Interaction in Virtual Archives: The Polar Bear Expedition Digital Collections Next Generation Finding Aid

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Abstract

This article analyzes the design and provides a preliminary evaluation of an experimental finding aid incorporating social interaction created by the Finding Aids Next Generation Research Group at the University of Michigan. It discusses the development of the Polar Bear Expedition Digital Collections, an online access tool employing Web 2.0 technologies and evaluation of the first six months of its deployment (January–June 2006). Using Web analytics, an online survey, semistructured interviews, and content analysis of comments, the researchers explore visitors' initial reactions, and their uses of and interactions with this new type of finding aid. The study also offers insights from other disciplines and considers how social navigation features might enhance accessibility to archival materials. Initial findings suggest that enabling direct and indirect interaction among visitors and archivists, collaborative filtering, and other Web 2.0 features might make archival materials more accessible and enrich the traditional finding aid.

I n January 2005, students and faculty at the University of Michigan School of Information formed the Finding Aids Next Generation (FANG) Research Group.[1] FANG's goal was to rethink and re-imagine the display and functionality of online finding aids using Web 2.0 technologies.[2] The group also wanted to experiment with an interactive archival access tool that would allow

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[1] The original student members of the group were Dharma Akmon, Christie Peterson, Polly Reynolds, and James Sweeney. Since that time, Andrew Bangert, Magia Krause, Ricah Marquez, Seth Shaw, and Jeremy York have contributed to the research.

[2] Web 2.0 refers to a second generation of Internet services that are more interactive and collaborative, and feature shared control, e.g., social networking sites, wikis, and folksonomies. See the Wikipedia definition of Web 2.0 for a more detailed explanation with links to illustrative sites, available at http://en.wikipedia.org/wiki/ Web_2, accessed 9 January 2007.

the voices of archives' users as well as those of archivists to be heard and distinguished. As we developed our ideas for the site, we searched for appropriate content—a large collection or group of collections—with which to experiment. This search led us to the Polar Bear Expedition Collections at the Bentley Historical Library, also on the University of Michigan campus.[3]

The Polar Bear Expedition

The "Polar Bear Expedition Collections" is a nickname for a group of collections related to the event formally called the American Intervention in Northern Russia, 1918–1919. The collections document a little-remembered event in the aftermath of World War I. The U.S. sent soldiers, many of whom were from Michigan, to join an international team of allied troops in northern Russia to fight the Bolsheviks who had seized power in 1917. The nickname acknowledged the long, cold winters the soldiers faced in this campaign. The men recorded their experiences, including their weakened morale, in personal diaries, photographs, and recollections. The Bentley Historical Library has worked to document this episode important to Michigan's history since the 1960s, acquiring over sixty collections relating to the Polar Bear Expedition.

Although the Bentley retains the provenance of each collection, maintaining each according to the individual or family who created or assembled its contents, these materials are also described collectively and presented as part of the larger story based on this event. This brings all of the related collections under one intellectual umbrella to facilitate access for users interested in the Polar Bear Expedition. These collections are popular and researchers at the Bentley frequently request them. In 2000, the Bentley decided to digitize the collections both to preserve the originals by reducing handling and to facilitate access.[4] In 2004, University of Michigan Digital Library Production Service (DLPS) digitized the collections according to digital preservation standards and best practices. Most were digitized at 400 dpi 8-bit grayscale resulting in master TIFF images. Selected color and large images were scanned separately at other resolutions. The FANG research team later digitized a seven-minute film and a two-hour oral history that were also part of the collections for incorporation into the site. In addition, the Polar Bear Expedition Digital Collections site

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[3] The research group wishes to thank the director and staff of the Bentley Historical Library for their generosity in providing the digital images of the rich Polar Bear Expedition Collections with which to experiment. The Bentley staff also answered innumerable questions about the materials, which helped us to properly contextualize the materials online. In many ways this was a leap of faith on the part of the Bentley, and we appreciate its support. See http://bentley.umich.edu/, accessed 16 April 2007.

[4] For a general history, see Richard M. Doolen, *Michigan's Polar Bears: The American Expedition to North Russia, 1918–1919,* Michigan Historical Collections Bulletin 14 (Ann Arbor: University of Michigan, 1965).

incorporates XML from the EAD finding aids, selected information from the MARC records, and a Filemaker database listing over 6,100 soldiers who served in the campaign.

Designing the Next Generation Finding Aid

The FANG Research Group found the Polar Bear Expedition Digital Collections a good fit for its project for several reasons. First, the interrelatedness of the collections, tightly focused on one historical event, lent itself to robust description in which the relationships among materials could be enhanced. Second, the materials have always been popular with researchers, both academic scholars and Polar Bear Expedition enthusiasts. Third, the FANG team was intrigued that digitization involved entire collections rather than selected items. Finally, we thought the large amount of existing metadata available for reuse would facilitate implementation of the new finding aid.

Once the FANG research team selected the Polar Bear Expedition Collections as the data set, planning and design moved ahead in earnest. The lead programmer started the process to select the system, and other team members began designing the interface and analyzing the existing metadata.[5] We selected the Everything2 engine as the content management application for the website.[6] MySQL serves as the locus of the persistent data store for the content management system. Cascading style sheets (CSS) form the interface, and the system relies on Encoded Archival Description (EAD) to generate the finding aids. In addition to EAD, the site embraces Web 2.0 functionalities and utilizes open source software, such as Apache, and programming languages (Perl and Javascript) to develop a dynamic interface with multiple features designed to engage the use of the finding aid.[7] Figure 1 is a screenshot of the homepage.

The FANG research team was inspired by sociotechnical systems in everyday use, including Amazon.com, Flickr.com, and deli.cio.us.com, as well as by movements toward the implementation of social applications in museum systems such as the Art Museum Social Tagging Project.[8] The team selected the following set of features and functionalities to enhance the finding aid:

[5] A description of the Polar Bear Expedition Digital Collections site will appear in Elizabeth Yakel and Polly Reynolds, "The Next Generation Finding Aid: The Polar Bear Expedition Digital Collections, A Case Study in Reference and Access to Digital Materials," *Proceedings of the New Skills for a Digital Era Colloquium,* ed. Richard Pearce-Moses and Susan Davis, forthcoming.

[6] See Everything2 website at http://www.everything2.com, accessed 14 February 2007.

[7] Visit the site at http://polarbears.si.umich.edu, accessed 15 May 2007.

[8] Art Museum Social Tagging Project, available at http://www.steve.museum, accessed 14 February 2007.
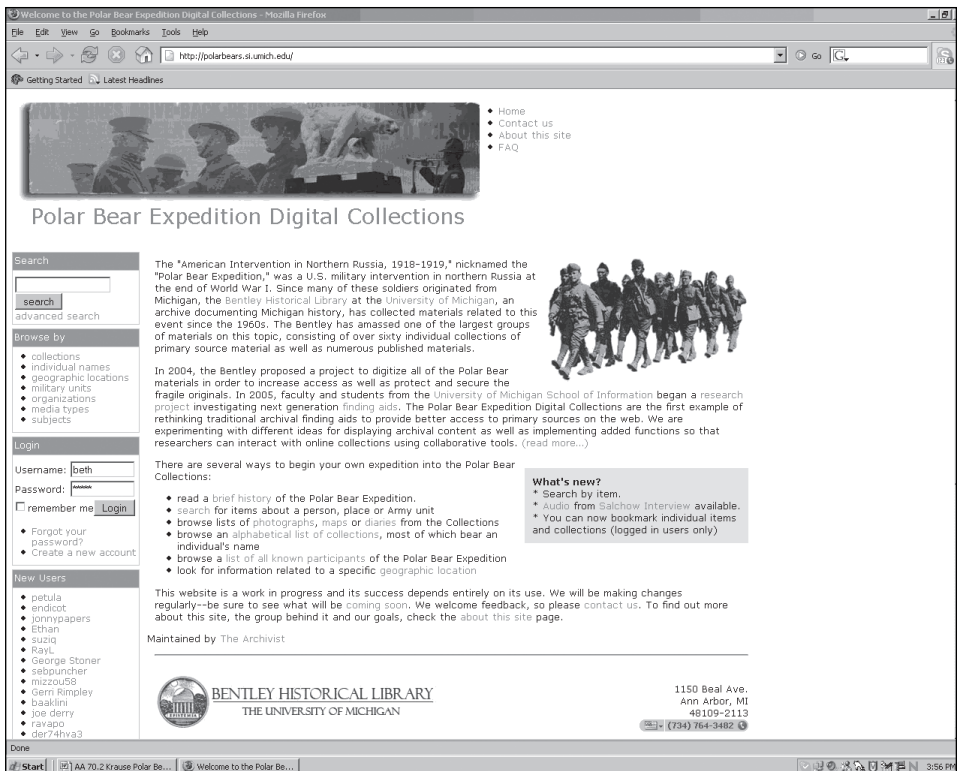
FIGURE 1. Homepage of the Polar Bear Expedition Digital Collections

1. *Bookmarks* allow users to save a link to a collection or individual item and keep that information in his or her account for later reference. Returning users can go directly from the homepage to the sources they have previously identified. Bookmarks provide a convenient method for retrieving archival materials in large online finding aids and are familiar to most users due to their prevalence in bibliographic catalogs, websites, and even EAD systems such as the Digital Library Extension Service (DLXS) system.

