Curating Collections Knowledge: Museums on the Cyberinfrastructure

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Introduction

As museums move more of their programming into digital space, effective program delivery will be enabled by an integrated information management strategy, that views collections documentation as an asset: a key, collection-related resource that forms an integral part of the value and appreciation of collections themselves and supports the ability of the museum to fulfill its mission. Investments in interpretation will be leveraged and re-used, as part of the institution's knowledge of its collection rather than created and cast-off when the temporal context for their initial use passes. Museum professionals, in all parts of the institution, contribute to this developing corporate memory, building institutional knowledge as part of the cultural trust of the museum. Providing public access to this knowledge, through exhibition, publication and reference, and conserving it for future generations, is emerging as a key ethical responsibility of museum work. Curating collections knowledge requires an acknowledgment of a multiplicity of information sources, inside and outside the institution, each of which contributes to a developing understanding.

Ensuring that collections are enlivened by context requires an active approach to museum documentation. Rather than passively recording information about a work of art, artifact or specimen, museums are challenged to acknowledge information sources beyond the museum, and change their practices to incorporate new perspectives into both interpretation and documentation. Positioning museum objects in a networked information space as part of the "cyberinfrastructure" also positions them in a social space, and invites their creative and recombinant use. As communities respond to collections, so must museums respond to communities, ensuring that a diversity of voices provide context in the future as well as the present. The richer web of context provided by multiple interpretations adds to the value of

cultural objects, enriching their position within collections and the position of collections within societies.

Museum collections are relevant when they are used. As museums take their place in the cyberinfrastructure as a trusted source of specific kinds of information and experience, they also assume additional responsibilities to maintain that position, and support those who use their collections. In a distributed knowledge society, use will be initiated from outside as well as inside the institution. The creations that result from that use, whether scholarly or personal, will be expressed in numerous, unanticipated forms. This new documentary heritage should itself become a part of the curatorial trust; recording it an active challenge.

Creating Collections Information

Museums have collections at their core. As defined by the International Council of Museums (ICOM) (2004), they "preserve, interpret, and promote aspects of the natural and culture inheritance of humanity" through an active stewardship of artifacts that represent cultural or scientific history and knowledge. That stewardship includes physical care of the collections, through proper storage, management and conservation.

Managing information about collections has emerged in the past two decades as an activity as important as managing those collections. While initially somewhat controversial (Sledge, 1988), this responsibility is now reflected in the ICOM Code of Ethics, the document of the "museum professional" that "sets minimum standards of conduct and performance" (International Council of Museums (ICOM), 2004, p. Introduction). The growing awareness of the curatorial importance of collections documentation may reflect a more critical consciousness of the nature of collecting itself. The encyclopedic representative museum of Franz Boas (1907) has given way to a more situational understanding of the history of museums and their collections.

> Collecting, as a core museum practice, is complex and largely beyond scientific rationalism. It is an act of authorship and connoisseurship. It is a physical interpretation

> of a set of circumstances or body of potential data. The object is thus placed within a collection according to an individual's beliefs. (Knell, 2003, p. 137)

This Post-Structuralist awareness of the importance of context in the assertion of meaning is embodied through conscious expressions of the significance of an object at the time it enters the collection in documents such as Acquisition Reports, or an Acquisitions Justification (Buck & Gilmore, 1998) and through repeated re-documentation whenever a work is included in an exhibition, published in a book or article, or hung in a gallery, or otherwise engaged in the service of the museum's educational or research mission. Comprehensive collections documentation practices record all these representations of the significance of an artifact.

Conceptualizing collections information in a central rather than supporting role may also have its roots in the developing understanding of the museum as a social institution, of significance in the maintenance of the "civil society." As museums reorient their institutional focus towards society and community, communication and engagement gain priority: "It is important for museums actively to use information to create understanding or to help their audiences exploit effectively the information resources in their self-directed quest for knowledge" (MacDonald & Alsford, 1991, p. 306).

A tension has emerged between the knowledge of collections that the museum creates, and knowledge that is created external to the institution, in an individually- or socially- defined context. MacDonald and Alsford (1991) posit that museums are involved in the "generation," "perpetuation," "organization," and "dissemination," of knowledge. Active interpretation is assumed, as museums are responsible for "both making information readily available and ensuring that its users have the ability to comprehend it" (MacDonald & Alsford, 1991, p. 307). But they don't see museums as receptors of knowledge that is created elsewhere. Works in the museum's collection are not seen as part of a broader story that involves others as well as museum professionals in its telling.

Authenticity and quality may set museums apart in the information landscape (Trant, 1998), but static assertions of value stand in conflict with the emerging conversational metaphors of

information use in the museum context (Dietz, Besser, Borda, Geber, & Lévy, 2004). With individuals making their own meaning—for example, curating their own exhibitions—what happens to the role of the museum? It no longer has the luxury of being the sole arbiter of an object's interpretation. Rather than being challenged, and feeling a competitive need to assert authority in interpretation, museums could make a significant contribution through the longer-term management of the knowledge about objects in their collections, knowledge with a provenance as varied as the objects themselves. Just as museums acknowledge that theirs is not an "Unassailable Voice" (Walsh, 1997) they must accept responsibility for curating the context of their collections as told in many voices.

Collecting Collections Information, Historically

Collections Inventories

The role of basic collections documentation in responsible stewardship was established in large-scale inventory projects that provide the foundation for museum computing activity. With an emphasis on fiduciary responsibility, these projects emerged in a main-frame computing environment, and dominated most of the first and second generations of museum computing. ((Jones-Garmil & Anderson, 1997). Motivated by the challenge to be accountable to governing bodies and the sense that "if you don't know where it is, you might as well not have it" museum inventory projects laid the groundwork for technology in museums by producing databases that summarized holdings, and recorded their vital statistics (acquisition, location, physical description, as outlined, in for example, the early CHIN Humanities Data Dictionary, maintained to this day as the foundation for Artefacts Canada; see (Canadian Heritage Information Network (CHIN), [2005]).

Collections Management Processes

The next generation of collections documentation systems were designed to support collections management processes. Information was conceived as deriving from or supporting aspects of museum operations. A desire for internal efficiencies led to calls for integrated systems that

removed redundancy and assigned appropriate controls on authorship. Functionally-based museum data standards, like SPECTRUM (the most recent version of which is McKenna & Patsatzi, 2005) illustrate the role different elements of museum information play in conducting the business of the museum. Conceptually, these systems reflect the view that most museum documentation is created for internal use. Hence, it is tied to the functions and offices that are responsible for its birth. As an example, Paul Marty's (1999) discussion of the Spurlock Integrated Museum Management Information System shows how museums began to see collections information systems as tools to support the functioning of the museum. Collections information was no longer just a thing to be kept, but a thing to be used by museums themselves.

