MUSEUM INFORMATICS

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ABSTRACT

Museum informatics is the study of the sociotechnical interactions that take place at the intersection of people, information, and technology in museums. This article presents an overview of museum informatics, covering such topics as information representation, information organization and access, information management, information technology, information interactions, and information professionals in museums. It explores the impact of information science and technology on museums, museum professionals, and museum visitors, and argues that museum researchers must take a sociotechnical approach to studying the use of information resources and technologies in museums.

INTRODUCTION

Museum informatics is the study of the sociotechnical interactions that take place at the intersection of people, information, and technology in museums (1-2). Over the past few decades, museum researchers and professionals have explored the impact of information science and technology on the people who use museum resources. Museum professionals and museum visitors—including curators, registrars, school children, and scholars—have found their understanding of what museums can and should do dramatically changed by the introduction of new information resources and technologies into museums (3).

Museums have traditionally served as repositories of objects for the purposes of research, preservation, and education (4). For thousands of years, museums have acquired, stored, and exhibited objects of art, cultural heritage, natural history, science, and technology. Yet museums are not only repositories of objects; they are repositories of knowledge (5-6). The modern museum is an information service organization where information about museum collections is just as important as the collections themselves (7-8). As knowledge repositories, museums store knowledge; as information service organizations, they make this knowledge accessible and usable for their visitors.

Today's visitors to museums—from elementary school children to academic researchers—expect instant access to extensive information about every object in the museum's collections. To meet these expectations, and to serve their clients as effectively as possible, museum professionals have become more skilled in managing information resources in museums (9). They have honed their expertise in information organization and access, become more sophisticated in the application of information technologies designed or adapted for use in museums, and developed skills in such areas as digitization, information storage and retrieval, collections management systems, and Web-based educational outreach (10).

The changing needs and expectations of the users of museum information resources have prompted corresponding changes in the capabilities and services provided by museums. This article will examine those changes, and explore the impact of new information technologies on museums, museum professionals, and museum visitors.

Taking its cue from the scholarly and practitioner literature published on this topic over the past few decades, this article will examine museum informatics within the context of the museum profession. It is only recently that the field of museum informatics has begun to develop the critical framing and discourse necessary for the advancement of the field as a theoretical area in its own right. While this article, therefore, focuses primarily on the professional activities of museum informatics, it concludes with a discussion of the importance of moving from practice to theory, and the future of museum informatics as a research area.

INFORMATION RESOURCES IN MUSEUMS

Many types of information resources are important to museums. The most important information resource that any museum possesses is its collection of artifacts. These objects are valuable documents in their own right, providing information about the world's culture, art, history, science, and nature.

Equally important, however, is the extensive information that museum professionals possess about the objects in their care. When a museum acquires a new collection, information about each object is recorded and organized. Museum professionals must know what they have, when they collected it, why it is of significance, where it came from, what condition it is in, etc. They record specific data about each object such as nomenclature classifications; physical dimensions; material analyses; geographical, cultural, and temporal designations; artifact histories; scholarly remarks; condition and conservation records; research notes; and so on. They also maintain related information resources such as donor files, accession records, exhibit histories, research studies, temporary loans records, visitor attendance reports, information requests, etc. (see (11) for more information about museum records).

INFORMATION REPRESENTATION

When working with information about their collections, museum professionals rely on principles of information representation to create information surrogates or aggregates that can be manipulated more easily than physical artifacts. Surrogates are created by taking information entities and making them physically or informationally smaller (e.g., catalog card records), while aggregates are single resources that represent groups of information entities based on shared data (e.g., a list of all artifacts accessioned in the same year). Information surrogates and aggregates are usually easier and faster to handle than artifacts themselves, especially when searching, sorting, or manipulating museum resources. In addition, working with object surrogates is safer for artifacts, as museum professionals can research collections, develop exhibits, and work with scholars while artifacts remain safely in storage.

Over the years, museum professionals have used a wide range of tools (such as ledgers, card catalogs, computer databases, and digital collections management systems) to organize and

provide access to information representations in museums. While no information representation can duplicate the physical artifact in its entirety, access to a sufficiently-detailed information representation can meet the needs of many users, including researchers, scholars, teachers, students, and the general public. For information resources to effectively meet the needs of the museum's users, information must be properly organized and easily accessible.

