Museum Informatics and Collaborative Technologies: The Emerging Socio-Technological Dimension of Information Science in Museum Environments

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The museum offers a starting point from which to examine the fundamental nature of collaborative work and interdisciplinary scholarship. This article examines the socio-technological impact of introducing advanced information technology into the Spurlock Museum, a museum of world history and culture at the University of Illinois. It addresses the implementation of such methodologies as computer-supported cooperative work (CSCW) and computer-mediated communication (CMC) in the museum environment. Discussions are illustrated with examples and scenarios drawn from the Spurlock Museum and emphasize the intimate relationship between the museum’s social structure and information systems. Viewed in a holistic fashion, such studies of collaborative activities within the museum will help shape the future of museum informatics, an emerging sub-discipline of the field of social informatics.

Introduction

A museum offers a unique environment from which to study the way in which knowledge is accumulated, analyzed, and distributed by information professionals. A university museum, especially when located at a university that actively encourages innovative and interdisciplinary research, offers an ideal setting from which to study the way in which scholars and students from many different fields and disciplines interact and collaborate.

In 1996, we inaugurated an ethnographically-informed study of the Spurlock Museum at the University of Illinois in which we are examining how the Spurlock’s professionals and patrons have been affected by the introduction of advanced information technology into the museum environment. The research agenda of this study has been the design and development of information systems that support the collaborative production and use of the specialized knowledge characteristic of the museum environment. In this case, knowledge refers to information contained within the artifacts themselves as well as information about the artifacts held in the minds of museum professionals and affiliated scholars. This study has raised many interesting questions: What impact do these information systems have on the way in which such knowledge is shared? How are such systems best created? What role does advanced information technology play in the creation of such systems? How can such systems promote collaboration among different types of users of museum resources? How do these forms of collaboration differ within an individual museum, between two or more museums, among museum professionals, or between scholars, students, and the general public? To address these questions, our research has focused on an examination of how information technology enhances or otherwise affects collaboration among the various users and producers of museum-based knowledge.

Why Study Museums?

Around the world, information professionals have recognized the museum environment to be an important emerging field of study for information science. An extensive corpus of literature now covers the rapidly changing information needs of museums and other institutions of cultural heritage (Thomas & Mintz, 1998; Jones-Garmil, 1997; MacDonald, 1992), highlighting the importance of this area for future research and development. As museums work to build digital collections of artifact images and data, new needs and challenges arise (Gladney, 1998; Lucas, 1998; Samuels, 1998). As these opportunities for growth are met and evaluated, the lessons learned can be applied to the study of information science in general. The museum-oriented literature of today—primarily focused on information storage and retrieval practices, issues of electronic classification and nomenclature, and database design and development—is in transition. In the near future, we will see the field of museum informatics evolve to produce new analyses of the social impact of information technology on museums, museum professionals, and museum users.

JASIS’ fiftieth anniversary provides an opportunity to reflect upon the role information technology will play in
encouraging collaboration among museum professionals. Over the next fifty years, studies of museum environments will allow information scientists to draw connections between museum studies and diverse aspects of Library and Information Science. For example, the growing concern that the digital information developed by museums be freely distributed and made accessible for educational, professional, and general interest uses (Bearman & Trant, 1998; Moen, 1998) has prompted many museum professionals to employ the principles of social and organizational informatics, computer-supported cooperative work (CSCW), and computer-mediated communication (CMC) in their day-to-day activities. Such a development in the traditionally conservative world of museum studies offers a parallel to the transitions currently on-going in the field of Library and Information Science as a whole (see Haythornthwaite et al., in this same issue).

One of the most interesting challenges we face today is to analyze and understand the social dimension that emerges when advanced information technology is integrated into an organizational context. Museums offer an unusually interesting vantage point for many library and information science professionals precisely because museums have rarely been studied in this way (Rayward, 1998). Museums are of particular interest now as they begin to incorporate information technology into their work environments, raising many issues about the social organization of museums and many questions about how collaborative technologies can effect social change.

