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A User Profile for Researchers Studying Objects: Implications for Computer Systems

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A USER PROFILE FOR RESEARCHERS STUDYING OBJECTS: IMPLICATIONS FOR COMPUTER SYSTEMS

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Abstract

A group of twenty-five researchers who study objects was observed over a four-year period. A variety of methods of data collection was used: observation, interview, questionnaires, and analysis of published materials. This report identifies the features needed in computer systems to facilitate the research of those who study objects. The researchers need to link objects with text, work with a variety of data types, and collaborate with colleagues over a computer network.

KEY WORDS:

computer systems; features; humanities; information needs; numismatics; requirements; user profile; user requirements

1. INTRODUCTION

Little is known about how researchers studying objects and using a variety of information resources work. As used in this report, the terms object and artifact refer to a physical entity that is studied as a representation of a particular culture. A recent study (Moline, 1994) provides an understanding of how one group of such researchers works. Further, the methodology developed for the study provides a basis for further studies which could lead to generalizations across disciplines. Synthesis of the results of several studies would provide a framework for building a new class of information systems to meet the users' requirements.

A group of numismatists working with ancient coins was studied. Twenty-five members of the group were observed over a four-year period. Data were obtained from observations of the group working as a whole, as well as individuals working alone, and from products used by and produced by members of this group of researchers. Members of this group are concerned with the individual object, the object as part of a set, and other objects that are related to the set by material, iconography, etc. These researchers analyze and document the inherent properties such as material, weight, size, and markings. They develop hypotheses regarding events that directly or indirectly lead to the production of new coin types, to explain variations in inherent properties, and to explain the finding of coin hoards in diverse locations. They develop expertise in a variety of disciplines, for example, archeology, metrology, metallurgy, and social, political, economic, and art history.

The information handling features needed in systems used by these researchers are identified in this report. The report includes sections on informational needs, a discussion on meeting those needs, general guidelines and a direction for future work, and a scenario illustrating how a system might meet a user's needs. Appendices document the research supporting this report.

2. *INFORMATIONAL NEEDS*

Researchers working with cultural objects need large, comprehensive information bases. They use objects as their primary source material but they also depend on a wide variety of secondary resources. The researchers need access to textual materials in a variety of formats and fonts. They also need to create and access high quality images. Not only are they interested in images of the objects under study, but also they want to see images of other objects with which to compare the characteristics found on the objects being studied. They need three-dimensional images or, preferably, the object itself. Further, they need multiple views of objects to simulate touching and rotating the object to let light fall on the various parts of the object to allow careful analysis of the surface and edge features.

3. *FACILITATING RESEARCH WITH INFORMATION HANDLING SYSTEMS*

The following section discusses the computer system features that would facilitate the work of researchers studying objects. Studies having identified needs for these researchers are relatively scarce. However, published results are included in the following sections along with the findings from the study of numismatists. The discussion presents imaging needs, database management needs, computer communications needs, document preparation and windowing needs, and information retrieval needs.

3.1 *Imaging Requirements*

For numismatists and others working with objects, the most important tools would be those which facilitate the manipulation of a large collection of images. Some of the functionalities needed follow:

- To provide ways to match images
 - retrieve additional objects by finding objects similar to a given object.
 - tell the user how similar a particular object is to another and others.
- To provide ways to show images of a variety of objects or views of an object on the screen, i.e., the same object from various angles and also various objects.
- To provide images that can have
 - 3-D rendering, i.e., manipulate the image as if turning/tipping the object from side to side.
 - cataloguing schema.
 - referencing and cross-referencing.

In addition to the findings collected from the study on numismatists, Jaritz's study regarding the use of medieval image databases found other features to be important. The additional important features of digital imaging systems are zooming, image enhancement, lifting discrete components of an image out of context, and comparing multiple contexts (Jaritz's 1991).