INFORMATION ORGANIZATION AND ACCESS IN MUSEUMS

Until the 1960s, information resources about museum artifacts were organized into paper records and card files (12). There were many drawbacks to this paper-based system, especially in terms of information access: only a limited number of individuals could access the files at any one time; and access was restricted to only a few data points, usually accession number, donor name, and occasionally the object's name or classification.

With such a system, answering questions such as "When did we receive this particular artifact?" or "What has this donor given us?" might be simple enough tasks (assuming the card files were kept up-to-date). Searching through and sorting records to answer more sophisticated questions could be laborious and time-consuming. Within the limitations of paper-based systems, certain questions prove virtually impossible to answer, including: "How many oil-based paintings do we have that were painted before 1450?" or "Do we have sufficient numbers and types of shoes to create an exhibit illustrating the history of shoemaking over the past five hundred years?" When faced with such questions, even the most knowledgeable and skilled museum employees might be unable to provide satisfactory answers.

This situation improved with the introduction of modern, computerized systems for museum cataloguing (13). Museum professionals were now able to search and sort digital records about their collections using almost any database field. They could store more information about their artifacts, and they could share data more easily with other institutions. Museums had the potential to work together to improve the quality of their information resources and provide better, more useful, and more accurate information to their users; but the realization of this potential did not turn out to be an easy task.

There were few accepted standards for organizing information within museums, and organizational methods were typically institution specific and varied greatly from museum to museum. Given the inherent uniqueness of museum artifacts, it was impossible for one museum to document an object and then share that information with other institutions with the same object. No two institutions would record the same information in their ledgers, or use the same terminology when describing their collections. How, then, could museums develop standards to improve the quality of their records and more easily share data about their collections?

STANDARDS AND METADATA

There have been many attempts to create data content, structure, and value standards for documenting and describing museum artifacts (14). Cultural heritage institutions, for instance, frequently classify collections of man-made objects using a nomenclature system developed in 1978 by Robert G. Chenhall (15), later revised and expanded by James Blackaby *et al.* (16). It is

difficult to develop a classification system that works equally well across all institutions with widely different kinds of collections. Museum professionals attempting to use Chenhall's nomenclature may encounter many difficult questions, such as: Should an ancient Egyptian document written on a torn piece of papyrus be classified as a material fragment or according to the content of the document? or Should a wine jug from ancient Greece be classified under the generic term "Pitcher, Wine" or the specific term "Red Figure Oinochoe?" Different institutions tend to answer such questions in their own way, thereby making it very difficult to establish standards that can be upheld by all organizations.

Museum professionals at many different institutions are working to solve these problems. The Getty Research Institute has developed detailed vocabularies and thesauri specifically for the use of museums (17). The products of their research include structured vocabularies such as the Art and Architecture Thesaurus (which provides 131,000 terms for describing cultural materials), the Union List of Artist Names (which contains 293,000 names of artists and architects), and the Thesaurus of Geographic Names (which includes 1.1 million terms for geographical and historical locations). The Getty Research Institute has also developed the Categories for the Description of Works of Art, which establishes a data content standard for describing museum objects and images.

International organizations have developed and evaluated metadata standards to see whether they can be used when describing museum artifacts. The International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM) has led the development of the Conceptual Reference Model (CRM), providing perhaps the most complete model for describing concepts and relationships when documenting cultural heritage objects (http://cidoc.ics.forth.gr/). During the late 1990s, the Consortium for the Computer Interchange of Museum Information (CIMI) evaluated the effectiveness of the Dublin Core Standard for describing museum artifacts, concluding that Dublin Core elements are useful to cultural heritage institutions in the abstract, but potentially problematic when used for institution-specific needs. More recently, academic researchers have been investigating the use of Extensible Markup Language (XML) for describing museum artifacts, and exploring the potential of the Open Archives Initiative for harvesting museum metadata for collections repositories (18).

Museum associations have also been working to develop standards for best practices when managing museum collections information. The Museum Documentation Association (MDA) in the United Kingdom has developed a standard called SPECTRUM that is a guide to good practice for all museums when documenting their collections (19). The Visual Resources Association (VRA) has established data content standards for Cataloguing Cultural Objects (CCO), fulfilling much the same purpose as the Anglo-American Cataloguing Rules (AACR2) in library and archives communities (20).