The Spurlock Museum: A Holistic Approach to Museum Informatics

The Spurlock Museum at the University of Illinois in Urbana-Champaign offers an unusually interesting environment for the kind of research discussed here. The Spurlock is a museum of world history and culture; it possesses a collection of approximately 40,000 cultural and ethnographic artifacts from diverse and varied historical time periods, ranging from ancient Sumeria to modern America. Staff members at the museum include ten permanent employees, several dozen student assistants, and a handful of affiliated academic curators. Thus, in its size, the Spurlock represents a comprehensive, yet still manageable and readily understood research environment. Moreover, as a university museum, the Spurlock is situated within an extremely supportive academic environment that encourages innovative research into information science, such as this study of technology-enhanced collaboration in a museum environment.

In 1996, the museum initiated a five-year program designed to prepare the museum, its staff, and its collections for a complete move across campus to a brand-new facility scheduled to open in the year 2001. As part of this program, the museum implemented a comprehensive reorganization of its use of advanced information technology in the fall of 1996. Today, the technologies and information systems in use at the Spurlock include the following features:

**Artifact collections management.** Extensive data on the museum’s artifact collections is now contained within detailed computerized databases, developed through an ethnographically-informed systems design methodology (Hughes et al., 1992; Sommerville et al., 1992; Hughes et al., 1994). Through these databases, museum staff members track detailed artifact specifications including nomenclature classifications, physical dimensions, material analyses, geographical, cultural, and temporal designations, accession records, artifact histories, exhibit information, scholarly remarks, condition and conservation records, research notes, etc.

**Museum administration support.** The regular practices of the museum staff are currently supported by a series of interlocked and relational database systems, affecting and coordinating every aspect of museum operations. Advanced information systems help support, manage, and maintain crucial museum policies such as collections management, registration, conservation procedures, packing and shipping, curation, exhibit design, and educational outreach as an integrated whole.

**Digital image repository.** A digital image repository is under development that will contain digital representations (including some 3D imaging) of all 40,000 artifacts in the museum’s collections.

**Museum web site.** Strong relations with the professional, academic, and educational community are maintained through the museum’s web site (www.spurlock.uiuc.edu) which allows exhibit designers to collaborate with curators on gallery creation, scholars to browse detailed records on the museum’s artifact holdings, the general public to follow the progress of construction, and teachers to base lesson plans around digital artifact representations.

Over the past two and a half years, we have been able to observe the effect of these new technologies upon the social infrastructure of the museum. The on-going technological innovations have had a direct impact on the way in which museum staff members interact internally among themselves as well as the way they interact with external users of the museum’s resources. Internally, the energies of the museum staff are mostly focused on: 1) the time consuming process of researching, completing, and updating artifact records in the database systems; 2) the task of sorting and selecting artifacts for display in the new facility; and 3) the maintenance of all information resources necessary for a successful move, including packing and shipping, registration, and conservation procedures. Externally, the system is used by: 1) academic researchers, such as university scholars using the museum’s collections data to facilitate their studies; 2) professionals, like the architects and exhibit designers designing the new Spurlock museum; and 3) educators, including the many K–12 teachers who regularly use the system to bring the museum’s resources and holdings into the classroom.
The rapid integration of advanced information technology into every aspect of museum procedures and practices has meant that in a very short period of time, the Spurlock has experienced substantial and significant policy and procedural modifications. In particular, these changes have affected the social dimension of the museum’s community. The role of information technology in museums is no longer confined to data entry in collections management (MacDonald, 1991; Metropolitan Museum, 1968) or information kiosks in exhibit halls (Hooper-Greenhill, 1995; Nash, 1992; Vergo, 1989). Instead, it extends throughout the entire museum environment, leaving the work practices of no member of the community unaffected. It is, in fact, the emerging social dimension of digital collaboration among and between the museum professionals and patrons at the Spurlock Museum that provides so valuable an opportunity for study.

The goal of this article is to examine the socio-technical challenges faced by the information professional working with the increasingly digital museum and in particular to explore the multi-faceted dimensions of CSCW and CMC as applied to museums, the potentials of which are only now beginning to be realized. Through a study of the interplay between the museum’s social and technological systems and the way in which they affect communication and collaboration among museum professionals and other affiliated scholars, we hope to advance the state of knowledge about scholarly collaboration and knowledge sharing through advanced information technology. In the process, we hope to prove the value of the museum as a topic of study for information scientists.

In the following sections we briefly examine some of the areas of study that museum informatics embraces. They include cooperative problem solving, collaborative help giving, history-enriched digital records, user profiling, computer-supported cooperative learning, and asynchronous collaboration among museum staff members and external scholars and professionals. Each will be illustrated by means of actual or imaginary scenarios and examples drawn from the Spurlock Museum. The principles of scenario-based design (Carroll, 1995) have allowed us to explore the theoretical potentials of new technologies while simultaneously raising a set of concrete issues that anticipate the social and administrative needs of the museum and guide the design of the technical systems necessary to support them.