3.2 *Database Management Requirements*

Once a system has the image manipulation capabilities necessary, such as those in Table 1, the researcher needs a database management application, Table 2. As Jaritz points out, an image database contains images, descriptions of those images, and links connecting the images and descriptions. Further, although standardized terminology may be used to access iconographic content (i.e., traditional or conventional images or symbols commonly associated with a subject), other historical research demands additional

Image processing and rendering
multiples images on screen
3-D rendering
full motion manipulation
zooming
image enhancement
lifting discrete components out of context
comparing multiple contexts
Multiple search and retrieval methods
cataloguing schema
referencing and cross-referencing
text surrogates
browsing images
finding "similar" objects
defining similarity
Various media for storage
videodisc (with or without second screen)
videotape (with or without second screen)
CD-ROM
hard disk
other

TABLE 1. Imaging Needs

features. Examples of such features are facility for a specialized and/or detailed description and analysis of some iconographic elements of an image; links among data from written sources to the description and to the image; contextual retrieval of data showing relations, hierarchies, semantic nets, etc.; and readily available facility for statistical analysis (Jaritz, 1991, p. 16).

Besides pointing out user needs, Jaritz identified the problem users face when they attempt to access image databases created in various formats and structures and with contents not clearly defined (Jaritz, 1991, p. 15). Thus, to interchange information, some standard or compatible formats must be provided. Further, some centralized indices must be developed to give the users hints about what the contents of any given database might include. The evidence collected from the numismatists shows that each of those using a computer is using different software. In almost all of the cases, the data cannot be shared among these scholars except in the most basic form, i.e., as a string of alphanumeric characters encoded in ASCII.

An application for researchers studying objects must allow data to be structured, as well as linked to images. Some additional characteristics that researchers would find

Multiple images related to various other objects
Links among databases
images
textual
video
audio
Versioning of fields to allow tracking, e.g., of provenance
Various formats for interchange
Search and retrieval inter/intra database
Unlimited length fields
Unlimited number of fields
Option of prefixing a field to indicate data reliability
Option of specified fields
mapped into statistical analysis algorithms
dynamically updated

TABLE 2. Database Management Needs

helpful follow:

- To provide a classification schema or hierarchy; the system might facilitate the building of a tree or grammar of related sets of objects.
- To discretely record the value of an object and perhaps provide an automated mechanism to update that information via links with data obtained from sales catalogues.
- To provide multiple records for a single object, i.e., each side of the object might have a separate record. If each side of an object is a record, matching is by side, e.g., for each coin there would be three records, one for obverse, one for reverse, and one for edge.
- To provide information retrieval to allow tables, files, images, etc. that can be matched and searched in a variety of ways:
 - by proper name.
 - by events.
 - by attributes of objects, e.g.,
 - physical characteristics such as weight, diameter/size, material, thickness, etc.

- iconographic characteristics such as symbols and other images.
- textual characteristics such as content of inscription, style.

A recent study (Bates et al., 1993, p. 31) supports the above as a general need by pointing out that humanities' scholars need thesauri including named individuals, geographic terms, terms referring to dates and historical periods, and discipline terms. Further, although databases are being created, there are still enormous retrospective collections of primary interest to humanists that need to be converted to machine-readable files (Farrell, 1991, p. 69). A basic list of requirements is suggested in Volk's (1984) article entitled "An International Database for Numismatics." Volk proposes the following:

- The need for a descriptive record that is sufficiently complete that it would be useful to researchers (p. 229);
- The possibility that the computer file could be an aid to producing a printed catalogue or as a substitute for a printed catalogue (p. 229);
- The idea of distributing a "short-title" listing or indices that could be supplemented by on-line searches with illustrations supplied on demand (p. 230);
- The importance of archaeological context and provenance as part of an object's record (p. 230-1);
- The usefulness of qualifying data by a prefix indicating the reliability of the information (p. 232);
- The need to easily apply standard statistical tests to the data (p. 232); and
- The need to coordinate efforts in order to develop records that may be widely used over the network (p. 236).

