

Digital Futures I: Museum Collections, Digital Technologies, and the Cultural Construction of Knowledge

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ABSTRACT

Digital technologies and their uses within museum collections have until recently been explored primarily from a technical viewpoint. Increasingly, museum professionals are moving beyond technologically-driven reasoning to entertain new ways of conceptualizing both collections and information. This is leading to knowledge models beyond those already imagined. This paper considers the synergy between theoretical ideas in the academy and the computer ontologies that have been brought to bear on collections information. Drawing on user research findings from the *Themescaping Virtual Collections* project and the work of leading literary and media theorists, the paper examines how user needs and digital technologies are reformulating our understanding of museum collections and the relationships between museums and audiences.

DIGITAL TECHNOLOGIES AND NEW STYLES OF INFORMATION

The knowledge connection—Media theorist Marshall McLuhan (1964, xi) challenged technologically deterministic arguments to account for the emergence of new technologies (notably print, and, more recently, television). McLuhan stated: “We become what we behold that we shape our tools and thereafter our tools shape us.” Viewing the world in terms of embedded knowledge structures, he argued, enables the development of tools that emulate new social and theoretical ideas. New ways of perceiving encourage social transformation. These tools—and the technological innovations they reflect—offer possibilities beyond those originally imagined.

In the current technological context, poststructuralism and postmodernism are the theoretical structures that enabled multimedia and the Internet to emerge as forms of information architecture. Multimedia, hypertext, hypermedia and the Internet might be described as the ultimate postmodern media set. The intellectual characteristics of post-

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structuralist and postmodern texts parallel a computer's ability to organize, manipulate, re-work and deliver information in modular and multifarious ways (Manovich 2001, 131).

Modernist "grand narratives" can be technologically disrupted in favor of new styles of postmodern texts in which pluralistic narratives arrange information into galaxies of relationships and links. The ability to present information as numerically coded knowledge components and to retrieve these components as discrete information modules in potentially infinite variations promotes multiple views and shadings of meaning.

Postmodernist thinking holds the idea that no one fixed truth exists. Rather, particular interpretations of phenomena are individually and socially determined. This idea translates into an ability to intellectually traverse trajectories of information, providing almost limitless choices. Self-perception and interpretation are engaged through the use of searching and browsing tools, hypertext, hypermedia, and sophisticated three-dimensional navigational environments such as semantic maps and immersive experiences. Semantic mapping in particular is a strategy used to graphically represent concepts and multiple relationships between items. Knowledge has the potential to become customizable rather than remain tethered to a single fixed standard. New styles of readership and authorship are supported by information architecture, retrieval methods and interactivity.

Changes are gradual. As Fredric Jameson argues, "[R]adical breaks between periods (modernist and postmodernist regimes) do not generally involve complete changes but rather the restructuring of a certain number of elements already given" (Jameson 1983, 123). Indeed, both modernist and postmodernist trajectories—styles of narrative, navigation, and information retrieval—are represented in computer culture, synthesizing these two histories. Similarly, new media may contain older forms such as graphics, cinematic moving images, sounds and texts within new forms of data visualization and navigation.

Digital technologies as cultural objects—Providing another viewpoint, Lev Manovich (2001, 15–16) asserts that new media is culture encoded in a digital form. Databases are cultural objects in themselves. Their function is to help construct some referent such as a physical object, historical information or a cataloguing system. Interfaces and navigational systems offer a transparent window into data, but they also bring strong messages of their own. Digital media privileges particular models of the world and of human experience that in turn also influence how the user conceives the data contained therein (Manovich 2001, 37).

Cultural theorist Jean Francois Lyotard (1984, 47) also challenges the utopian idea that digital technologies foster a democratic relationship between users and institutions by promoting multiple narratives, information access, and interactivity. Instead, he suggests that new technologies continue to support established power relationships.