DATA SHARING INITIATIVES

Efforts to develop international standards acceptable to a range of institutions have resulted in initiatives to build extensive shared collections databases. From local to national levels, collections of digital information resources organize and allow access to a variety of data from museums of all types. The Canadian Heritage Information Network (CHIN) connects hundreds

of Canadian museums into one national network, providing a searchable database of millions of museum artifacts and an extensive Virtual Museum of Canada. The Collections Australia Network (CAN) provides a portal for information about Australian museums, including a searchable index of hundreds of thousands of Australian artifacts.

When developing these shared collections, museum professionals often have the opportunity to evaluate different standards and recommend best organizational practices. During the 1990s, the Museum Educational Site Licensing Program explored a variety of issues ranging from data standards to intellectual property rights, when six museums worked with seven universities to share information resources about thousands of digital images (21). More recently, the Art Museum Image Consortium (AMICO) was able to use the resources of its extensive library of digital images to develop detailed specifications and data dictionaries for institutions scanning and organizing data about images (22). These projects frequently relied on the resources of their member institutions to test different methods for providing access to distributed sets of artifact data, and for connecting multiple museum databases while accounting for variations in data types, semantics, and query terms (23).

Museum professionals often form consortia to achieve the common goals of the member organizations collaborating on digital projects. Typically, these consortia are able to undertake projects of greater complexity than any one institution would be able to handle alone. Museum collaborations are usually formed to create a collective digital resource to which all participating organizations will contribute. The Museums and the Online Archive of California, for example, brings together 75,000 object records from eleven cultural institutions in California (24). The Collaborative (formerly Colorado) Digitization Project brings together cultural heritage materials from institutions across the western United States into one shared resource repository (25). The Scottish Cultural Resources Access Network has gathered hundreds of thousands of multimedia and text records about Scotland into one central repository (26). These cooperative endeavors testify to the museum community's commitment to finding new ways of organizing and sharing information resources.

INFORMATION TECHNOLOGY IN MUSEUMS

The first attempts to computerize museum collections occurred in the early 1960s, when several institutions began exploring the potential benefits of automating their collections management with computerized systems (27-28). These early systems were developed on mainframe systems and used to store descriptive information about museum artifacts. The Smithsonian Institution, for example, developed information systems, such as SIIRS (Smithsonian Institution Information Retrieval System) and SELGEM (Self Generating Master), which were used at institutions across the country during the 1960s and 1970s. The Museum Computer Network (MCN), founded in 1967, developed and distributed a system called GRIPHOS (Generalized Retrieval and Information Processing for Humanities Oriented Studies) to their member organizations. One of MCN's first projects was to evaluate standards for information organization and access at twelve art museums nationwide, and MCN sponsored the first conference on computers and their potential applications in museums at the Metropolitan Museum of Art in New York in 1967 (29).

Soon, a number of institutions were using mainframe systems to store data about their collections in electronic format. Museum professionals began to meet at a variety of conferences to discuss organizational standards, best practices, and new uses for information technologies in museums. As computers became cheaper, faster, and easier to use, even professionals working for small, poorly funded museums were able to purchase computer systems and database software for collections management. Vendors started developing and distributing collections management systems for many different types of museums. By the 1980s, new technologies had been developed that supported digital imaging, and museums began to experiment with building digital image databases. As the use of digital networks such as the Internet became more widespread, museum professionals found even more ways to share data about their collections. Today, museum professionals face a rapidly evolving information environment, and conferences such as the international conference of Museums and the Web and the annual meetings of the Museum Computer Network help keep hundreds of museum professionals up-to-date with the latest techniques and methods of bringing museum information resources online.

MUSEUMS AND DIGITIZATION

When museum professionals discuss "digitizing their collections," they refer to a process in which two things can occur: 1) they record in electronic format descriptive data about their artifacts; and 2) they produce some type of digital representation or image of each object. These two activities are often easily confused. When museums first began working with computers, digital imaging was not even a possibility, and when museum professionals referred to "computerizing" their collections, they meant taking descriptive, textual data from their ledgers and card files and converting them into electronic format. Today, with the prevalence of digital cameras and scanners, most museum professionals have expanded their definition of "digitization" to include digital imaging, and it is easy to forget that when a collection is digitized, the museum professionals in charge of the project must do more than produce a digital image of each artifact. They must also record descriptive data about the object (such as its provenance, classification, and composition) in electronic format, and generate new, additional metadata for the electronic object.