Several of the points mentioned concern data interchange; e.g., updating values of objects in the database from data available on the network, sharing records, etc. Crawford (1986, p. 569) points out that with the thousands of private databases being developed in the humanities, "the most pressing need boundaries." Current work toward information interchange in the museum community (Bearman and Perkins, 1993) provides evidence that museum personnel are interested in exchanging information about objects among themselves electronically. This access could also be passed on to the researcher.

3.3 Computer Communications Requirements

Another recent study (Wiberley, 1991) analyzed some of the specific traits of humanities' scholars in terms of using electronic mail, access to secondary sources over the network, and the use of general bibliographic databases. The specific characteristics of humanists that he used are (1) reluctance to ask questions of general reference librarians; (2) respect

for influential peers; and (3) concentration on research specializations to the exclusion of other activities (Wiberley, 1991, p. 17). Regarding providing documents over the network, Wiberley cautions that since humanists often need to read an entire document, "this is more easily done when the document is in paper rather than on-line" (Ibid., p. 19). It must be pointed out, however, that if a desired document were found, the humanist could print it out in order to read it. Further, Wiberley goes on to point out that since humanists tend to follow the footnote trail, general bibliographies will only be useful to undergraduates, librarians, and scholars working outside their field of expertise (Ibid., p. 20).

The data collected on the twenty-five researchers for this study supports the need for communication among the scholars. They meet regularly to share information. However, this group is not familiar with the potential for E-mail and on-line document retrieval. Therefore the findings do not emphasize the need for on-line services.

Access to repositories - distributed databases of collections museums, individuals, etc.
Access to other users
E-mail
"talk"
Access to supplementary materials
Access to services
librarians as intermediaries for on-line search
dealers for quotes, catalogues, price lists, etc.

TABLE 3. Computer Communication Needs

There have been several recent studies made of on-line searching requirements for humanists (Lehmann and Renfro, 1991; Muratori, 1990; Siegfried, 1993; Walker, 1990; Walker and Atkinson, 1991). Of particular relevance is Hurych's (1986) study that identified the need for retrospective searching of eleven or more years and the need for material in foreign languages. These requirements are evidenced in the study of numismatists and must be considered by computer applications developers.

Based on the data collected for this study and the specific suggestions noted from recent studies, researchers require communication capabilities:

- To provide access to networks and E-mail capabilities so the researcher can communicate with others.
- To track sales at auctions by object type and condition, i.e.,
 - The information provider provides a service from auction houses on a subscription basis based on a user's profile.

- The user could update values of similar objects in his collection, track provenance of objects, make bids based on this information, etc.
- To locate published materials held in libraries and other collections.
- To locate objects of interest and relevance in museums and private collections.

Table 3 summarizes the computer communications requirements of scholars working with cultural objects.

3.4 Document Preparation and Windowing Requirements

To produce papers articles catalogues camera ready copy multimedia presentations Using a variety of "page" layouts with screen prints, 2-D, 3-D, holograms, etc. formatted text, tables, and images importing components from diverse files linking to sound and video clips
--

TABLE 4. Document Preparation Needs

In order to produce papers, articles, catalogues, etc., the researcher needs text processing and document preparation tools. These tools must provide for the needs presented in Table 4. What makes these somewhat specialized is that while writing or editing a document, the researcher needs to bring up multiple windows of text and images on the screen in order to verify his ideas, compare evidence, or simply jog his memory. Table 5 identifies the combinations of data types that are necessary in the windows.

Some of the users' requirements include the following:

- To provide multiple window capabilities so that a variety of data types can be displayed simultaneously, i.e., text, images, data, and perhaps video and sound.
- To provide a text editor that facilitates creating multimedia documents, at a minimum, text with high quality images. Ideally, one could include links in the "document" to video and sound and perhaps 3-D and holographic images.
- To provide document processing capabilities to allow preparation of camera ready copy in a variety of page layouts with

image and text
data and image
multiple images
multiple images and text
sound / video concurrent with any of the above

TABLE 5. Window Capabilities

- text;
- various fonts, e.g., scripts and alphabets;
- tables;
- figures; and
- images.