THE THEMESCAPING VIRTUAL COLLECTIONS PROJECT

A wealth of data illuminating these dynamics has been generated by the *Themescaping Virtual Collections Project*, a collaborative effort of the Australian Research Council in

partnership with the University of Sydney History Department, the Powerhouse Museum, and Vernon Systems Ltd. *Themescaping Virtual Collections* sought to profile a range of user groups. Research methods consisted of interviews and focus groups. Users included Indigenous museum workers, collection managers, curators, teachers and museum educators, a range of non-specialist users and IT specialists in Sydney and New Zealand. The project also evaluated existing online collections. There was analysis of current user research, state-of-the-art portals and online databases, search functionality, browsing, searching, narrative and personalization tools, metadata and information architecture. Sites were selected for their ability to illustrate common Web genres, a range of collection types, browsing and searching solutions, narrative structures as well as their use of multimedia and interactivity.

The *Themescaping* findings provide insight into the current practice and future potential of online collections. They illuminate issues of public access, content, interpretation, navigation, and narrative. Placing these issues within a theoretical framework, we may address intangible questions: about collections information and computer ontologies, relationships between museums and users, and issues of curatorial authority and autonomy.

The data we gathered provides a useful forum for a discussion of the theoretical considerations introduced above. Technological and theoretical considerations are radically transforming museum collections management. Changes are occurring in the way information is organized, in the construction of knowledge environments, and in the relationship between museums and users. We explore these issues by discussing the *Themescaping* findings in relation to the work of McLuhan, Jameson, Manovich and Lyotard.

Digital technologies, media theory, and online collections—McLuhan's perspective. Returning to McLuhan's argument for a moment, we may ask: How are social and theoretical transformations and digital technologies operating together within a collections environment to create new styles of information content and architecture? How are new abilities to store vast amounts of data—to automatically classify, index, link, search and retrieve them—leading to novel narrative forms? In what ways are these narratives different from those seen before around collections?

Digital technologies have the potential to rewrite the meaning and significance of collections. By promoting polysemic (plural) models for interpreting collections, for instance, they bring into question absolute claims about meaning, enabling alternative and sometimes conflicting interpretations to appear.

Jameson's perspective. Returning to Jameson's argument about gradual restructuring of knowledge structures, we may ask: What modernist knowledge models and information architecture are retained? Alternatively, what newer poststructuralist/postmodernist ones are created, and how do these relate to the information needs of a growing community of users? Some critics suggest we must abandon the modernist systems that are based on hierarchical organizations of information and linear narratives and replace them with poststructuralist/postmodernist multi-relational links and networks (Landlow

2001, 1). But is this what audiences want in terms of collection access and information retrieval? Is the modernist text really dead?

Manovich's perspective. Drawing on Manovich's argument, the question here is: What knowledge models are required to serve the needs of an emerging community of users? Computer culture and digital technologies are unique mechanisms for social and cultural exchange. Organizing and presenting information to users promotes particular world-views and knowledge of museum collections. How are these cultural ideas encoded through digital collections, and what particularistic views of the world do they promote?

Lyotard's perspective. Finally, addressing Lyotard's anti-utopian argument, we ask: How are the roles of museums as containers of expertise and authority being redefined through interactivity and two-way communication? Do digital technologies promote a truly democratic relationship between museums and users or support established power relationships?

Online collections, current trends—The scale and speed at which many museums and providers of collection automation systems are responding to digital technologies is remarkable. This is true even in institutions traditionally viewed as retrospective, where strict conventions rooted in the empirical tradition govern collections management and documentation (Robinson and Cameron 2003). Over the last decade, responses to these possibilities have led to considerable technological advances in the field of collections access on the World Wide Web, and to investments by museums and providers of collections automation systems.

We may divide museum responses to the Web challenge into three broad categories. The first two are evident in the actuality of current stratagems for Web sites. The third will be discussed in relation to the *Themescaping* project.

THE FIRST GENERATION

This generation of online collections is typified by thematic solutions to narrative. Examples include American Strategy (www.americanstrategy.org/home.html), National Maritime Museum, Collections Online (www.nmm.ac.uk/collections), the J. Paul Getty Museum Collections (www.getty.edu/art/collections) and the Museum of English Rural Life Collections (www.ruralhistory.org/interface.index.html). Here, digital objects are presented in a hierarchical story line with theme and sub-theme. This solution employs an HTML approach: Traditional museum devices such as object labels, graphic images and didactic text panels are presented in a fixed sequence that is light on interactivity and hyperlinks.