Cooperative Problem Solving

The museum environment of yesterday was very different from the emerging computer-supported and highly-technical environment in museums today. At high-tech museums, dozens of employees may be working on integrated database systems at any given moment, each on their own particular project, each with their own particular problems. CSCW technologies offer museums the potential to increase efficiency, accuracy, and productivity (Twidale & Nichols, 1999; Hughes et al., 1994; Fisher & Reeves, 1992; Nardi & Miller, 1991; Grudin, 1989). By successfully incorporating these technologies, museum management systems will provide mechanisms which will enable museum staff members to collaborate simultaneously with their supervisors, other staff members, and external experts, solving problems as they occur rather than postponing them and perhaps forgetting them later. By providing better communication through improved collaboration techniques, museum staff members become aware that they are not working in a vacuum. Other users are continuously and contemporaneously logged in and any one of these other users could be of potential assistance.

As the following scenarios indicate, work at the Spurlock suggests how a museum’s existing information systems may be extended into a more collaborative environment for reporting, receiving, and giving help. Currently, when museum staff members encounter problems, or when they find themselves in a situation where they are not completely confident in their ability to proceed accurately, they can report this easily with a single button click; moreover, the system can automatically direct these requests for assistance to the appropriate experts. The addition of more advanced collaborative methodologies, such as video links between museum staff and external experts, will increase the system’s capacity to assist in cooperative problem solving.

Scenario. A museum staff member analyzing a particular piece of ancient pottery is uncertain whether to classify it as Sumerian or Akkadian. Existing records, paper or electronic, provide useless and/or conflicting data while there is no one else on the museum staff expert in this field. As a result of the digitization of the museum’s collections, the staff member can now transmit the pertinent electronic data records to scholars for examination, obviating the need for experts to travel to the museum itself in all but the most difficult cases. To facilitate this process, the Spurlock Museum has established relationships with scholars, both on and off the University of Illinois campus, who willingly participate in such solicited problem solving activities. In the past year, African experts have examined the entire Sub-Saharan African collection. Near Eastern experts have looked over our cuneiform tablets, and Ancient Egyptian scholars have perused the museum’s collection of ostraka with Demotic script writing. They have helped the staff to solve many difficult problems while using only the museum’s digital resources. In the future, we hope to build from these isolated incidents by implementing a more collaborative and more automatic method of electronically requesting the help of external experts. By maintaining lists of experts in different areas, the system will be able to direct the unanswered questions posed by museum staff members to appropriate experts through e-mail (and eventually video links), automatically attaching electronic copies of the pertinent records. These experts will then be able to examine the attached materials and answer the museum’s questions at their convenience.

Scenario. A student employee working at the museum com-
pleting artifact data records discovers that one particular record contains an inconsistency. The student is not qualified to deal with the problem and yet no supervisor is available to provide assistance. If proper cooperative problem solving technology is not integrated into the museum’s internal computer systems, such errors typically are left unresolved or, even worse, resolved incorrectly by a guess on the part of the student. Therefore, to prevent damage to the system’s records, we have implemented cooperative problem solving techniques into the Spurlock’s databases that allow students to bring problem records to the attention of the registrar, indicating the problem succinctly. The registrar can then examine these problems, decide upon the appropriate action, and enter the decision into the system. Eventually, the system will be able to recognize these types of problems as they occur and automatically notify the registrar of any similar errors.

We hope to extend the processes of cooperative problem solving illustrated above from the simple to the complex through the development of a new integrated system, with built-in collaborative aspects, covering all the museum’s standard operating procedures. In this way, we believe that the different elements of the museum’s internal workings, standard operating procedures, and other day-to-day functions will eventually be made to work together through information technology to facilitate better collaboration among the various museum roles: conservator, registrar, curator, etc. By designing the systems to be integrated from the very moment of their inception, the resulting Spurlock Integrated Museum Management Information System (SIMMIS) will put an end to the isolation of work commonly found in museum environments and encourage better collaboration among the museum staff members and a more professional museum environment as a whole.