3.5 Information Retrieval Needs

The researcher, as evidenced from determining the needs of the numismatists, needs a variety of methods for searching and linking objects with information about those objects. Links or buttons are perhaps the easiest for a limited number of connections. However, once the researcher has all of his resources on-line, buttons connecting the related pieces soon become unmanageable. Therefore, search methods using full-text, key words, and browsing all have a place. Further, the researcher needs to refine his search using relevance feedback, interview techniques, such as a structured expert system or a more informal question asking procedure, and similarity measures to determine how close one object is to another (as represented in image format). Finally, the researcher would like to revise the retrieval system to include new links or other references which become links or trails through a body of data. Table 6 summarizes the additional features that the researcher would find useful.

Besides the interactive features that a researcher might require in his ideal system, there are a variety of supplementary resources which would facilitate his research. The supplementary materials would vary from researcher to researcher but might include some of the following: dictionaries, encyclopaedias, language parsers, atlases, maps, site plans, diagrams, schematics, catalogues, monographs, articles, newspapers, image bases, databases, and other information bases. These materials might be available on-line at some site that could be reached through the communication package. Even more likely would be that a site would provide one type of material and thus the researcher would be seeking information from a distributed "database" on the network. What would be required for the researcher would be an interface that allows the user to specify what information is needed. The system would then use its resources to locate a cost efficient

ADDITIONAL USEFUL FEATURES

Search (IR) methods
links/buttons
full-text
key words
browsing
Refining Search
relevance feedback
interview
expert system
asking questions
image similarity measures
Revision of IR new
links
tours or trails

TABLE 6. Desired Retrieval Capabilities

SUPPLEMENTARY MATERIALS

Dictionaries
Encyclopaedias
Language Parsers
Atlases/Maps
Site Plans
Diagrams
Schematics
Catalogues
Monographs
Articles
Newspapers
Image Bases
Databases
Information/Document Bases

TABLE 7. Supplementary Resources

source of the information.

Although not all inclusive, this discussion has identified some of the features that would facilitate the work of researchers working with objects. If we were to provide for

the custodian of collections of objects or the curator, we would also want to provide computer-aided design capabilities so that displays could be planned and drawn to scale and more extensive management tools would have to be included.

This discussion dealt with requirements. However, crucial for any system is the user interface. Researchers do not want to become computer gurus in order to do their work. They need powerful systems with carefully engineered interfaces that help them articulate their needs.

4. GENERAL GUIDELINES AND DIRECTION FOR FUTURE RESEARCH

A system for researchers concerned with artifacts, or objects, must facilitate

- linking objects with records and other textual information;
- image creation, import, export, and manipulation (high-quality, multiple views of an object, search capability on various object representations, etc.);
- document generation in one window while other windows are available for viewing images, database records, other documents, notes, etc.;
- the user's role in creating, revising, and storing the massive amounts of resource materials and documents generated so that the user has ready access to them; and
- network communication for information exchange and collaborative research.

Once prototype systems are built for those working with objects, they must be tested. As part of this testing, the issue of images as substitutes for objects must be investigated. Because the objects are so important to researchers, we must determine what type of computerized rendering of the object satisfies what research needs. There is no doubt that research can be enhanced by image manipulation, comparison, etc., but the question of replacing the objects with images cannot be resolved until further research has determined more specifically the issues regarding qualities of images for specific tasks.

5. *SAMPLE SCENARIO OF A FUTURE SYSTEM*

The following scenario identifies some characteristics of a system of the future. At the workstation of the researcher, the following scenario might take place.

A newly obtained object would be placed in a holder that fits in a special chamber manipulated by the computer. The "system" would perform the following:

- Assign an identification number.
- Generate the fields of physical data, e.g., weight, size, thickness, shape, material, and other information.
- Generate images of the object, e.g., scan the object and produce a file from which photographic likenesses, line drawings, etc. could be produced.
- Generate a description of the object, i.e., the system does a series of pattern matching algorithms that relates components of the new object to others in the database and then generates a "map" for each face of the object with references to closest examples available.
- Interact with the researcher for verification of previous data and then interactively, through an expert system as intermediary, determine the type category for this object and refine any data entry that has been done.
- Interact with the researcher to provide additional fields that depend on the knowledge provided by the previous owner such as publication, cost, provenance, etc.
- Assign a storage slot (box, shelf, cabinet, vault, etc.), so that the item would be physically close to similar objects.