Beyond Accountability and Process: Collections Knowledge Made Public

Functionally derived conceptual models formed the basis of collections documentation systems and provided the motivations for their use. But networked access to collections information enables many unanticipated uses, most of which take place outside the museum. External communities of users were originally "supported" through access to collections information in the form of on-line databases, tools museum professionals hoped would lessen the burden of "reference" by enabling users to see "all of the collection, all of the time."

A desire to open-up museum collections and enable their use motivated participants in the Museum Educational Site Licensing Project (MESL), one of the first large scale museum information sharing projects. MESL was designed to explore the possibilities and limitations of museum collection information as an educational resource. Content from seven collections was made available to seven universities to mount on their campus networks and use as they saw fit. (For a summary of findings, see (McClung & Stephenson, 1998; Stephenson & McClung, 1998; Trant, 1995, 1996b, 1996c)b. For project rationale, see(Trant, 1995, 1996a, 1996b, 1996c). While our initial sense that museum content would be worthwhile was reaffirmed, participating in MESL taught us a great deal about the nature of museum collections information and its potential use. This was the first time that museum collections documentation had been exchanged in any volume, and seeing it outside the local systems within which it was created and managed had an impact. New application contexts surfaced many presuppositions about meaning

in museum documentation. While the museums tended to think about objects, academics thought about themes; museums valued technical descriptions of the physicality of a work, teachers wanted more about the context of its creation and use. The language and perspectives of the two communities didn't mesh. For individual museum objects to be useful in an educational environment, it seemed that had to be wrapped with interpretation: included in a lecture, referenced on a course Web page, analyzed in an assignment. For the users on MESL campuses, individual museum works were a point of departure, not the end in themselves that museum professionals thought they were.

MESL surfaced a disjunction between accessibility and usability. We might have been able to facilitate discovery of works in museum collections, but we relied entirely on users to create meaning from them. The on-line catalog was like open storage; collections were visible, but not necessarily comprehensible. The metadata that was supplied with MESL objects was rudimentary, based on assumptions about what label copy should be provided in a gallery. The MESL project was conceived before the World Wide Web, and implemented in the early days of Web-accessible resources, when simply populating the Web with content and then enabling others to find it were worthy goals. We lost sight of the fact that discovery was the beginning of the journey, not the end; that by sharing museum resources, we wanted to facilitate research and learning, not just show people our stuff. Much of the learning in MESL was in the museums as they watched how works from the collections were used in teaching and research. Seeing that perspective was invaluable.

Little of the investment that museums make in interpretation or contextualization that comes from the curatorial care of the object was visible in the documentation shared with university users in the MESL project. While much digital content is created as a by-product of museum activities, including exhibition development, publication, and education program development, this isn't considered part of the core documentation of museum works, and is rarely recorded systematically or shared broadly. This is not just a problem of text: visual materials are often created as part of conservation (such as views under alternative lights sources, or views of a work under restoration) provide more detail about an object, installation photographs of exhibitions (such as the amazing glass plate negatives at the Art Institute of Chicago showing the

galleries when the museum opened) document its presentation and interpretation, audio files created for a tour of an exhibition provide curatorial insight and analysis. But this contextual detail is often dispersed throughout the museum, and is not accessible to a researcher enquiring about the work itself, either in person or on-line, a failure of museum process that doesn't reflect the interests of the public in the many facets of an object and its interpretation.

An Example: Documenting Collections Care (Conservation)

Documenting the physical state of an artifact is a *sine qua non* of any intervention or treatment, whether preservation or conservation. Whenever a conservator intervenes in the physical state of an artifact its informational content is altered. Documenting that intervention is an ethical imperative. But often, that knowledge is kept inside, the province of the department, not even the museum as a whole. The scientific tools conservators have at their disposal can also aid in the interpretation of objects. Non-interventionist techniques, such as examination under Ultra-Violet light or with X-radiography illustrate characteristics not visible to the naked eye. These can assist in the authentication of an artifact, and in the understanding of its physical make-up and process of creation.

As more and more conservation documentation becomes available in digital form the museum bears a responsibility to make these additional analytical sources available to scholars, and to share the process and excitement of discovery with a broader public. Conservation has proven to be one of the more fascinating of the "behind-the-scenes" museum processes. Allowing "views" on the treatment of painting, for example through its public cleaning or treatment, illustrates the active nature of collections care, and helps demystify the role of the museum in the preservation of culture (Minneapolis Institute of Arts, 2004; Sayre, 2000).

Expanding Our Concept of Collections Documentation

Embracing the reality that museum collections are multi-faceted and that our knowledge about them grows and changes over time challenges conventional approaches to museum documentation. Static standards and cataloging strategies that focus on recording information

must give way to extensible information architectures that are flexible enough to accommodate incremental growth and change. Multiple perspectives, and multiple—at times conflicting—opinions reflect the richness of culture and the development of knowledge. Museum information in a public space should provide a record of this conversation, and encourage its continuance.

The AMICO Library™ developed as a way for members of the Art Museum Image Consortium (AMICO) to enable educational access to multimedia documentation of their collections. It was conceived with an understanding that what is known about museum objects grows and changes over time. Its model was a growing, changing knowledge-base rather than a static permanent collection catalog. AMICO members added to the public view of their collections in The AMICO Library when resources became available internally, or as was the case with audio files from Antenna Audio, when the consortium negotiated access to a body of material. The AMICO Data Specification (Art Museum Image Consortium (AMICO), 1996, 2000) outlined a modular record format that allowed for a core catalog record to be augmented by any number of related visual, textual or multi-media sources (Figure 1).

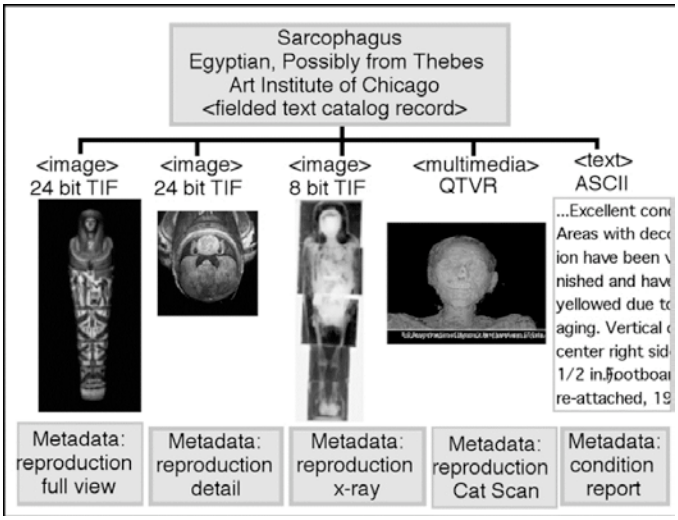

Figure 1. Each work in The AMICO Library is documented by a catalog record, an image file, and an image metadata record. Additional media files may also be present. Each of these has a metadata record. © Art Museum Image Consortium / Art Institute of Chicago

User feedback about The AMICO Library reaffirmed the value of contextual information, often as a 'point of departure' for future enquiry. Students presented their own interpretations and contextualizations of works, based on an active reading and their own research (For an example of student work see Alperstein, 2003).