2. Visitors can add *comments*. They can supply information about sources, ask questions, or participate in discussions. These comments can be used in a variety of ways including correcting errors, posting additional information, and creating cross-references to other resources both within and outside of the site. All visitors can read comments. Registered visitors can also add comments to a document or respond to comments by other researchers or the archivist. Comments are searchable and identified as comments in the search results. Michelle Light and Tom Hyry recommend including user-supplied contributions in online

finding aids,[9] and this site is the only one we know of that allows this type of interaction.

3. *Link paths* are "footprints" or trails of previous visitors captured by the system and processed to indicate generalized navigation through the site. The Everything2 engine uses a collaborative filtering mechanism known as "soft links." We adapted this and refer to these as "link paths" on our site. The link paths are intended to alert visitors to related pages viewed by other users. Link paths are an unobtrusive collaborative filtering mechanism in the Polar Bear Expedition site that show relationships among documents by collecting usage information from all site visitors (collaborating), pooling this information (filtering), and feeding back an aggregated form of these data to later visitors. Generally, the more visitors to the site, the better the filtering feedback will become.[10] Amazon.com utilizes this mechanism when it suggests books based on the purchasing and browsing patterns of other customers. The link paths are one form of recommender or reputation system that uses the judgments and/or behaviors of earlier users to help current visitors make decisions.[11]

4. *Browsing* is the central navigation mechanism on the Polar Bear Expedition site. We created seven browsing categories for the Polar Bear Expedition materials: individual names, collections, military units, geographical locations, organizations, subjects found in the MARC record, and media type. We thought that these categories leveraged the information in the underlying EAD, MARC, and soldiers' databases by providing a variety of different access points. Generally, EAD systems allow browsing by only title and/or creator.[12]

5. *Searching* directly complements browsing and is available on every page of the site. The search engine scans all content and delivers a report organized by the location of the results. Thus, search results differentiate hits in the scope and content notes for the collections from those in the comments provided by site visitors.

6. *User profiles* are optional. Visitors can create a user profile when they register. Registration can be done at any time. Visitors also have the option

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[9] Michelle Light and Tom Hyry, "Colophons and Annotations: New Directions for the Finding Aid," *American Archivist* 65 (Fall/Winter 2002): 216–30.

[10] David Goldberg, David Nichols, Brian M. Oki, and Douglas Terry, "Using Collaborative Filtering to Weave an Information Tapestry," *Communications of the ACM* 35, no. 12 (December 1992): 61–70.

[11] Paul Resnick, Richard Zeckhauser, Eric Friedman, and Ko Kuwabara, "Reputation Systems," *Communications of the ACM* 43, no. 12 (December 2000): 45–48. An earlier online version is available at http://www.si.umich.edu/~presnick/papers/cacm00/index.html, accessed 24 January 2007.

[12] Jihyun Kim, "EAD Encoding and Display: A Content Analysis," *Journal of Archival Organization* 13 (2004): 41–55.

of adding a biographical statement to their user profile. This can be viewed by other registrants. Visitors who register are also able to take advantage of all the advanced features of the site: making comments, bookmarking, maintaining a list of one's most recently viewed collections, viewing other users who are simultaneously using the site, and accessing other users' profiles.

Launching and Evaluating the Site

The Polar Bear Expedition Digital Collections site was officially launched in January 2006, and information about it was released in various forms, including a university press release, an email message to the Archives listserv, a hyperlink to the site from a Wikipedia entry on the Polar Bear Expedition as well as other World War I entries, and inclusion in the Internet Public Library.

Because this was an experimental program, the FANG Research Group set up an evaluation program for the site. Planning for the evaluation of the Polar Bear Expedition Digital Collections began before the site went live. We were keen to explore visitors' initial reactions, their use patterns, and their interactions with this new type of finding aid. We hoped to use these data both to improve the site and to further our knowledge of how social navigation features might enhance accessibility to archival materials. Our objectives were to determine whether some level of interactivity increased the accessibility of archival materials and to assess how users would interact with one another to augment their archival experience. The major research question guiding this study was "Can social navigation features be used to facilitate the accessibility of archival materials?"

Because the research question underpinning this study was broad in nature, we used a multimethodological approach to analyze the site. Both quantitative and qualitative data were collected through Web analytics (transaction logs, user statistics, and search term analysis), content analysis, an online survey, and three in-depth, semistructured interviews. Data collection was divided into two groups: system data and participants' perspectives. This approach was designed to enable triangulation of these data to test, confirm, supplement, and provide contextual information for findings. After this initial study, we plan future studies of the Polar Bear Expedition Digital Collections as the user base grows and the system evolves; therefore, another purpose of this study was to test the viability of data collection methods to reuse in future investigations.

Literature Review

Four themes emerged from the research question: accessibility, common ground, awareness, and interactivity. Accessibility is the umbrella concept and the

other themes explore different aspects of it. We wanted to identify those features and functions that enhance the usability of a finding aid, create common ground, and provide "social affordances" that encourage interaction, such as the participation of users to help one another. These issues will be explored by examining literature from the archival and human-computer interaction (HCI) fields.

Archival Literature

For the purposes of this study, *accessibility* refers to users' ability to make meaningful use of descriptions of archival materials or to enhance their understanding of archival materials. Accessibility is also related to the background users bring to an archives, which contributes to their expectations. Broadly, background includes knowledge about a topic, previous archival experience, and the nature of the user's information needs. In his glossary, Richard Pearce-Moses formally defines *accessibility* as "[t]he characteristic of being easily reached or used with a minimum of barriers."[13] Elizabeth Yakel expands this definition of *accessibility* to the "intellectual and cognitive abilities required to make effective use" of archival descriptions about materials.[14] Access to archival materials may also be related to institutional policies, preservation requirements, government secrecy classification, and sociocultural norms. In both of these definitions, the concept of *accessibility* goes beyond physical access to archival materials and involves making meaningful use of those materials through descriptive aids that enhance access.

We posit that by allowing archival researchers to contribute descriptive notes and other information to archival collections and items, these materials will become more intellectually accessible to a wider variety of users. Furthermore, by capturing this interaction history, researcher participation will enhance the meaning of archival materials. This idea that users can contribute to descriptive products is not new. Reference archivists and users may add to their description information gained in using the records. In 1989, the Working Group on Standards for Archival Description noted that

> Each time a researcher interacts with a collection, something new is learned about the materials; ideally, even information gleaned during reference activities should be captured and integrated with more formal descriptive compilations.[15]

[13] Richard Pearce-Moses, *A Glossary of Archival and Records Terminology* (Chicago: Society of American Archivists, 2005), available at http://www.archivists.org/glossary/term_details.asp?DefinitionKey=2740, accessed 17 July 2006.

[14] Elizabeth Yakel, "Impact of Internet-based Discovery Tools on Use and Users of Archives," *Proceedings of the XXXVI Roundtable on Archives (CITRA) Meeting, Nov. 11–14, 2002, Marseilles, France,* published in *Comma* 2, no. 3 (2003): 191.

[15] Society of American Archivists, Working Group on Standards of Archival Description, "Report of the Working Group on Standards for Archival Description," *American Archivist* 52 (Fall 1989): 441.

As a result of the Working Group's report, Vicki Walch adds user input in the definition of description:

> Archival description is the process of capturing, collating, analyzing, and organizing *any information* [italics added] that serves to identify, manage, locate, and interpret the holdings of archival institutions and explain the contexts and records systems from which those holdings were selected.[16]

Mary Jo Pugh incorporated these ideas in both the 1992 and the 2005 editions of *Providing Reference Services for Archives and Manuscripts:*

> The users of archives may also enhance description of them. Reference archivists and users may add information gained in using the records to their description . . . archivists should seek user input as finding aids are redesigned. Most reference archivists know from experience that current finding aids are undecipherable by many users.[17]

Postmodern archival theorists point to inadequacies in archival description, exploring ways in which user contributions could be enhanced. Terry Cook, for example, expands on the call for researcher input and asserts that the record is not a static artifact, but rather a "mediated and ever-changing construction" affected by its use.[18] The voice of the user, the language the user employs in searching for information, and the meaning that emerges from a record's use are rarely captured in archival description. Postmodern theorists argue that the flow of information has traditionally been outward from the specialized domain of the archivist and institution to the user. Cook notes that the archivist often records only superficially the user's interaction with the materials as an administrative function of the archives. Wendy Duff and Verne Harris are concerned about this loss of meaning and express the "need to create holes that allow in the voices of . . . users."[19]

In a recent article, Heather MacNeil explores the connection between archival description and authenticity of the records. She argues for increased transparency in the production of finding aids, viewing the Web as an "ideal vehicle for transcending the artificial limits imposed by current descriptive

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[16] Victoria Irons Walch, comp., *Standards for Archival Description: A Handbook* (Chicago: Society of American Archivists, 1994), available at http://www.archivists.org/catalog/stds99/intro.html, accessed 24 January 2007.