An alternative scenario would involve the researcher comparing one object with others in the database. Again this object would be introduced into a special chamber where it is evaluated. The evaluation would include the features from above but might also include comparing holographic images to produce schematics showing where and how the objects differed from those closest in likeness.

Appendix A: METHODOLOGY

This appendix briefly describes the methodology used for the study. Data were gathered by observation of numismatists at meetings, by observation and interviews of small groups and individual numismatists at work, from research by the researcher, and by analysis of published materials. The kinds of information used by numismatists were identified; the tasks performed by numismatists were identified and described; products generated by numismatic research were identified and described; the research areas that numismatists pursue and the materials used for this work were identified; and the problems numismatists encounter as they do their research were identified.

In order to collect data on how numismatists work, a variety of approaches and settings were used to obtain the needed breadth. The approaches included observation, interview, informal questionnaires, and analysis of materials, those used to do numismatic research and those published as numismatic research. The settings included private homes, the hotel where a specific annual coin show is held, and a museum.

The situations or settings in which data were gathered provided a variety of data types. In fact, the situations determined the data types. For example, the Coin Society meetings were taken very seriously by the members because attending a meeting involves a major investment of time for each attendee. Meetings are three hours long and are held once monthly. Besides the length of the meeting, depending on where it is held, transportation can involve anywhere from one-half hour to one and one-half hour drive each way. As a participant-observer in the group, I could not interfere with the goals of the members of the group. Therefore, information had to be obtained in the least obtrusive manner possible, i.e., by observation logs and tape transcripts. On the other hand, working with small groups or individuals provided the flexibility to gather data from a wide variety of sources using a variety of data types including observation logs and notes, tape scripts, informal questionnaires and interviews, and publications.

After data were collected, they were coded and reduced and then stored in forms to facilitate analysis. Reduced forms of the data include tables, lists, flow charts, and figures. Other data were left as text in context with codes embedded, i.e., marked up text.

As the propositions were confirmed, modified, and amplified by data collected, they became the narrative, which is a thorough description of numismatic endeavor. The data collected were linked to the propositions, and discussed. The data were analyzed looking for patterns and synthesized where possible into a model with the processes and resources identified. The result is a rich description of how numismatists work. (See Appendix B for the narrative.)

Appendix B: HOW NUMISMATISTS WORK

The following assertions are based on a clustering and aggregation of the data collected in the study.

RESOURCES:

Numismatists

- work with objects, especially with coins. These objects are their primary resource.
- are interested in published methodological discussions, such as making surrogates, recording collection objects, analyzing objects, proving the authenticity of objects, dating objects, grading objects, buying and selling objects, using computers, analyzing style, displaying objects, trends in collecting, the need for indexing and cross-referencing, and how to prepare camera ready copy for publication.
- see personal communication with experts as important for authoritative information. They often begin with discussions with colleagues and experts. Once they become expert in an area, there are often few others with whom to consult on their area of specialization.
- find that surrogates, particularly casts or photographic reproductions and written descriptions, if thorough, must often substitute for personal observation. However, when working with hand struck coins, they would like to see all items since each is a unique document; it is not enough to see one of a series of coins.
- use objects, books, coin catalogues, auction catalogues, articles, papers, numismatic journals, numismatic newspapers, coin sale catalogues, dictionaries, slides, atlases, encyclopaedias, genealogies, and surrogates, such as casts and photographs. They prefer printed black-and-white reproductions in catalogues, books, and journals. However, color photographs are also helpful for determining the condition of a coin, such as pointing out flaws and patina. Further, they use monographs more than journals. Those responding to a questionnaire use monographs and coin catalogues 83% of the time and periodicals 26% of the time.
- use personal libraries, occasionally other libraries, and museums. They depend mostly on their personal libraries. They depend on standard references although some numismatists buy books frequently and most add auction catalogues to their libraries regularly. Further, they receive a few (2-6) numismatic periodical subscriptions per year. They do not visit libraries regularly for numismatic research, nor do they use archives, the telephone, photocopies, microforms, or slides, nor do they consult librarians. Respondents to questions about their personal libraries said they frequently consult 1 - 16 of their coin books (median = 5) and use 1 - 12 of their own catalogues (median 6.5). Each has the basic reference sets of his own specializations, as well as

