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PERSPECTIVE

Digital Museums and Diverse Cultural Knowledges: Moving Past the Traditional Catalog

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Web 2.0 technologies have introduced increasingly participatory practices to creating content, and museums are becoming interested in the potentials of "Museum 2.0" for reaching and engaging with new audiences. As technological advances are opening up the ways in which museums share information about the objects in their collections, the means by which museums create, handle, process, and transmit knowledge has become more transparent. For this to be done effectively, however, some underlying contradictions must be resolved between museum practices, which privilege the account of the "expert," and distributed social technology practices, whose strengths lie in allowing for many, sometimes contradictory, perspectives. This article presents a theoretical position and framework for the adaptation of Web 2.0 technologies within the traditional work of the museum, in ways that support the generation and representation of knowledge in, by, and for diverse communities. We then expand on this theoretical perspective by discussing several case studies of exploratory work in this area, and close the article by presenting a few tactical, bottom-up initiatives that museums and distributed communities can take to facilitate the diffusion of this new conceptual framework. Though the subject of this article is online museums, the issues are relevant to all online collections, in particular portals, online public access catalogs (OPAC), and content management systems.

Keywords Web 2.0, ontologies, local knowledge, digital museums, museum documentation

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For many years, museum professionals have acknowledged that the discourses and descriptions they present around objects do not fully account for the diversity of possible perspectives. Critics have pointed out that the role of the museum as an "authority" has led to the establishment of a single, or at least dominant, curatorial voice that determines the persistent meaning around museum objects (Macdonald, 1998). Museum practitioners have sought to open up their accountability and engagement with the public whose cultures they have historically represented by strategically including indigenous communities in activities such as exhibition design, interpretive panels, presentations, and talks (Peers & Brown, 2003). However, these solutions are largely temporary, limited to the life cycle of the rotating exhibition or event and outside of the museum's permanent information record—its catalog. Indicative of this asymmetric approach, museums

have enthusiastically pushed forward the standardization of their catalog metadata, borrowing from the example of libraries (Chenhall, 1978; Bower & Roberts, 2001; ICOM, 2006), allegedly in order to facilitate sharing and to expand public access. As museums have engaged in digitizing their records, this process of standardization has resulted in the narrowing of the categories that are being used in the process of museum documentation and in the resulting museum catalogs (Blackaby, 1988; Getty Art History Information Program, 1994). In effect, the informational core of the museum, namely, the representations and classifications of objects in the museum's catalog, is being stripped of the multiple meanings and ontological perspectives in this rush to digitize and enable "universal access" and interoperability between museums. Within these new technologies of digitization and "access" also lie opportunities to rethink the ways that institutions represent, classify, and describe, particularly as Web 2.0 methods of tagging, blogging, and social computing are increasingly being adopted in museums (Furner et al., 2006). This issue applies not only to museums, but to all kinds of institutions with online collections—archives, libraries, heritage centers, and the like. We argue that as these collecting institutions increasingly participate in the online environment, and consider the possibilities offered by Web 2.0 innovations, they must fundamentally shift the principles upon which they have built their catalogs. Rather than focusing on standardized and universal descriptions, museums and other institutions should instead look to the successes of social computing to represent multiple, often conflicting, perspectives, upon which the many technologies known collectively as Web 2.0 are built (Boast et al., 2007; Furner et al., 2006; Tapscott & Williams, 2007). Further, we argue that this extension of Web 2.0 multiplicity should not be limited to public interfaces or temporary exhibitional displays, but should be extended into the heart of the catalog.

The first section of this article presents our argument, building on museum studies and knowledge institution theory and discussing museum methods in light of relevant theories of knowledge and its representation. These methods of knowledge representation are foundational not only to museums, but to the practices of all collecting institutions including most online archive systems such as online public access catalogs (OPAC), content management systems, and portals. The second half of the article presents several notable examples of innovative projects that blend the philosophy of participatory, social technologies into systems that present information about digital collections. We find these examples useful because they show a range of possibilities for how the theory discussed in the first section can be put into practice in local contexts. This article makes a contribution by providing an important theoretical basis by which museums, and other information institutions, can realign their documentation and organization practices in light of technological innovations. Our objective is to encourage collections-holding institutions to reconsider the nature of the catalog, and how new technologies allow different sorts of engagement with local descriptions and vernacular accounts from diverse expert communities—an engagement that would successfully address the well-established criticism that institutionalized collections present but a narrow and static view of important cultural heritage objects.

THE PROMISE OF THE NEW MUSEOLOGY

Museums have been going through major changes over the past 30 years, beginning with a major reorientation at the end of the 1970s, which at the time was termed "the new museology." While this term is no longer popular, we consider it important to look at the motivations behind this paradigm. Some argue that the movement arose from the International Council of Museums' redefinition of museums in 1974 (ICOM, n.d.), others from De Varine's (1978) definition, and others from Peter Vergo's edited volume of the same name (1989). At the core of the new museology is an assumption that the museum is neither a center of research nor primarily a collecting institution, but it is in fact an educational instrument. The goal of the new museology was, and largely still is, the transformation of social practices through the transformation of the museum from a collection of singular expert accounts to a site of different educational engagements.

At the core of the body of research that has been undertaken under the rubric of "contemporary museum studies" is a particular set of assumptions about the social and political nature of the ways in which knowledge is produced and reproduced in the museum context. A summary of this set of assumptions could be as follows:

1. Reality, truth, and knowledge are all fundamentally relative. The nature of reality is dependent on the perspective from which it is observed; logical consistency with other positively evaluated statements is not a necessary condition of the truth of a statement about reality; and different, potentially contradictory sets of true beliefs count as knowledge for different communities of knowers.
2. The procedures and practices by which an individual comes to know something are inherently social, in that (a) knowledge is generated discursively through participation in conversation with others, and (b) an individual's willingness to treat a given statement as knowledge depends primarily on the extent to which the individual believes the statement is treated as knowledge by the members of a trusted community.