[17] Mary Jo Pugh, *Providing Reference Services for Archives and Manuscripts* (Chicago: Society of American Archivists, 2005), 85. See also Mary Jo Pugh, *Providing Reference Services for Archives and Manuscripts* (Chicago: Society of American Archivists, 1992), 32.

[18] Terry Cook, "Archival Science and Postmodernism: New Formulations for Old Concepts," *Archival Science* 1 (2001): 3–24.

[19] Wendy Duff and Verne Harris, "Stories and Names: Archival Description as Narrating Records and Constructing Meanings," *Archival Science* 2, nos. 3–4 (2002): 279.

practices" by allowing users to explore along "multiple pathways."[20] The first step in engaging the user in archival description is to make transparent the archivist's mediating role in description, echoing Duff and Harris's call for archivists to disclose their biases and "world-views" while making their presence known to users.[21]

In an analog descriptive system, it is difficult to make changes in descriptive tools. As a result, the notes, findings, and conjectures created by a researcher are lost, irretrievable by subsequent researchers who might benefit from previous uses of the collections. Archivists' incorporation of social navigation tools into descriptive systems has the potential to allow researchers to interact with archivists, collections, and other users to validate, categorize, and describe records in different and potentially more meaningful ways.

Michelle Light and Tom Hyry suggest the use of colophons, which are "statements regarding the creation of a work, written or printed after the main text has concluded."[22] A familiar tool in book publishing, colophons are deliberate metadescriptions that provide details about the typeface, paper stock, and other physical aspects of a publication. During the process of archival description, archivists could create colophons that include insights about their thinking, knowledge of the materials, decisions, and even biographical information. In reminding users of the archivist's presence, a colophon would make clear that descriptions reflect the knowledge and experience of one or more archival writers. Such a statement would advise researchers that the representation is just one possible among several, and that it is incomplete. The colophon would also provide a possibility for dialogue between archivists and users that might be particularly useful as more researchers come to archives remotely without participating in face-to-face reference interaction in the reading room. A colophon might assist users in understanding the archivist's rationale in processing the materials and provide both formal attribution and authorial responsibility to the archivist. Yet, many questions remain about this approach. Are archivists able to identify their biases so readily? Would this information diminish the professionalism and authority of the finding aid? Would users truly find colophons valuable or ignore them in the vast amount of text comprising many modern finding aids?

Light and Hyry present a second idea for engaging the user in archival description, recommending the use of Web-based annotations in online finding aids as a way of "allow[ing] multiple voices to express different perspectives and readings of a collection after processing is complete."[23] Annotations could take

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[20] Heather MacNeil, "Picking Our Text: Archival Description, Authenticity, and the Archivist as Editor," *American Archivist* 68 (Fall/Winter 2005): 276.

[21] Duff and Harris, "Stories and Names," 278.

[22] Light and Hyry, "Colophons and Annotations," 223.

[23] Light and Hyry, "Colophons and Annotations," 226.

the form of additions or amendments to existing descriptions, information
about use of the materials, and references to other collections, transforming
fairly static finding aids into dynamic documents and creating a more open
descriptive system. Annotations would assist archivists in the descriptive process
and could encourage the development of a community of users interested in a
particular collection, repository, or theme. Additionally, annotations might
facilitate the ways in which historians currently locate primary sources. For
example, Ian Anderson's recent study of U.K. historians' information-seeking
behavior confirms earlier research and reveals that these historians located
sources primarily through tracking down citations or heeding the recommen-
dations of their colleagues.[24] Web annotations could assist historians and other
archives users in filtering and identifying relevant materials by taking advantage
of the value of socially constructed descriptions and taxonomies.

Yakel calls on archivists to incorporate the voice of the user in online access
tools.[25] She recommends introducing features to archival descriptive systems
such as "interactive forms, synchronous virtual reference" and "recommender
system" features to enhance the user's experience. Her article ends with a futur-
istic vision, à la Vannevar Bush,[26] of a researcher locating archival materials
online with the help of a virtual reference archivist and viewing annotations left
by leading scholars in the field. A recommender system would alert users to
related collections used by scholars. Yakel's vision, although unrealized, is
increasingly plausible in light of the technological developments of Web 2.0.

Human-Computer Interaction Literature

Developments in the field of Human-Computer Interaction (HCI) can sup-
plement the ideas emerging in the archival literature concerning new possibil-
ities for description. We examined how the concepts of social navigation,
interaction history, and social interaction were used in the HCI literature, specif-
ically because this literature describes fruitful outcomes of user contributions to
information sources similar to the development of the Polar Bear Expedition
Digital Collections. Paul Dourish and Matthew Chalmers introduced the term
"social navigation" into the HCI literature in 1994. They define social navigation
as an information system that supports collaborative activity.[27] Since then, other

[24] Ian G. Anderson, "Are You Being Served? Historians and the Search for Primary Sources," *Archivaria*
58 (2004): 81–129.

[25] Yakel, "Impact of Internet-based Discovery Tools on Use and Users of Archives," 200.

[26] Vannevar Bush, "As we may think," *The Atlantic Monthly* 176, no. 1 (1945): 101–108.

[27] Paul Dourish and Matthew Chalmers, "Running out of Space: Navigating in Information Spaces,"
Adjunct Proceedings (Short Papers), HCI'94, Glasgow, August 1994.

scholars have explored this concept, particularly in terms of enhancing systems to promote the retrieval of information through the experiences of other users. Andreas Dieberger, et al. view social navigation simply as a type of navigation "through which decisions are informed by the behavior of other people."[28] They point out that social navigation shows the way people interact with information spaces by using and transforming them. For example, new information spaces arise from use like a path forged through snow, and they provide alternative possibilities for navigating through a system. Evidence of use communicates a message to subsequent users, much the same way as a busy restaurant acquires even more patrons who assume the food must be delicious.

Alan Wexelblat and Patti Maes examine another important aspect of social navigation, "historicity" or interaction history, which they claim imbues objects and spaces. This concept signifies the "records of the interactions of people and objects," and these authors assert that "history-rich objects" are those that contain "historical traces that can be used by people in the current time."[29] They take various forms, such as a used book with text highlighted by a previous owner. These signs, created by the interaction between people and objects, communicate a useful message, such as the need to slow down on a steep curve. Wexelblat and Maes's concept of "footprints" is similar to Peter Pirolli's notion of "information scent" as "the (imperfect) perception of the value, cost, or access path of information sources obtained from proximal cues, such as bibliographic citations, WWW links, or icons representing the sources."[30] In other words, the traces left by previous users of an information source can provide clues about its contents, serving as an additional way to assess and navigate the information.

Closely related to the concept of social navigation and interaction history is the broad notion of social interaction discussed by Allison Lee and her colleagues. Starting from the belief that everyday social interactions in the physical world, such as sharing experiences and providing support, are valuable endeavors, the authors seek to examine whether certain elements foster social interactions in an online environment. They consider the following elements: place-making, common ground, awareness, and interaction enablers.[31] Place has

[28] Andreas Dieberger, Paul Dourish, Kristina Höök, Paul Resnick, and Alan Wexelblat, "Social Navigation: Techniques for Building More Usable Systems," *Interactions* 7 (2000): 38.

[29] Alan Wexelblat and Patti Maes, "Footprints: History-rich Tools for Information Foraging," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* ed. M. G. Williams and M. W. Altom (New York: ACM Press, 1999), 270.

[30] Peter Pirolli and Stuart Card, "Information Foraging," *Psychological Review* 106, no. 4 (1999): 643–75.

[31] Allison Lee, Catalina Davis, Todd Miller, and Younghee Jung, "Fostering Social Interaction in Online Spaces," in *Proceedings of INTERACT 2001: IFIP TC.13 International Conference on Human-Computer Interaction* (Amsterdam, The Netherlands: IOS Press, 2001), 59–66.

been identified as important in both the archival[32] and the HCI literatures. Steve Harrison and Paul Dourish[33] assert that places have social meaning, develop over time, and can mean different things to different groups. Places are created by their "appropriation" and "adaptation" by users. On a website, information architecture can be used to foster a sense of place. For example, incorporating cascading style sheets to promote internal consistency helps users become familiar with a site more quickly and find it more familiar upon returning. Also, a visitor's ability to use features, such as bookmarking a page of interest and thus leaving a "personalized, permanent" mark on the website for future use, engenders ownership and a sense of place.