Manovich argues that each interface has its own grammar of actions and metaphors, as well as a physical component (2001, 73). In these examples, collection his-

Figure 1. J. Paul Getty Museum Collections Web Site. *Photo courtesy of the J. Paul Getty Trust © 2003. All rights reserved.*

tories are presented as hierarchies of information structured around a central theme, likened to a modernist paradigm. Particular narratives are privileged over others by virtue of these hierarchies and by the fixed sequences through which users access them, as evident in this example from the J. Paul Getty Museum Collections Web site (figure 1).

In most of these examples, the authority of the museum remains intact; authorship is retained by such devices as prescribed subjects, anonymous narratives and singular interpretations.


Artists
Three-Line Group

Collection Types
Decorative Objects and Vases
Bottles and Pots

Subjects
How We Live
Celebrations
Rites of Passage
War
Mythology
Mortals
Natural World
Horses
Science and Industry
Transportation

Media Gallery

Black-Figure Amphora



Zoom In

Photograph by Bruce White

Attributed to the Three-Line Group
Greek, Athens, about 530 B.C.
Terracotta
96.AE.93

For the Greeks, Alcestis was the model woman. When Admetos, the king of Thessaly, was fated to die young unless he could find someone willing to die in his place, only his wife Alcestis would sacrifice her life for his. Most depictions of Alcestis focus on her death and subsequent resurrection. The scene on this vase is an unusual allusion to the later event: a group of deities accompany the wedding procession of Alcestis and Admetos.

THE SECOND GENERATION

Recent trends encourage more adaptive responses to the rethinking of collections data and how it can be put to more productive interpretive ends. Examples include the EMP Digital Collections (Experience Music Project, www.emplive.com); HyperMuseum (www.HyperMuseum.com); Revealing Things (www.si.edu/revealingthings) and History Wired (Smithsonian National Museum of American History, www.historywired.si.edu/index.html) (Gillard 2002). These Web sites offer users alternative pathways through collections information while offering greater contextual possibilities via additional multimedia text-based and image-based navigational systems, such as semantic maps. A three-dimensional navigational system, such as a semantic map, views information as a series of points in a web of knowledge. Relationships are emphasized. Parallel and intersecting narratives are graphically created. Spaces are offered for play: for individual choice, not fixed interpretation.

These solutions present a more truly postmodern approach by empowering the user to create pathways—and new organizational systems—for information. Knowledge is presented as separate modular elements to be assembled in an almost infinite series of



Figure 2. Smithsonian without Walls, *Revealing Things*, Smithsonian Institution. Photo courtesy of the Smithsonian Institution © 2003. All rights reserved.

sequences. One example is the HyperMuseum Theme Generator System, which is one aspect of the European virtual museum portal. Its function is to assist in the creation of personalized themes, allowing the user to bring together a unique collection of multimedia items and to create a personal rendering of perceived and recorded relationships between collection items (Stuer, Meersman and De Bruyne 2001).

Through these methods, the world is presented as a non-hierarchical system ruled by relationships. Significantly, these solutions radically reform the way museum collections can be represented and interpreted, thus enabling a shift in knowledge/power relationships between museums and users through a new storytelling, analytical and interactive space (figure 2).

THE NEXT GENERATION

Despite these advances, key issues remain. The first, originally raised by Sarasan and Donovan (1998), is whether collections databases and exported data presented in the public realm really fulfill the needs of an emerging community of online users.

To determine the potential for a third generation of Web site usage-architecture in museums, the *Themescaping* study set out to investigate the current thinking of users. Our research for the *Themescaping* Project revealed four broad user groups: curators, collection managers, educators and non-specialists.

The curatorial user profile—Curators need quick and reliable access to objects, and information and images for collection identification, research and exhibition tasks. Consequently, their primary concerns were in improving research capabilities through more intelligent searching and browsing mechanisms, and in devising combinations to mine data. The preferred option for specific searches consisted of keywords with a thesaurus (organized by subject, function and classification). Mechanisms that suggest search terms and phonetic spellings and make typological corrections were especially helpful.