3. Each of the conversations through which an individual generates and shares knowledge is a contribution to multiple, simultaneous, ongoing discourses that are, in turn, dynamically situated in multiple overlapping networks of relationships.
4. Every sequence of knowledge-claims takes the form of a narrative or story by which the nature of the objects of the knowledge-claims may be understood, explained, or accounted for. Such narratives are endless, unstable, and context dependent (i.e., they are chronologically, geographically, and culturally specific).
5. Knowledge is knowledge of (or about) objects; objects are things of (or about) which knowers know. (In this sense, knowledge can be seen as embodied within objects). A necessary condition for the generation of knowledge is engagement with objects. Engagement involves more than perception and cognition; rather, it involves purposiveness and interpretation.

However, despite this apparent alliance with a core set of insights from science and technology studies (STS) (Macdonald & Fyfe, 1996; Macdonald, 1998), museum practice, and much of museum studies, museum practitioners have interpreted these principles through the lens of the educator, and from the "new museology" paradigm. Despite these arguments in favor of a pluralistic approach to interpretation and presentation, the intellectual control over the informational core of the museum, its catalog of objects, has largely remained in the hands of the museum and its staff of elite experts. The extension of the new museology into museums, over the past 30 years, has introduced a regime where the educator and the marketing manager control the voices of the museum's presentations for a relatively narrow, selective view of "public" interest. The maintenance of the museum as academic gatekeeper has been replaced by the museum as educational gatekeeper, focusing increasingly on simply supporting current educational programs and standardizing documentation of collections only to support their role as educational illustrations.

This change is clearly represented in the dichotomy between the diversity of educational performances in museums (talks, guides, school tours, and exhibitions) and museum documentation, the methodical and universalist recording of information about the museum's objects. While the museum allows many voices to be expressed from different experts, authorities, and even the public, rarely do these voices pass beyond a local and temporary educational performance, and rarely are they recorded in an enduring way in the museum's documentation systems. Students are allowed to voice their understandings and interpretations about a work of art during the school tour with a museum educator. They are allowed to reproduce the works in clay or paint, perhaps even briefly be displayed. Indigenous voices often find their way onto labels and interpretive panels for a temporary exhibition, or disagreements among several experts may form the theme of an exhibition. Increasingly, those communities that an exhibition represents are invited as collaborators or advisers. Though all of these practices are to be applauded, and even required by museums, they all suffer from further removing the museum from the contexts of expert practice and removing the objects from a role beyond the illustrative. Diverse stories are collected and disseminated, but rarely do they engage directly with the objects' biographies and use. This is largely because, in the new museology, objects themselves are not at the forefront of the knowledge sharing process. Instead, it is the act of expressing educational accounts that has become the focus.

Recently, a renewed motivation to reconnect research and practice has been identified by Macdonald (2006) as a core component of a "second wave" of "the new museology" that has emerged since the year 2000. Some of the operations that have been examined from new perspectives and, at least partially, transformed as a result of such analysis are collections development, exhibit display, conservation, and museum education. Curatorial staff, for example, have long appreciated that by selecting only some kinds of objects for preservation and public display museums recognize, represent, and affirm the identities of only some communities, and that decisions of the kinds taken in the acquisition process—decisions both about what should be selected and about who should be involved in selection—should continuously be reviewed and questioned.

We wish to make it clear here that in arguing for a return to expertise and the role of collections as dynamic research objects we are not arguing for a return to the 19th- or even early 20th-century model. The criteria for expertise and research were far too narrow, as has been appropriately critiqued by museum studies scholars and professionals. We agree that there must be a vastly extended definition of expertise to include all those people and communities who have a deep and engaged understanding of the objects in question. The worldviews that are associated with the objects, given their travel from indigenous sites of origin and movement within and through scientific, archaeological, and curatorial communities, all present relevant insight into the means by which such objects can be classified, retrieved, and described. Further, we believe that research must be extended to include engagements and uses beyond those of academics to include multiple communities and multiple forms of research. Many anthropology and archaeology museums, particularly in Oceania and North America, are providing specialist spaces for source community engagement with collections, in addition to academic research spaces

(Mountain, 2008). Nor are we saying that members of the general public, those who come to an object or collection for the first time, have nothing substantial to contribute. Through the increasing application of Museum 2.0, such public spaces are becoming common online. However, they remain spaces of definitive representation, with aspects of individual classification and comment. What we are arguing for here is that objects should be more than illustrations, more than brief educational diagrams, more than standardized edifying images. A return to the object, and the infusion of new models of representation and outreach, can enable this to occur, particularly in the context of emerging digital museums.

THE STRAITJACKET OF TRADITIONAL DOCUMENTATION PRACTICE

Recent theorizing has provided an understanding of museum objects not as simple types or exemplars of larger categorical ideals, but as citations, i.e., entities around which, and through which, a multitude of accounts have circulated (Smith, 1996; Clifford, 1997; Sefa Dei et al., 2000). Conversely, in practice, the systematizing of the classification and interpretation of objects is still seen as fundamental to the institutional mission of the museum, as it has been for more than a century (Lane Fox, 1874; Murray, 1904; Chenhall, 1978; Orna & Pettitt, 1980; Bower & Roberts, 2001). From the rise of the public museum, in the early to mid 19th century, museums have increasingly become gatekeepers for the accounts and interpretations of objects. Through classification, control of expert accounts, publication, collecting practices, and even exhibition, museums have become the filter through which such accounts can, or cannot, associate themselves with the object. These traditional practices are now so deeply embedded in daily museum work that they are rarely questioned, and museums' professional accreditation is even based on their ability to perform these systematic activities.

