Supporting Community-Building in Digital Libraries: A Pilot Study of LibraryThing

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Abstract

Many digital libraries do not support well, through their content and services, the social context surrounding and within them, and should better support community-building activities around and within themselves so as to integrate better with social groups and communities. This exploratory research study provides a preliminary step to studying and solving this problem by piloting a survey instrument to measure the support for community-building in digital libraries, using LibraryThing (librarything.com) as a test case. Limited to a sample of five doctoral students from the Florida State University School of Library and Information Studies, the survey responses indicate the level of support provided by LibraryThing for community-building is rather low, with the social networks of participants with regard to LibraryThing and its users not being especially wide-ranging or dense. In addition, community-building activity was actually observed in the results, but was not supported by the digital library. The validity, reliability, generalizability, and usefulness of the survey instrument and the results and findings uncovered here can be improved by adding open-ended questions; following up with other research methods, such as qualitative interviews; and drawing on the concepts and theories of boundary objects, social worlds, and information worlds.

Supporting Community-Building in Digital Libraries: A Pilot Study of LibraryThing

The field of digital libraries has historically held two differing concepts of what a "digital library" actually is. One definition followed by many researchers considers digital libraries as "[digital] content collected on behalf of user communities," while another followed by many practitioners considers digital libraries as "institutions or services" (Borgman, 1999, p. 227). However, Bearman (2007) maintained that digital libraries are "not mere technical constructs" (p. 251), not simply information retrieval systems or databases; instead, they are inherently social organizations and environments, requiring *both* content *and* services. This consideration was not new; Levy and Marshall had argued that digital libraries should be considered social as early as 1995 (Levy & Marshall, 1995), and this line of thinking could be considered to go back as far as Bush (1945), who intended the information stored in a "memex" to be socially exchanged, constructed, and discussed by scholars and scientists. Digital libraries should thus be considered as (a) collections of digital content collected on behalf of a user community, (b) services relating to the content that are offered by or through the digital library to the user community, and (c) formal or informal organizations that manage the content and services. This parallels the roles of physical libraries (Pomerantz & Marchionini, 2007, p. 506), which are not just physical collections but also physical and conceptual spaces that "link people to ideas and to each other."

From this definition, it should be clear that one of the biggest objectives of digital libraries is to support and build the differing kinds of "knowledge communities" that use their content and services (Bearman, 2007, p. 245). Such communities may vary in many respects: they may already exist or be newly created; they may be entirely online / virtual communities, entirely offline, or a hybrid of both of these; they may consist of practitioners, those with similar interests, or those with similar learning needs. The "knowledge community" of users that Bearman (2007, p. 245) argued should be supported by a digital library could and should be considered to be of any and all of these types of communities.

Digital libraries most certainly "can affect the health of these communities" (Agre, 2003, p. 227), changing their "existing processes" (Van House, 2003, p. 272), "restructur[ing] their relationships" (Adams & Blandford, 2004, p. 71), and hopefully improving them and their health by successfully supporting the "internal workings of these communities and their links to the rest of the world" (Agre, 2003, p. 227). This is especially true since "tools, systems, [and] interfaces"

that deal with information are tightly bound with communities, particularly those of common practice; the two concepts should and do converge with each other and are hard to examine separately (Star, Bowker, & Neumann, 2003, p. 244).

The need for digital libraries to consider and support their communities and community-building activity is clearly evident and supported by both researchers and practitioners in the library and information science field. This is true as far back as the earliest digital library conferences in 1994, where Ackerman (1994, p. 198) argued that it is "unwise … [and] unnecessary … [that] social exchange and interaction" be ignored by digital libraries. Levy and Marshall (1995) maintained that digital libraries were not only used by sole individuals and that information seeking "is more collaborative than generally realized" (p. 80). More recent arguments and evidence for the need to support and build communities have been given by

- Neuhold, Neiderée, and Stewart (2003, p. 1), who stated digital libraries must support "community efforts to capture, structure, and share knowledge";
- Marchionini, Plaisant, and Komlodi (2003, p. 121), who noted that digital libraries "are embedded in many different communities … [and] contexts" which are "inescapable";
- Van House (2003, p. 272), who argued digital libraries must support "cognitive or knowledge work" that is critically "situated, distributed, and social";
- Marshall and Bly (2004), who concluded digital libraries must allow for the finding and sharing of information that strengthens communities and social ties;
- Lynch (2005, para. 21), who maintained digital libraries must be "connect[ed] and integrat[ed] … with broader individual, group, and societal activities" and must support social interactions; and
- Gazan (2008, Introduction section, para. 2), who argued content in digital libraries is naturally part of "an ongoing conversation among a community," and that digital libraries should not ignore that conversation.

Providing successful support for growing and building communities surrounding digital libraries also requires serving and satisfying users' information needs, not just their individual needs but also social and group information needs. However, many digital libraries have not been designed or developed with such social needs and contexts in mind (Adams & Blandford, 2004), and often have weaker service offerings than physical libraries, especially in serving users

and user communities (Gazan, 2008; Pomerantz, 2008). Indeed, unlike many physical libraries digital libraries as a rule have not focused on strongly supporting the sharing of information within and between communities (Farooq, Ganoe, Carroll, & Giles, 2009; Gazan, 2008) or on strongly supporting community-building in general (Bearman, 2007; Pomerantz, 2008); thus they have effectively ignored the "ongoing conversation" (Gazan, 2008, Introduction section, para. 2).

This leads to a practical and research problem: many digital libraries do not support well, through their content and services, the social context surrounding and within them; they should improve this support of social interactions—particularly the support of community-building activities and behaviors around and within themselves—to integrate better with social groups and communities (Lynch, 2005). The purpose of this exploratory, pilot research study is to provide a preliminary step towards this goal and in studying this research problem. It pilot tests a survey questionnaire intended to operationally measure the support for community-building in digital libraries, using LibraryThing (librarything.com) as a test case. While a number of interesting findings have been uncovered from the results of the pilot test, the primary aim of this study is to determine what changes need to be made to the survey instrument to help ensure its validity, reliability, accuracy, usefulness, usability, and readability in broader use. This broader use will help determine what level of support for community-building is provided by LibraryThing and other digital libraries, particularly as judged by the users and communities that use their content and services.

Literature Review

A number of different attempts have been made to offer support for community-building activities in and around digital libraries. Many have developed models, theories, or frameworks to aid socially-aware digital library development, but not all have then developed a functioning digital library. Of those that have, some have only progressed as far as prototypes while others have resulted in partial or full implementations. The success of such methods and attempts can thus be characterized as mixed, and only a small number of projects and methods can be characterized as rousing successes. There are still overall lessons and themes found in the literature, however, and these are discussed below. First, however, a brief overview of differing conceptions of communities and community-building provides necessary context and illuminates the study of community-building in digital libraries.

Conceptions of Communities and Community-Building

Online or virtual communities. "Virtual communities" were originally coined by Rheingold as "cultural aggregations that emerge when enough people bump into each other often enough in cyberspace" (Rheingold, 1994, p. 57, as cited in Preece & Maloney-Krichmar, 2003, p. 597). Since then, an ever-growing number of researchers from multiple disciplines have researched online or virtual communities[1], using different definitions but maintaining some common characteristics (Preece & Maloney-Krichmar, 2003). These include shared goals, repeated and active participation, emotional ties, shared activities and resources, reciprocity, and shared social context (Whittaker, Issacs, & O'Day, 1997, as cited in Preece & Maloney-Krichmar, 2003, p. 597). The definitions and characterizations of virtual community in the library and information science field often share in many of these criteria. Burnett et al. (2003, Virtual community section, para. 3) considered them "consistent with … communities of practice," while Haythornthwaite (2007) stressed interaction and the social ties between members. In addition, the boundaries of communities and how they are crossed (or not) are important (see Burnett, Besant, & Chatman, 2001; Star et al., 2003).