Scenario. The museum acquires a new artifact which must be properly registered and entered into the appropriate database systems. The registrar creates a new record in the registration system; when the registration record is complete, SIMMIS is automatically informed of the existence of a new “incoming object.” SIMMIS then signals the curator, collections manager, assistant director, and other museum staff members that a new artifact exists and must be processed through the museum’s systems. Meanwhile, SIMMIS automatically runs several pre-scripted programs designed to warn museum employees of possible problems. For example, informed by the collections manager that this new acquisition may quite possibly be susceptible to infestation (by pests, mildew, mold, etc.), SIMMIS compares the artifact’s material type as entered in the database with the museum’s integrated conservation system in order to learn about all possible infestation problems. Having obtained this information, the system proceeds to call upon another linked database, the Integrated Pest Management System, to learn if any of the possible pests which could infest this artifact are currently active in the museum. If so, SIMMIS warns the museum’s conservator that the artifact needs to receive preventative treatment. Finally, SIMMIS informs the registrar that the new artifact is ready to be accessioned into the museum’s permanent collection. Following agreement from the Acquisitions Committee, the artifact is automatically accessioned by SIMMIS.

Collaborative Help Giving

As well as asynchronous cooperative problem solving of the kind dealt with above, synchronous collaborative help giving (Ackerman, 1994; Rouncefield et al., 1994; Kantor, 1993; Twidale & Nichols, 1997) will be a focus of immense importance for information professionals working with museums in the future. Users who are experiencing problems working with a system will be able to request and receive simultaneous help from technical support specialists or from more expert users (their supervisor, other staff members, or external experts) who are currently on-line. In such cases, the system must support direct communication between the user and the expert help-giver. Moreover, the expert must have the ability to observe what the user is currently doing; it will be especially useful when each can easily see what is on the other’s screen. Eventually, users will be able to share search sets and search histories collaboratively, especially useful when dealing with the results of complicated searches. We have not yet implemented such collaborative help giving in the Spurlock Museum; however, the following examples demonstrate the capabilities we plan to introduce in the near future.

Scenario. A museum staff member is completing a brief material analysis report for a particular artifact, which will later be used as a basis for a more detailed conservation report by the museum’s conservator. This particular staff member can recognize and report accurately on only the most obvious situations: breaks, cracks, missing pieces, etc. It takes extensive training for most employees to correctly identify a patina, distinguish between active or passive corrosion, or observe the subtleties of bronze disease. This situation can result in inaccurate material analysis reports that may temporarily mislead the conservator in formulating a later diagnosis. Currently, the Spurlock Museum avoids this problem by prohibiting anyone but those assistants personally trained by the conservator herself to enter material analysis reports. In the future, we hope to implement a collaborative video link between worker and conservator to provide assistance in difficult situations, possibly involving a video file from which illustrated examples of past material analyses can be retrieved for instructional purposes.

Scenario. A new user of the museum’s computer systems has a question about the technical workings of a program: how to perform a search, for example, or how to operate on more than one record at a time. There is no one around to provide assistance and he or she does not know how to proceed. Currently, the user in such a situation must rely on the integrated help system (a simple series of context-sensitive text files), which is non-collaborative and often does not fully address the
user’s questions. Consequently, users are forced to address their questions directly to the computer support specialist in person, a method that often results in wasted time for both parties, since the user generally cannot proceed until his or her question has been answered. In the future, we will have a new collaborative help system to allow users to remotely contact the computer support specialist for help and allow the specialist to examine the user’s screen from afar, assess the situation, and recommend action. Moreover, this collaborative help system can provide the functionality for the technical support specialist to record these responses as illustrated examples for future use by others in similar situations.

**History-Enriched Digital Records**

Once museums embark upon the path of integrating collaborative methodologies into their work environment, it becomes extremely important that a careful history be kept of every modification made to the artifact records by students, staff, or scholars. Referred to by Hill (1994) as “history-enriched,” this technique addresses the inherent advantage paper documents have over their digital counterparts—that they leave a paper trail while digital records usually have no such built-in redundancy. Unless explicitly specified in the program schematics, deleted or overwritten information in database records is unrecoverable. Moreover, usually no information exists to inform the curious as to “who changed what, when.” The Spurlock Museum took steps to address this need very early in the development cycle of the museum’s database system. The museum’s information systems now record each modification as it is made, producing a history that allows all changes made to the artifact system to be traced. The following scenarios demonstrate the importance and research potential of such a modification history for records.