Complementing this, our research revealed a need for a range of logical search schemas. Suggested options included highly structured searching, intuitive browsing mechanisms and navigational tools. These tools might include well-indexed subject searches and theming search engines connected to a theme generator function like the HyperMuseum model (Stuer 2001). Future options might add personalization mechanisms popular in e-commerce environments such as Amazon.com. As one focus group participant remarked,

I like the way Amazon.com associates things such as suggested readings based on a similar subject/author and so forth...if you search for a book that interests you it will find other suggested readings...it would be good to have a clear personalization engine working within the collections environment. (Cameron and Kenderdine 2001, 28)

Certainly, in a collections context, personalization has the potential to generate relationships between objects/topics while searching. Other desirable features included advanced searching across databases and the comparison of related search results (using the indexing of metadata or an existing metadata index). Mechanisms to elicit responses to search results and collections information from users were also high on the list of priorities.

By uncovering relationships between objects previously not easily attainable through searching, an almost infinite galaxy of meanings and relationships is opened up around specific collection items. With no primary axis of organization, user interests become the searching and organizing principle (figure 3).

Curators preferred browsing options, on the other hand, that specifically supported collection enquiries. Options included: question and answer search engines, predetermined thematic tours, or collection descriptions showing highlights of the collections, followed up by an advanced search using keywords and a browser to further mine data. Collection statements connected to a hyperbolic tree or site map were also seen as a way of specifying its scope.

Significantly, curators felt it vitally important to provide information in various forms to suit the conceptual maps of a range of users. These include standard timeline chronologies and information hierarchies by theme and sub-theme as well as more innovative “mindmaps” such as the *Revealing Things* (www.si.edu/revealingthings) and *EMP Digital Collections* (www.emplive.com) models (Adolsek 2001). *Revealing Things*, the first Smithsonian exhibition to be created specifically for the Internet, uses common, everyday objects to tell stories about people and their cultures, and to explore the meanings they

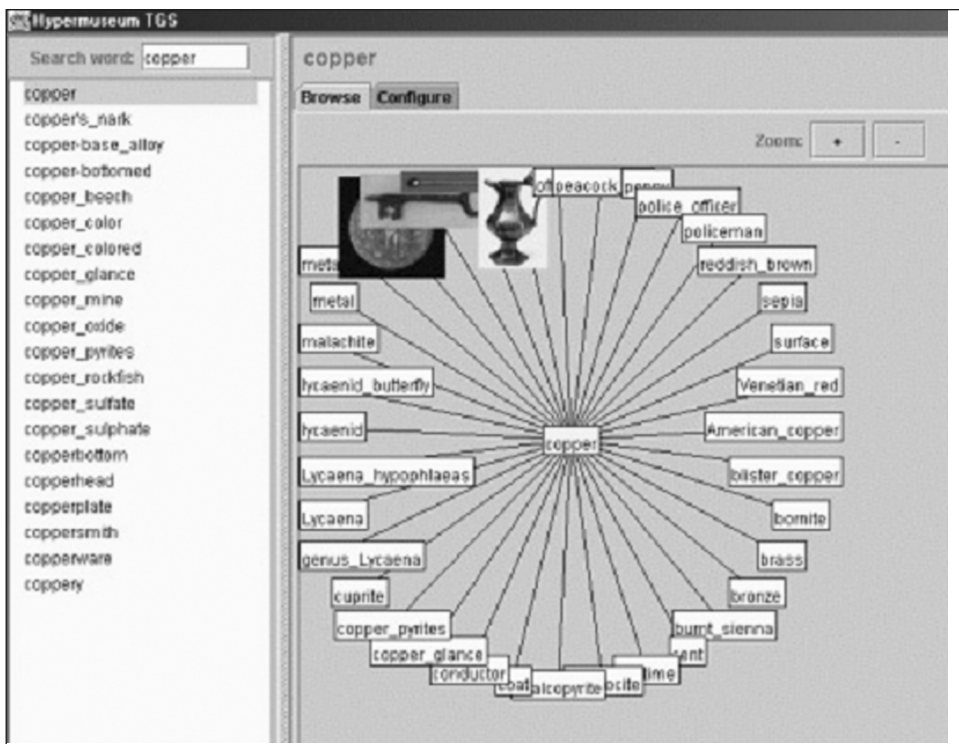


Figure 3. HyperMuseum Theme Generator System. Smithsonian Institution. *Photo courtesy of the Smithsonian Institution © 2003. All rights reserved.*

associate with their possessions through a graphical interface. EMP (Experience Music Project) is an interactive popular music museum located in Seattle, Washington. Within this typology, objects can be searched, retrieved and clustered under categories such as object name, music styles, era and people.