Distance learning communities. The rich literature on distance learning communities also has much applicability to community-building in digital libraries, because much of it focuses on the development and building of communities amongst distance learners. Haythornthwaite, Kazmer, Robins, and Shoemaker (2000) examined "temporal and technological dimensions," focusing on distance learners' patterns of interaction and support. They found the learning community was particularly important for supporting the students' learning and progress through the program, and recommended promoting initial bonding amongst students, supporting and encouraging continued participation and interaction, and providing multiple means of communication. Kazmer and Haythornthwaite (2001) extended this work to the concept of social worlds (discussed further below) and found that new social worlds were formed through distance learners' interactions with others, not directly through the technologies used for distance learning; the technologies did support existing social worlds and integrate them together, however. Better integration between worlds also built those worlds—or communities—into more useful resources for themselves and for others, leading to Kazmer and Haythornthwaite expressing a need for further study of the social worlds that are "brought into play … juggled, [and] integrated" by members of distance learning communities (pp. 527-528).

Finally, Kazmer (2005) further expanded upon this by examining the existing, embedded ties students had to other worlds and communities beyond their distance learning world. She explored five different types of "cross-transfer" between these communities (p. 194), many of which resulted in "improved learning outcomes" (p. 202) and supported, built, and improved the communities that learners were part of. Barriers included resistance to change; different tolerances for experimentation; enforced or narrow worldviews; and enforced interaction.

Social, small, and information worlds. Strauss's (1978) concept of social worlds, based in symbolic interactionist sociology, included not just interaction but also "activities, memberships, sites, technologies, and organizations" (p. 121), taking an ecological approach. Social worlds are groups similar in purpose and role to communities; they partake in activities, have certain members, often gather in certain locations, use certain technologies, and often end up forming informal or formal organizations to manage themselves and their activities (p. 122).

A related concept and theory is that of information worlds, developed by Burnett and Jaeger (2008). Unlike social worlds, however, it originates from the work of Chatman (1992, 1996) on small worlds and her theory of normative behavior (Burnett et al., 2001), combined with the work of Habermas on lifeworlds and the public sphere. Small worlds, as defined by Burnett and Jaeger (2008, "Small worlds" section, para. 2), are "the social environments where individuals live and work, bonded together by shared interests, expectations and information behaviour." As hinted at in their name, they are usually relatively small in size. The theory of information worlds includes three concepts taken from Chatman's theory of normative behavior: (a) social norms, or the "sense of rightness and wrongness in social appearances within a small world" ("Small worlds" section, para. 5); (b) social types, or "the ways … individuals are perceived and defined within the context of their small world" ("Small worlds" section, para. 7); and (c) information behavior, "the full spectrum of normative [information] behavior … that are available to members of a small world" ("Small worlds" section, para. 8). Burnett and Jaeger added the concept of information value, which focuses on the value judgments of different information within and across small worlds (G. Burnett, personal communication, April 1, 2010).

In contrast, Habermas conceptualized lifeworlds as "the collective information and communication environment—the social tapestry—of a society" (Burnett & Jaeger, 2008, "Public sphere" section, para. 7). As Burnett and Jaeger cogently summarized:

> Chatman's small world theories are not able to encompass the concepts of either the public sphere or lifeworlds. On the other hand, Habermas's concepts do not directly address the kinds of local and contextually specific issues central to Chatman's work. ("Relationships" section, para. 2)

Burnett and Jaeger's theory of information worlds thus combines lifeworlds and small worlds into one continuum. Using it allows the concepts of small worlds, lifeworlds, social norms, social types, information behavior, and information value to be used in harmony to study information-rich social groups of all sizes in a variety of settings. Information worlds also share many of the features of Strauss's social worlds: they have members who are involved in a particular world, information behaviors are similar to activities, information and communication technologies (ICTs) are used to further those behaviors, and organizations may form to coalesce information behaviors and develop ICTs. These concepts are also similar to the characteristics of online communities discussed by Preece and Maloney-Krichmar (2003), including shared or normed activities, behaviors, views, and resources.

Communities of practice. Communities of practice theory originated in the early 1990s out of Lave and Wenger's studies of situated, organizational learning (Brown & Duguid, 1991; Cox, 2005), but has been extended to and popularized within multiple disciplines (Cox, 2005; Hara, Shachaf, & Stoerger, 2009; Wenger, 2006). Such communities are formed by "groups of people who share a concern or a passion" for a particular task or practice (Wenger, 2006, para. 4), and typically share a particular "set of problems" relating to that task or practice, interacting "on an ongoing basis" (Wenger, McDermott, & Synder, 2002, p. 4, as cited in Hara et al., 2009, p. 740). Brown and Duguid (2002) also introduced the concept of *networks* of practice, applying to a broader group that has a practice in common but does not work in the same organization and may not even be aware of each other's existence. Brown and Duguid's use of *network* parallels the word's use in social network analysis (see Garton, Haythornthwaite, & Wellman, 1997); networks of practice are essentially social networks that have a particular practice in common.

Communities of practice theory can also be extended further. Communities of *interest* are separate from those of practice because not all who have a particular interest are professionals in the field in question. Communities of *learning* do arguably share a particular practice—learning about a topic—and the early development of communities of practice theory was to explain situated, organizational learning (Brown & Duguid, 1991; Cox, 2005). However, learning

communities have many unique characteristics as well as a rich research literature and tradition of their own. While at least one member of that tradition considers learning communities and communities of practice to be equivalent (Haythornthwaite, 2007, p. 132), it is often a need or desire to learn that is shared, not necessarily the actual practice of learning. Thus, communities and networks of learning and of interest should be considered separate types[2].

Of these conceptions of community and community-building, this study chose to focus on communities and networks of practice, interest, and learning, because these concepts have strong applicability to and face validity for studying the problem of supporting community-building in digital libraries; in addition, they clearly share many similarities with other conceptions. Digital libraries can improve and build these communities by supporting both their "internal workings … and their links to the rest of the world" (Agre, 2003, p. 227); indeed, they should be tightly bound to these communities (Star et al., 2003) and need to support building them to better serve individual, social, and group information needs. Since these communities and networks are social networks, social network analysis (Garton et al., 1997; Haythornthwaite, 2007) is a popular research approach; unfortunately, this method has rarely, if ever, been used to study the communities surrounding one or more digital libraries. Other methods, approaches, and theories, including social annotations, wikis, and boundary object theory, also show much promise in supporting and studying community-building activities surrounding digital libraries. However, first one must review those methods and approaches that have not been so useful.

Failures

A number of different models for community-based digital libraries that have been proposed by researchers showed great promise at first but have not been greatly successful in retrospect. In addition to these, an early indicator of the difficulty in supporting community-building in digital libraries is provided by the Worm Community System (WCS). There were many reasons for these failures, including overly ambitious planning; lack of time, effort, and funding; a high level of idealism; and a lack of understanding of the organizational, social, and technological context of digital libraries.

WCS. The WCS, discussed by Star and Ruhleder (1996), was a pre-World Wide Web, custom-built "electronic community system" which "might be thought of as … an electronic library" (Schatz, 1991, p. 88, as cited in Star & Ruhleder, 1996, p. 111). Unfortunately, WCS was not widely adopted; many of the biologists whom it was targeted at chose to use other

systems instead. The researchers identified gaps between different levels of communication, which resulted from a lack of understanding of usage, language, and socio-technical contexts. They recommended that future digital library projects should consider and be placed in a socio-technical context so as to "bridge the contextual divide" (p. 130).

Sharium. Marchionini (1999, p. 1) proposed the "sharium" model for digital libraries, stressing collaboration and sharing within communities and networks "to facilitate communication and distribute the load of solving information problems." Proposed features included (a) experts sharing knowledge and time in digital reference, question-answering, and recommendation services; (b) easy contribution and sharing of digital content by the community; and (c) better support of collaborative, self-directed learning.