Cultural Contexts for Collections

Site-specific and process-based Contemporary works of art highlight the failure of traditional documentation practices. These works, such as Antony Gormley's *Field* may exist in both museum space and public space. Their creation may be collective, their perception varied and dependent upon where a viewer encounters the work. As an example, Figure 2Figure 3show versions of the *Field* installed in two different contexts, one speaking to the viewer in a neutral space, the other to the viewer in an art-historical context. The difference is palpable.

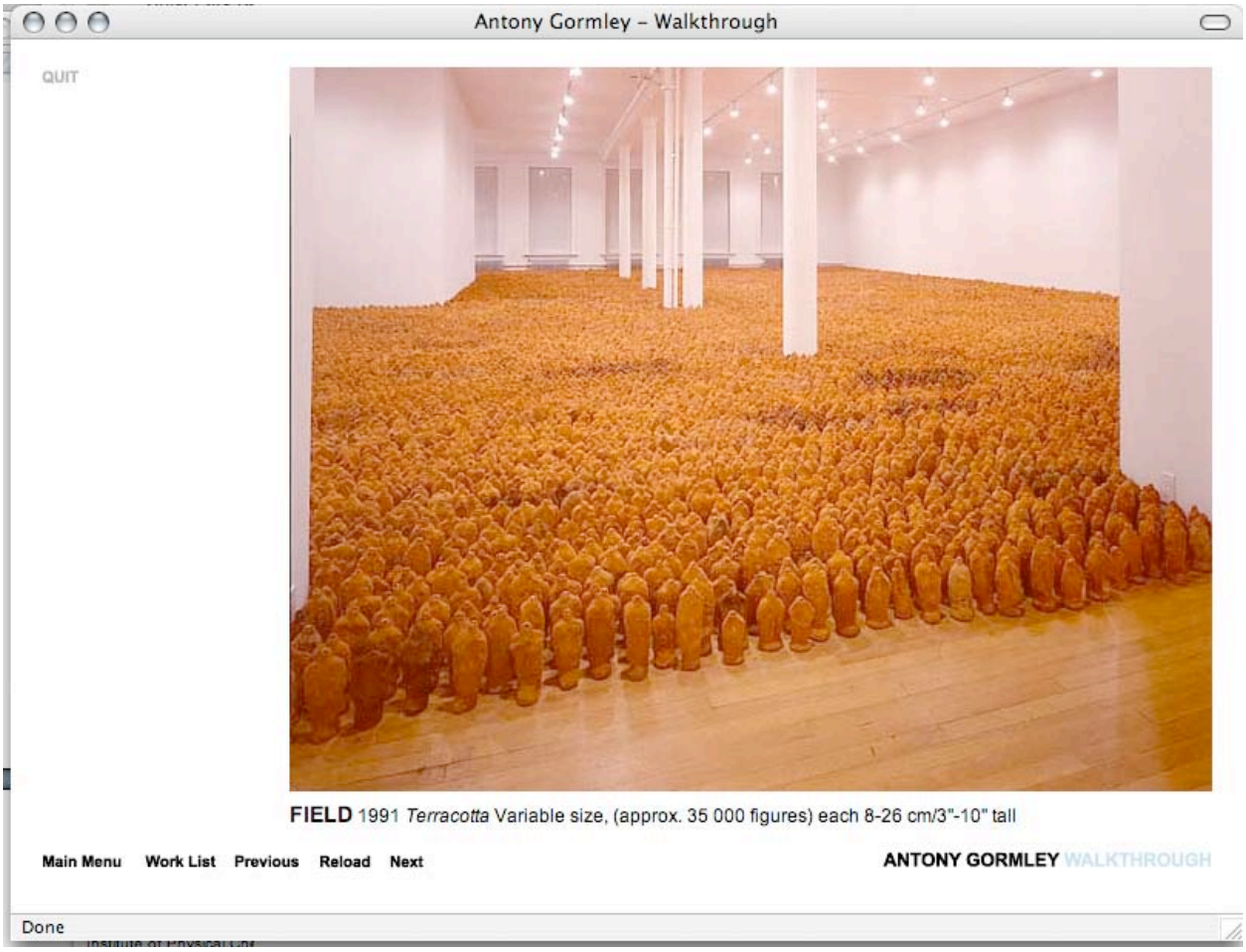

Figure 2. Antony Gormley, American Field, Terracotta, Variable size, (approx. 35 000 figures) each 8-26 cm/3"-10" tall, Installation photograph (http://www.antonygormley.com/walkthrough/239x2_american_field.htm)