**Scenario.** The registrar, performing quality control on student data entries, discovers that a record contains a bizarre error: the artifact’s cultural designation, which should have read “Prehistoric: Neolithic,” actually reads “Norwegian: Netherlands.” Without a modification history, even if system backups were available, it would be impossible to determine who changed the cultural designation, why, or when.

**Scenario.** A curator, browsing a list of Native American artifacts, discovers that one of the two records representing a pipe (one record for the bowl and one for the stem) is missing. An expanded search of the system locates the record and reveals that the inventory number for the pipe stem has been unexpectedly changed. The modification history allows the curator to discover who made this change, when, why, or under what authority.

**Scenario.** The conservator, working on a particular artifact, notices that although the database, as well as an older paper file, records the artifact’s “Material Type” as ivory, the real material is actually bone. When the conservator corrects the error in the record, the modification history ensures that anyone looking at this record in the future (perhaps with a mind to change it back to ivory) will know exactly who changed the Material Type field, and that the change was made with authority.

**User Profiling**

The primary problem faced by system users for any database system is that of knowing how to search effectively, finding all relevant data with minimum effort. To accomplish this efficiently, users often need to possess detailed knowledge of the database itself, especially of valid search terms. We cannot assume that all users of any system, especially novice users, will understand the inner workings of the database well enough to make intelligent use of “insider information” known only to the experienced system users. One way in which CSCW techniques can help such users is through the implementation of user profiles (Myaeng & Korfhage, 1990; Jones, 1988; Rich, 1979). Simply put, such a system recognizes and reacts to the fact that different users will have different needs.

For the Spurlock Museum, it has become clear from the varying needs of the users currently accessing the Artifact Collections Management System that effective use of the artifact database by large numbers of different users will necessitate the creation of extensive user profiles containing detailed information on the needs of each user. Different users will need different access to either all or some of the museum’s data. Just as in a real museum, visitors to the virtual museum’s electronic data repository will wish to encounter the available data differently; some will want to browse the system freely while others will want the equivalent of a personal guided tour (Bearman & Trant, 1998). Collaboration among teachers, students, museum staff, academics, and other professionals will be necessary to ensure that everyone gets the correct type of information needed. The best way of maintaining records on how different individuals make use of the same electronic data repository will be to build extensive profiles on the museum’s system users. The following scenarios provide three very different types of illustrations of how we plan to implement user profiling in the Spurlock’s data systems.

**Academic.** It is most likely that the typical academic will benefit from a very open interface with little guidance beyond help with basic searching. Academics are likely to prefer to generate their own contexts for artifact data, working with the raw data only. Nevertheless, building profiles of the specific interests of each academic user will enable the system to provide suitable guidance when needed. Academic users, for instance, may very well wish the system to assist them in building a new search based on their previous research results. Moreover, by carefully observing the needs of academic users, the system may be able to prompt them with previously unexplored yet potentially beneficial lines of research that they may not yet have considered.

**Professional.** The professional user is often interested only in very specific information relevant to certain specialized needs of which the system is more likely than not to
be unaware. Museum exhibit designers and building architects offer good examples. Exhibit designers may need to determine the relative sizes of Roman terracotta statues, for example, in order to prepare an attractive assortment for display in a particular case. It would be difficult for the system, merely by observation, to build an accurate profile of these users’ needs based on such arcane specifications. However, if the user were to provide the system with enough basic information about his or her own personal needs (e.g., “I’m looking for a group of statues that will match a particular color scheme”), then a profile could be developed which would help the professional user with future database searches.

Educational. Users with educational interests, such as teachers or students, will approach the system in yet another way. Few students will want to wade through one detailed record after another in search of relevant information, and few teachers will need only the specialized information desired by the professionals. Instead, the system, guided by a particular educational profile, will have to direct these users to relevant information in an environment that is user-friendly and requires a minimum of effort on the part of the teacher or student. A teacher, for example, who informs the system that his or her class is studying ancient Egypt would receive a list of topics relevant to Egyptian history with certain key representative artifacts as illustrations. The teacher could then choose to fine-tune these results, requesting greater detail and more artifact information on, for instance, the principles of mummification or the building of the pyramids. Once this information is stored in the teacher’s profile, students of this particular teacher who access the Artifact Collections Management System would find pre-scripted lesson plans, devised by the system based on the teacher’s specifications, that would walk them through the available resources, presenting artifact information that supplements their studies while suppressing information irrelevant to their needs.