The sharium model was applied to three digital library projects. The first, the American Front Porch (AFP) project, was overly ambitious, including a long list of features (Sonnenwald et al., 1999). Unfortunately it has been abandoned, and what little is left is missing all of the collaboration services promised and inherent in the sharium model. Similarly, progress within the second project, the Baltimore Learning Community (BLC), was deemed "slow and arduous" by Marchionini, Plaisant, and Komlodi (2003, p. 132). The middle-school teachers that used the BLC rarely added comments on content, rarely used content shared by other teachers, and faced many technical issues in creating and sharing content. The researchers concluded that "content and technologies are not sufficient to create sustainable communities" (p. 133). The final project, the Open Video Digital Library (OVDL; Marchionini, Wildemuth, & Geisler, 2006), had many of its sharium features stripped; for example, videos to be added were only accepted as part of already existing collections and only from universities and government agencies, precisely those who would have been able to contribute to the OVDL even if the sharium model did not underpin it. Its current support for collaboration and interaction is minimal, and contributions are not being accepted as of April 2010 (Open Video Project, n.d.). Overly ambitious and idealistic planning led to severe neutering of the social aspects of the OVDL and its lack of successful support of community-building.

CKESS. CKESS, proposed by Bieber et al. (2002), was a highly ambitious model and project that included (a) synchronous and asynchronous communication, (b) concept and process mapping tools, (c) hypertext / hypermedia capability, and (d) decision analysis support. Unfortunately, its ambition, specificity, and lack of realistic consideration of context—expert

knowledge of a modeling language and semantic concept maps was expected of users—heavily restricted the CKESS model's ability to be adopted by other projects as well as its own progress. Its long-term usefulness was also not likely helped by its publication in a management information systems (MIS) journal, rather than in more common sources of digital library literature (K. Burnett, personal communication, September 16, 2009).

CYCLADES. CYCLADES, intended to be supportive of collaboration and interaction within a community of interest (Candela & Straccia, 2003), was based on "the folder paradigm" (p. 158), allowing users to create their own private or shared folders of digital library content drawn from archives outside the system. Content could be rated, commented on, or discussed in a forum (Candela & Straccia, 2003); user and content recommendations were also provided (Renda & Straccia, 2005). Unlike CKESS, a prototype of CYCLADES was actually implemented (see CYCLADES, n.d.); however this is no longer online and a login page noted by Renda and Straccia (2005, p. 12) is no longer active. Its defunct site indicates it was funded through the end of August 2003 by the European Union (CYCLADES, n.d.); it is likely CYCLADES ran out of funding and was unable to secure more.

Alexander. The Alexander project was intended by Kolbitsch and Maurer (2006a) to build "a community around an encyclopaedic body of knowledge" (p. 185) combined "with contemporary news articles" (Kolbitsch, Safran, & Maurer, 2007, Prototype Implementation section, para. 1). Their proposal for Alexander was nearly as ambitious as CKESS, including an interactive, multi-level community; social annotations; collaborative content creation; personalization features; discussion forums; and private messages (Kolbitsch & Maurer, 2006a). A prototype was developed that included a subset of the intended features (Kolbitsch et al., 2007). Much like CYCLADES, however, there no longer appears to be a functioning version of the system online, and the project concluded in 2007 (Institute for Information Systems and Computer Media, n.d.) without any further publications of the results of its pilot test as planned per Kolbitsch, Safran, and Maurer (2007). Alexander apparently failed due to a lack of funding, overly ambitious planning, and its focus on the technology rather than on the socio-technical context of the system and its associated community.

Further Study Required

Three other approaches and methods to community-building in digital libraries have not failed, but neither can they yet be called successful, due to a lack of significant study of them.

Social constructionism theory as applied to digital libraries focuses on "discourse" and multiple expressed perspectives (Tuominen, Talja, & Savolainen, 2003, p. 564), and has been applied to a digital library prototype, ScholOnto (pp. 565-567); however, that project now appears moribund (Knowledge Media Institute, 2004). However, a number of "Web 2.0" sites—such as FriendFeed (friendfeed.com), Twitter (twitter.com), Facebook (facebook.com), and Google Wave (wave.google.com) have, like social constructionism theory, focused on the centrality of social discourse to users' information behavior. The application of social constructionism to the development and study of digital libraries thus requires further study.

Wikis appear a natural fit for providing at least some elements of community-building to digital libraries, and have been discussed in the context of communities formed around knowledge (see e.g. Kolbitsch & Maurer, 2006a, 2006b), collaborative learning within these (see e.g. Chu, 2008), and how these organize themselves and their practices (see e.g. Stvilia, Twidale, Smith, & Gasser, 2008). However, there is remarkably little literature that specifically applies wikis to the design and development of digital libraries and in the building of digital library community. Krowne (2003) is one of the few exceptions, developing a successful digital library called PlanetMath (planetmath.org) using a wiki-like approach he called "commons-based peer production" (Introduction section, para. 1). Wikis may thus prove useful for digital libraries, but further research and application is required here as well.

Social network analysis. Another approach that requires further study but shows a lot of promise for studying and supporting community-building in digital libraries is that of social network analysis. Its goal was described by Garton, Haythornthwaite, and Wellman (1997) as being

> … to describe networks of relations as fully as possible, tease out the prominent patterns in such networks, trace the flow of information (and other resources through them), and discover what effects these relations and networks have on people and organizations. (The Social Network Approach section, para. 3)

Social network analysis measures the relations between people; the ties they have to each other; how many forms of relations are included in a tie, termed "multiplexity"; and the composition of relations and ties (Garton et al., 1997, Units of Analysis section). In doing so, it effectively studies and describes the community or network which exists surrounding an organization or group of people.

In particular, two measures used in such analysis as discussed by Garton et al. (1997) have face validity as good predictors of the level of community-building in a digital library. The first, range, measures both the size and the heterogeneity of the social network. A larger, less similar network surrounding a digital library could imply that that library has better support for community-building. The second, density, measures how many relations and ties actually occur in a social network compared to the theoretical maximum number possible. A denser community or network has more interaction, probably resulting from high support for such community-building interaction; a less dense community or network has less interaction and probably less support for community-building. However, it is necessary to control for community-building activities that are not caused—directly or indirectly—by or the result of the digital library or its content.

Others have suggested social network analysis as an effective method for studying digital library communities. Neuhold et al. (2003) argued for using it to discover the "interrelationships" included in what they called a "user's Personal Web" (p. 8), or their social information network; Farooq et al. (2009, p. 305) agreed, saying that visualizing and analyzing the social networks surrounding "scholarly communities of interest or practice" would be a useful design tool for digital libraries. Star et al. (2003) also suggested its use to look at how social networks and communities of practice are similar and different; and Haythornthwaite (2007) recommended taking a social network approach to the study of all forms and types of communities, including those in and around digital libraries. Unfortunately, despite the wide application of social network analysis to other settings no studies are known to have used social network analysis to examine the social networks of digital library users, especially with regard to community-building. Further research is clearly necessary to examine and confirm the potential of social network analysis as a method for studying digital libraries, to apply it to the study of communities and networks within digital libraries, and to evaluate whether it can indeed be successfully used as a framework or theory to support community-building. This study intends to contribute towards that, as will be seen below.

Relative Successes

However, first it is useful to briefly review two promising techniques for studying and supporting community-building in digital libraries: social annotations and boundary object theory.

Social annotations. Annotation has been defined as "the enrichment of information object[s] with comments and other forms of meta-information" (Neuhold et al., 2003, p. 10). Social annotations are those that are publicly shared and can be annotated or "enriched" themselves by other users (p. 11). They can let digital library users and user communities "take a more active part" in the digital library and provide "a valuable medium for collaboration" within and beyond these communities (p. 11). Three digital library projects have shown some degree of success with the use of social annotations for supporting community-building.