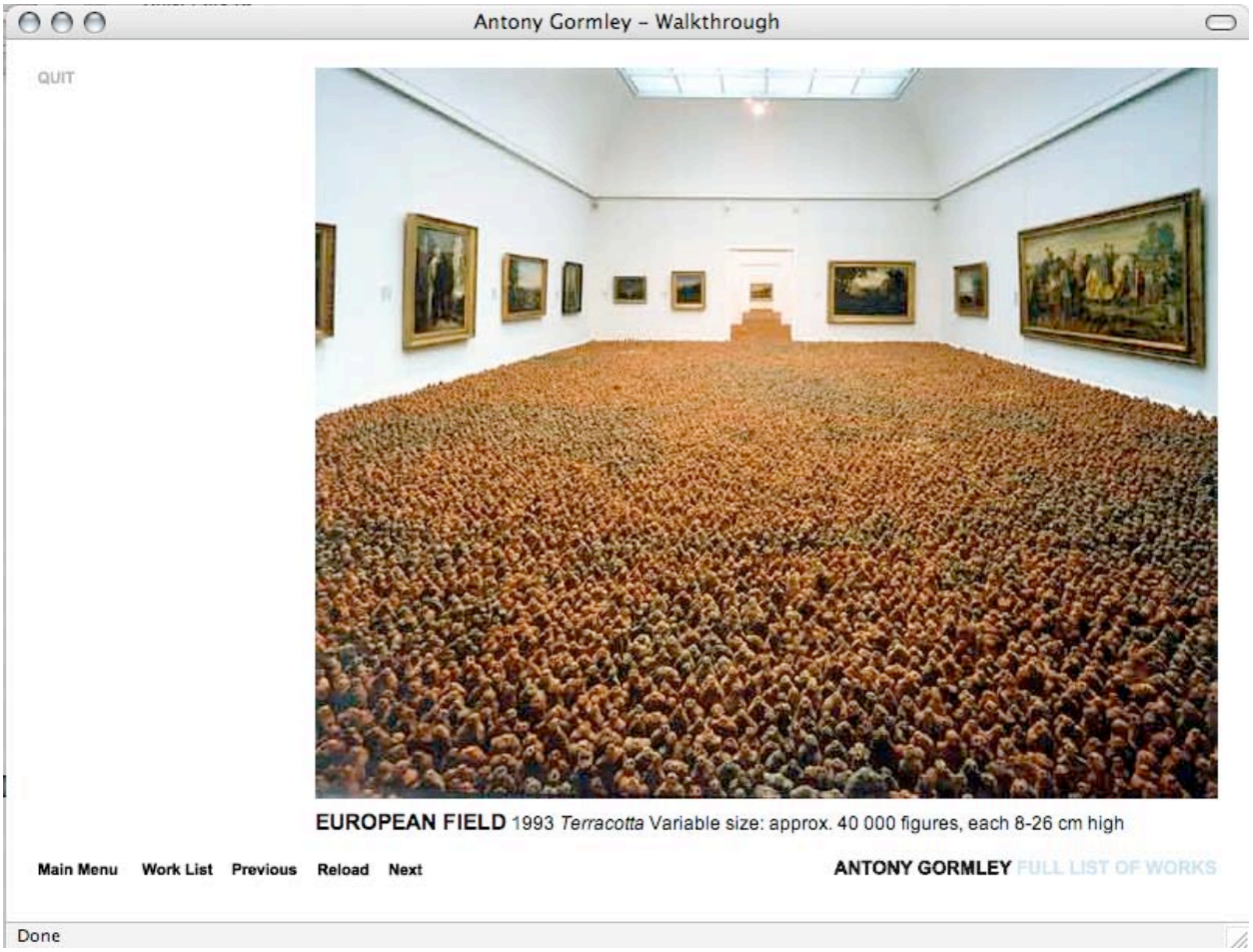

Figure 3. Antony Gormley, European Field, Terracotta Variable size: approx. 40 000 figures, each 8-26 cm high, installation photography (http://www.antonygormley.com/full_list/283x5_european_field.htm)

Installation photographs (such as Figure 4, Figure 5, Figure 6, Figure 7) add an additional dimension. They document the creation of the work in a particular space, providing an essential perspective on variable works, particularly helpful when they are reinstalled in a different gallery context.

Figure 4. Antony Gormley, European Field, Terracotta Variable size: approx. 40 000 figures, each 8-26 cm high installation photograph, 1994 (http://www.antonygormley.com/photo_essays/field_pe03.htm)

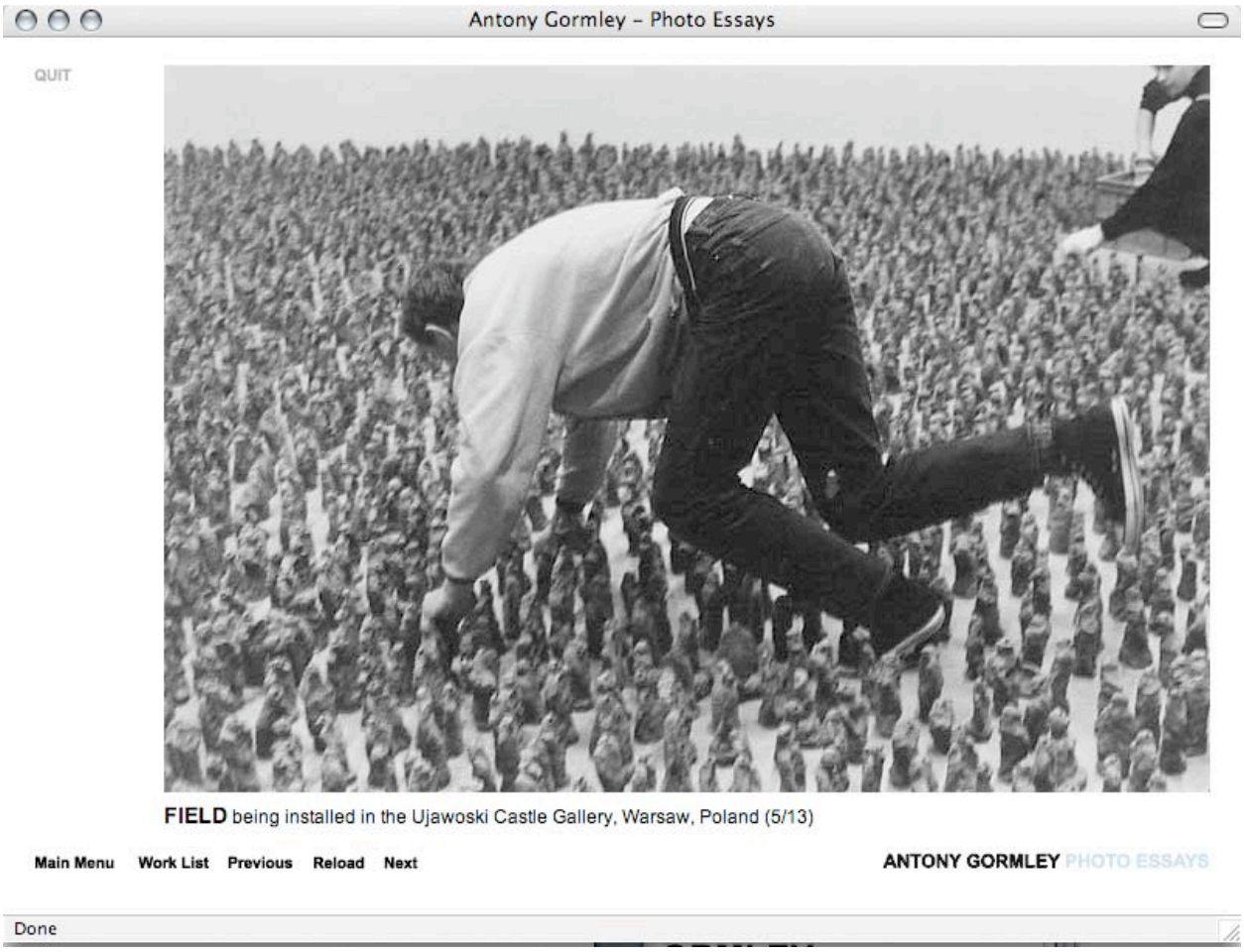

Figure 5. Antony Gormley, European Field, Terracotta Variable size: approx. 40 000 figures, each 8-26 cm high installation photograph, 1994 (http://www.antonygormley.com/photo_essays/field_pe05.htm)