**Computer-Supported Cooperative Learning**

Profiling, as indicated above, can be an important aspect of on-line educational outreach. The opportunities afforded by collaboration technologies for education (Fowell & Levy, 1995; McConnell, 1994) have not gone unnoticed by the museum community (Bearman & Trant, 1998). The Spurlock Museum is concerned to make the best possible educational use of its electronic museum archives. To this end, the museum is currently working with several K-12 schools to develop programs that focus explicitly on the needs of teachers and students. Teachers interested in having their pupils study African and Indonesian masks, for example, or unique musical instruments from around the world can request that online educational resources based on these interests be designed using the museum’s virtual artifacts. Thus, the museum’s education department can create programs aimed directly at the specific needs of these users.

The educational function of the Spurlock as a virtual museum is of particular interest because the only connection K-12 schools will have with our museum over the next two years, while the building is closed to the public, will be through the virtual environment. It is anticipated that over 5,000 students per year will access the system, searching for artifact data for class projects and other homework assignments. The Spurlock Museum plans to build on its existing record of working with the schools in the community to make artifact and museum data available on-line to students, as the following examples illustrate.

Example. Recently, the Spurlock Museum participated in an outreach program designed to determine whether students unable to travel to the museum itself could effectively make use of digital artifact data integrated with their current classroom activities. The sixth-grade class at a local middle school—frequent visitors to the museum—engaged in a problem-based learning exercise on ancient Egyptian history and archaeology. Presented with an alleged specimen of Egyptian cartonnage (the outer wrapping of an ancient Egyptian mummy), these students assumed the roles of museum professionals and researched the culture, beliefs, and practices of ancient Egypt, as well as the rules, regulations, and practices of museum professionals, in an attempt to determine the authenticity of their cartonnage specimen and its relevance to the museum’s ancient collections. For financial reasons, the school was unable to arrange a tour to the museum to allow the students access to the museum artifacts. Therefore, for the duration of this two-week project, approximately 80 sixth-graders communicated with the Spurlock Museum staff through e-mail and telephone conversations and accessed the museum’s database through a specially designed web page that presented comparative data on a series of representative cartonnage fragments owned by the museum. The project was so successful that it is being repeated this year and several other schools have requested our participation in similar projects.

Example. A group of high school students from Chicago used the museum’s on-line resources to develop their own instructional web pages in an integrated classroom activity linking history with chemistry. For one popular project, the students examined the world-famous frieze panels from the Parthenon Temple on the Athenian Acropolis. The Spurlock Museum owns one of the earliest, best preserved, and most complete plaster cast copies of the Parthenon Frieze. These casts were created before the original marble panels were removed from the Parthenon and taken to London by Lord Elgin, where they are currently on display in the British Museum. By comparing the condition of the original marbles with the Spurlock’s earlier plaster cast copies, the students were able to analyze the rate of chemical erosion and extent of physical vandalism in the frieze panels. Much of this work was done on-line and their results were made available over the Internet.

These particular projects demonstrate the valuable educational impact digitized museum resources can have on K–12 schools. Moreover, our experience shows that the
virtual museum format provides flexible and unique approaches to allowing different students different access to common electronic artifact data. From a common underlying repository of electronic artifact information, we can present data tailored to the needs and interests of different school children. While students in one grade level, for example, may prefer having access only to digital photographs of several choice artifacts in certain exciting topic areas, students at a higher grade level may very well desire access to detailed statistical information about hundreds of artifacts. Thus, the same database of virtual artifact data can be presented in different fashions to different students according to their educational needs.

**Computer-Mediated Communication**

A great portion of current CMC research is focused upon the creation of virtual communities and on the interaction among individuals within those communities (Kiesler, 1997; Jones, 1995). Current research in the field of CMC will have important consequences for information professionals working in museum environments. Successful collaboration among museum professionals will depend greatly on the will of the individual to take the initiative in creating, providing, disseminating, and sharing artifact information; moreover, all members of the virtual museum community must share the burden of producing digital artifact data resources equally. The application of results from CMC research into the role of the individual could prompt the virtual museum community to integrate every individual, whether museum professional or member of the general public, into the content creation process, thereby changing the user from a passive information recipient to an actively involved contributor. Eventually, collaboration among virtual museums around the world will become a social effort where every individual user of museum data plays a role as significant as any other individual or any institution.