The DEBORA project supported communities of humanities scholars around a collection of digitized images of Renaissance books (Nichols et al., 2000), and allowed these users to choose whether their annotations were fully private, fully public, or available only to certain groups; annotations could also be chained together through hyperlinks to provide trails (like Bush, 1945). DEBORA was at least partially successful because the humanities scholars liked the chaining feature and did appreciate the social annotations (Nichols et al., 2000); however, they also felt the interface for them was particularly confusing and would be increasingly so with more annotations. The DEBORA project appears to have become a casualty of lack of funding (see Lancaster University Computing Department, n.d.); however, results from it imply social annotation features and their interfaces must be carefully designed and tested with both individual users and user communities, to ensure they are useful, usable, and provide community-building support in both theory and practice.

The COLLATE project (Frommholz et al., 2003) developed a prototype system that provided for annotations, keywords, and collaborative cataloging of digital content, which was used by film studies scholars at three film archives. Unfortunately, there was and has been little discussion by the researchers of how successful COLLATE was in practice, despite a promise to conduct user studies; still it did at least progress to the prototype stage, unlike the CKESS or AFP projects mentioned earlier.

Finally, the Digital Library for Earth System Education (DLESE; www.dlese.org), used by earth science educators, students, and scientists (Arko, Ginger, Kastens, & Weatherley, 2006), featured comments, "teaching tips" (a special type of comment), and "structured reviews" that rated content on a number of dimensions (About the CRS section, paras. 6-8). These annotations were and are displayed in a number of places within DLESE and exposed to searching functions; however they do not display directly on the content pages for many items and were and are at

least two clicks away (sometimes more). All reviews and comments were also required to be vetted by "an experienced earth science educator" (Lessons Learned section, para. 6); while such vetting might be necessary, it puts another barrier between users, social interaction, and community-building. DLESE, while certainly quite a successful example of a digital library using social annotations, echoes the need for careful design and testing of user interfaces and to carefully consider and remove barriers to participation and community-building activities.

In similar systems. Three other systems, while probably not digital libraries, have also helped prove the usefulness of social annotations for building community. AnswerBag (answerbag.com) is a Web 2.0 social question and answer site that according to Gazan (2008) has faced many of the same community-building challenges that digital libraries face; it has been highly successful, with over a million users (Answerbag, 2009). Based on AnswerBag, Gazan identified eight major decision points he felt were important to social annotations in digital libraries: "display; ease of annotation; anonymity; control of [digital] content; harvesting annotation content; ease of retrieval; traffic and network effects; [and] notification and sharing" (Gazan, 2008, Analysis and Discussion section, para. 2). Fringe, studied by Farrell, Lau, and Nusser (2009), was a prototype of a folksonomic contact manager which expanded social annotations and tagging from documents to people. Fringe's users wanted to share their tags "to inform others about a group or to inform members of [a] group about each other" (p. 358); these behaviors were an emerging form of community-building activity that the researchers did not expect. They concluded tagging and folksonomies provided incentive for community-building, and that further study of this form of social annotations in this and other contexts would be useful. Finally, the Steve project[3] (www.steve.museum) is intended to explore "the role of social tagging" and to study "the resulting folksonomy" around digital art museums (Trant, 2006, p. 1), which have many similarities with digital libraries. Trant's study of a preliminary tagging prototype concluded that "social tagging seems a promising way to supplement museum [metadata] records with terminology" to improve access (p. 22); the prototype also appeared relatively successful at building community. Steve, Fringe, and AnswerBag are good examples of the potential of social annotations for building community around and within digital libraries.

Boundary objects, coherence, and convergence. Star and Griesemer (1989) theorized that *boundary objects* exist in the places where Strauss's (1978) social worlds intersect. They defined these as objects that cross the boundaries between multiple worlds and are used within

and adapt to many of them "simultaneously" (Star & Griesemer, 1989, p. 408). Such boundary objects are considered structurally weak when used across worlds, but are seen as structurally strong when created and used in individual worlds (p. 393). The "different" and overlapping meanings they have across social worlds can cause "mismatches," which require negotiation (p. 412); successful negotiation requires careful management of the boundary objects, their representations, and the interfaces they provide between social worlds. Maintaining "coherence"—the degree of consistency between different translations and social worlds—is a critical role of boundary objects (p. 393).

Since the initial development of boundary object theory, it has been applied to communities of practice, Chatman's information-rich small worlds, and digital libraries. Star, Bowker, and Neumann (2003) provide an example of all three that has strong implications for how to design and develop digital libraries to support community-building activities. They first defined a further development of coherence in "convergence," which considers how well the "tools, systems, interfaces, and devices for storing, tracking, displaying, and retrieving information"—labeled "information artifacts"—"are fitted to" the communities of users they serve (p. 244). Such convergence occurs "when use and practice fit design and access," when communities of practice and information artifacts fit together (p. 244). They then applied the term *information world*—Chatman's theory of normative behavior (Burnett et al., 2001)—to the result of this convergence process. As Star et al. (2003, p. 244) defined it, an information world is a set or collection of information resources and artifacts that individuals, groups, communities, and networks use "to solve [information] problems, learn, play, and work." The specifics of this definition differ some from that of Chatman and quite a lot from the theory of information worlds later developed by Burnett and Jaeger (2008), which is somewhat problematic; the broader meaning is similar, however. Boundary object theory, coherence, and convergence thus appear quite useful for the study of digital libraries, which are almost always used by multiple social worlds and communities.

Star et al. (2003) presented three case studies; the first, studying the information behavior of 38 research scientists and students with regard to the information systems and digital libraries they used, is particularly illustrative of the potential of boundary object theory. They found that professors with many years of experience already had an established infrastructure or information world and were deeply embedded in a community and network of practice. The

convergence and coherence between communities, digital libraries, and information worlds was deepest for those who were the most experienced and specialized in their fields; this echoed an earlier study of another digital library conducted by Bishop and her colleagues (Bishop et al., 2000). However, Star et al. (2003, p. 248) found such deep convergence could lead to the "clos[ing] off [of] other possibilities of finding information … because they are not part of the routine." Of course, students and others new to a field faced a different problem, needing to become more established in the community through participation and integration of its information world into their own; this process of convergence was "rarely smooth" (p. 248).

Van House (2003) provided another example of the use of boundary object theory, coherence, and convergence in a digital library context. She examined a subset of the University of California–Berkeley (UCB) Digital Library known as Calflora, a "collection of botanical datasets" on over 8,000 plants and "nearly 675,000 records of plant observations" (p. 273). Van House's results showed that the users of Calflora had a "generally high level of interest in sharing data," using the digital library to reach a wider audience (p. 275); social and technical barriers for sharing data had been removed and coherence and convergence were quite high. However, trust was found to be a major factor; users feared their data would be misused or misinterpreted, especially without extra work, obligations, and accountability that were required of them if it were to be presentable for and understandable by others. Some users also questioned the quality and credibility of others' data. Van House found that these issues in Calflora stressed the difficulties in crossing boundaries between different communities and different social or information worlds; in other words, in converging multiple sets of information artifacts and communities together via the digital library as a boundary object. Her overall conclusions were that (a) digital libraries are boundary objects, (b) they must be "aligned with communities of practice" and translate between these different groups (p. 286), and (c) such translation would be difficult but successful if digital libraries "fit with ... [existing] practices" across multiple communities while also supporting emergent work processes (p. 290).

It is clear that some level of convergence and coherence between digital library users and their social and information worlds is necessary for a successful community to be built. As such, community-building efforts should be supported by digital libraries in such a way that the coherence and convergence between users' individual social and information worlds, and between these worlds and the digital library itself, is established, maintained, and deepened via

the digital library acting as a boundary object. However, communities and networks of practice, interest, and learning that already exist must also be supported by the digital library, especially since these often overlap to an extent. If digital libraries do not support the integration of and convergence between these overlapping communities, then they risk closing off other possibilities as Star and her colleagues mentioned; consistent groupthink is to be avoided. Further research into and using boundary object theory in the study of community-building in digital libraries—and indeed in information systems and libraries in general—is necessary to fully confirm its applicability. While this study does draw on some of the ideas of boundary object theory, it does not use it outright; however, future research should draw more directly on the concepts and propositions it raises with regard to community-building in digital libraries.