Additionally, the repackaging of information to suit the specific needs of each broad user group profile allows users to tailor their experience. One model is the Museum of English Rural Life, created by the University of Reading (www.ruralhistory.org/index.html). These varied forms acknowledge emerging user diversity and the need to present collections information according to a range of motivational and intellectual characteristics beyond that required by in-house professional users.

Enriching collection information by using both narrative and object-centered histories, according to our research, has the potential to extend collections information for a range of conceptual needs. Exploiting the hyperlinking abilities of the technology in the creation of object-centered histories allows for the layering and exploration of multiple meanings, contexts and relationships between objects according to a polysemic model. Furthermore, it invites the user to actively explore collections in more depth while allowing self-guided interpretations. This approach is likened to the curator telling multiple stories as a web of connections.

Suggested content included: juxtapositions of subject, disciplinary/cultural perspectives, contexts, information on the use and manufacture of objects, and visualizations showing their creation histories (Milekic 1999). Additional ways to expand the relational connections included: first-person voices and quotes, statements relating significance, curatorial/expert opinions, artists' comments, and primary source material with supporting documents, images, audio-visual and bibliographic information. This approach is likened to Barthes's contention that an object's meaning is constantly evolving (1974, 5–6).

Notably, an expansive interpretive framework is now within reach of the curator/author. With hypertext and other forms of information architecture, curators are able to present a range of narratives linked to other texts and resources. The arbitrary nature of the museum's voice is acknowledged through the inclusion of other voices and sources. An oversimplified interpretation of the history of objects is altered by engagement with pluralistic narratives, validation of alternative views on collections, and a shift to self-perception and analysis through interactivity.

From this standpoint, the writing and presentation of collections information thus becomes less static and objective and more dynamic and subjective. Constructing and reading collections information according to this approach can be likened to a complex molecular model. Here each module of information operates as an idea or chain of thought, expressed through hypertext or semantic mind maps.

According to our research, some curators felt that allowing users to advance their own interpretations of collections material supports a constructivist approach to learning. Surprisingly, for others it was read as a threat to curatorial authority. These concerns were expressed by one participant and confirmed by others.

A curator's authority is threatened when the user can teach and discover thematic relationships for themselves. There is an issue if audiences are invited to construct something without any professional guidance and especially if it goes out into the public domain so we need to be careful about the information they can pull out, i.e. privacy and information on people. (Cameron and Kenderdine 2001, 29)

Our research clearly demonstrates curators' desire to ensure that the museum's voice retains authority in advancing acceptable collection interpretations. The museum's voice may nonetheless be qualified through devices—such as alternative voices, interpretive statements and links to policy statements—that contribute to a user's understanding of how meaning and value are formulated within the museum context. The supreme voice of the curator is thus potentially made open to dispute.

There is a need on the part of this profile to present content as a kind of grand narrative. Here an object's meaning is clearly defined as a knowable set of facts. One significant interpretation is privileged over others, therefore acting as an alternative to the polysemic model. Presenting a grand narrative may occur in tandem with such interpretive techniques as: zoomable thumbnail images, 3D objects, object movies and prompts to highlight significant points. These devices offer a greater understanding of an object's form through multiple views, movement and sound. The authority and the subject posi-

tion of collections statements were seen as vitally important in contributing to the usefulness of information. So too were links that encouraged people to go further with their research or visit the institution.

Registrars/collection managers user profile—Registrars and collection managers are mainly preoccupied with the tasks of acquisition, inventory control and collections documentation. Therefore, like curators, collections managers primarily desire to increase the functionality of search tools.