assorted histories and other materials.

TASKS AND TECHNIQUES:

Numismatists

- collect or study coins and related objects and classify, catalogue, and interpret these objects. They classify them by relating them to the accepted book(s) for that specialization. New objects are fit into the appropriate series. Interpretation is done on an item or series basis.
- sell and trade objects at coin meetings, bourse, and through dealers.
- visualize a variety of coins; the researcher needs a large mental database of objects against which the object in question can be compared. Numismatists compare the details of coins to those of other coins and to those of other art forms: style, composition, motif, iconographic, calligraphic, physical details, such as quality of the die from which the coin was made, the quality of the strike, and metallurgy. They compare details noting the significant ones while the unimportant, as determined by a heuristic based on experience, are ignored. They require firsthand visual examination of the objects for much of their research, e.g., epigraphic style, ornamentation, and die study; derive some information from printed sources but find their most important information physically encoded on coins. They consider each coin as an original document containing significant information.
- travel several times per year more than 2 hours from home for numismatics related activities. Also, they visit museums several times a year.
- do thorough literature searches locating and checking extensive references; they must know how to locate and use the indices and other finding aids for a wide range of disciplines.
- relate coins to catalogue entries, historical events, places, and personalities, and economic conditions drawing on other fields searching a wide range of materials.
- use bibliographic references and explain the object in terms of causes, effects, and circumstances. They use experts, colleagues, footnotes, reviews, and sometimes bibliographies of familiar monographs and bibliographic tools. They use the following information seeking pattern: sometimes find respected opinion relating directly to the object under scrutiny; identify additional information relevant to the object; and interpret the object in light of existing information and original observations.

- contribute to a wide range of fields: archaeology, art history, history, economics, and historical sociology.
- create reference files: search for specific articles or books, search with a topic in mind, search for works of art, verify references, and study visual materials such as photographs, published reproductions, and objects on display.
- maintain collections; this involves many or all of the following: acquiring/accessioning, cleaning, computerizing records, conserving, exhibiting, labeling, loaning, photographing, preserving and protecting, securing, and storing objects.
- revise attributions of objects as new information becomes available.

PRODUCTS:

Numismatists

- create coin collections.
- publish their findings in specialized publications (i.e., monographs, dealer publications, numismatic journals, and coin weeklies).
- locate sources and assemble comprehensive bibliographies.
- produce exhibitions and other displays.
- produce handbooks for the public.
- produce scholarly catalogues.
- produce translations of classic numismatics treatises.
- produce computer inventories of their numismatic collections.

RESEARCH AREAS / TOPICS:

Numismatists

- study the significance of coins to the culture in which they were created.
- determine the name of an object, its place of origin, its maker, and its contents (meaning of its images and text).
- determine the sequence in which coins were issued. are concerned with iconography, criticism, and metallurgy.

- are interested in history, economic history, and metrology.
- analyze the text on coins regarding orthography, grammatical constructions, phraseology, epigraphical style, titulature, religious inscription, and geographical terms.
- relate the details on coins to those on other art forms.
- study monetary policy who determined it, and who carried it out.
- study the inherent properties such as object weight, size, medium, and markings as indicators of authenticity of coins. That is, these properties are carefully documented and are used to determine standards and ranges of authentic objects.