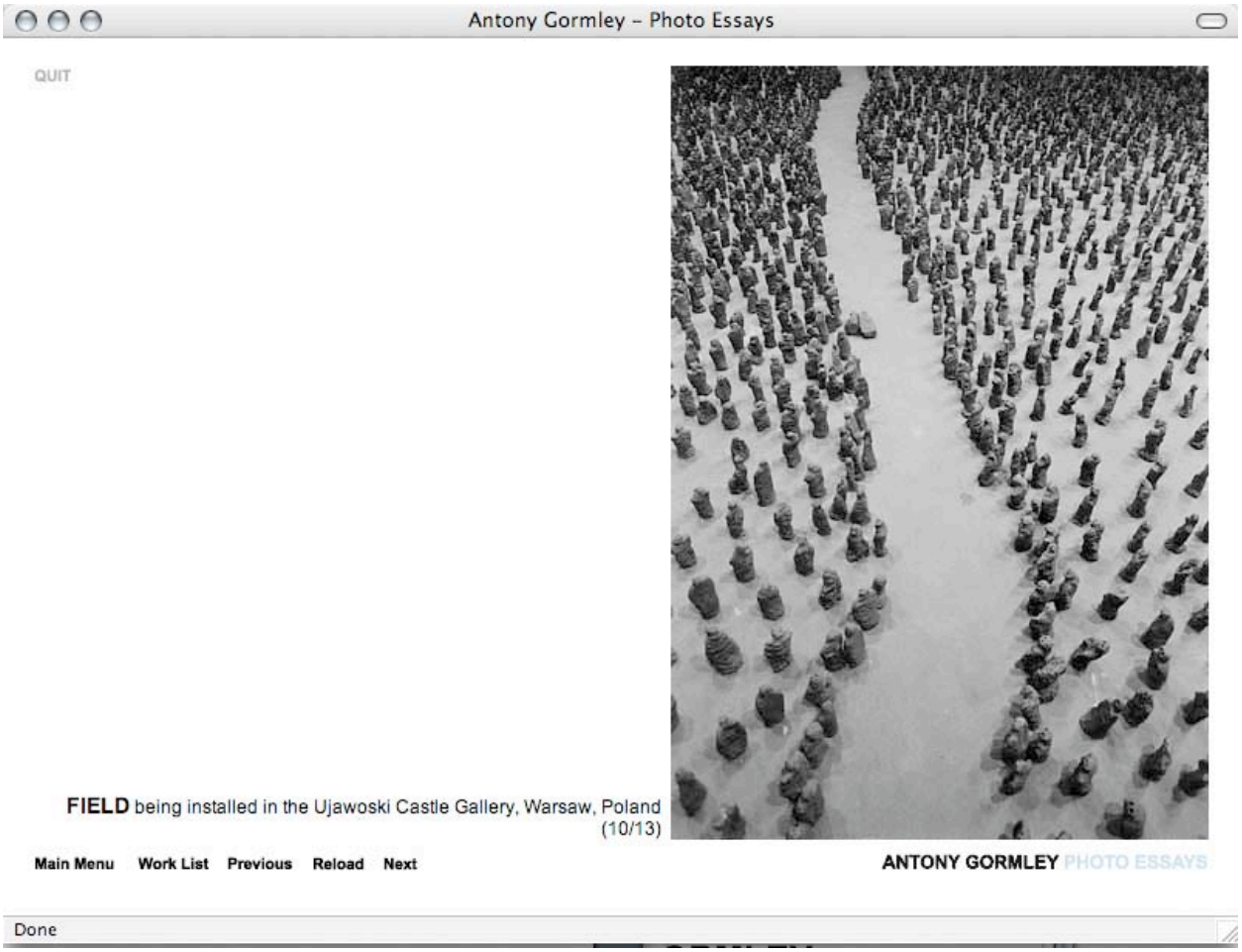

Figure 6. Antony Gormley, European Field, Terracotta Variable size: approx. 40 000 figures, each 8-26 cm high installation photograph, 1994 (http://www.antonygormley.com/photo_essays/field_pe10.htm)