Recording data about museum artifacts in digital format offers museum professionals immediate benefits. These benefits include the ability to make a virtually infinite number of perfect copies of digital surrogates, and transmit them great distances with no loss in quality; to offer new levels of interactivity between objects and users; to take advantage of hypermedia and multimedia to remove objects from the constraints of physical space and present arrangements impossible in physical galleries; to provide remote access to information resources for visitors, scholars, researchers, and students; and to target unique information needs, by broadcasting information resources to wide audiences or narrowcasting information resources to individual users.

The ever present push for digitization has created new problems and exacerbated old ones for museums. These problems include concerns, worries, or fears over such issues as copyright and intellectual property; the potential lessening of the "aura" or authenticity of museum artifacts; the blurring of individual museum identities online; and the potential impact of access to digital surrogates on physical museum visitation. The opportunities and challenges afforded by

digitization have prompted new questions and concerns about the rise of the digital museum in the information age.

THE DIGITAL MUSEUM

New technologies and online museums mean easier access and wider use of information resources that may previously have been more firmly controlled by the governing institution (30). Some museum professionals worry that when they digitize their collections and make digital resources available online, they lose control over the museum's intellectual property and other copyrighted materials. Such concerns have prompted some institutions to protect their intellectual property by restricting access to certain types of data or making it difficult to reproduce the content they control. For example, museum professionals may attempt to prohibit the illegal duplication of digital images by embedding visible or invisible watermarks into digital image files (31). These approaches are only stopgap solutions, however, and a true solution to this problem will only come when the museum community reevaluates its approaches to rights administration and content distribution, developing new economic models for digital cultural heritage (32).

Another question asked about digital museums concerns whether visitors will stop visiting physical museums as more information about museum collections is available online. This fear has become even more prevalent as the quality of digital artifact representations online has increased; many museums offer extremely high-resolution images of their artifacts online, and some even offer three-dimensional representations that can be manipulated by virtual visitors and examined from all sides. With such features available online, some museum professionals wonder whether museum visitors will still bother to visit the real thing. Fortunately for museum professionals, recent surveys have provided compelling evidence that online museums actually drive physical museum attendance instead of discouraging physical visits; in the majority of studies, planning a museum visit is consistently cited as the primary reason people visit museum websites (33-34). Kravchyna and Hastings (35) found that 57% of museum website users visit museum websites both before and after they visit physical museums. Similarly, Thomas and Carey (36) found that 70% of museum visitors specifically looked for online information prior to a museum visit, and that 57% said the information they found online increased their desire to visit the museum in person.

Despite the potential challenges, museum professionals remain eager to digitize their collections, prompted no doubt by the growing number of museum visitors who now expect museums to provide access to their collections in digital formats. As the technologies required to build a digital collection become easier to use and cheaper to acquire, more museums have the opportunity to embark upon digitization programs, and more opportunities arise for museum visitors to interact with digital museum collections.

INFORMATION INTERACTIONS IN MUSEUMS

Museum professionals use new information technologies to develop innovative ways of reaching their visitors, online and in-house (37-38). Inside the museum, interactive kiosks encourage visitors to explore topics in greater depth and at their own pace. Online, virtual museums allow

visitors to plan gallery tours, research artifact collections, and learn from interactive educational exhibits. New information technologies have changed how museum professionals achieve their missions, and encouraged museum visitors to embrace the new capabilities of the digital museum.

MUSEUMS AND THE WEB

When museums started going online in the 1990s, museum professionals discovered that the Web offered them the potential to provide more than information about their museum's location, hours of operation, and brief descriptions of their collections. They began to explore the capabilities of online exhibits, realizing that increased access to digital collections offered new opportunities for interacting with museum collections and information resources.

Online museums and virtual exhibits have the potential to cover topics in ways not possible in physical museums. For example, Douma and Henchman (39) present an online exhibit that allows visitors to digitally remove layers of a painting (Bellini's Feast of the Gods), examining earlier versions using simulated infrared or x-ray lenses. Gillard (40) explores how the National Museum of American History's HistoryWired project encourages visitors to manipulate a collection of artifacts, uncovering connections between objects along temporal, cultural, and thematic lines. Sayre (41) describes how the Minneapolis Institute of Arts allowed online visitors to follow the restoration of a painting in real time, drawing them into the process and building stronger relationships between the museum and its visitors.

Many museums offer three-dimensional interactive tours online that mimic the experience of visiting the museum in person, while simultaneously opening an array of new possibilities for interaction (42-43). Online museum visitors, for instance, can compare and contrast artifacts that in real life may not be in the same exhibit or even the same museum. Some institutions have experimented with live online exhibits, using webcasting techniques to interact with global audiences in real time. The Exploratorium in San Francisco, for example, broadcasts live coverage of solar eclipses (online and recently in the virtual world of Second Life) and has developed a related online resource guide (http://www.exploratorium.edu/eclipse/).