Summary

No one particular approach or method has already been determined to be the absolute best way to support community-building in digital libraries. Social annotations are particularly promising; wikis might also prove useful, given further study of their advantages and disadvantages. Social constructionism theory, boundary object theory, and social network analysis also show increasing levels of promise as approaches to studying community-building efforts by digital libraries. A common theme in the literature is that digital libraries must be studied in various contexts; organizational, cultural, institutional, and cognitive contexts all have important affects on users and their information behavior as it relates to building both communities and networks of practice, interest, and learning. Above all, however, it is the *social*—and socio-technical—context that must be studied and considered; communities, networks, and interaction within and between them clearly cannot be supported in a digital library that ignores the social conversation it is naturally a part of (Gazan, 2008). Research is clearly required to (a) examine existing digital libraries to see how well they support community-building; (b) identify what works best in practice and social context; and (c) relate this back to previous research, practice, and theory. This proposed study is a first step along that path, piloting a survey that examines the level of support the LibraryThing digital library provides for community-building activities

Method

This exploratory pilot study examined LibraryThing, a social digital library with over a million members as of April 2010 (LibraryThing, n.d.-c) that allows users to catalog books that

they own, have read, or want to read. Users can also assign tags to books, mark their favorites, and create and share collections of books with others; these collections are searchable and sortable. In addition, LibraryThing suggests books to users based on the similarity of collections. Books can be rated and reviewed by users, and these are shared across the site along with users' tags (LibraryThing, n.d.-b). LibraryThing also provides groups, which include shared library collection searching, forums, and statistics on the books collected by members of the group (LibraryThing, n.d.-a). Discussions from these forums about particular books are also included—along with tags, ratings, and reviews—on each book's page. Finally, each user has a profile page which links to their collections, tags, reviews, and ratings, as well as listing other user-provided information such as homepage, social networks used (Facebook, Twitter, etc.), and a short biography (LibraryThing, n.d.-b).

Population and Sample

The population for this pilot study was students currently enrolled in the doctoral degree program at the Florida State University (FSU) School of Library and Information Studies (SLIS)—either as a doctoral student (pre-preliminary exams) or a doctoral candidate (post-preliminary exams)—who had used LibraryThing at least once in the twelve months prior to completing the survey. Students who were over the age of 65 or who had completed their doctoral degree recently were not eligible to complete the survey. The choice of population was due to the need to pilot the survey instrument with a smaller population first, to ensure its validity, reliability, readability, usability, and overall usefulness.

From this population, volunteers were recruited via an announcement posted to a FSU SLIS doctoral e-mail list; this announcement reached the entire population. The announcement explained the study, eligibility criteria, procedures, minimal risks, and benefits, as well as providing contact information for the researcher and instructions on how to volunteer to participate. It also noted that participants would remain anonymous when completing the survey. Eight students / candidates volunteered during the one week recruitment period and were all sent a link to the online survey (discussed further below). The sample selected (n = 8) was small due to the narrowly defined population and pilot test nature of this study.

Data Collection

Survey administration. After the one week recruitment period, each student / candidate that volunteered was sent a link to the survey, shown in the Appendix. The survey itself was

anonymous; the link was the same for all participants and no identifying codes were included in the link or the e-mail. The first page participants saw upon visiting that link was similar to the recruitment announcement, including all of the information noted above along with the end date for the survey (three weeks from receiving the link), contact information for the FSU Institutional Review Board (IRB), and an informed consent statement. The latter ensured that all participants fully understood the minimal risks and benefits of the study, that their participation was entirely voluntary, and that they had asked the researcher and/or IRB any questions they might have prior to completing the survey. Participants were able to close or cancel out of the survey at any time and were not compelled or forced in any way to complete the survey, any of the questions within it, or the study as a whole. The survey was hosted on a Web site created by the researcher on a Florida State University server. It consisted of five pages, with questions broken down a few at a time so as to not overwhelm users with too many questions at once. Headings for each page are shown in the Appendix for clarity, but were not shown to participants.

Measuring community-building. Most of the operational dimensions used to define and measure community-building in this study and survey were based on the methodology of social network analysis, particularly the measures of range and density (see the literature review above and Garton et al., 1997). One other dimension was independently constructed to support the concepts of communities and community-building being used, serve the needs of this study, and allow for multiple dimensions of measurement. All dimensions were intended to, when used as part of a broader future study, allow for a socio-technical analysis of the role LibraryThing plays in community-building in a social, organizational, and technological context. These dimensions were:

(a) how often users of LibraryThing interacted with each other;
(b) how recently users of LibraryThing had discussed it or its content with other people;
(c) the closeness of the users' ties with other people with which they had interacted;
(d) which method(s) they had used to undertake these interactions and discussions;
(e) how they had met those they have interacted or discussed with; and
(f) their general perception of how well LibraryThing had supported their identification of useful contacts and how well it had supported their working and communicating with others that shared their profession, interests, or learning needs.

Dimensions (a) through (e) above correspond to the concepts of range and density in social network analysis (Garton et al., 1997). A larger range and/or denser network—with more interactions, ties, and methods used—should imply more success at supporting community-building. The closeness of the users' ties with others—dimension (c)—also corresponds to the work of Marsden and Campbell (1984) on social ties, although not at the same level of detail as in their methodology and analysis. Dimension (f) served as an extra measure that did not adapt the methods of social network analysis, and provided for a more subjective measurement of the level of support as it was judged by the users.

Other potential operational measures—quantitative and qualitative—of the level of community-building are certainly possible, and have been used by other researchers as noted in the literature review. However, the dimensions above were chosen due to their face validity and the face validity of the concepts and methods of social network analysis they were based on.

Response rate. Of the eight volunteers that were sent a link to the survey, one volunteer determined they were not eligible and thus did not complete the survey. Two other volunteers had not returned the survey within the three weeks given to do so, leading to five complete responses for a response rate of 63% (71% not counting the ineligible volunteer). While both the number of volunteers and the response rate could have been a little higher, they were certainly sufficient for this pilot test and to produce interesting results (discussed below). The volunteer rate and response rate were helped by the choice of population—doctoral students who were willing to help pilot test the survey instrument and provide feedback on it—the relatively short length of the survey, and the minimal potential harm and risks to the participants for completing the survey.

Ethical considerations. It is not believed that this study violated any ethical principles or procedures. Informed consent was obtained, and participation was entirely voluntary and anonymous throughout the study. It is also not believed that any significant or permanent harm came to the participants as a result of their completion of the survey; besides the loss of a small portion of their time the known risks and harms were no greater than those experienced in their everyday lives. The potential participants to participants were also great enough to outweigh any small possibility of harm or any risks. The study was explained sufficiently to ensure participants were aware of the potential risks and benefits, their right to withdraw at any time, and their choice to not participate at all if so desired before giving their informed consent. Finally,

participants were not deceived during this study in any way; in particular, the identity and affiliation of the researcher was known to all members of the population via the information in the e-mailed announcement and at the beginning of the survey questionnaire.

Results

Interactions and Discussions

The results of the questions on the first dimension of community-building, how often they interacted with other LibraryThing users, indicated that none of the participants interacted more often than monthly with other users; one participant said they never do and another was unsure. As to the second dimension, how often they discussed LibraryThing or its content with others, four of the five participants had discussed the digital library itself. However, only two participants had discussed specific content from LibraryThing with others; also, for all but one participant these discussions of LibraryThing or its content had taken place more than a month ago.