Two of the most important kinds of decision taken by object record creators in today's museums are (i) the choice of a metadata schema—i.e., the selection of the categories, facets, metadata elements, attribute-types, or fields (e.g., "Object Type," "Date of Creation," "Dimensions") that collectively make up a record—and (ii) the choice of vocabularies—i.e., the selection of the term sets or value sets from which are drawn the values that are assigned to given fields in given records (CHIN, 2007). The history of the collaborative development of international standards for museum documentation—both for record structures and for vocabularies of terms, such as the "preferred" or "authorized" names, not only of individual people, places, periods, and works, but also of kinds of object and other abstract concepts—began in the 1960s (Parry, 2007). The current state of the art (Baca et al., 2007) is perhaps best represented by the following standards:

- Cataloging Cultural Objects (CCO), a set of cataloging rules produced by the Visual Resources Association (VRA) in the United States (http://vraweb.org/ccoweb/cco/index.html).
- SPECTRUM, a manual of collections-management procedures produced by The Collections Trust (formerly the Museum Documentation Association) in the United Kingdom (http://www.mda.org.uk/stand).
- The Conceptual Reference Model (CRM), a data model produced by the International Council of Museums' International Committee for Documentation (ICOM-CIDOC) (http://cidoc.ics.forth.gr).
- The CHIN Data Dictionaries, a set of vocabularies produced by the Canadian Heritage Information Network (http://www.chin.gc.ca/English/Collections_Management/index.html).
- The Categories for the Description of Works of Art (CDWA), a metadata schema produced by the Getty Research Institute (http://www.getty.edu/research/conducting_research/standards/cdwa).
- the Art and Architecture Thesaurus (AAT), a controlled vocabulary also produced by the Getty Museum (http://www.getty.edu/research/conducting_research/vocabularies/aat).

These standards, and others, are built into the collections management systems (CMSs; not to be confused with content management systems, though both have deep similarities) that museums use to organize and disseminate their collections information, and that have proliferated over the past 20 years—MODES, Willoughby's MIMSY, and Gallery Systems' TMS and EmbARK, to name but a few. All this standardization is in the name of access—the goal is interoperability between vast and diverse collections. Through standardized fields of information, controlled descriptions, and even terminological thesauri, the core instrumental meanings of museum objects are being distilled in the name of universal access.

In a museum world populated by massive, heterogeneous collections of unique largely nontextual objects, traditions of consortia forming and data sharing among institutions are weak, and the history of standards development is relatively short compared with the experience of libraries. Like museums, libraries are institutions whose staff members have long been concerned to provide effective public access to information about cultural resources, and many of the standards that systematize library practices today date back to the 19th century (Chan, 2007; Miksa, 1998). Librarians' recognition of the problems and challenges associated with standardization is almost as long-standing as their enthusiasm for the perceived

benefits, which include (i) the technical interoperability of retrieval systems that provide access to multiple collections of records, (ii) the ability for different institutions to share their data, (iii) a reduced learning curve for users encountering a particular system for the first time, (iv) an opportunity for library users to learn from experts in domains with which users may not be familiar, and (v) a provisionally effective solution to the fundamental "vocabulary problem" that always precludes perfect retrieval—a problem expressible as the empirical fact that different people often use different words to refer to the same thing (and, just as intractably, different people often use the same word to refer to different things). On the flip side, the challenges of standardization include (i) the effective silencing of the voices of those many who cannot or do not contribute to the "expert consensus"—those who may well not have been invited to contribute, or who have no idea that contribution is possible, and (ii) the reproduction of the biases, prejudices, and other assumptions held by those few who do contribute (Olson, 2002; Furner, 2007b; Bowker & Star, 1999).

Challenges of these kinds are as real for museum documentation as they are for library and information system cataloging and classification. The approach toward museum information described earlier conflicts with the participatory spirit of social computing that motivates this article's perspective and contribution. Most existing examples of social computing in museums, some of which are discussed next, are notable because of their distance from the core information systems in museums. Whether local or generic blogs, tagging, and podcasts, all these systems are on the periphery of the museums' core systems that control the descriptions and accounts of object collections. An indigenous community member can access podcasts of a curator's description of the object, but he or she cannot directly and meaningfully add to how that object is described or classified. The principles and practices with social computing and participatory media speak to the growing role of the digital museum as a public institution. This shift focuses on the core of how museums organize, record, classify, perform, and present their collections. To allow the museum to perform as a contact zone (Clifford, 1997), for the object to act as a citation of active knowledge, as an actor in those knowledgeable practices, a reorganization of museum practice is required, both online and off.

KNOWLEDGE REPRESENTATION IN MUSEUMS

Our assertion is that knowledge is knowledge of practices; it is knowing how to adjust to a specific social-material setting (Smith, 1996; Brown & Duguid, 2000; Garfinkel, 1967, 2000; Suchman 2002, 2006; Turnbull, 1991, 2003). Knowledge is performance: It is embodied in practice, not something we have, nor even something we can name consistently. Moreover, a necessary condition for the generation of knowledge is engagement with objects, but engagement involves more than perception and cognition; it involves purposiveness and interpretation—intentionality. Earlier in this article, we argued that museums are using two modes of representation, (i) the educational, which gives primacy to the individual interpretation, and (ii) the standard classificatory, which gives primacy to the universal. A conflict exists between the two approaches. The problem with the systematic classificatory approach of museums is that it denies, fundamentally, the role of an object as citation. It gives primacy to the definitive account upon which all other secondary accounts are placed, while the educational, or interpretive, engages with the classificatory only as a mode of access to objects as illustrations. While museums have become increasingly open to grassroots access and the ability of social computing to provide for greater audience participation, an important step of reconsidering object citation and representation still has yet to be fully taken. This article takes a preliminary step in this direction.