Common ground is also an important element of social interaction. Herbert Clark views common ground as "the sum of . . . mutual, common, or joint knowledge, beliefs, and assumptions."[34] Common ground requires shared assumptions about an activity, the meaning of artifacts, and in the case of archives, common knowledge about language and terminology. This can be absent in the interaction between researchers and archivists as well as between researchers and records resulting in a researcher's inability to locate relevant materials.[35]

Awareness means having knowledge about the presence of other users and is another feature of social interaction that can be designed into an online space. It can be built into a website in various ways, such as having a public list of individuals currently logged on to a site.[36]

Lastly, interaction enablers allow for spontaneous informal encounters within a shared environment in order to foster meaningful interaction. The social navigation literature identifies two basic forms of interaction: direct and indirect.[37] Direct social navigation is explicit, as in asynchronous conversations between people or synchronous online chat. People engaging in this type of direct interaction are aware of one another. Indirect interaction guides people indirectly through information left as a byproduct of another's activities.[38] Karel

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[32] See, for example, Luciana Duranti's article on the importance of the archive as a physical structure in ensuring the authenticity of records: "Archives as a Place," *Archives and Manuscripts* 24 (November 1996): 242–55.

[33] Steve Harrison and Paul Dourish, "Re-Place-ing Space: The Roles of Place and Space in Collaborative Systems," in *Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW'96)*, (New York: ACM Press, 1996), 67–76.

[34] Herbert Clark, *Using Language* (New York: Cambridge University Press, 1996), 93.

[35] Elizabeth Yakel, "Listening to Users," *Archival Issues* 26, no. 2 (2002): 53–68.

[36] Allison Lee, et al., "Fostering Social Interaction."

[37] Kristina Höök, David Benyon, and Alan Munro, "Editors' Introduction: Footprints in the Snow," in *Social Navigation of Information Space,* ed. A.Munro, K.Höök, D. Benyon (London: Springer-Verlag, 1999).

[38] Andreas Dieberger, "Social Connotations of Space in the Design for Virtual Communities and Social Navigation," in *Social Navigation of Information Space*, ed. Alan Munro, et al. (London: Springer-Verlag, 1999).

Kreijns and Paul Kirschner define *social affordances* as "certain properties . . . that facilitate the triggering of a communication episode in which informal social interaction may take place."[39]

We conclude this literature review with a case study that greatly affected our own research. Martin Svensson and Kristina Höök conducted a five-month study of Kalas, a Web 2.0 social navigation system for food recipes.[40] The Kalas study used a three-pronged methodology focusing on self-reported question-naires, log files, and a handful of interviews, all of which revolved around the use of recipes. The authors' intention was to test Kalas to determine whether a system could be designed to foster social navigation. Using questionnaires and transaction logs focused on recipe usage patterns, the authors found the system easy to use overall and people mostly recognized the symbols of social interaction, including icons representing other users and an online chat function. The authors assessed the users, dividing them into categories based on the frequency of their use of the site and the frequency of specific activities on the site. Four participants were selected for in-depth interviews. Svensson and Höök profiled these individuals to provide contextual information about their use of Kalas. In their assessment of Kalas, the authors found that some features of the site, such as recommendations, were influential, and that users generally appreciated the features enabling social interaction even if they did not fully understand or utilize them. For instance, Svensson and Höök remark that the chatting feature was barely used and although users reported appreci-ating comments, only eleven were posted to Kalas. The authors point to the problem of critical mass—when too few users are simultaneously logged in it is difficult to "see any interesting effects of the real-time presence of others."[41] Svensson and Höök speculate that users often take advantage of social naviga-tion features without conscious awareness of doing so, thus making evaluation difficult. They conclude with a call for various data sources in addition to log statistics in order to tease out the applicability and usefulness of interactive features.

More than any other research, the study by Svensson and Höök provided the best model for the research described in this article. Similar to the Kalas system, the Polar Bear Expedition site is also an experiment to assess the

[39] Karel Kreijns and Paul A. Kirschner, "The Social Affordance of Computer-supported Collaborative Learning Environments," in *Proceedings of the 31st Frontiers in Education Conference, Reno, NV, October 10–13, 2001,* IEEE: 14.

[40] Martin Svensson and Kristina Höök, "Social Navigation of Food Recipes: Designing Kalas," in *Designing Information Spaces: The Social Navigation Approach,* ed. Kristina Höök, David Benyon, and Alan Munro (London: Springer: 2003), 201–22.

[41] Svensson and Höök, "Social Navigation of Food Recipes," 397.

feasibility of using social navigation and interaction in a new domain. Yet, unlike the Kalas study, we are also experimenting with a well-established archival genre, the finding aid, and testing whether adopting Web 2.0 features and functionalities can increase accessibility.

Methodology

As noted, our major research question was, "Can social navigation features be used to facilitate the accessibility of archival materials?" To approach this large question, we sought to answer three specific questions:

1. What features facilitate this accessibility and what features hinder it?
2. How does this finding aid address the expectations and predispositions of various users?
3. How do people interact with one another in this finding aid?

To answer these questions, we utilized a variety of qualitative methods including transaction logs, an online survey, interviews with visitors, and analysis of the comments on the site. We analyzed the data from these sources and then triangulated it in an attempt to answer our questions.

Web Analytics

The transaction logs of the Polar Bear descriptive system automatically generate data about users' behavior. The research group set up a basic Web analytics regime from the beginning and collected data about how visitors arrived at the Polar Bear Expedition site (search engine, other website URLs), how they navigated within it (terms entered into the Polar Bear search engine or browsing information), and the traffic patterns of users via link paths. These data enabled a variety of different analyses including network analysis of the link paths to identify the most frequently used pages, connections between nodes, and patterns of use.

Survey Questionnaire

For approximately six weeks between February and April 2006, we posted a brief survey on the Polar Bear Expedition site available to both nonregistered and registered users. The survey served two purposes: to recruit participants for either face-to-face or telephone interviews and to provide initial data about visitors' perceptions of and suggestions for the site. The survey asked users to rate various features of the site and provide information about their use of the Polar Bear Expedition collections. We analyzed the six responses to the survey using both qualitative and quantitative methods.

Semistructured Interviews

We conducted semistructured interviews with three users of the Polar Bear website, using approximately twenty questions (see Appendix 1). We grouped the questions in the following four thematic categories: 1) definition of the term *accessibility;* 2) expectations of the site; 3) site features; and 4) community awareness of other users and social interaction. Analysis of interviews involved transcribing them and then coding the transcripts both inductively and based on themes emerging in the data or from the literature.

Analysis of User Comments

Registered users of the Polar Bear website may leave comments on any page of the site. We aggregated them in a table including the thread, author, content, and date and time. The comments were also coded using the same inductive codes utilized throughout the interview coding process. Our goal was to identify patterns and themes that illustrate how people use this comment feature and whether it encourages social interaction among users.

Findings

Visitors to the Polar Bear Expedition Site

Of the thousands of visitors to the Polar Bear Expedition site, 114 users registered during this study, that is, they had established a user account as of 30 June 2006. When creating an account, users had the option of posting their real name and/or adding a biographical statement. Of the 114 registrants, 57 (50%) posted real names[42] on the registration form. Fifteen chose to maintain their real name as their username. This suggests users placed a level of trust not only in the research team behind the system but also in other registered users of the site. Twelve users (11%) added a "biographical statement," although the nature of these statements varied. Ten of these twelve (83%) included information about a Polar Bear veteran, sometimes posting links to photographs or other resources. These links were all personal; visitors usually cited a family connection to a Polar Bear Expedition veteran. Five (42%) of these registrants sought additional information about the Polar Bear veteran to whom they were related. Only 1 of the 12 registrants did not state a personal connection to a Polar Bear veteran. Of the 12 users who posted biographical information, 4 (25%) added

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[42] A *real name* is considered to be a profile with both first and last name.

personal contact information, encouraging other visitors to contact them with more information or suggestions.

It is interesting to note here that 52 of the 114 registered users (46%) never actually logged in to the site during the study period. These visitors took the time to register but never actually used their accounts. Thus, only 62 (54%) registered users were active, and of this number only 12 actually participated in the site during the first six months. This could be a result of many factors, including the relative newness of the Polar Bear Expedition site as well as uncertainty regarding the benefits of logging in and actively participating in the site. Part of this phenomenon could be explained by the problem of critical mass described by Svensson and Höök. More active visitors to the site may be needed to make it useful, thus providing an incentive to register and participate. Subsequent analysis is needed to explore this phenomenon further.

We learned a bit more about visitors to the Polar Bear Expedition site from our survey. Of the 6 survey respondents, 5 identified themselves as members of the general public and 1 as a student. One also noted membership in the Polar Bear Memorial Association, a community that meets annually on Memorial Day to commemorate the Polar Bear Expedition veterans, all of whom are now deceased. Four of six survey respondents cited genealogy or family history as their primary reason to use the Polar Bear Expedition site, although they also indicated that they used the site out of historical interest. One respondent cited that he was using the site for a class paper. In terms of user demographics, 4 (67%) users were fifty years of age or older, and all have had more than one year of experience using the Internet. In conclusion, based on these limited data from the user profiles and the survey, we surmise that genealogists are the more engaged visitors to the Polar Bear Expedition site.