Closeness of Ties

The results for the third dimension of community-building, the closeness of participants' ties with others they interacted with, showed that all but one participant interacted rarely or never with those they had discussed LibraryThing with about other topics, implying their connections to these people were not especially close. The remaining participant, however, discussed other topics daily with those they discussed LibraryThing with, implying his or her ties with these people were indeed close. These tentative interpretations are, however, somewhat confounded by the relationships participants expressed having with those they interacted with (shown in Table 1). These relationships included friends, good friends, and very close friends (these answers, combined, were given by three participants), as well as colleagues within their organization (i.e FSU / SLIS; this response also given by three participants). Participants had generally known the other people that they interacted with for months, although one participant had known them for a number of years. Particularly in the case of good friends and very close friends, the implication was that the ties and connections were stronger than implied by the answers to the first question.

Methods of Interaction

The results for the fourth dimension, the methods and media participants used to interact with and discuss LibraryThing with others, are summarized in Table 2. There was a range of responses, but also a lot of commonality. For all but one participant, face-to-face interaction was

rare; e-mail was similarly rare. Text, audio, and video chat were even more rarely used, with no more than three participants using chat to any extent. Telephone calls (either landline or cell) were never used and postal mail was only rarely used by one participant. Of the five participants, only one used the LibraryThing forums and other online forums for interactions and discussions about the digital library; only two used other social networks and those two only used them rarely.

How Did They Meet

On the fifth dimension of community-building, how participants had met LibraryThing users and those they discussed LibraryThing with, four of five participants had met these others at their workplace, school, college, or university. Only two participants listed other methods, which included one mention each between them of a traditional, physical library; an interest group or organization; networking with their other contacts; an online social network; and an online forum or discussion board. LibraryThing itself was notably absent from participants' responses.

General Perceptions

Finally, regarding the last dimension, their general perception of LibraryThing's community-building support, four of five participants agreed they had found useful contacts via the digital library and that it supported interacting with those who shared their profession and their learning needs. All five agreed that it supported interacting with those who shared their interests. Most of the participants did not strongly agree with any of the statements, however; none strongly disagreed. These results are summarized in Table 3.

Survey Feedback

The last question of the survey asked for feedback on the instrument's design, question wording, and answer choices, as well as any other issues they faced or felt others might face. Only three participants answered this question, unfortunately.

Of those who did provide feedback, all three appeared to think the survey was successful overall, calling it "good" and "excellent work." However, there were a couple of issues raised with the usability and the readability of the study. One participant did not like how each page was simply labeled "page 1," "page 2," etc. and suggested that usability would be enhanced if the total number of pages was also indicated (e.g. "page 2 / 5"). Another participant questioned the inclusion of the "unsure / can't remember" and "choose not to answer" response choices,

believing they would not "help you [the researcher] collect the data you want." None of the participants raised any issues with the reliability or accuracy of the instrument. One participant did discuss the usefulness and validity, saying they were unsure if the survey would be useful or valid because "I do not know [the researcher's] end goal … unless I missed it."

Discussion

The results mentioned above and shown in Tables 1-3 imply that, at least within this small pilot test sample, the level of support provided by LibraryThing for community-building activities is relatively low. The amount of interaction between participants and users of LibraryThing was clearly low, as was how often they discussed LibraryThing and particularly its content with others they knew. This was shown repeatedly in the responses to the survey questions, particularly driven home by the methods and media participants used to interact with others (see Table 2). Such a low level of interaction about LibraryThing implies that any communities or networks of practice, interest, or learning that participants were part of did not involve LibraryThing within their social networks, at least not to any great extent. In social network analysis terms, both the range and the density of participants' social networks with relation to LibraryThing were low, due to low levels of interaction with other LibraryThing users, small numbers of contacts that were LibraryThing users, and many contacts having similar ties to the participants (friends and colleagues).

This finding parallels many of the studies of communities mentioned in the literature review earlier—particularly those of Haythornthwaite (2007; Haythornthwaite et al., 2000)—as well as the focus on ties and interactions present in social network analysis (Garton et al., 1997). It also echoes the "ongoing" interaction that Wenger felt was necessary in a community of practice (Wenger, McDermott, & Snyder, 2002, p. 4, as cited in Hara et al., 2009, p. 470). The absence of any participants having met any contacts through LibraryThing itself—and thus the absence of social ties formed this way—was also particularly telling as to the digital library's low level of support for community-building, at least amongst the small sample used herein. This result clearly will require further testing, through broader use of the survey instrument piloted in this study, to see if it holds up with a larger sample of LibraryThing users and / or with users of other digital libraries. In addition, other limitations of this study are discussed below.

Before such a larger study can be performed, however, the instrument itself requires some minor modifications to fix problems uncovered during this pilot study. In addition,

collecting further data of a more qualitative nature via open-ended survey questions and/or follow-up interviews may—as noted particularly by the feedback received—also improve the validity and reliability of future studies of community-building activities in and around digital libraries. In addition, future studies should also overcome some of the inherent limitations of this pilot study. Finally, community-building activity was actually observed in the results of this pilot survey, but it was not heavily supported by LibraryThing; this finding requires further exploration in future studies. These issues are discussed below in turn.

Validity and Reliability

It is believed that the results of this study have high validity, particularly with regards to internal and content validity. As noted earlier, the measures adapted from social network analysis that were used in the survey instrument have high face validity. The reliability of this study was also relatively high within the specific setting and population under study: users of LibraryThing who are doctoral students at FSU / SLIS. The survey was also carefully examined prior to pilot testing in order to produce sufficiently reliable results to allow useful analysis and discussion of the results that would contribute towards refining the survey instrument for use in future studies. The clear operational definitions that were used for this study (see the Data Collection Procedures and Instruments section above) also helped to improve reliability. This is not to say there were not issues with reliability, however.

Closeness of ties. The results on the closeness of ties (see Table 1) indicate a potential problem with the reliability of the operational definition and measurement of close ties. Can a person be someone's very close friend—thus strongly and closely tying the two together—if interaction between them only occurs rarely? In relation to this, Marsden and Campbell (1984, p. 482) found that tie strength relies not just on the "depth of the relationship" but also the "time spent in [the] relationship." It is possible that this was the case here, especially since the participant who said at least one of the people they interacted with was a very close friend also indicated they had known them a number of years, as noted in Table 1. It may be that this closeness is due to the length of the friendship rather than how often they interact.

For the purposes of measuring the support for community-building activities in a digital library, both the frequency of interaction and the length of interaction are of interest, hence the inclusion of both questions in the survey instrument. The participant in question did not feel LibraryThing supported their finding of useful contacts, interacting with those in their

profession, or interacting with those sharing similar learning needs, however (see the General Perceptions section below); this could imply that frequency of interaction is more important for supporting community-building. The literature on social network analysis, virtual communities, learning communities, and communities of practice also backs up a frequency of interaction-centric interpretation (Hara et al., 2009; Haythornthwaite, 2007; Haythornthwaite et al., 2000; Preece & Maloney-Krichmar, 2003). However, until this is known for sure increasing the reliability of this measure in future studies could be achieved in at least two ways. First, an open-ended question could be included in the survey instrument, asking participants to explain the nature of the relationship(s) and tie(s)—especially close ties—that they have with others. Second, follow-up interviews could be conducted with a subset of participants to discuss further their relationships with others. Either of these methods would provide further data—primarily of a qualitative nature—that would help more reliably measure (a) the closeness of participants' ties with others; (b) the digital library's role in the building of those ties; and (c) the digital library'r role in building communities and networks of practice, interest, and learning.