As institutions endowed with presenting the tangible and intangible cultural heritage of diverse populations, museums are confounded by the challenge of representation—in short, all of the many decisions that go into the selection of objects, their classifications, arrangements, accounts, and the development of mechanisms by which the objects can circulate and interact with diverse stakeholder communities (such as indigenous groups, scholars, museum curators, students, etc.). These decisions generate a significant dilemma that museums must consider in relation to their objects. Theoretical and applied scholarship in museum studies has brought to light, more than ever, the paradoxical relationship between the object as specimen, and the object as embedded (Hildreth & Kimble, 2002; Latour, 1987). That is, "object as specimen" shows how an object can associatively point to a larger body of knowledge, yet "object as embedded" clarifies that knowledge itself is constituted in its local groundedness. How is the museum then to express the representativeness of the object around these different layers of knowledge, while still allowing the object to be presented in a way that is relevant to a specific stakeholder community?

We argue that to answer this question museum representation must involve a consideration of the diverse ontological frameworks associated with different expert communities who have an informed experience and interaction with the object (Boast et al., 2007). Archaeologists, cultural preservationists, curators, and, critically, indigenous peoples must all interact around the object, and influence its selection, acquisition, classification, and presentation. We use the term *expert communities* to speak

to the communities that have a lasting, historical, and informed relationship with the cultural object. In this regard, though the museum has privileged only the first three of these types of experts, it too must consider the power of the indigenous community from whom its objects originated. Indigenous peoples hold contextual, experiential, and historical knowledge around objects that are often absent from catalog entries. These knowledges are often passed on through stories, intergenerational communication, and contextualization of cultural objects by considering present uses. This allows the museum to perform as a "contact zone" space that fosters incommensurability and dialogue (Pratt, 1992; Clifford, 1997). Moreover, it allows the object to serve as an active expression of a set of traditions, allowing those traditions to directly speak about the object.

> The fact is that individuals within a given community attach different descriptions to shared phenomena, and they need to continue to describe the world differently. These different descriptions do not arise, only, from different languages and different semantics, but arise from different, often incommensurable, knowledge practices. As each of us is a member of different communities, we each describe and classify our world using different concepts at different times and for different purposes. And these different descriptions—these contrasting and fluid ontologies—remain important. Not only are they useful, but they are the ontological keys that unlock the doors to diverse, rich and incommensurable knowledge communities. They are not merely alternative translatable ways of expressing the same piece of knowledge, but more accurately are diverse "ways of knowing" about the world and are necessary to organize, find and use information. Hence, embracing these multiplicities is fundamental to experiencing and creating faithful representations of knowledges. (Boast et al., 2007)

Thus, we argue that the core information artifact of the museum, its catalog, must be fundamentally altered by the diversity of reactions that the presentation of an object must consider. The object, as a piece of tangible cultural heritage, is a gateway to a number of intangible, yet critically connected, practices: the telling of a story, a prayer, the process of research, the history of the exhibition, the relation to other objects, and so on. Therefore, we wish to re-expose these intangible processes around the object, through the consideration of "multiple ontologies" (Boast et al., 2007; Srinivasan, 2007; Srinivasan & Huang, 2005) and models of participatory design (Crabtree, 2004). We find this goal particularly pertinent and possible in the context of digital museums.

THE PROMISE OF NEW TECHNOLOGIES

Complementing this critique is the changing dynamic around emerging information and communication technologies (ICTs) being put to use to share cultural information. A growing schism is developing between grassroots ICT efforts devoted to activism, participation, and cultural mobilization versus the top-down bureaucratic approaches toward digitizing cultural heritage objects. The former efforts, samples of which are introduced in the Influential Case Studies section later in this article, view ICTs as reconfigurable technologies that must be socioculturally appropriable if they are to mobilize an indigenous agenda. These projects are intimately concerned with collaboration, modes of inclusion that transcend user studies to consider who a community is, what its realities are, and how it can design, author, and adopt new ICTs. Srinivasan (2006) has argued that networks and databases are two features of new media technologies that allow for mobilization by marginalized populations, specifically because of the ability each has to transcend space and organize cultural knowledge, respectively. The latter efforts largely lie in the domain of organizations such as UNESCO that aim to create digital media to preserve and share tangible (objects) and intangible (stories, songs, performances) cultural heritage, for the good of "society as a whole" (UNESCO, 2003).

Concurrently, Web 2.0—distributed, open-sourced, grass-roots involvement of web users—has taken the online world by storm (O'Reilly, 2005, 2006; Tapscott & Williams, 2007). This is not that surprising as, as many have argued (Wellman, 1997; Hampton & Wellman, 2000; Boast et al., 2007) that such grass-roots modification and subversion of online resources has always taken place. The well-known web applications such as Wikipedia, Google Maps and the many Google applications and APIs, blogs, Citizendium, Flickr, MySpace, YouTube, etc., have been joined over the past year or so by literally thousands of others. Modifiable, personalizable, and mashupable, web applications and services are now rife and the choices are growing exponentially. Through easier production of APIs and mashups, including increasingly simple API or mashup builders, the ability of individuals to easily mashup online information or to construct their own custom APIs has never been easier. In fact, the possibility for any user to directly intervene on any web page, or to extract information, and reuse that information, is now relatively simple. We can mention two of the many that exemplify this new direct intervention into web pages—Diigo and Dapper. Diigo (http://www.diigo.com) is a free web service that allows you to tag information on web pages, for example, allowing one to highlight individual bits of text or images, to attach comments to any part of a web page, to bookmark any bit of a web page, and to attach tags or blog entries to any of these bits of intervention. You can then simply see these interventions yourself, make them public, or share them with any groups you may have set up. Diigo allows the user to directly intervene