For those in art museums, searches may be organized by date, collection types, media and artist, and alphabetically by artist/subject. The searching process may reveal the scope and breadth of the collection by posting collection overviews and site maps. Thematic highlights may be added. There may be graphical representations of browsing pathways, and multiple entries to collections information. The ability to store search results via a notebook was also deemed desirable. As in the curatorial profile, this array of searching and browsing options meant identifying and retrieving a finite number of search results as well as opening up a series of relational connections and object metaphors. More sophisticated searching and browsing options, according to this profile, expose an unexpected range of relationships between objects.

Improving the search function leads to new tasks of identification and documentation. These content options may include: zoomable thumbnail images, links to sources, a glossary function, collection percentage statements, copyright information, summaries of the exhibition status of objects, and language translation.

Teachers and museum educators user profile—Educators favored a range of searching/browsing options. These included: tailored thematic trails, intelligent keyword searches, and customizable personalized search engines.

Preferences were for traditional hierarchical structures, similar to a book paradigm, plus timelines and chronologies, and mindmaps for visually connecting objects, ideas and related themes. Likewise, it was felt that graphically-driven interfaces to search, browse and contextualize collections offer an engaging interactive experience, and serve as a departure from catalogued information.

This profile, like the two previous, preferred two forms of information structure: on the one hand, fixed hierarchical sequences and linear narratives in which each object has a well-defined place; on the other, postmodernist models with multiple relational links between objects and information.

According to educators, it was vitally important to support student projects with a range of interpretive opportunities and organizational concepts. One solution consisted of object-centered histories with links to sources and bibliographic information. Another consisted of narrative-centered themes organized by significance. New narratives made possible by digitalization mean that the reader is no longer wholly directed to read stories according to the order set out by the curator/author. This non-linear way of presenting information enables readers to follow their own path, creating their own order and meaning out of the material, thus emphasizing the role of the unexpected.

“The more realistic the better” was the feedback we received from educators. Suggestions included: scaled 3D simulations of objects, and object movies in which students can manipulate digital objects. These allow students to explore the form, construction, texture and use of objects. Moreover these technical possibilities have the potential to expose the hidden physical qualities of objects not observable first hand. Games technology, such as 3D environments and browsing tools, can create a contextual ambience around collections within a narrative format.

As one participant stated, “This technique is particularly important for younger children as they need to visually explore the connections between objects, contexts and stories” (Cameron and Kenderdine 2001, 30). Educators emphasized the need for younger children to engage a range of senses and experience collections as part of a contextual narrative. In games technology, older theatrical/cinematic traditions of illusion join with newer ones where the user can freely modify data and select narrative trajectories.

Non-specialist user profiles—The research of Kravchyna and Hastings (2002) suggests that a large proportion of users access online collections and museum Web sites before and after visiting the physical site. Our investigation supports these findings. Potential users of online collections are generally museum visitors who value free choice learning. Users access online collections to explore and discover new things and build on their knowledge base as a form of entertainment, and to plan visits to museums. Significantly, the belief in the integrity of information on a museum Web site was also a motivating factor in accessing online collections.

Due to the diversity of the profile, multiple skill levels were needed: simple searching and browsing tools for the inexperienced, and challenging tools for the initiated. Delivering complex media to support a rich range of learning and entertaining needs was deemed essential.

Younger members of the group preferred browsing options over specific searches. Their interest was in 3D space as an exploratory medium. They preferred theme generator tools and mindmaps with magazine style interfaces, visual prompts and interactivity. One younger member put forward a persuasive argument for the use of 3D semantic structures in which “you see relationships and the way they change and interact using the metaphor of 3D space . . .” (Cameron and Kenderdine 2001, 30).

Surprisingly, this group was less interested in prescribed material, choosing to drive their own pathways through collections and to explore object-centered narratives with rich streaming media, 3D objects and visual environments. Solutions such as these attempt to emulate postmodernist principles similar to the way our minds normally work, that is, not in a straight line but as a series of networks and associations.

By contrast, older participants preferred traditional exhibition metaphors for structuring information and familiar classifications such as collection overviews with keyword searches, thematic structures, chronologies/timelines, linear browsing pathways and searches under known categories. As one focus group contributor pointed out, “These techniques are so simple they are like eating sponge, but there is nothing wrong with eating sponge.”