New technologies have also offered museum professionals ways to bring information about their collections directly to their audiences. As museums continue to digitize their collections, it has become more common for museum professionals to make their records available online to the general public. These resources are used by a wide variety of online visitors, from recent visitors interested in learning more about artifacts they saw in person, to academic researchers at distant universities searching for particularly unique specimens. As more museums develop online collections databases, museum professionals have explored the potential benefits of linking these databases directly into their online exhibits, providing online visitors with instant access to the latest collections data (44).

PERSONALIZATION TECHNOLOGIES

Modern museums can personalize the museum-going experience in ways never before possible. It is now common for museums to offer handheld devices—such as audio guides—to their

gallery visitors. In essence, visitors to these museums have their own digital docents that can discuss artifacts of personal interest to them, providing a digital twist on traditional museum guided tours (45). Using a handheld device, visitors can listen to audio descriptions of works of art, allowing them to explore the gallery's contents in any order and at their own pace.

As handheld computers become less expensive, museum professionals continue to experiment with the capabilities of these devices, offering their visitors detailed text and digital images in addition to audio tracks. Projects that explore the educational potential of mobile computing devices in museums are becoming especially crucial as more museums integrate such systems into their exhibits and learning experiences (46). Several projects have demonstrated the value of mobile computers for increasing visitor interactions and improving educational experiences in museums (47-48).

As museum professionals explore new methods of making collections information available online, revolutionary trends in personalization have occurred in the online museum environment (49). A growing number of museums, including the Metropolitan Museum of Art, the Virtual Museum of Canada, and the Fine Arts Museums of San Francisco, now allow visitors to create personal digital collections of their favorite artifacts, adding or removing artifacts at will, and returning to view their collections whenever they like. Some museums, such as the Minneapolis Institute of Arts and the Walker Art Center, allow online visitors to group digital artifacts into personal galleries, annotate them with textual descriptions, and share them with other online visitors.

The future of museum personalization can be found in the application of web 2.0 and social computing technologies for online museums; the collaborative social tagging project Steve (http://steve.museum) provides an excellent example of how these technologies can be implemented for museums. It will likely soon be common for museum professionals to encourage their online visitors to draw new connections between artifacts, store those connections on the museum's computers, and share them with other museum visitors. In this way, museum visitors will add value to digital collections, contributing their knowledge to the museum's collections by adding new connections and interpretations across user communities (50-51).

INFORMATION MANAGEMENT IN MUSEUMS

Information management skills have always been important for museum professionals, who have a lengthy history of working with information resources and technologies (52). As museum information resources become more technically complex, and the users of those resources become more information literate, the needs and expectations of visitors have become increasingly sophisticated. Users of museum resources are no longer satisfied with limited access to information about museum collections, and many desire twenty-four hour access to museum data, no matter where the data are located, or how the data are organized. While the ability to manipulate and manage information resources has long been an important skill for museum professionals, meeting these changing expectations can be difficult for museum professionals.

Changing ideas about the museum's position as an information service organization can pose difficult challenges for museum professionals, often requiring them to learn new information management skills and integrate new information technologies into their daily work (53). Increased access to the digital information resources of libraries, archives, and museums has driven changing expectations from all museum users, including museum visitors and museum professionals, about the information resources museums should provide online and in-house (54). Users of all types frequently expect digital museums to act more like digital libraries—a situation that puts immense pressure on museum professionals to live up to the changing needs and expectations of their users.

INFORMATION PROFESSIONALS

Museum professionals have become increasingly concerned with the ability of museums to function in the information society, to meet user needs, and to ensure that the right information resources are available at the right time and place, inside or outside the museum. To accomplish these goals, a new role has emerged for information professionals in museums (55). The success of museums in the information age will depend largely on the work of information professionals trained to deal with the problems of museum informatics and the museum's information needs.

Information and communication technologies in museums change so rapidly that museums need individuals on staff who can guide them through the hazards of planning digitization projects, purchasing collections information systems, or joining online data sharing initiatives. Museum administrators know that if a museum is to participate in the information society, someone at the museum needs to be able to set information policy, manage information resources, administer content management systems, implement metadata standards, evaluate information interfaces, etc. While some technical jobs (including web design) can be outsourced, museums that do not have in-house skills with museum informatics will find it difficult to meet the constantly evolving demands of their increasingly information-savvy audiences.