into the web page, rather than simply collect the web page. Dapper (http://www.dapper.net) is a really innovative free API builder. This application allows users to identify any bit of information on a web page, even if it is served from a database, label it, group it, identify search fields, and serve it back to themselves as RSS, XML, HTML, JSON, or a number of other formats. What information providers, including museum professionals, thus need to realize is that they no longer have direct control over how their information is getting accessed and used. These are but a few examples of the thousands of ways that users can access, appropriate, and reuse information locally. Given these diverse appropriations, can a digital museum initiative consider and actively build on diverse, distributed appropriations?

We believe that the possibilities of Web 2.0 create new models for rethinking representation. However, the ambivalence surrounding this question has also been translated to the web. On the one hand, there is the approach exemplified by Google and other web search engines, in which resources are represented by records that are created automatically and without explicit human intervention, that have little structure, and that contain terms that are simply extracted from the content of the resource rather than assigned from a predefined list of "preferred" terms or authorities. The state of the art of information retrieval based on automatic indexing of this kind is to sidestep the vocabulary problem by additionally characterizing resources by the frequencies with which they have been linked to, cited by, or otherwise recommended by authorities with good reputations. Out of the frying pan, into the fire: The result can often be a "tyranny of the majority," which ranks resources in order simply of popularity, and in which minority voices struggle to be heard (Lanier, 2006). On the other hand, there is the social tagging approach. In this case, the proposal is not that manual indexing be replaced by an automated indexing mechanism, but that catalogers' descriptions of resources are augmented by multiple users' descriptions (Furner, 2007a).

The simple term "tagging" is sometimes used to refer to any process by which the resources in a collection are assigned tags (in the form of words, phrases, codes, or other strings of characters) with the dual intention (i) that the tags individually or collectively represent features of the tagged resources (or of resource–tagger relationships) and (ii) that such representations or descriptions may be exploited by search services that enable people to discover the particular resources that are of interest to them at particular times. More commonly, social tagging or user tagging is understood to refer to tagging that is done by the "users" of search services—by those whose participation in the resource discovery or information retrieval process has historically been limited to the expression of information needs and construction of search queries, stopping well short of the determination and recording of resource metadata (Furner et al., 2006).

The implementation of social tagging in the museum environment is just one manifestation of a new general direction that has been termed "Museum 2.0," with more than a nod to Web 2.0. The vision of Museum 2.0 is not in itself a technological phenomenon. Museum 2.0 is neither tool focused nor application focused. Its aim is to create an environment in which museums improve people's lives by facilitating the construction and strengthening of diverse communities, and by supporting social interaction among members of those communities. Beginning in the late 1990s, developers of web-based tools and services have been successful in reaching large numbers of users with applications of social computing, especially programs (e.g., blog software, wikis, podcasting software, recommender systems, and tagging services) that allow users to collaborate with others in generating, organizing, sharing, and disseminating various forms of content, and/or to identify and converse with others whose membership in (and level of participation in) various overlapping online social networks or "virtual" communities is determined by the extent to which their goals, interests, or contexts are (perceived to be) shared. In the early-2000s, museum staff began to experiment with social software of various kinds, thereby participating in, and helping to construct, the emergent Web 2.0 (Simon, 2007).

A multitude of larger museums around the world have been relatively quick to embrace many of the ideas of Web 2.0. The Brooklyn Museum in New York; the Walker Art Gallery in Minneapolis; the Powerhouse Museum in Sydney, Australia; and the Victoria and Albert Museum, the Science Museum, the Natural History Museum, and the National Gallery in London all employ different forms of social computing. Almost all provide some form of podcasting (see http://www.museumpods.com/id31.html for an extensive list of museum podcasts), and several have blogs for disseminating information about the museum. The Powerhouse Museum (http://www.powerhousemuseum.com/collection/database/about.php) provides a tagging feature on its Collection Search 2.2, and the Brooklyn Museum even has a blog for visitors (http://www.brooklynmuseum.org/community/blogosphere). Beyond individual museums, there are new professional wikis (http://museums.wikia.com/wiki/Main_Page). One notable example of this is the Steve.museum project (Chun et al., 2006), described as "a collaborative research project exploring the potential for user-generated descriptions of the subjects of works of art to improve access to museum collections and encourage engagement with cultural content" (http://steve.museum). Currently, the central component of the Steve project is a web-based, public-access tagging tool that allows users to tag images of works of fine art from the institutional members of the Steve

consortium. Though it remains somewhat uncertain how the participating museums might use these grass-roots tags, one proposal is that user-generated tags could be used to improve access to tagged works, by adding them to the sets of descriptive terms that are already incorporated in the existing records created by museum professionals for those works. However, while the openness in this model is admirable and interesting, we still believe that the persistent repository of the catalog should be interrogated, thus more deeply impacting museum core representation.