How Visitors Used the Site

We think that *how* the site is used is as important as *who* visits the site, so we also analyzed which social navigation functions worked best in the virtual archives and why. We examined the mechanisms to facilitate site navigation and social navigation: bookmarks, comments, link paths, browsing, searching, and user profiles. In addition to examining these functionalities, we also studied use of the content of the sixty-five fully digitized collections.

Bookmarks

The six online survey respondents cited the importance of bookmarks. Five respondents found bookmarks to be either very important or somewhat important. The respondent who did not identify bookmarks as important may not

have intended to return to the site. At the time of the online survey in early 2006, the utility of bookmarking was limited since individual digitized items could not be bookmarked. The transaction logs show that at least one individual tried repeatedly to bookmark individual items. For whatever reason, bookmarking has not become a popular feature. Although the most avid visitor bookmarked nineteen pages, most visitors only mark a single page, usually a collection or a biography of an individual. As implemented, bookmarking facilitates individual use of the site, and visitors' personal browsers may be an easier way for them to keep track of favorite pages. In the future, the research team may consider implementing social bookmarking, such as is done at del. icio.us.com, to foster a greater sense of community and common ground on the site.

Comments

Between January and June 2006, 26 comments were posted to the Polar Bear Expedition site. Visitors posted 17 comments suggesting corrections and/or requesting information to be added to the site. Nine comments were responses from the archivist. All but one of the survey respondents were aware of the comment feature. They read the comments of other users, although only 2 of the 6 respondents (33%) indicated that they had contributed a comment. Qualitative analysis and coding of the comments identified two major themes: error correction and information sharing.

Visitors pointed out a variety of errors including spelling, unit attribution, and death date. Six of the comments were categorized as error detection in the legacy finding aids, providing spelling correction for a veteran's name or commenting on the listing of an individual with the wrong military unit. Typical comments included:

> Wilfred L. Martell is incorrectly posted to the wrong unit. PVT Martell was in the signal detachment of the Headquarters unit not Company H. I'll send documentation. (Comment on Wilfred L. Martell, 2/5/2006)

> The record for Daniel Steele shows up when you browse the list of men supposedly in the 310th Engineers, Company F (it also shows up in the correct list for the 339th, Company H). (Comment on Daniel Steele, 6/5/2006)

These comments generally received a timely response from the archivist acknowledging them and offering to make the corrections upon receipt of appropriate documentation. Users respected the need for documentation to make an authorized change to the finding aid. This collaboration between users and archivist is constructive.

These examples suggest that users who have more knowledge of specific content in a collection can enrich the descriptive information available about

archival materials. Future archivists can also learn from the interactions among their predecessors and former users. Users benefit in two ways. First, by actively contributing to the site, they gain a sense of ownership and a vested interest in the site's continuation and improvement to address their information needs. Second, their corrections benefit future users of the materials. Even if sufficient documentation is not available to support changing the description, the comment still stands for later visitors to consider. Light and Hyry envision this type of collaboration to enhance accessibility by providing a richer context for archival materials. Archivists have always had to respond to user feedback and error detection; the online environment is a public forum that creates a new transparency in the archival decision-making process as archivists acknowledge, verify, and either make corrections or refute comments.

Information sharing was the other prominent function of the comments. Examples include:

> O. A. Mowat stands for Oliver Alexander Mowat. (Comment on O. A. Mowat, 3/19/2006)

> Harold W. Laird was my much-beloved grandfather, and the Polar Bear Expedition was such a part of his entire life. Although this document notes he attended the 1958 reunion, I know that my mother also took him to a reunion in the 1970s. He never forgot this time in his life, and we are so proud of his service. My grandfather died in October 1975. (Comment on Harold W. Laird, 4/15/06)

User comments conveyed a willingness to share information about the Polar Bear veterans. Nine comments added factual information or external resources. Several of the commentators offered archival materials to the Bentley or digital copies of items that they wanted to see incorporated into the Polar Bear Expedition website, for example, "If there is any information that I have that you would like to add to your collection I would be happy to send it along to you" (Comment on O. A. Mowat, 3/19/2006). We did not expect offers of donations and we quickly had to set up a standard response. The research team developed a process with the Bentley Historical Library to review these offers to ensure that they went through the proper collection development and legal processes. Although we did not intend that our descriptive system would be transformed into a collection development system, this is a logical extension.

Other visitors took on the role of reference archivist, offering their contact information to interested users or responding directly to comments. One user considered himself an "authority" on a particular individual's life noting, "I would presume that I am the authority on Henkelman's life, therefore, please feel free to contact me for further information, and/or you may refer any researcher to me directly" (Comment on William Henkleman, 1/29/2006). One user responded directly to another who was inquiring about her great uncle and

referred her to several external resources. The user, in response, welcomed the information and was grateful for the citations. She, in turn, posted the URL of her webpage, extending the invitation to copy or save anything from her website.

Such uses of the comment feature can assist the archivist with reference tasks and extend the traditional archival finding aid by documenting the questions and responses of users for the benefit of future visitors. The system preserves the interaction history among users and the finding aid and also affords opportunities for information sharing among users (including archivists).

Link Paths

Three of the six respondents to the online survey viewed link paths as very important. The remaining three respondents either thought they were somewhat important, neutral, or somewhat unimportant. This ambiguous response to link paths was also reflected in the three semistructured interviews, in which only one participant commented on this feature of the website, mentioning that he was unaware of it initially and wanted to learn more about it, stating, "I haven't actually used that before, I didn't know that feature existed. . . . Can you explain to me a little bit what it is 'cause it sounds like something I might use" (Interview 2, sections 63 and 65). As a result, we decided to adapt the Amazon tag line "Customers who bought this item also bought" for our site. Now under the link paths section we have the caption "Researchers who viewed this page also viewed. . . ." As noted above, the lack of critical mass affects the link paths more than the other features. The more traffic, the more robust the link paths become. In future analysis of the site, we will consider whether the link paths are working and analyze the connections in greater depth.

Browse

All three interviewees mentioned that browsing was the most important navigational feature of the Polar Bear Expedition site. Their appreciation of the categories for navigating quickly through the system are reflected in this statement, "My preference has basically been to browse by just going through type of subset and then either alphabetically or whatever then go down, scroll down the list until I find what it is I'm looking for" (Interview 1, section 19). Transaction log data concerning traffic patterns on the site confirm this preference for browsing. We analyzed these patterns both qualitatively and quantitatively by creating a spreadsheet containing traffic data. Given the unwieldy size of these data, we limited the number of traffic patterns to those that had at least 100 hits in the system, totaling 839 patterns. The transaction logs showed the node (webpage) visitors started from and the node they traveled to as well as the number

Table 1. The Twenty-Five Most Heavily Trafficked Patterns

Node-From	Node-To	Hits
Welcome to the Polar Bear Expedition Digital Collections	browse by : individual name	2597
Welcome to the Polar Bear Expedition Digital Collections	browse by : collection	2192
Welcome to the Polar Bear Expedition Digital Collections	browse by : geographic location	1642
Welcome to the Polar Bear Expedition Digital Collections	advanced search	1302
Welcome to the Polar Bear Expedition Digital Collections	Polar Bear History	1256
Welcome to the Polar Bear Expedition Digital Collections	About this site	865
Welcome to the Polar Bear Expedition Digital Collections	browse by : media type : Photographs	853
Welcome to the Polar Bear Expedition Digital Collections	browse by : military unit	700
Welcome to the Polar Bear Expedition Digital Collections	browse by : media type	665
Welcome to the Polar Bear Expedition Digital Collections	The Archivist	653
Welcome to the Polar Bear Expedition Digital Collections	Contact Us	649
Welcome to the Polar Bear Expedition Digital Collections	browse by : subject	592
Welcome to the Polar Bear Expedition Digital Collections	What is my password	585
Welcome to the Polar Bear Expedition Digital Collections	browse by : organization	583
Welcome to the Polar Bear Expedition Digital Collections	browse by : media type : Diaries	568
Welcome to the Polar Bear Expedition Digital Collections	Coming Soon	555
Welcome to the Polar Bear Expedition Digital Collections	browse by : media type : Maps	530
browse by : collection	Henry J. Abel papers	523
browse by : geographic location	Search Results	447
Help	Help : User Account	415
advanced search	browse by : collection	380
advanced search	browse by : individual name	379
advanced search	Welcome to the PBEDC	378
browse by : geographic location : Detroit (Mich.)	Search Results	371

of hits (frequency) for every node-from and node-to pattern. Our spreadsheet consisted of three columns of data: the webpage visitors started from (node-from), the webpage they arrived at (node-to), and the number of times this particular node-from-to pattern was exhibited by a visitor (hits). A qualitative analysis of the twenty-five most heavily trafficked patterns provides a snapshot of the most common navigation choices made by visitors to the site (see Table 1). The most common traffic pattern for all visitors to the site began with the homepage and proceeded to the "browse by: individual name" link. This pattern received 2,597 hits during the six-month trial period. We found that each of the seven browse categories listed on the homepage were included in the top fifteen traffic patterns revealing that visitors made frequent use of the browsing categories, at least initially, to navigate the site.

