to criticize imperfect metadata creation or gaps in documentation based on decisions of the past, it is more important to know how to use these resources and look to the future. Little can be done to fix ambiguous metadata on this large a scale, but as metadata is created in the future, the non-expert user needs to be the focus. To fill in gaps in the subscription databases, in-house collections can and should be selected for digitization; such holes can be discovered only by using the resources regularly. Much visual resource collection cataloging was originally done with only a department's needs in mind. Now these collections are being used by the entire university population, from professor emeritus to first-year student. By keeping that in mind as cataloging practices are developed, the community can hope to provide better access to all. Furthermore, through partnerships with interface developers there is assurance that more seamless access to the diversity of digital resources will be provided to all levels of users.

This research is presented with a few caveats. Many aspects of the research were not ideal beyond the ones specifically mentioned throughout the article. On the whole, there are many ways for future research to improve upon this initial work. Ideally, students themselves should be used for user studies so that professionals know how the user group would search for both objects they know as well as for ones they have never seen. Also, it would be interesting to see how students use these databases to browse and what role serendipity may play. Any new research that investigates and reports on image databases will be a boon to the field at large.

Acknowledgments

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Notes

1. Definition from Peter Morville, *Ambient Findability* (Sebastopol, CA: O'Reilly, 2005), 4: "find-a-bil-i-ty n: a. The quality of being locatable or navigable; b. The degree to which a particular object is easy to discover or locate; c. The degree to which a system or environment supports navigation and retrieval."

2. ARTstor, <http://www.artstor.org/index.shtml>.

3. Bridgeman Education, <http://www.bridgemaneducation.com/>.

4. Bridgeman Art Library, "Philosophy & History," <http://www.bridgemanart.com/about-bridgeman/philosophy-and-history.aspx>.

5. ARTstor, "Mission & History," <http://www.artstor.org/our-organization/o-html/history-and-mission.shtml>.

6. H.W. Janson, *History of Art*, 5th ed. (Upper Saddle River, NJ: Prentice Hall, 1995); Marilyn Stockstad, *Art History*, 2nd ed. (Upper Saddle River, NJ: Prentice Hall, 2005); Richard G. Tansey and Fred S. Kleiner, *Gardner's Art Through the Ages*, 10th ed. (Fort Worth, TX: Harcourt Brace College, 1996).

7. Edie M. Rasmussen, "Indexing Images," *Annual Review of Information Science and Technology (ARIST)* 32 (1997): 169-96.

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