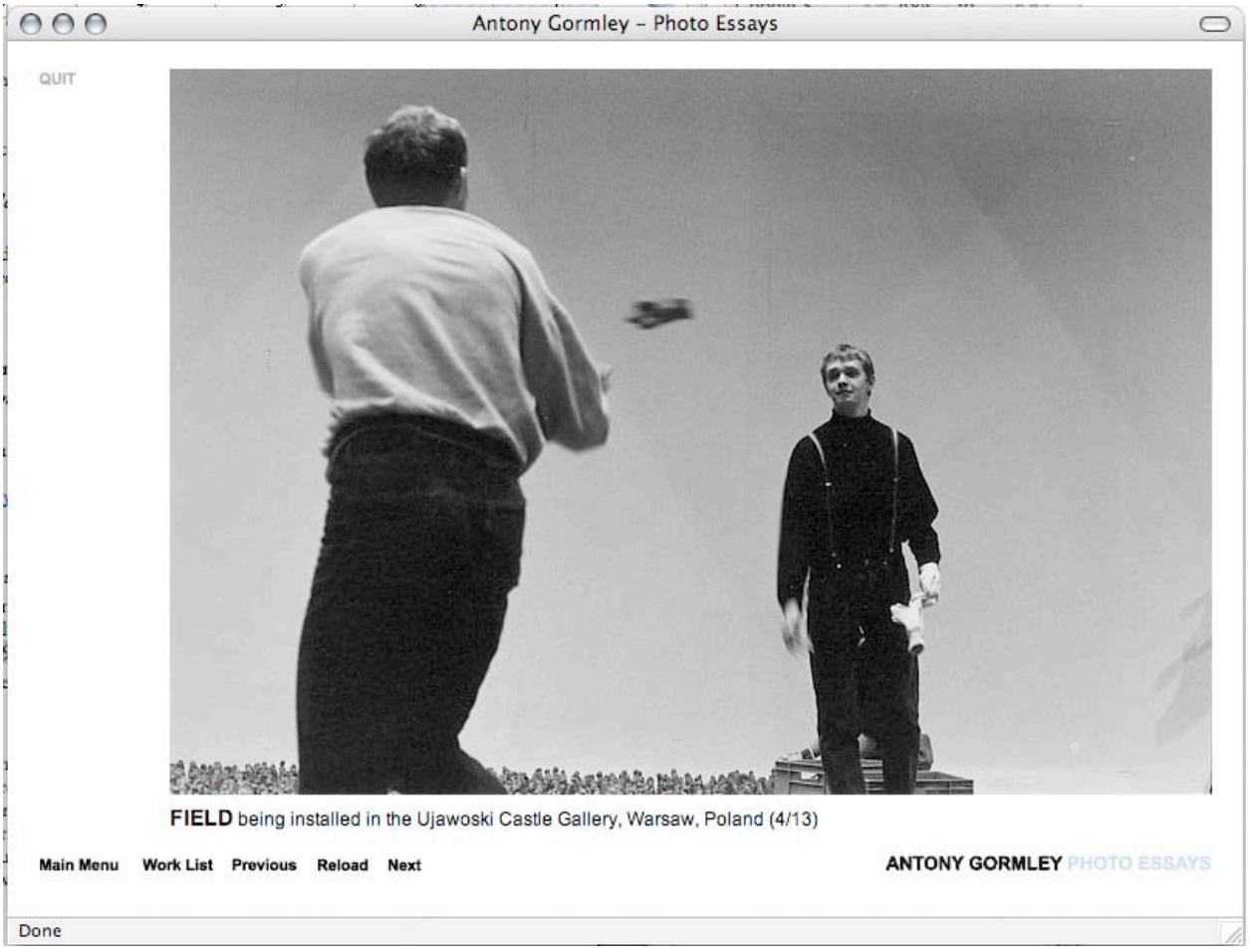

Figure 7. Antony Gormley, European Field, Terracotta Variable size: approx. 40 000 figures, each 8-26 cm high installation photograph, 1994 (http://www.antonygormley.com/photo_essays/field_pe04.htm)

But often a full understanding requires knowledge of a work's creation; knowing that the *Asian Field*—another iteration of this work comprising 190,000 figures—was made by a group of 350 people in village of Xiangshan in a period of 5 days moves the figures from anonymous to personal. Hearing the artist speak adds an additional element of meaning. Gormley has said,

> Field is part of a global project in which the earth of a particular region is given form by a group of local people of all ages. It is made of clay, energised by fire, sensitised by touch and made conscious by being given eyes. (British Council, 2003)

The work exists inside and outside the museum, in the mind of the artist and the eye of the viewer, in the participants who created it, and the teams that install it. In each context, different aspects of meaning resonate. Understanding the work requires appreciating those many perspectives. Documenting them requires new strategies and approaches (Rinehart, 1999, [2004]).

Museum Objects Used in Many Different Ways

As *Field* shows, there are many approaches to collections documentation. What is recorded, however, is often colored by the museum's perception of the importance of the work.

> In the museum, the real object is capable of being an archival resource, a site of meaning making, a component in an educational programme, primary data in a research project and so on. But museums tend to select different objects for different jobs; a tattered item of costume might present a researcher with critical clues to an aspect of textile history but will never form an exhibit …" (Knell, 2003, p. 139)

If what is valued is the assertion of the institution, then other aspects of interpretation are neglected, and therefore negated. But "Never" in a museum, is likely to be "Now" in a research project.

An Example: Education and Interpretation

The provision of some context as scaffolding for self-directed learning about museum collections is a basis of technology-enabled interpretive strategy (Dierking & John H. Falk, 1998). The STEM project at the Science Museum, London consciously "encourage[d] students and teachers to create their own perspectives, projects and educational resources related to the Science Museum, and to make them available on the Web by publishing them on their own servers" (Jackson, Bazley, Patten, & King, 1998). The resources of the Science Museum, London were presented as "raw material" to support a quest for understanding. But that understanding is not

part of the Science Museum. The project architecture maintains the arms-length association between the museum and its third-party collaborators. The Science Museum has consciously chosen to point to resources rather than integrate the material into content for which the Science Museum takes "responsibility."

Information Architectures to Support Recombinant Use

Museums must take responsibility for the contextual construction of knowledge of and about collections objects that occurs as they are used in museum programs. Educational programs have led the way in using electronic sources to bridge the gap between work of art and viewer. For example, at the San Francisco Museum of Modern Art the *Making Sense of Modern Art* series (Samis, 1999; Samis & Wise, 2000) has provided a framework for the inclusion of artists' voices, one of a number of multiple points of view that are necessary to engage different types of audiences, and support different kinds of interpretation (MacDonald & Alsford, 1991, p. 309) and successful, "visitor-centered" experiences (Frey, 1998).

Some would argue that to keep everything that the museum produces would,

> Give permanence to acts which only exist temporarily in the museum. The more liberal interpretation of educators and exhibitors exists only for the period of engagement with an audience, while the objects themselves exist for the most part in the world of the specialist, where more pedantic forces of integrity and authenticity predominate and, ideally, associate an arcane dataset with the object. (Knell, 2003, p. 139)

These words speak too harshly of the educator, but illustrate the hierarchy of value tacitly affirmed by many scholars. The retention of digital documentation made for many purposes may, to this point of view, be a compromise that the museum should not make for fear of sacrificing institutional goals of authority. But it's one that does a disservice to the active role of the museum in society and its long-term place as a cultural repository.

Extending knowledge of museum collections is one of the key aspects of museums' responsible stewardship. Traditionally, museums have focused on curatorial research on collections and the reporting of that research in exhibitions and publications. As part of a cyberinfrastructure, however, museums can become the site of research carried on by others, and the repository of results that relate to works in their collection. Re-use, and re-interpretation are essential by-products of the public distribution of collections information. Museums can both encourage the creation of new knowledge about their collections and play an active role in recording it.

The Challenge of Re-Use

If museum collections information is going to have a longer life, and is going to become, in itself, a source for someone else's work, then the recording of the context of creation of that information becomes important. When that content is made explicit, for example through metadata about digital documents, or the recording of authorship in on-line catalog entries, the institution is "released" from its burden of authority: the source becomes responsible, rather than the institution as a whole. The museum is playing valuable role, but it is as conduit, not arbiter.

Could this be seen as an abrogation of responsibility? Not if the institution is enabled to record more information through this strategy. The challenge in providing on-line information about collections is often that of "getting it right," or overcoming the fear of "getting it wrong." If on-line provision of access to museum information is perceived as a traditional "publishing" function, then the quality of the data may not be up to "museum-standards" (one reason cited for not participating in CHIN's National Humanities Databases (Decima Research, 2004, p. 6)4]). Explicit sourcing of data might free the institution from the self-imposed requirements that impede the flow of information.