With the help of a freely available online text analysis tool,[43] we also conducted a text analysis of the node names listed in the spreadsheet to determine

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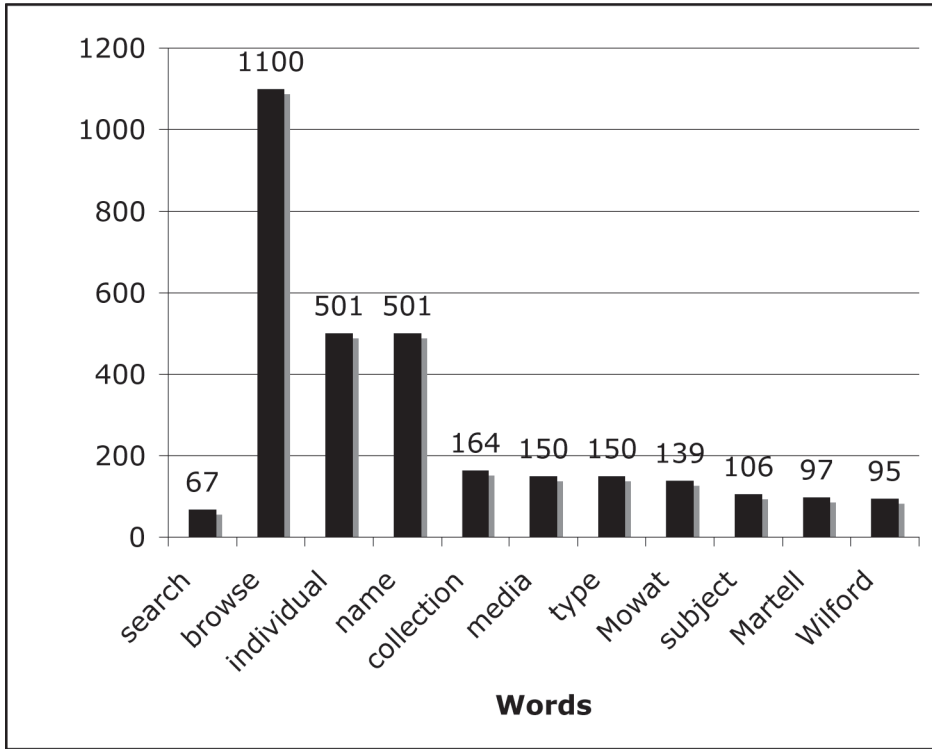[43] Textalyser, available at http://textalyser.net/, accessed 1 August 2006.

FIGURE 2. **Frequency and Top Types of Terms in 839 Traffic Patterns**

how often the browse and search features were utilized.[44] The results of the text analysis (summarized in Figure 2) display how often a particular word occurred in a node within the 839 traffic patterns we examined. The most common word in these most heavily trafficked patterns was "browse." As part of the name of a node, "browse" occurred either in the webpage visitors started from or the one where they ended up 65% of the time,[45] occurring in 1,100 of the 1,678 nodes in our spreadsheet. We found that the advanced search function was part of the most heavily trafficked nodes less than 1% of the time. These data add more weight to the assertion that the browsing categories are used much more frequently to navigate through the Polar Bear site and that advanced search is less popular.

[44] Node names that indicated use of the browsing categories contained the words "browse by" and those that indicated that visitors had used the search engine contained the words "advanced search." Because the node architecture on the site was set up in this way, we were able to obtain frequencies of how often these words appeared in the traffic patterns.

[45] Because we looked at 839 traffic patterns of node-from and node-to names, we had a total of 1,678 nodes in our spreadsheet.

Search

Although we think that our findings point to browsing as the most important navigation feature on the Polar Bear Collections site, we recognize that the search function is a familiar and necessary navigational component. To encourage visitors to use it, we placed a convenient link to a keyword search box on every page. To understand more about how visitors utilize the search feature, we again examined the transaction logs. We were interested in identifying the type of information sought and the types of search terms utilized. We analyzed and categorized the search terms and found that over half of the queries were individual names (63%). Many users typed and retyped names with different spellings to try to locate information on an individual. Another popular search category was subject, with users seeking anything from medals to dogsleds. Geographic location was also a frequent search term as well as military unit. These types of search queries align with the browsing categories on the Polar Bear Expedition site. Figure 3 illustrates the most common types of terms visitors used to search the site. An advanced search option also available to visitors was not a heavily used navigation tool according to our analysis of the transaction logs.

In analyzing the use of the search feature, we found inconsistent data. For example, in the results of the online survey, search was listed as being as important as bookmarks and more important than browse, contrary to the transaction log data. The interviews also yielded ambivalent information about the search function. One participant expressed some frustration with the search box, claiming it yielded unreliable results:

> I tried the search box occasionally. It didn't always yield consistent results. Sometimes I'd get an error message. (Interview 1, section 4)

The transaction log listings of search terms entered also demonstrate visitors' uncertainty concerning the search function. Search has often been cited as problematic because it requires researchers to come up with terms on their own, and our transaction log data support this finding. Users repeatedly typed the same terms into the search box indicating that they did not get a satisfactory response from the system after one, two, three, or more attempts. It is possible that frustration over the search function dissuaded some users from returning to the website or pushed them into browsing, although we do not have data to support this speculation. Our research alerted us to problems with the search function, and we have made improvements that we will analyze in the near future.

User Profiles

Only 2 of the 6 online survey responses found user profiles to be very important. Interview participants were equally ambiguous. Participant 2, a history
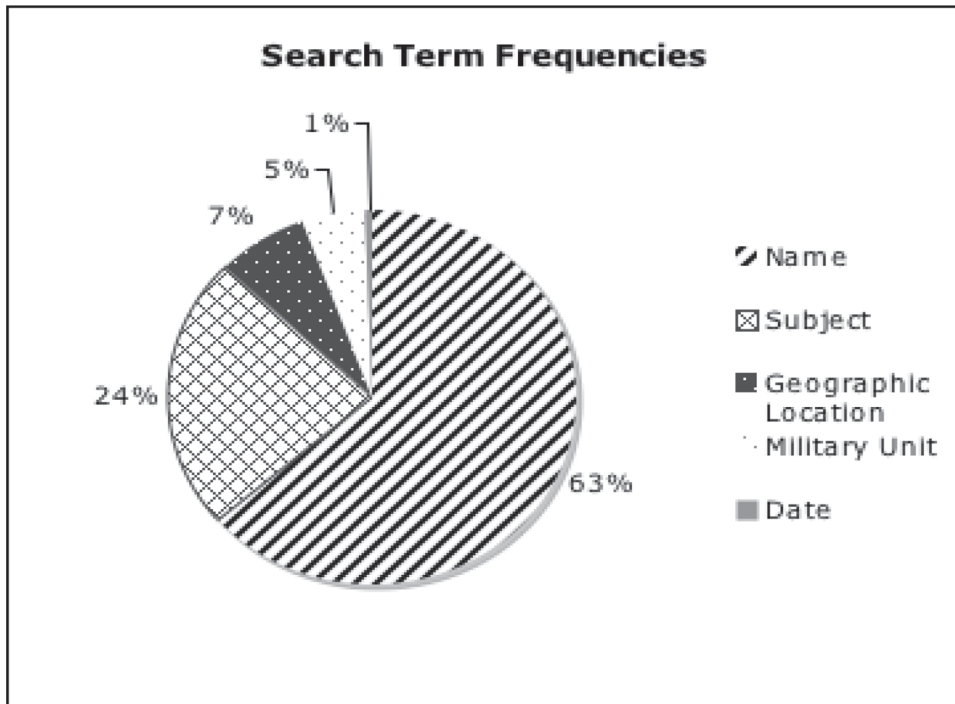
FIGURE 3. **Search Term Frequencies by Category**

student, admitted to not "making extensive use of" his user profile, perhaps because he was less interested in the social aspect of the site and more focused on the materials. Participant 3 admitted he was a "novice" but viewed user profiles as a potential networking tool:

> Well I like the fact that I was able to post and say that I was looking for information on my grandfather Charles Doe and given the engineering regiments 310th company A. That's sort of neat because obviously everyone on this webpage is going to be interested and there could be a great deal of networking that perhaps someone knows something. It's sort of a shot in the dark, if you will, but it's a nice feature to be able to take advantage of other people's expertise that's using the website. (Interview 3, section 224)

Because of the comment feature on the site, we did not expect visitors to use the biographical statement as a forum for seeking more information. Although the use of the biographical statement feature by visitors does show a willingness to interact with other users of the site, that only 12 of the visitors (11% of the 114 registered users) took advantage of this feature corroborates the survey responses suggesting that profiles of other users are relatively unimportant to these visitors. Perhaps the incentive to register may be low because visitors can read comments without registering and creating a profile.