Clearly, as technologies have developed, and more sophisticated and more ingenious applications of those technologies have been imagined and (in many cases) implemented, the functionality and popularity of Museum 2.0 have grown. However, though the advocates of Museum 2.0 have remained committed to community building, resource sharing, social networking, and other important collaborative activity, they have done so largely without recognizing the fundamental conflict between these new systems and the existing identity and use of objects in the museum, as articulated earlier in this article. We believe that the apparent separation between cultural heritage and participatory ICT projects could be bridged by directly considering the museum as a space for living and fluid representations of the objects it holds. The examples we present in the following section show a great deal of promise in this direction and motivate the perspective and argument that drives this article. We believe that first and foremost the conceptual argument for the need to including multiple knowledges around collections is critical, and that the institutional, practical, and historical barriers emerge from the conceptual difference. With such a lengthy history and reified worldview, it is not reasonable in our mind to argue that museums themselves, from a top-down perspective, can overhaul their activities. Yet we recognize that to shift museum practice, one must consider best practices that emerge from a wide array of global projects that start locally and tactically, considering grass-roots networks to insert change that diffuses to upper institutional levels. We point to these practices by introducing notable projects in the next section.

INFLUENTIAL CASE STUDIES

With this, we turn from our introduction of the initial discussion of the framework and critique of museum representation and Museum 2.0. We now present a set of cases that show some possibilities for museums to engage directly with multiple stakeholders via new participatory, social, Web 2.0-type technologies, most notably with indigenous communities. Across these cases, some of which are institution led and others which are managed by indigenous and previously subaltern publics, we see the possibility to further close the gap between a participatory model of cultural input in digital collections and the dominant cultural heritage institution-driven paradigm critiqued above. A critical component of all of these case studies is their collaborative intent, in essence establishing the relationships between institutions and groups as partnerships on equal footing, which is an increasingly important innovation in the changing dynamic between museums and indigenous peoples. These projects open up museum representation to "expert" and "source" communities who have something to say about the objects based upon an historical, cultural, and social relationship. This idea of multiplied communities and ontologies does not imply an "anything goes" or "anyone can tag" idea, but instead redirects the controlling dialogues onto specific relevant stakeholders.

Considering Multi-Stakeholder Partnerships: The Reciprocal Research Network, Museum of Anthropology, University of British Columbia, Canada

Instead of arguing for an overhaul of their institutional practice, museums can develop lasting, meaningful partnerships that accommodate multiple collaborators, and therefore enable an agenda that is diversified, escaping the univocality that we critique. The Reciprocal Research Network (RRN) is a co-development of an online collaborative catalog being developed at the Museum of Anthropology (MOA) at the University of British Columbia as part of their Renewal Project, *A Partnership of Peoples*. The RRN is a collaborative project between the MOA, the Stó:lō Nation–Tribal Council, the U'mista Cultural Society, and the Musqueam Indian Band, which is supported by several other international institutions and museums. On its web site, the project is described as:

> technology-supported research network comprised of communities, researchers, and cultural institutions. It will enable geographically dispersed users and institutions—including originating communities, academics and museum staff—to carry out individual or collaborative cultural heritage research projects. (http://www.moa.ubc.ca/RRN/about_overview.html)

The goal is to extend collections-based research, usually the domain of museums and universities, to originating communities. The RRN is still very much "in development" and, as a collaborative project, much work remains to be done. However, it may yet prove to be a landmark in collaborative collections research between museums and originating communities.

First experiences of the RRN web site (http://www.rrnpilot.org) show it to be a fairly traditional online museum catalog with an updates feature that allows for comments ("user-submitted information") from specific

logged-in users. The catalog includes some images, a title, a brief description, and secondary information including holding institution, cultures, creators, creation locations, and materials. The language of description is very much the language of the museum catalog, and there is little evidence, yet, that other voices are entering in the descriptions, or that they will be allowed to enter in the descriptions in the future. It does have some nice features such as personal collections and saved searches, but the most distinctive features are the commenting-discussions associated with the objects, and the discussion forums that give users the means to talk with others about specific objects, or about other relevant topics.

However, the problem with commenting-discussions around catalog entries is twofold. First, there is a problem of eliciting discussion of museum catalog entries at all, since much research discussion arises around collections of objects rather than individual objects, and second, that discussion of individual catalog entries tends to be about the accuracy or appropriateness of the catalog entry itself, rather than about the object. However, it is early days for the RRN and time will, we are sure, provide many exciting developments, especially as more people begin to participate in the system.

Support Projects That Are Outside the "White Box" and Start in Communities: Ara Irititja

Museums, in their mission to serve diverse communities, can focus on setting up distant, off-site projects in community settings that escape the shackles of historic institutional practice. They can report on and create exhibitions of these field-based efforts, while promoting a project that is led by communities previously neglected when it comes to core issues of the catalog and object representation. One such admirable project we recognize has been led by John Dallwitz, and the Pitjantjatjara elders of Australia have worked together to create a resource of cultural information and objects that returns materials to local communities in a form that works given infrastructural and resource-related issues within the remote Pitjantjatjara communities (http://www.irititja.com). The project partners decided that series of ruggedly designed standalone computer workstations, each containing a version of the Ara Irititja database of records describing photographs, videos, and objects, could make a much larger archive possible and allow the community to bypass the expensive and resource-intensive process of creating a physical cultural center to maintain a collection of repatriated physical objects (Hughes & Dallwitz, 2007). The custom-designed, culturally sensitive Ara Irititja interface therefore has allowed numerous objects to return in digital form to the communities, and enabled community members to update, change, and add existing knowledge about photos, audiotapes, and video clips they encounter in the system (Christen, 2006). The database was created around indigenous categories that define access to objects and knowledge within the communities, such as kinship, gender, family relations, and territorial knowledge. By presenting different possibilities for interaction, Ara Irititja enables the community to take traditional knowledge-sharing to the digital domain, by allowing tagging, blogging, commenting, and access to occur around community-driven parameters.