Clearly the modernist-style text is not dead. It has an important role in organizing information according to knowable and easily recoverable information structures mirroring the physical and sequential construct of a book and museum exhibition.

CONCLUSION: EMERGING TRENDS

Modernist, poststructuralist, and postmodernist theoretical positions engage a computer ontology that in turn influences the ways collections information is authored, retrieved and presented. Collections in a digital format become a database of encoded knowledge made up of images, sound, video clips and text; individual elements can be linked and navigated in a variety of ways. This collection of data not only mimics older forms of representation and communication such as the printed word and cinematic experience but also engages newer ones such as 3D space.

Each of these cultural technologies has its own discursive effects. For example, by engaging emerging and diversified user groups and presenting collections and knowledge in a more cinematic way (through 3D objects, immersive environments, and 3D semantic structures such as mindmaps), the goal moves beyond that of basic information access. A greater emphasis is placed on action and psychological engagement with a consequent decline in description as a primary form of information provision.

Our research also shows that databases and narratives can work together in new ways. Given that no inherent narrative logic exists in a database, a new relational structure emerges. Thus collections become polysemic, exhibiting a range of meanings and contexts.

One of the most important emerging technical capabilities is the ability to distribute information in space. By promoting visual navigation, collections information becomes a catalogue of discoveries; interpretation becomes dynamic and subjective. Furthermore, it enables the telling of collections stories from a broader context by incorporating other cultural traditions and voices. For the first time, collections information is technologically liberated from linear hierarchical narratives and a linear spatial structure so familiar in a physical exhibitions environment. These solutions place greater value on individuality in interpretation, passing a greater interpretive responsibility to the user.

Collections, museums and authority—Overwhelmingly, user group profiles expressed a desire to engage with collections information as dispersed narratives. Looking at this from a theoretical standpoint, the fragmentary and subjective nature of the postmodernist paradigm is moderated and qualified in this context. Even with postmodern polysemic models, for example, the curator retains control by authoring information, selecting and defining all possible links and trajectories.

Paradoxically, the modernist text still remains important. This type of authoritative text only remains acceptable if the author is acknowledged. Many users did not want to take full responsibility for the interpretive process. Rather, they require some level of certainty in the process, thus continuing to look to the museum to provide trustworthy, authoritative and meaningful scholarly information.

Redefining museum/user relationships—Although the curator retains an authoritative interpretive position, the user can select and combine information in a new ways due to the underlying malleable and modular nature of data. Manovich argues that this presupposes the emergence of new styles of authorship (2001, 127). Here, knowledge-making involves the selection and recombining of elements or paths chosen from a menu/catalogue/database designed by the curator/designer. Can this process really be classified as authorship? Arguably, authoring in any context involves the borrowing and recombining of known elements, as well as the creation of new ideas or altered perspectives.

So how is the identity of users reformulated in this context? Here the user is conceived as a spatial wanderer, traversing information and freely selecting trajectories and viewpoints. The user is also conceived as an individual, whose thoughts and desires are treated as unique through devices such as user profile interfaces. New database narratives may not be as directed as linear and hierarchical ones, but that's not to say that hyperlinking cannot be used to seduce the user through a careful arrangement of arguments and counterarguments. Users are still asked to identify with the curator's mental picture, a position foundational to modernist interpretation.

Postmodern conceptual structures and their technological form place new physical and cognitive demands on users. Mental processes—reflection, problem solving and association—are materialized rather than internalized through these various modes of representation.

New narratives/older forms—Is the modernist text dead? Certainly, our research has shown that familiar forms of architecture and narrative—with clear “knowable facts” laid out in a standard format, either thematic or chronological—are still required by a significant range of user groups, particularly older age groups and educators. In some instances however, these narratives are modified through hyperlinking to other information, representing a refashioning of the modernist text according to current needs and technological possibilities.