Digitized Resources

The sixty-five fully digitized collections are the most important feature of the Polar Bear Expedition website and include digitized photographs, letters, journal entries, maps, military records, oral histories, and a motion picture film. The online survey revealed that 5 out of 6 respondents (83%) thought the digitized resources were very important, and only 1 respondent found them very unimportant. The digitized resources were also discussed in the semi-structured interviews. Two participants pointed to the value of the proximity of the surrogates to the textual descriptions and the potential of the visual nature of the site for understanding the historic event. Two interviewees commented:

> But the visual aspect is what's attractive here, you can go in and see the photos as well as the newspaper clippings they brought back which you can't find unless you go looking at microfilm somewhere and here you can see it in the positive instead of the negative. I found some interesting newspaper articles in there as I was browsing you know, that they'd clipped or their family had clipped while they were there and it gives you a whole different perspective of what the papers were saying at the time. The visual I think is important. (Interview 1, section 147)

> Well I was shocked at the . . . again, I don't know what I expected . . . the technology behind the scans. I think the scans are just fantastic. (Interview 3, section 58)

For these participants, the quality of the digital images on the Polar Bear Expedition site provided a more authentic portrayal of the event in American history. The visual images also helped these interviewees imagine the lives of their ancestors with greater clarity. The convenience of accessing the images remotely was also cited:

> I'm sitting here in my stockinged feet looking at the website as we talk in my home is just a Godsend. To be able to look at this material . . . and I found my grandfather's name and, in fact, my sister thinks we found a picture of my grandfather . . . we are just ecstatic to be able to do that from the comfort of our home. (Interview 3, section 24)

Discussion

In the preceding section, we suggest that the FANG project for the Polar Bear Expedition Digital Collections offers more than description combined with digital surrogates of archival materials. Features embedded within the site encourage social interaction among visitors as well as among visitors and archivists. The question is whether these also enhance accessibility.

As previously noted, Lee, et al. identified four elements of social interaction: 1) place-making, 2) common ground, 3) awareness, and 4) interaction enablers. We will use this framework to examine how the functionality and features of the Polar Bear Expedition site enhance social interaction as well as accessibility to the collections. Table 2 summarizes how we think the features in the Polar Bear Expedition site align with these four dimensions of social interaction.

Place-making

The Polar Bear Expedition site is a virtual archives in the sense that it is self-contained and provides the ability to interact with other users or archivists. The digitized resources help to create this sense of place in the site because of their proximity to the descriptions. Visitors reacted in different ways to this site. Two interviewees pointed to the availability of the digital images of the Polar Bear Expedition site in both piquing interest in the event (particularly for younger generations) and in creating a "flavor" or impression of the veterans' experiences:

> I was hoping to find more information about grandpa X's wounds and his record . . . coming back to the United States. . . . I had selfish hopes of finding all this documentation of my granddad and obviously I haven't found that kind of . . . it's going to be hard. So I guess . . . I wanted to get more of a . . . flavor of what they went through up there, you know what kind of experience it was. And the pictures on this website are really helping that. (Interview 3, section 54)

Although this interviewee was not able to find information on his grandfather, he did acquire a broader sense of the event through the digitized images available on the Polar Bear Expedition site. Place-making, then, can occur even when specific information needs are not met.

Bookmarks also enable place-making. Hammond and his colleagues noted that shared bookmarks can "create a series of shared spaces that have the potential to become 'living' resources that maintain and extend the relevance of each

Table 2. Four Elements of Social Interaction in the Polar Bear Site

Four Social Interaction Elements[1]	Polar Bear Expedition Digital Collections
Place-making	Digitized resources, bookmarks, consistent style
Common Ground	Genealogical interests; Polar Bear Memorial Association
Awareness	List of "new users"; user profiles, simultaneous visitors
Interaction Enablers	Comment feature, bookmarks, link paths

[1] Lee et al. (2001).

paper beyond its initial publication."[46] While the bookmarks on the Polar Bear Expedition site cannot yet be shared, they do create a sense of place by allowing individuals to customize the site and return expeditiously to the collections or to the information in which they are most interested.

Finally, consistency in the site's appearance and style also added to the sense of place in the virtual Polar Bear Expedition space. The FANG Team strove to create consistent design, implementing cascading style sheets, to ensure that page organization, navigation, and fonts were the same from page to page. By following these basic rules of website design, the site displays a single look and feel that has remained stable since its inception. As one interviewee remarked when asked what was different about the Polar Bear website, "very intuitive—once you got in there you didn't have to scratch your head and figure out what'll I do next, just continue and dig down, go deeper 'til you get to what it is you're looking for" (Interview 1, section 4).

Common Ground

Common ground is another important element for fostering social interaction. Clark and Brennan define common ground as "mutual knowledge, mutual beliefs, and mutual assumptions."[47] Our study suggests that users of the Polar Bear Expedition site have either a genealogical tie to the veterans or a historical interest in the intervention. The most active visitors bring an informed background as well as knowledge and experience to the site. For visitors who are less familiar with the historical event, a brief historical sketch provides contextual information and helps to foster common ground.

An additional factor that may enhance common ground in this virtual space is the existence of the Polar Bear Memorial Association. This group meets yearly to commemorate the veterans in an annual Memorial Day event. Several users of the Polar Bear Expedition collections were attracted to the association either directly or indirectly through a hyperlink posted in the comments. Participant 2 mentioned that he was recommended to the Polar Bear Expedition site through the association, while participant 3, a member of the association, viewed the site as complementary, assisting people to connect with one another:

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[46] See Tony Hammond, Timo Hannay, Ben Lund, and Joanna Scott, "Social Bookmarking Tools (1)," *D-Lib Magazine* 11, no. 4 (April 2005), available at http://www.dlib.org/dlib/april05/hammond/04hammond.html, accessed 5 July 2006.

[47] Herbert H. Clark and S. E. Brennan, "Grounding in communication," in *Perspectives on Socially Shared Cognition,* ed. Lauren B. Resnick, John M. Levine, and Stephanie D. Teasley (Washington, D.C.: American Psychological Association, 1991), 127.

> We've gone to [Polar Bear Memorial Association annual meeting] for proba-
> bly 3 years. And . . . the first time it's like my goodness, these are people that
> have historical connections with the Polar Bears as well, obviously. But how in
> heaven's name else would you make contacts with these people, you see? I
> think this website . . . steps right in there. (Interview 3, section 260)

A w a r e n e s s

The Polar Bear Expedition Digital Collections foster awareness, or knowledge,
of the presence of others. The navigation column includes a list of "new users"
that leads to user profiles, and visitors are able as well to see who else is online.
The comment feature that attaches users' names to their postings also fosters
awareness. Hyperlinked names lead users to profiles and other comments by
that visitor.

In response to the question, "Do you notice the presence of other users in
the finding aid?" the interviewees acknowledged a vague awareness of other
users through their names and profiles. One participant expressed an interest
in contacting someone directly via their user profile:

> I look at what they're looking for. So I click on the name and see what they're
> looking for and obviously if it's something I can do . . . I would try to. . . . I
> don't know . . . if I could contact someone. . . . (Interview 3, section 230)

We concluded from both the survey and interview data that the user pro-
files were not an important feature for visitors. Additionally, comments were
more often directed to the Archivist than to other visitors.

The Archivist is a ubiquitous presence on the site, as each collection
description notes that it is "maintained by the Archivist." Visitors directed com-
ments to the Archivist through "contact us," as well as in comments for individ-
ual collections. This creates a bit of confusion and more detailed monitoring
than we envisioned. However, all of the comments to the Archivist are open to
other visitors so that they can learn from other users' reference questions and
the archivist's responses. Based on our data, the Archivist rather than the other
users has become the focal point of user interaction. While awareness is an
important element of social navigation in and of itself; however, Lee, et al. assert
that "awareness of users is a precondition for interaction."

I n t e r a c t i o n   E n a b l e r s

Interactivity in the Polar Bear Expedition finding aid transforms it from
a static to a dynamic document, an ever-changing resource that provides
multidirectional knowledge sharing. The Polar Bear Expedition site employs
both direct and indirect interaction enablers. We observed direct interaction in

the dialog between a user and the archivist or among visitors in the comment feature. Link paths are an example of indirect social navigation in that they foster connections between collections and items that are not intuitive, high-lighting new relationships that may be a valuable source of information for researchers. User profiles are also an indirect form of social navigation as they may offer guideposts or clues for future visitors to the site. Taken together, these social artifacts contribute to a sense of virtual community. This is particularly true since many of the comments and profiles are those of members of the exist-ing Polar Bear Expedition community. It is clear from the user profiles and comments that visitors to the site often come with a personal connection to a Polar Bear veteran and are interested in the archival materials and one another for this reason.