> What is primary is [Ara Irititja's] function as a tool for demonstrating the ways in which technology and cultural practices can be made to work together to fulfill contemporary goals . . . one can see how Pitjantjatjara understandings of knowledge sharing and information design depart radically from that of colonial museums models on which archives are still often built . . . In Australia, like other settler nations, cyberspace is also a place for (partial and practical) reconciliation. (Christen, 2005, p. 59)

While Ara Irititja forms an impressive and growing local knowledge archive, it remains to see how this will impact external institutions. Part of the answer to this question is that it need not have an impact. It is not necessarily a goal of the Ara Irititja project to provide anything to outside institutions, but to enable the Pitjantjatjara to collect and archive their own knowledge within their own social categories. Further, the goal of the project is to ensure, and maintain, local control and ownership over the archive. The key issue is not what the Ara Irititja project could do for outside institutions, but what outside institutions should learn from the growing movement of local knowledge archives (see The Mukurtu Wumpurrarni-kari Archive subsection next).

Considering Local Systems of Circulation: The Mukurtu Wumpurrarni-kari Archive

Museums can present objects and cultivate off-site efforts that consider property, access, and circulation in ways that respect local protocols. Museums, like many information institutions, are based on a liberal academic tradition that privileges the notion of unrestricted access to information, which is directly in tension with the cultural protocols of many indigenous groups around information sharing (Laforet, 2004; Becvar & Srinivasan, 2009). Developing a collaborative collections documentation project must, by necessity, account for the possibility of local restrictions and protocols on the circulation of information.

The Mukurtu Wumpurrarni-kari Archive has been developed out of a lengthy collaboration with the Warumungu community of Tenant Creek, Northern Territory, Australia (http://www.mukurtuarchive.org). This project demonstrates how new information technologies can serve to re-assert social relationships and boundaries, by

developing a database architecture for viewing cultural artifacts around existing cultural protocols. Furthermore, approaching the information design in this way has led to impacts both inside and outside of the community: First, local structures of accountability, governance, and kinship have been re-invigorated, and second, the community has appropriated digital technologies to mediate their relationships with groups outside of the community, such as the Australian government. Christen has explained that the Warumungu have exerted their own sovereign perspectives toward the digital archive project, denying the premise often embedded within cultural heritage projects that all information should freely circulate regardless of author or community protocol (Christen, 2005). Instead, the sociotechnical process of creating and deploying the system has allowed objects to be preserved and disseminated within and outside of the community, but only as subject to "structures of accountability, ongoing systems of inequity, and overlapping regimes involved in the always tense processes of cultural innovation" (Christen, 2005, p. 315). This has involved designing the archive to mirror systems of cultural patrimony and kinship within the community, and maintain a nested set of permissions and access rights based on the position of an individual relative to the larger community. Community social and cultural structures are reproduced and possibly reinforced via the digital archive, very much in contrast to the idea that all information (regardless of cultural bounds) should be universally mined (via algorithms such as that of Google) and made accessible (Christen, 2007b).

In order to enact these culturally based protocols around the sharing of cultural knowledge in the Mukurtu system, Warumungu community members are given a login-based profile in which they identify culturally significant details about themselves, such as their family and country, which also determine which records in the archive they can access. As new image, audio, or video content is uploaded into the system, a group of community members decides on which restrictions that content should be tagged with, restrictions that follow Warumungu cultural protocols. For example, if it is a photograph that shows the image of a deceased person and is tagged as such, a user who wants to see that image will first receive a warning that the photograph shows an image of someone who is deceased, because members of that person's family may not wish to see an image of that person for quite some time after they have passed away.

A digital culture project like the Mukurtu archive, often thought of as the vehicle of exporting and disseminating local knowledge (WSIS, 2005; Ginsburg et al., 2002; Ginsburg, 1999; Kindon, 2003), can also be a mechanism by which communities can re-assert their own boundaries and rework the multiple relationships they hold with outside institutions. Christen has argued that "indigenous cultural centers are a part of an emergent list of practices and projects aimed at redirecting the national gaze and re-writing a new list framed by self-determination and self-representation" (Christen, 2007a, p. 103; Clifford, 2001, 2004; Erikson, 2002). The digital system, therefore, functions very much in this manner, wherein indigenous sovereignty can concurrently re-assert itself in relation to external issues of cataloging, tourism, and nationalism and internal themes of privacy, kinship, epistemology, and politics.

Modifiable and Malleable Online Catalogs: The Collections Information System, MAA Museum of Archaeology and Anthropology, University of Cambridge

The Museum of Archaeology and Anthropology (MAA) at the University of Cambridge was one of the first museums in Britain to put its catalog online. From 1996, the MAA has had a searchable catalog, with basic catalog entries, available through its web site for most of its 250,000 accessions (representing roughly 850,000 objects). The MAA has also been a leader in developing, in house, a comprehensive collections management system, with most of its collections management being online since 2000. As the MAA has been an active collaborator with diverse research communities for many years, including the source communities for many of the objects in its collections, the latest and most comprehensive update of its collections management system has many features that set it apart from traditional museum catalogs and documentation systems.

The new collections information system, due to go live in mid 2009, is fully open-source with a MySQL back end and custom web interface. However, the unique feature, or at least we think it is unique, is that users will be able to edit, not just comment on, catalog entries. In other words, the diverse research communities that the MAA collaborates with will be given logins to the system and the collaborating researchers can add information to the fields such as names, descriptions, contexts, places, and relations as they see fit. All entries, even those of the museum, are authored and dated, so the individual holds intellectual rights over the information he or she adds.