PROBLEMS:

Numismatists

- find their resources widely distributed and difficult to access; find that enormous geographical distances separate American scholars from many of their sources. Specifically, the informants commented on the fact that access to coin cabinets and vaults, particularly in foreign museums where the bulk of ancient coins are located, requires contacts and the payment of admission to the museum.
- find preliminary searching for relevant materials, including locating coins of specific types, takes substantial effort.
- find it difficult to find others with similar interests.
- need to know the origins of new coins on the market, e.g., are they legal?
- need to choose a specialization.
- need to limit the size of collections.
- need to verify the authenticity or genuinity of coins, even those held in some museums or authenticated by dealers.
- find difficulty in reconciling multiple grading standards.
- find difficulty in reconciling multiple dating schema.
- find difficulty in obtaining surrogates of objects of interest.
- find difficulty keeping track of the various details.
- find difficulty determining if old coins were reissued by later rulers.

- find difficulty in keeping abreast of changing historical interpretations.
- find difficulty in securing objects on exhibit.

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REFERENCES

- Bates, Marcia J., Deborah N. Wilde, and Susan Siegfried. "An Analysis of Search Terminology Used by Humanities Scholars: The Getty Online Searching Project Report Number 1." *Library Quarterly* (January 1993), 63/1:1-39.
- Bearman, David and John Perkins. "Standards Framework for the Computer Interchange of Museum Information." *Spectra* (1993), 20/2-3.
- Crawford, David. "Meeting Scholarly Information Needs in an Automated Environment: A Humanist's Perspective." *College and Research Libraries* (November 1986), 47/6:569-574.
- Farrell, David. "The Humanities in the 1990s: A Perspective for Research Libraries and Librarians." *Library Hi Tech* (1991), 9/1:69-71.
- Jaritz, Gerhard. "Medieval Image Databases: Aspects of Cooperation and Exchange." *Literary and Linguistic Computing* (1991), 6/1:15-19.
- Lehmann, Stephen and Patricia Renfro. "Humanists and Electronic Information Services: Acceptance and Resistance." *College and Research Libraries*, (September 1991) 52:409-413.
- Martin, Thomas H. *A Feature Analysis of Interactive Retrieval Systems*. Office of Science Information Services Report SU-COMM-ICR-74-1. Distributed by NTIS (PB-235 952).
- Moline, Judi. *A Longitudinal Study of How Numismatists Work: Information Needs for Scholarly Research Involving Artifacts*. Ann Arbor: University Microfilms, 1994.
- Muratori, Fred. "RLIN Special Databases: Serving the Humanist." *database* (October 1990), 13/5:48-57.
- Siegfried, Susan and Bates, Marcia J. "A Profile of End-User Searching Behavior by Humanities Scholars: The Getty Online Searching Project Report Number 2." *Journal of the American Society for Information Science (JASIS)* (June 1993), 44/5:273-291.
- Siegfried, Susan L. and Deborah N. Wilde. "Scholars Go Online." *Art Documentation* (Fall 1990), 9/3:139-141.
- Stam, Deirdre Corcoran. *The Information-Seeking Practices of Art Historians in Museums and Colleges in the United States, 1982-83*. Ann Arbor, MI: University Microfilms International, 1984.
- Stam, Deirdre C., and Angela Giral. "Linking Art Objects and Art Information: Introduction." *Library Trends* (Fall 1988), 37/2:117-264.

- Volk, T.R. "An International Database for Numismatics." *International Conference on Automatic Processing of Art History Data and Documents: Papers Volume I*. Los Angeles: J. Paul Getty Trust, 1984, 225-240.
- Walker, Geraldene. "Searching the Humanities: Subject Overlap and Search Vocabulary." *database* (October 1990), 37-46.
- Walker, Geraldene and Steven D. Atkinson. "Information Access in the Humanities: Perils and Pitfalls." *Library Hi Tech* (1991), 9/1:23-34.
- Wiberley, Jr., Stephen E. "Habits of Humanists: Scholarly Behavior and New Information Technologies." *Library Hi Tech* (1991), 17-21.