In addition to interaction among visitors and between visitors and the Archivist, the research team wanted to create a different type of interaction between the user and the finding aid. For example, registered visitors can book-mark pages of interest to return to when they next log on to the site. For regis-trants, the site also automatically keeps a record (in the navigation column) of the last items viewed. These features allow for a different type of interaction with the finding aid as well as with the primary sources.

Accessibility

Our main research question studied how to enhance accessibility for archival materials. We found that direct and indirect interaction, enhanced by the technological features of the Polar Bear Expedition site, did indeed make the archival materials more accessible by enriching the traditional notion of the finding aid.

Place-making within the Polar Bear Expedition site is a good way of increas-ing accessibility. The proximity of digital surrogates of original materials enhances remote access, and the intuitive categorization of the materials makes them more accessible to users. These features appear to increase accessibility the most. Interviewees often defined accessibility based on experiences with other archival finding aids and collections. They appreciated the convenience of remote access to digitized primary resources, and one visitor explicitly defined accessibility in terms of what she/he was looking for, noting, "It's find-ing it. That's I think the number one thing. You generally go in knowing some-thing of what it is you're looking for . . . either it's something to do with a name . . . or a geographic location or a feature" (Interview 1, section 27). Reflecting on the browsing categories one interviewee stated:

> One thing that I appreciate about the Polar Bear Expedition site is that it breaks it down by different media types and different subject categories. You

can search by correspondent or letters . . . they have a whole list of different ways you can search all the different files on the Polar Bear Expedition site so that's one thing I really appreciate about it. (Interview 2, section 70)

We had difficulty creating common ground and awareness. The features requiring registration, such as the user profiles, comments, awareness of simultaneous online visitors, and bookmarking, were less successful because of the small number of people taking advantage of the registration process. We did find that the user profiles and comments introduce the voices of users into the formerly closed finding aid environment without compromising the authoritative quality of the finding aid. Comments also become a forum through which users point out errors and make suggestions to clarify the descriptions of these materials. We also found that the research team and archivists at the Bentley Library could easily manage this. Any fears that we had about misuse of comments, overwhelming numbers of suggestions for change, and our inability to administer this feature were not realized.

When asked whether the Polar Bear Expedition site makes the materials more accessible, interviewees answered positively, citing the convenience of the search function, the extensive cross-referencing, and the ability to share the website with other family members:

Yes, something that strikes me is we have a relative in Oklahoma, my sister's up in Northern Michigan . . . I have another cousin over in Freeport, Michigan, I think Freemont, Michigan and we are all able to access your collection and then collaborate via email with the things we find and different things that we discover. So by having this on the web you're allowing people in three different states to be able to do research [that] otherwise would have been impossible for us. (Interview 3, section 106)

We had not considered information sharing in this way, and this discovery provided interesting insight into the ability of the Web to create ties in the physical world. From the interviews and our analysis of feature usage, we would argue that the definition of accessibility goes beyond the official *SAA Glossary* definition of accessing information with a "minimum of barriers" and that it should include the careful consideration of interface and information architecture issues, organization of information into meaningful categories for visitors, and the affordances of being able to share the information with other users.

Interactivity on the Polar Bear Expedition site takes place primarily between the Archivist and individual visitors. We had anticipated that users having similar interests and needs would collaborate to improve accessibility to the archival resources by helping one another. In the first six months after launching the site, we did see some of this type of interaction, but users solicited the Archivist more often than they did other visitors through both the user profiles

and the comments. While the research team did not use colophons, the presence of the Archivist is made explicit in several ways. First, the Archivist is identified as an authoritative voice in the finding aid through the words "maintained by the Archivist" on pages containing archival descriptions and content. Second, the Archivist is present on the website through responses to questions, suggestions, and comments. These responses include frequent updates and less frequent changes to the database when users present reliable evidence. These interactions between users of the site and the Archivist are an important step in enhancing the accessibility of archival materials. But, they also make the Archivist the key participant on the site and the focus of all questions. The interviews, however, suggested a more limited role for the Archivist. None of the interviewees felt they could ask a reference question and receive a response from the Archivist:

> I don't know if that's clearly expressed on that, I hadn't thought of it that way. All I've done in the past is if I had a question, I emailed . . . the archivist for this collection so I used the link on the other website directly to him and send it that way. Now that you mention it I don't see that sort of suggestion or link. It's not clear who's reading the comments. . . . (Interview 1, section 155)

In future projects, we will address the ambiguity of the role of the "Archivist" and create a more prominent "virtual reference space" to encourage interaction with the Archivist. It will be interesting to analyze the development, rediscovery, and use of visitors' comments in the long term since they become an intrinsic part of the authoritative finding aid, preserving the history of interactions with the materials, among visitors, and between visitor and Archivist that potentially adds an additional layer of information.[48] We hypothesized that these insights would enhance the archival materials and make them more meaningful for the user community. In terms of providing an additional layer of descriptive information, comments have great potential. So far, however, users have refrained from posting insights about the digitized collections, choosing instead to include additional information about individual Polar Bear veterans.

Conclusions

We began the study inspired by developments in archival thinking that demonstrate a more transparent, "user-centered," and "needs-based" approach

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[48] Further analysis of visitors to the site and their interactions is available in Elizabeth Yakel, Polly Reynolds, Seth E. Shaw, Jeremy York, and Magia Krause, "Polar Bear Expedition Digital Collections: Enhancing Online Use through Digital Curation," *Proceedings of DigCCurr 2007 Chapel Hill North Carolina, 18–20 April, 2007*, available at http://www.ils.unc.edu/digccurr2007/papers/yakel_paper_4-4.pdf, accessed 16 May 2007.

to archival finding aids. We believed that users of archives approach materials with rich backgrounds and can contribute constructively, either directly or indirectly, to description of and access to the materials. We thought this collaboration could be advantageous for archives as well as for current and future users, transforming the finding aid from a static document into a dynamic one that contains a contextualized interaction history of users' experiences.

The Polar Bear Expedition Digital Collections site provides a glimpse of this future. Our initial assessment suggests that archivists can employ social interaction tools productively in finding aids to add to the depth and accuracy of descriptions. We are disappointed, however, in the limited use of some of the interactive features, which may be due to the relative newness of the site and the preponderance of visitors interested in their own heritage and not necessarily in information on other soldiers or the broader history of the Polar Bear Expedition. We are encouraged by the reactions of those who did use the social interaction tools and report being very satisfied with their online interactions. The question remains as to whether these social navigation tools are the most appropriate for archival finding aids or whether other tools such as annotation of the finding aid itself, tagging, and explicit ranking might better serve archival audiences.

As the site evolves, we will continue to study both the site and the community it engenders and report our findings to the archival community. For example, we are interested to see whether the increasing number of comments will inspire other visitors to comment, particularly regarding the images. Since writing this article, we have enabled commenting on individual items and visitors have taken advantage of this ability. Also, we have made several adjustments to the collaborative filtering mechanism, and we can now study whether this is being used more extensively as visitors retrace the paths of others. In conclusion, we are encouraged by this experiment and will continue to push the boundaries of current descriptive representations and reconceptualize how the interactions among archivists, researchers, and records can enhance the archival record.

Appendix 1: Interview Protocol

Accessibility

1. Are the Polar Bear collections the first archival materials you have ever used?
   a. Has your experience with the Polar Bear materials been different? If so, in what ways?
2. We are interested in how the online finding aid for the Polar Bear collections does or does not make the materials more accessible. Can you tell me how you would define something that is accessible?
3. (Keeping in mind what participant has said), do you think the online finding aid makes the materials more accessible? In what ways?
4. Were there any barriers to your use of the site?

Expectations

5. What is your use of the Polar Bear collections?
6. Did you have any expectations of what you would find in the finding aid? If yes, what were they? How did the site meet your expectations?
7. Did you learn anything new from this site or contribute what you already knew?
8. Did anything surprise you?
9. Would you change anything?

Features

10. What features of this online finding aid have you used?
    a. Prompt with commenting, bookmarking, link paths?
    b. Tell me how you have used them.
       i. Have you found them helpful? Why or why not?
    c. If no, what is the source of your hesitation?

Community

11. Do you notice other users on the site?
12. Have you engaged in an exchange with other users of the site concerning a Polar Bear item?
13. What do you think about the active participation of users?
    a. Is it helpful to see how other users have commented on an item?
    b. Is it helpful to see which path other users have taken to a particular item?
14. Have you used comments? Written/read? Probe on this.
15. Did you notice the presence of the archivist in the finding aid? In what ways? Why not?

16. Do you feel that you could ask questions online and receive an answer?
    a. Does it matter if that answer comes from the site archivist or another user?
    b. Why or why not?
17. How does it make you feel to use the Polar Bear Expedition site?
    a. Does it make you feel like you are contributing something?
    b. Does it make you feel like you are a part of something?
    c. Do you feel like you have a voice in the finding aid?