MUSEUM INFORMATICS: FROM PRACTICE TO THEORY

The future of museum informatics as a unique research area depends on its ability to bridge multiple disciplines, drawing upon disparate theories and methodologies, and connecting the traditional professional world of museum studies with critical theories from the emerging worlds of new media and digital cultural heritage. Recent publications have been extremely influential in setting an agenda for museum informatics and providing the intellectual framework necessary for the advancement of the field as a research area, a particularly important achievement for an emerging field such as museum informatics (56-57).

The principal challenge facing the establishment of museum informatics as a unique research area lies in the fact that museum informatics is an extremely interdisciplinary field of study. Researchers interested in the museum's changing role in the information society have drawn upon theories and techniques from dozens of related fields, including digital libraries, human-computer interaction, social network analysis, cognitive science, museum studies, library and information science, etc. While early work in this area focused primarily on how information technologies should be used in museums, researchers are now emphasizing the need for an

underlying body of theory and methods for studying museum informatics as well as related fields such as museums and new media or digital cultural heritage (58).

To explore new theoretical perspectives and to develop new methodologies, researchers and professionals from around the world have joined together to form evolving communities of practice, dedicated to providing guidance to museums and other institutions of cultural heritage as they address important issues in museum informatics (59). Interest in museum informatics is now widespread, and each year, thousands of people worldwide participate in discussions, projects, and research initiatives related to museum informatics.

Museum professionals and researchers today belong to many different professional organizations and attend a variety of conferences dedicated to exploring museum informatics, including the meetings of such organizations as the Museum Computer Network, the Museum Documentation Association, the International Council of Museum's International Committee for Documentation, the International Cultural Heritage Informatics Meeting, the International Museums and the Web Conference, and the Institute of Museum and Library Services' WebWise Conference. The published conference proceedings from these meetings, many of which are freely available online, provide important, timely, and often extremely cutting-edge primary resources for individuals interested in studying museum informatics.

The prodigious number of museum informatics related events (including conferences, training events, symposia, etc.) as well as their regular high attendance are indicative of a continued and widespread professional engagement in this area. In addition, during the last few years, there has been a flourishing of university programs in this area. In the United States and Europe, for example, there are educational programs where students can study exclusively in such areas as museum informatics and digital cultural heritage. These programs are indicative not only of an increase in research activity by academics, but also of the increase in interest and demand by students for resources and publications in the area of museum informatics. To meet this demand, a growing number of scholarly journals now publish papers about museum informatics. The *Journal of the American Society for Information Science and Technology* the *Journal of Digital Libraries*, and *Curator*, for example, have all published special issues on museum informatics. More recently, the *Journal of Museum Management and Curatorship* has added a permanent section on Digital Heritage to its quarterly issues.

While the increase in publications related to museum informatics (including books, journals, and conference proceedings) is extremely encouraging, the increasing amount of literature has posed challenges for museum informatics researchers. In particular, the natural interdisciplinarity of museum informatics (covering such topics as technology, communication studies, museology, education, information science, etc.) tends to result in a centrifugal approach to publishing, where key pieces of research can appear in very different domains, speaking to very different peer groups. As interest in museum informatics continues to rise, therefore, researchers and practitioners seeking to establish museum informatics as a research area must collaborate to bring together any and all research related to the intersection of people, information, and technology in museums—including both the practical processes and theoretical discourses that relate to the organization, management, and use of museum information resources.

CONCLUSION

The study of museum informatics requires a sociotechnical approach to information resource management in museums. New information technologies have changed the way museum professionals think about the purpose and capabilities of museums. These sweeping changes have affected the way museums manage their information resources, in-house and online, in almost every aspect. The world of museums is being altered constantly by the introduction of new information technologies, as new technologies reshape the job of the museum professional and the overall function of museums in the information society.

To understand these changes, museums must be examined as complex sociotechnical systems that evolve and adapt to meet new challenges. Museum researchers must study museum informatics within complex and interlocking organizational and social contexts affecting the nature of museums in general and the expectations of museum professionals and visitors in particular. In this way, museum professionals and researchers will be able to embrace the growing role of museum informatics in the 21st century museum, and continue to explore the sociotechnical implications of people, information, and technology interacting in museums.

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