Survey Feedback

As noted above, only three participants provided feedback on the instrument's design, question wording, answer choices, and other issues they faced or felt others might face. Obtaining more feedback from more participants could have been achieved via follow-up interviews or by having participants fill out the survey in the presence of the researcher. Both of these would have required the identity of each participant to be known, resulting in a lack of anonymity; the latter would also have negative ethical implications, since it could be seen as putting pressure on participants to respond. In retrospect, an approach maintaining confidentiality but not anonymity might have allowed not just for following up for feedback on the survey, but also for follow-up interviews with participants about their responses to clarify some of the issues with the results mentioned in other parts of this discussion.

The inclusion of the "unsure / can't remember" and "choose not to answer" choices—questioned by one participant—was intended to ensure participants would not feel forced into answering any of the questions or into trying to remember (for example) how often they interacted with someone. However, the "choose not to answer" option was never chosen and the "unsure / can't remember" option was only chosen once across all five participants, so it does not appear removing them from this particular pilot test would have been an issue. However, for

ethical reasons a "choose not to answer" response choice—or at least the ability to leave a question blank—should be included for all questions in a survey instrument, and so future use of this instrument should maintain at least that option.

As for the issue of unclear goals—and thus potential usefulness and validity problems—raised by one participant, the recruitment e-mails sent to potential participants and the consent statement shown to participants before they began the survey mentioned that the survey was intended to "measure the support for community-building activities provided by the LibraryThing digital library." However, the broader goals of the study—discussed in the introduction to this article—were left out so as not to produce any bias in participants' responses. For the purposes of this pilot study, more about the goals and purposes of the study probably could and should have been included. For actual use of the instrument piloted here in a broader sample of users of LibraryThing (or another digital library), it is believed adding too much additional information would introduce bias. A little further clarification, however, would likely aid participants' understanding of why they were being asked to complete the survey and what benefits they might indirectly receive from doing so.

Community-Building, But Without Support

An interesting artifact that emerges from the results of the survey is that at least two of the participants interacted more often with people they had discussed LibraryThing with than actual LibraryThing users themselves. This could imply they were not building a community around LibraryThing or its users, but around other systems, places, organizations, and/or people they knew. If true, this would be an example of community-building activities not supported by, caused by, or the result of the digital library or its content, as mentioned earlier in the literature review.

Despite the small size of the sample used in this pilot study, there is substantial further evidence for such an interpretation. Despite the overall results pointing to low levels of support for community-building, most participants felt LibraryThing had helped them to find useful contacts and to interact with those in a similar profession, with similar interests, or with similar learning needs (see Table 3). While this apparent contradiction might indicate a reliability issue with the survey instrument, it is more likely an indicator of community-building activities occurring—to at least some extent—independently of any support offered for them by LibraryThing. This interpretation is strengthened by considering, on the one hand, that the two

participants who strongly agreed with some of the general perceptions statements (two each) were those who interacted more often with LibraryThing users and discussed the digital library itself or its content more often. On the other hand, the participant who had a long relationship with a very close friend but only interacted with them rarely (as discussed above) did not feel LibraryThing supported their finding of additional useful contacts or interacting with others that shared their profession and learning needs. One can conclude that—within the limited sample and population used in this pilot study—heavier users of LibraryThing, who discussed it more with others and interacted more with its users, found it to support their community-building activities and interactions with others to a greater extent. The direction of causation is somewhat unclear here, but the answers to the earlier questions in the survey imply that it is likely to be that other community-building efforts on the part of some of the participants intervened and led them to respond more favorably to questions about LibraryThing's support for such activities.

Further evidence includes the fact that community-building in general varied among the participants, with at least one participant appearing to have built strong community interactions with other people via a variety of media and methods. However, as shown by the previous questions he or she did not appear to discuss LibraryThing or its content with those people very often at all. In addition, most participants had not met LibraryThing users or those they discussed the digital library with online, and particularly not via LibraryThing itself. Most participants' social networks did not appear to involve LibraryThing or its users in any substantial way.

Thus, community-building was arguably occurring, but was not caused or supported by LibraryThing, especially with regard to developing new communities and new social contacts. In terms of the literature, this might be best seen as a failure on the part of LibraryThing to serve as a boundary object (Star & Griesemer, 1989) between individuals and communities (see also Van House, 2003). The digital library also did not successfully act as a medium for creating and continuing interconnection, interaction, and integration within and between users' social networks (see Haythornthwaite, 2007; Haythornthwaite et al., 2000; Kazmer & Haythornthwaite, 2001); instead such interactions were taking place by other means and did not integrate or translate between multiple communities of practice, interest, or learning. If similar effects were to be found in a broader sample of LibraryThing users, this would prove to be an important and interesting finding—strong communities and networks being built, but not being supported

through the digital library—with clear implications for both LibraryThing and for digital libraries in general.

Exploration of such a finding in future studies could be achieved through open-ended survey questions or follow-up interviews that discussed why users (a) did or did not interact with other LibraryThing users, (b) did or did not discuss LibraryThing often with their existing contacts, (c) found or did not find many new contacts via LibraryThing, and / or (d) built their communities through other methods and media than LibraryThing itself. Questions could also be added—or existing questions adjusted—to ascertain participants' opinions of various features of LibraryThing with regard to finding useful contacts or interacting with others with whom they shared a profession, interests, or learning needs. Incorporating boundary object theory and the concepts of coherence and convergence into future studies would also likely prove useful in determining how successfully LibraryThing and other digital libraries act as boundary objects and connect users to each other and to other communities and networks of practice, interest, and learning.

Limitations

As with any study, this pilot study faced a few limitations. The survey instrument probably did not capture the full range of the opinions, judgments, and experiences present in the entire population (users of LibraryThing that are doctoral students at FSU / SLIS). There were at least three reasons for this: (a) survey responses were only available from those users who volunteered for and returned the survey within the three week time period, (b) only a small number of users were selected as part of the sample for this pilot study, and (c) no open questions were included to obtain more subjective opinions and judgments (except overall feedback on the survey). These issues can be resolved in future studies by having a much larger sample of LibraryThing users, from a more broadly defined population (e.g. all LibraryThing users who participate in at least one group), be sent a link to a refined and updated survey instrument that includes more open questions (as discussed above). However, it was better to pilot test the survey instrument first with a smaller group, as was done in this study. As such, while it will need resolving for future studies this limitation should not be considered especially problematic for this pilot study.

Many limitations resulted because of the narrow population and research setting for this proposed study. LibraryThing is but one digital library, and only users of it who were doctoral

students at FSU / SLIS were part of the population for this study. Any results obtained from surveying this population are naturally limited only to these users. It is clearly not possible to apply the results to other digital libraries and their users directly, nor to the broader population of LibraryThing users as a whole. It is expected that some of these other digital libraries and populations will have similarities to LibraryThing, its users, and the surrounding research setting used in this study, and thus there may be potential transferability. There is also likely to be some degree of transferability of the results from the narrow population used here to users of LibraryThing in general. However, further research will be required in order to confirm whether the findings in the discussion above are true for LibraryThing as a whole, other digital libraries, and other user communities.

One final limitation was that this study was not able to prove that a particular method for supporting community-building is better than another one. LibraryThing is but one digital library, and while it does use some of the methods mentioned in the literature review—particularly social annotations—it does not use all of them. Follow-up studies using the survey instrument piloted here (with adjustments), in addition with other methods such as interviews, need to be conducted in order to establish whether the low level of support identified in this study is accurate for LibraryThing as a whole and/or for other digital libraries. These studies, should also—eventually—be able to identify which methods prove to be most successful in building community within and around a digital library. The use of different conceptions and measures of community and community-building, as well as promising theories such as boundary object theory, could also help improve the ongoing reliability of measures of community-building in digital libraries in general and the survey instrument piloted herein in particular.

Conclusion

Overall, the survey instrument was relatively successful at measuring the level of community-building in digital libraries. While only a pilot study and thus facing many limitations, some interesting findings were nevertheless uncovered based on the answers given to the survey instrument by the five participants. Unfortunately, the level of support provided by LibraryThing for community-building appeared rather low, with the social networks of participants with regard to LibraryThing and its users not being especially wide-ranging or dense. In addition, community-building activity was actually observed in the results, but was not

supported by the digital library. These interesting findings require further study and exploration with a larger sample to see if they are true in the broader populations of LibraryThing users and users of other digital libraries.