**Example.** Recently, the Spurlock Museum encouraged academics and other scholars, regardless of location, to examine our collections on-line using the Virtual Spurlock Museum. From this, we have begun to observe how researchers react and interact with our museum professionals. For instance, specialists in African art examined the records for over 200 artifacts from sub-Saharan Africa over the Internet and sent detailed notes via e-mail for each and every artifact to the museum staff. These data were discussed with other African art experts, then integrated into the museum database systems, thereby automatically updating the Internet version. It is our hope that the presence of on-line comments from one particular expert will encourage other experts in that same area to submit their own comments and contributions to the museum’s artifact data resources.

**Example.** The task of deciding which artifacts will be placed on display, how they will be grouped, and where in the new museum they will be located is remarkably complex (Hooper-Greenhill, 1992). It is therefore very important that every individual working on the design of any new museum have access to up-to-date information about artifact arrangements. At the Spurlock Museum, as the curatorial staff members plan each gallery in the new museum, they specify in the Artifact Collections Management System exactly which artifacts will be displayed where in the new building. Then, when a virtual visitor accesses the online version of the new Spurlock Museum, the system links to the museum’s internal databases and automatically arranges artifacts on-line according to the available gallery schematics. In this fashion, accurate and timely information about where the various artifacts will be exhibited in the new facility is displayed dynamically to architects, exhibit designers, and interested members of the general public. Thus, years before the Spurlock actually opens to the public, interactive CMC technologies allow planners, designers, or the curious visitor to browse the plans for the new museum and virtually visualize artifact locations just as they will be in the new building.

**Example.** The Spurlock Museum holds many artifacts of a type similar to those in other museums. A series of Attic red-figure vases, all from the same archaeological site, may be divided among many different museums. As each of these museums digitize their collections information, museum professionals can take advantage of the potential offered by CMC technologies to link these disparate artifact resources together through web-based hypermedia. Eventually, researchers studying or visitors browsing collections data for any museum will be able to seamlessly merge from one museum’s holdings to another, following trails of similar or otherwise related artifacts.

The museum of the future, augmented by the techniques of CMC, will go a long way to eliminating the exasperating drawbacks of distance between museums, museum professionals, museum users, and related experts. A scholar from London examining over the Internet the rich collections of the Hermitage will be able to collaborate and interact, possibly via a 3D virtual display, with a fellow researcher from Los Angeles studying the same collection. Students, teachers, academics, scholars, and members of the general public, armed with only a computer and an Internet connection, will be able to browse the collections of every museum world-wide, including those artifacts which are not currently on display. Moreover, they will have immediate access to the accumulated knowledge of a wide variety of experts in every field from every country. Virtual visitors physically located thousands of miles apart will stand next to each other in 3D representations of archaeological sites so realistic as to be indistinguishable from the real thing, handle 3D virtual representations of priceless artifacts rendered with laser mapping accurate to the micron, exchange data files, multimedia presentations, and other information resources with the ease of a handshake, and collaborate in ways never before possible.
Conclusions

Throughout the course of this discussion, we have had the opportunity to reflect upon the role information technology can play in encouraging collaboration among museum professionals and museum users. We have seen many examples of the opportunities for study which museums afford information scientists, and it is our hope that such analyses will advance the state of knowledge in the field of information science about collaborative technologies in general.

Of course, difficulties will arise: integrating advanced information technology into the museum environment is nothing if not hard work; doing it successfully requires dedicated information professionals working side by side with museum professionals for long periods of time; extensive ethnographic evaluations will be necessary just to determine if the right steps are being taken; and every museum will represent a unique situation for study, because all museums’ needs and challenges are different. In spite of these difficulties, museums offer a vast, important, and virtually untapped environment for information professionals. They provide a starting point from which to examine the fundamental nature of collaborative work and interdisciplinary scholarship.

As museums around the world recognize the importance of integrating systems for collaborative and interdisciplinary research, studies of how information systems such as these are developed and used will prove useful not just to any one particular museum but to all institutions of cultural heritage and to all who study collaborative technologies and methodologies. Surely the next 50 years will see results and implications currently unimaginable spring forth from the work of museum researchers. At the Spurlock, we will continue to study our museum as a test case for the implementation of collaborative technologies and information science in the museum environment as we look forward to what the next 50 years will bring.

References