A conscious expression of how much research as been conducted on an object is also helps internal or external readers of museum documentation. The seductive apparent veracity of a database record can be counteracted with an explicit indication of the "hardness" of a piece of data. At the Canadian Centre for Architecture (CCA) it was possible to overcome some curatorial reluctance to computerized documentation by including an explicit indication of

"Catalog Status" (Trant, 1991, 1993). While this data element is not included in the records subsequently made available on-line, the existence of varying levels of research, and the changing nature of documentation is referenced in the preface to this searchable on-line database (Canadian Centre for Architecture (CCA), 2004). Explicitly or implicitly communicating functional context also helps the reader. For example, at the Fine Arts Museums of San Francisco, presenting the volunteer-assigned keywords in the Thinker in alphabetical order re-enforced their role as access-points rather than scholarly interpretation (Futernick, 2003).

If institutions are to manage content created for different audiences and delivered in different contexts, it needs to be sourced. There may be different standards of accountability in each of these areas that, if not explicitly referenced, could impede future interpretations. Without this, the perceived "equality" of a database might unintentionally privilege an interpretation, sliding subconsciously back into the "Unassailable Voice" of the audio guide (Walsh, 1997).

But in a context of multiple venues for user/collection interaction and multi-channel communication museums simply can't to control all that is said about their collections. Not trying to opens up the museum to possibility that expertise exists elsewhere, and that the museum could benefit from the knowledge of many communities (Marty, 1999). It also positions the museum to be able to participate in dialogues that are situated in users' space as much as in museum-space.

Multiple Audiences with Different Needs

Museums have acknowledged that there are many ways to communicate their message.

> From the recognition that cultural heritage does not lie only in material objects but also in intangibles—such as behaviours, beliefs, activities and processes—has come the appreciation that diverse media are required to capture and communicate the many facets of culture. (Macdonald & Alsford, 1995, p. 132)

A diversity of media provides an opportunity to present multiple voices. But interactions with cultural heritage, both on-line and on-site occur in different contexts. Models of those interactions can help museums structure the content that could support user engagement, and encourage the recording of insights that derive from user interactions with collections. In their exploration of interactive storytelling and user-driven narrative in Belgium, Pletinckx, Silberman, and Callebaut (2003, p. 226) note the "different modalities by which people visit historical sites: coach tours with guide; small unguided groups of friends or family; and as individuals. Each visitor group type has different requirements" (p. 226), equally valid. To tailor information-based interactions in such diverse circumstances, museums must develop re-usable nuggets of information: "irreducible units of information from which the interactive stories are built" (Pletinckx, Silberman, & Callebaut, 2003, p. 226). This may require a disaggregation of traditional record-keeping strategies.

The ILEX system prototyped the delivery of customized content based on user interests, with dynamic hypertext (Hitzeman, Mellish, & Oberlander, 1997). Positing an interaction based on a personal tour through a gallery with a curator, the conversational model explored here included adaptations that were sensitive to the user's context, acknowledging levels of interest, expertise and previous experience. Interpretive content was delivered in an adaptive manner, driven by the communicative goals of the curator. No provision was made for dialog or user contribution of content.

Further explorations of interactive storytelling, in projects such as Telebuddy (Hoffmann & Goebel, 2003) attempt to personalize the museum experience and make it conversational, in this case by encouraging interaction between visitors on-site at the museums, and those who might be on-line through the use of a fuzzy intermediary. A similar philosophy underlies the development of the Musée Transfer Suisse. Jaggi and Kraemer (2004) aimed,

> To implement a new type of knowledge transfer from museums by digital storytelling, drawing on the often untold experience of life which museum collections hold. Virtual Transfer allows places and stories to be explored interactively in multimedia form, through a selection of objects and personalised modes of address. (p. 5)

In all of these scenarios, the active construction of knowledge within a social group is enabled, but the museum itself is [willfully?] excluded from the conversation.

Exhibitions and Public Engagement/Collections Information Context

Positioning museums as active players in an inter-connected cyberinfrastructure requires a conscious awareness of where and how museum collections information (and contextual information about collections) is created and used. In scholarly terms, we need to recognize the role of the museum in the research process, and appreciate and support where and how users encounter collections (in surrogate or in situ) and what information needs they have in these contexts (Bearman & Trant, 1998). In public terms, we need to engage visitors on-line and on-site in the active interpretation and appreciation of the works in our care. Respect for our multiple audiences requires supporting the adaptive reuse of collections content in multiple contexts.

The maintenance of museum documentation for future use is a more complex question than preserving it for future access. For information about collections to have meaning, it must be available in the context of those collections, supporting their understanding and enabling their interpretation. So museums bring a different, operational requirement to what has been called "digital preservation." The records of a museum collections are rarely held in its archive; if they exist at all, museum archives are repositories for documents of institutional history and governance. Museum collections records remain "active records" as long as the object is in the collection. Information about objects in the collection must be readily accessible, and malleable, so that it can form the basis for a future re-interpretation.

So the strategies of preserving electronic records in museums will need to be different from those that focused on the stability of information. Yakel (2004) posits a model for the long term management of digital assets in libraries and special collections (and she says museums though they are never discussed specifically). The "unit-based digital repository," the "institutional digital repository" and the "trusted digital repository" all assume a neutral "third party"

relationship between the custodian and the information being managed. The activity posited is to maintain the digital materials, not to use the information they contain. It is grounded in the theory that archives maintain evidentiary records of transactions in a content-neutral context.

Where museums differ from libraries and archives is in their active, programmatic use of the content in their collections, for interpretation, exhibition and education. Museums are themselves one of the primary users of their collections documentation. Just as content is produced by museum business process, knowledge of collections informs those processes. This internal focus has shaped our understanding of museum documentation and our construction of systems to support it. It has mitigated against inter-institutional information-sharing; we're first trying to understand how to move information across museum departments before we move it outside the organization.

Our documentation strategies must become active, not passive. In order to make collections meaningful we need to record and represent the context created in the full range of institutional activities: programs, exhibitions, interpretation as well as collections care. We need to acknowledge that curation of knowledge adds meaning and value to collections. In the context of exploding volumes of information, when the value of filters and authoritative sources is increasing, museums are well positioned to help satisfy an increasing demand for knowledge (Hutter, 1998). We need to "go public" with the full range of resources at our disposal, rather than hoarding our knowledge for future internal use.