Computer ontologies and collection worldviews—The standardization of collections information into a digital format is by necessity a culturally loaded form. Not all knowledge or experiences can fit the form of text, sound, graphics, 3D objects or interactive narratives. Our investigations suggest that two distinct and culturally specific collection worldviews emerge. The first, construed as 3D information spaces, presents a model of the world governed by relational connections between things. Here chronologies, historical time and privileged narratives give way to a flattened interpretive structure where various viewpoints or sources can be juxtaposed in space, each seen as equally valid (Manovich 2001, 78).

The second, a modernist structure, continues to act as an alternative to the above. Here the world is organized into hierarchies of information, offering a truth statement about the meaning and significance of a particular object or collection, ensuring that the museum's interpretive authority remains intact.

These two conceptual structures interrelate with each other. Modernist text is qual-

ified by hyperlinking to other sources and the use of visible authoring. Postmodernist views are moderated by the presence of authoritative texts to offer some certainty in the interpretive process. Providing a number of ways into information allows for cross-referencing between these two conceptual structures—the prescribed and the self-guided—each operating in a parallel universe.

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APPENDIX

User Research Summary

Findings from the *Themescaping Virtual Collections* project.

Searching

Advanced personalization search engine generating related topics, e.g., Amazon.com (all)

Advanced personalization/theming search engine connected to a theme generator and download function (all)

Personalized notebooks for storing search results (curators, collection managers, educators, non-specialists)

Free-text keyword search function with thesauri (curators, collection managers, non-specialists)

Intelligent keyword search function with suggested search terms, phonetic and typological corrections (curators, collection managers, educators)

Indexed subject searches (curators, collection managers, educators)

Thematic searches (educators, non-specialists)

Question and answer search engines (curators, non-specialists)

Advanced searching across databases: comparison of related search results using the indexing of metadata, or using existing metadata index (curators, collection managers)

Date searches (collection managers)

Collection type/media searches (collection managers)

Alphabetical search by subject/artist (collection managers)

Searching agents (non-specialists)

User dialogue: built-in responses to search results and collections information (curators)

Browsing

Thematic highlights with advanced keyword searching capabilities (all)

Provision of collection(s) description with scope and highlights (all)

Links to sources and bibliographies (all)

Collection overview options: site map or hyperbolic tree (curators, collection managers, educators)

Graphical representations of browsing pathways (collection managers)

Navigational concepts

Multiple entries into collections information by user profile, age groups and abilities (all)

Graphically driven interfaces/navigational tools (all)

Semantic maps connecting objects with ideas and related themes (curators, educators, non-specialists)

Hierarchical information structures-theme, sub-theme (curators, educators, non-specialists)

Timeline/chronologies (curators, educators, non-specialists)

Use of 3D metaphors: 3D and 2D visualizations (non-specialists)

Multimedia magazine approach to interface design (non-specialists)

Content***Narratives***

Links to sources, bibliographies and related websites (all)

Object-centered histories: multiple/alternative interpretations, artist/curator comments, linked resources, significance statements and multimedia (curators, educators, non-specialists)

Primary source materials: documents, images, audiovisual and sound bytes (curators, educators)

Themes: hierarchical narrative structures (curators, collection managers, educators, non-specialists)

Narrative-centered histories (curators, educators, non-specialists)

3D objects and object movies with "realistic simulations"

(curators, educators, non-specialists)

Timeline/chronologies (educators, non-specialists)

Objects in spatial and contextual relationships (educators, non-specialists)

Contextualization utilizing rich streaming media (educators, non-specialists)

Action spaces, multimedia and interactivity (educators, non-specialists)

User interpretations (curators, educators)

Information hierarchies based on the interpretive significance of an object, person, event, materials, movement, cultural context (educators)

Layering of information by complexity: general to specific (educators)

Multimedia magazine style presentations (non-specialists)

Supporting information

Thumbnail images with zoomable function (all)

Language translation facilities and disabilities access (all)

Glossary function: highlighted words within text descriptions (curators, collection managers, educators)

Authored content (curators, educators, non-specialists)

Interpretive prompts with object images (curators, educators)

Collections level information with accession numbers and contact details (curators, collection managers)

Collections percentage statements (curators, collection managers)

Copyright information (curators, collection managers)

Exhibition status of collection items (curators, collection managers)

Links to current exhibitions relating to search results (curators)