Although, to date, the core catalog information of museums has been isolated and sacrosanct, with only commenting or requested updates from the outside, always filtered through the curatorial gate, it is hoped that this development will represent an opening up of the core documented identity of the collected object. Here, it is hoped, the contributed information from a broad range of collaborating research communities will be recorded at the deepest level of the object catalog.

Enabling Tribal Museums and Building Strategic Networks Across Museums and Communities: Reconceptualizing Digital Objects Around Cultural Articulations

Building on the work being done at the MAA to develop its new collections system, the Reconceptualizing Digital Objects around Cultural Articulations (RDO) project is establishing the research groundwork that the MAA's new system relies upon. RDO is a joint project between the MAA, the Graduate School of Education and Information Studies at the University of California, Los Angeles, and the A:shiwi A:wan Museum and Heritage Center at Zuni, New Mexico. The project, funded by the National Science Foundation (NSF), is designed to bring both distant collections and their originating communities back together, and, more importantly, is intended to explore how the contribution of originating communities' expertise can be rejoined with the objects in museums while maintaining individual and community intellectual property rights and rebalancing the museum's editorial intervention over expert accounts.

The project aims to create a "collaborative catalog," by sharing digital objects (images and associated museum metadata) with the community for comment and revision, and then sharing those descriptions back with the participating museums as appropriate. This is not an open grass-roots commenting forum, although those have an important place in restructuring how, on a practical level, museum collections are described, and thus how they are accessed and accessible (Chun et al., 2006). The collaborative catalog approach recognizes the importance, and existence, of diverse forms of expertise, as well as the key role that museum catalogs play in our enduring understanding of objects and cultures. Descriptions are contributed by those members of the community, as identified by the community, who have a direct and deep understanding of the objects. The collected expert accounts are the property first of the individual, and second, of the community. What information returns to the museum, to be associated with the objects, is in the hands of the local community (Srinivasan et al., 2009).

Already the RDO project is expanding to involve more museum partners, including several museums in the Southwest region that are interested in broadening not just the kinds of expert information represented in their catalogs but also the nature of the relationships that they maintain with source communities and with tribal museums. Future iterations of the project will include a Web-based system where all the collected Zuni expert accounts will be gathered and managed in Zuni, according to local protocols. In the cases when the community considers it appropriate to share its descriptions of objects back with the partner museums, to "set the record straight" or to expand what is known about the museums' collections, the Zuni will decide what information is to be shared, and how. Structuring the collaborative catalog in this way balances the need to respect cultural protocols of information sharing with the iterative, and sometimes contradictory, nature of how knowledge is developed.

CONCLUSION

These examples show that many interesting possibilities exist for transforming the practices of collections documentation in order to accommodate multiple voices and perspectives, making particular use of emerging social technologies (Web 2.0) that encourage participation while facilitating access to cultural objects. While museums and other types of collecting institutions are making admirable strides toward bringing multivocal accounts into their public presentations of objects, we argue that these examples, and the arguments raised earlier, show that multivocality can be brought into the core documentation within these institutions in a more systematic way by fundamentally changing the philosophy with which these institutions approach documentation and description. Practically, this can be accomplished by considering tactical, network-based, off-site efforts such as those we promote in our case studies section. These examples speak to a rising grass-roots movement that will increasingly demand such changes.

These different projects demonstrate, in various ways, that for users to be interested in objects, and to be engaged in dialogue around objects, catalogs themselves need to undergo a much deeper change than merely the addition of Web 2.0 functions on top of their existing structure, format, and vocabulary. What all these project show is that engagement, use, and understanding are not secondary attributes merely added to a primary and fundamental description, but are actual reuses and alternative biographies in which the objects participate. The fundamental premise of museum catalogs—which also extends to digital asset management systems, content management systems, knowledge management systems, etc.—is that collected objects have a primary, fundamental meaning and identity that can only then be appropriated and embedded in various contexts of appropriate use. The goal of descriptive metadata to define and preserve this fundamental and appropriate identity [the following metadata standards are good examples of this: METS (http://www.loc.gov/standards/mets/), EAD (http://www.loc.gov/ead/), Dublin Core (http://dublincore.org/), RDF (http://www.w3.org/RDF/), and CDWA (http://www.getty.edu/research/conducting_research/standards/cdwa/index.html)]. However, as demonstrated by the examples discussed in this article, and the mass movement that is social computing and Web

2.0, a vast and global movement is taking shape against such centralizing and accumulative descriptions of digital resources. The direction is clear, and it is away from access through centralized and standardized descriptive metadata catalogs.

But what are the alternatives? As we see it, the new possibilities offered by participatory Web 2.0 technologies require us to rethink not only the fundamental assumptions about descriptive documentation (metadata), but also how collaboration figures into documentation and what the actual site(s) of documentation are. As technology broadens the reach of conversations around and about objects, the ongoing relationships between collecting institutions and the stakeholder communities who may be the most interested in objects and their descriptions are being called into question (Watson, 1990; Salazar, 2003; Verran & Christie, 2007). Museums and other institutions have made progress toward establishing the "consultation" model as part of their regular practice, increasingly bringing source communities into the institution as consultants whose descriptions are recorded as supplements to what exists in the catalog. But what we are arguing in favor of, and doing what we can to put into practice, goes much further than that. We envision participatory catalogs, built according to community interests and standards of intellectual property rights management, where ownership of cultural heritage resources—objects, descriptions, the essence of what makes these objects meaningful—is set squarely in the hands of the source communities, outside of the collecting institution's control. Participatory Web 2.0 technologies are offering very interesting possibilities as far as *how* this can be done, but only if museums and other institutions take them for what they are—a development that necessitate significant changes to the way we think about objects, descriptions, and the relationships between institutions and source communities.

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