Museums as Part of the Cyberinfrastructure

Recent discussions about the nature of scholarship in the context of ubiquitous, networked information have drawn attention to on the nature of the infrastructure required to support new forms of cultural creation and expression, and new understandings and interpretations of the past, present and future. John Unsworth, in the context of the American Council of Learned Societies, Commission on Cyberinfrastructure for the Humanities and Social Sciences (American Council of Learned Societies, 2004) has defined cyberinfrastructure as

> More than just hardware and software, more than bigger computer boxes and faster wires connecting them. The term describes new "research environments" in which disciplinary experts, in interdisciplinary teams, supported by specialized computational support staff, have global, instantaneous access to enormous computing resources. (Unsworth, 2004)

This community of users assumes that the full content of museums will be one of those many resources, easily searchable, readily accessible, suitable for use and reuse, analysis and representation.

What Role Might Museums Play There?

As part of the cyberinfrastructure, museums are custodians of information for future generations of humanities scholars. They are curators of knowledge as well as curators of collections. But to play this role they need to be connected, organized, available, engaged and of relevance: Connected to each other, and to the many communities that they serve; organized, so that the content in their care remains connected to related content in other institutions; available to a wide range of users in many different contexts; engaged with the active interpretation, and documentation of their collections and with the users of those collections; and relevant because they are responsive to user needs and interests.

Authenticity in collections, and authenticity in documentation, is one of the key values that museums bring to an information environment. It is in providing the authentic re-presentation of artifacts that museum professionals of the future may find their most challenging and rewarding roles.

Much museum documentation is at best the raw material for scholarship; managing it is presenting primary sources in a more accessible way. On-line cultural heritage documentation (in environments like the Web) offers the opportunity for museums to reach beyond their traditional local-service area, to provide service to a dispersed community of specialists and enthusiasts. Museums can move from only serving the "qualified researcher" (with an introduction) wishing

to consult items from the collection in storage, to providing access to basic documentation to a world-wide audience.

What is gained in access, however is sacrificed in mediation. It's not possible for museums to provide an interpretive wrapper around every work in every collection. Instead, other mediators are called upon to make meaning—teachers provide context for students, scholars provide new interpretations for their peers. The cyberinfrastructure provides a vehicle for others to make meaning about culture. Museums must be plugged into these grids, or they risk the well-being of their collections; they risk being bypassed by their core communities, simply out of ignorance.

Appreciating the inter-related role of collections and collections documentation reveals the importance of maintaining documentation of collections close to collections themselves. Only then is there a dialogue between the primary and secondary source, between the collections object and its growing, changing interpretation. To separate collections documentation from collections is to rob the artifacts of their meaning and their context, leaving them isolated, aesthetic objects or specimens, physically preserved and intellectually denuded.

Reconceptualizing the role of museum documentation as active curation of collections knowledge created inside and outside the institution enables museums to fulfill a broader role in society. Relevance is often defined in terms of "listening to our audiences"; responding to needs as "giving them what they want." But museums professionals need to hear what those outside the institution know, and record it, so that the knowledge is preserved to provide meaning to the collection. The museum information curator's selection, arrangement and care (curate 2 v., 2004) has as its object the cultural memory of the institution, a legacy to be guarded along with the physical preservation of objects themselves.

The vitality of collections derives from their use, interpretation and reinterpretation. Museums can enable the creation of contemporary "sampled" culture through the re-use of the past (Federman, 2004, p. 11). The symbiotic relationship between scholar and collecting institution is strengthened when scholar contributes to institution's knowledge of its collections as well as benefiting from their use. By enabling easy access to the past, museums can support the creations

of an ephemeral present, remixed, and re-presented as cultural meaning is brought forward, reinterpreted, and reinvigorated.

The full implications of those assumptions are implicit in this scenario of use, drawn from *Cyberinfrastructure for Education and Learning for the future (CLEF) a Vision and Research Agenda:*

> [A group of students are collecting information for an assignment.] When her digital agent tells Manuela that her friend Beth is near the town museum, she asks Beth to check out what's available. The students share the information they are collecting with each other and with other students back in school. The next day, the whole class interacts with these data to collate, represent and analyse them. They compare their data to those collected by students in other schools and in previous years. Manuela sends some of her results of the geological survey back to the museum where it is incorporated into the exhibition. Several weeks later, a proud Manuela takes her parents back to the museum to see the results of her work. (Computing Research Association, 2005)

What museum is ready to support Manuela? To have collections and the knowledge they represent readily available for re-use? To be open to the incorporation of that content into the work of others? To be able to incorporate the knowledge of others into their own interpretive [exhibition] and historical [documentary] space? To be a site of visible pride in the accomplishments of learning?

This scenario illustrates the unique cultural role museums play as a bridge: between formal and informal learning; between education and research; and between institutions and the public at large. Museums can be a positive, inter-generational public space that reflects community, on-line and off. But museums consistently sell themselves short when they don't share all they know. They ask users to take their assertion of the value of their collections on faith, rather than building on a moment of interest to transfer knowledge of the cultural context or significance of a work.

Impact on Museum Professionals

Professionalization is often a process of setting apart, as the unique contributions of a group of people with identifiable skills are identified, acknowledged and distinguished from the roles of others. But within the context of the cyberinfrastructure, museum professionals face a challenge of integration. Museum content has a vital role to play in the development of new social, educational and research spaces. But museum professionals can only ensure that cultural institutions are relevant by changing their stance about the nature of their role: it is possible to contribute authenticity without demanding authority. Authenticity is a value; its maintenance an imperative in collections of lasting value. But demanding authority is an act, often of arrogance, that denies the contributions of others to the development of knowledge.

Within the rapidly developing environment of social computing, communities of practice are forming that could contribute significantly to the development of museums. Historically we have acknowledged that specialists (and awkwardly often enthusiasts) have a better understanding of aspects of museum collections than the professionals charged with their care. There's an opportunity for this knowledge to converge with that of the museum. Museums can build on their experiments in integrating information into physical spaces to integrate the information spaces of museums and their many communities of users.

By offering the content of their collections in both mediated and unmediated manners, museums can meet their educational missions, while proffering the potential for richer kinds of encounters. By ceding control over interpretation, museums can enable a richer kind of interaction, an authentic experience for some users that builds on their specific contexts and knowledge. The challenge for museums is to create the contexts within which these encounters can take place, and to ensure that that newly created context becomes part of the cultural legacy of the institution, a knowledge to be curated as it adds value to the collections. Curation is as much for the future as the past. It is a reinterpretation and recontextualization of knowledge as well as a preservation of artifacts. Curating collections knowledge ensures that the many facets of collections are carried forward, and made available as the scaffolding on which new

understandings are created. Curating knowledge of collections becomes a part of the cultural trust of museums.

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