The survey instrument itself does require some changes in order to be more successfully applied to a larger sample, particularly with the addition of some open-ended questions. Following up survey responses with other research methods—particularly qualitative interviews—would also improve the validity and reliability of studies using the survey instrument developed herein. Such studies would be best to maintain the confidentiality of participants, but not their anonymity, so as to allow for specific survey responses to be explored further.

Finally, future studies should incorporate other theories and frameworks in order to study the problem of community-building in digital libraries, as well as different conceptions of community. While the use in this pilot study of concepts drawn from social network analysis and communities of practice theory was quite successful, other approaches should provide additional explanatory power and produce increasingly valid and reliable results. While using all of these in one study would be overwhelming, multiple studies that use and apply the concepts and theories of social worlds, information worlds, boundary objects, coherence, and convergence should prove particularly useful and relevant to the research problem. Surveys, interviews, and other methods using these theories and concepts can only help better measure how well digital libraries such as LibraryThing support community-building and improve their support of such activities and the social context that they are inherently part of.

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Appendix: Survey Instrument

Page 1: Eligibility Questions

Please confirm your eligibility to participate by answering the following:

Q1: Are you currently enrolled as a doctoral student and/or doctoral candidate in the Florida State University School of Library and Information Studies?

( ) Yes ( ) No

Q2: Have you used LibraryThing (www.librarything.com) at least once in the last twelve (12) months?

( ) Yes ( ) No

Q3: Are you between 18 and 65 years of age?

( ) Yes ( ) No

[If any of Q1 through Q3 are answered "No," the survey stops here.]

Page 2: Community-Building Dimensions (a) and (b)

Q4: How often do you interact with other users of LibraryThing?

( ) At least once a day
( ) At least once a week
( ) At least once a month
( ) Less than once a month
( ) Never
( ) Unsure / can't remember
( ) Choose not to answer

Q5: Have you discussed LibraryThing itself with anyone else?

( ) Yes, at least once in the last week
( ) Yes, at least once in the last month
( ) Yes, but not in the last month
( ) No, never
( ) Unsure / can't remember
( ) Choose not to answer

Q6: Have you discussed any content or information from LibraryThing with anyone else?

( ) Yes, at least once in the last week
( ) Yes, at least once in the last month

( ) Yes, but not in the last month

( ) No, never

( ) Unsure / can't remember

( ) Choose not to answer

Page 3: Community-Building Dimensions (c) and (d)

[If both Q5 and Q6 were answered "No, never" then Q7 through Q9 are skipped.]

Q7: Consider those that you have discussed content or information from LibraryThing with. How often do you interact with these people on topics *other than* LibraryThing or its content? Choose all of the options below that apply.

[ ] Daily

[ ] At least once a week

[ ] At least once a month

[ ] Rarely

[ ] Never

[ ] Unsure

[ ] Choose not to answer

Q8: Please identify your relation(s) with those that you have discussed LibraryThing or its content with. Choose all of the options below that apply.

[ ] Very close friends

[ ] Good friends

[ ] Friends

[ ] Acquaintances

[ ] Colleagues within my company or organization

[ ] Colleagues outside my company or organization

[ ] Strangers

[ ] Other—please specify: _____

[ ] Choose not to answer

Q9: Please identify how long you have known those you have discussed LibraryThing or its content with. Choose all of the options below that apply.

[ ] Day(s)

[ ] Week(s)

[ ] Month(s)

[ ] One to five year(s)

[ ] Five years or more

[ ] Unsure / can't remember

[ ] Choose not to answer

[If Q4, Q5, and Q6 were all answered "never," then Q10 is skipped.]

Q10: Please identify how often you use the following methods for interacting with other users of LibraryThing, and/or for discussing it or its content. Choose one option per method (row) listed below.

	At least once a week	At least once a month	Rarely	Never	Unsure	Choose not to answer
In-person (face-to-face)	( )	( )	( )	( )	( )	( )
Telephone (landline or cell)	( )	( )	( )	( )	( )	( )
Postal mail	( )	( )	( )	( )	( )	( )
E-mail	( )	( )	( )	( )	( )	( )
Instant messaging or text chat	( )	( )	( )	( )	( )	( )
Audio or video chat	( )	( )	( )	( )	( )	( )
LibraryThing forums	( )	( )	( )	( )	( )	( )
Other online forums	( )	( )	( )	( )	( )	( )
Online social networks (Facebook, etc.)	( )	( )	( )	( )	( )	( )
Another method Please specify below:	( )	( )	( )	( )	( )	( )

_____

_____

_____

Page 4: Community-Building Dimensions (e) and (f)

[If Q4, Q5, and Q6 were all answered "never," then Q11 is skipped.]

Q11: Please identify through which means you have met (face-to-face or online) other users of LibraryThing that you have interacted with, as well as anyone else you have discussed LibraryThing or its content with. Choose all options below that apply.

[ ] LibraryThing itself
[ ] Another digital library
[ ] A traditional, physical library
[ ] My workplace, school, college, or university
[ ] An interest group or organization
[ ] Networking with other contacts
[ ] An online social network (Facebook, etc.)
[ ] An online forum or discussion board
[ ] Another online setting—please specify: _____
[ ] Another offline setting—please specify: _____
[ ] Choose not to answer

Q12: For each statement (A through D) below, please read the statement and then choose one of the options presented.

A: By using LibraryThing I have found useful contacts who share my interests, profession, or learning needs.

( ) Strongly agree
( ) Agree
( ) Neither agree nor disagree
( ) Disagree
( ) Strongly disagree
( ) Unsure
( ) Choose not to answer

B: LibraryThing supports my interacting with those who share my profession.

( ) Strongly agree
( ) Agree
( ) Neither agree nor disagree
( ) Disagree
( ) Strongly disagree
( ) Unsure
( ) Choose not to answer

C: LibraryThing supports my interacting with those who share my interests.

( ) Strongly agree
( ) Agree
( ) Neither agree nor disagree
( ) Disagree
( ) Strongly disagree
( ) Unsure
( ) Choose not to answer

D: LibraryThing supports my interacting with those who share my learning needs.

( ) Strongly agree
( ) Agree
( ) Neither agree nor disagree
( ) Disagree
( ) Strongly disagree
( ) Unsure
( ) Choose not to answer

Page 5: Pilot Survey Feedback

Q13: Thank you very much for participating in this pilot study and answering the previous survey questions! Your feedback on this survey instrument's design, question wording, and answer choices, as well as any other issues you faced or feel others might face, would be greatly appreciated. Feedback—both good and bad—that you can provide on this questionnaire will help ensure its validity, reliability, accuracy, usefulness, usability, and readability in measuring the support for community-building in LibraryThing and other digital libraries. It will also help it provide more benefits—when used in follow-up studies—to digital library users such as yourself. Please provide your honest critique and feedback on the survey in the box below. Once you are finished, please click the "Submit" button below. Thank you again!

_____

_____

_____

_____

_____

_____

Footnotes

[1] Further review of studies of online and virtual communities can be found in Preece and Maloney-Krichmar (2003) and Haythornthwaite (2007); Burnett, Kazmer, Dickey, and Chudoba (2003) provide a briefer, yet still illuminating review.

[2] The unclear boundaries between communities and networks of practice, interest, and learning indicates further research is probably necessary to determine where the boundaries really lie. This study does not necessarily preclude that they are essentially identical, but does treat them as being at least partially separate so to allow for any and all differences that may exist.

[3] The name of the Steve project is variously capitalized and spelled in published literature, including being referred to as "steve.museum" after its Web site. It is capitalized here ("Steve") due to it being the name of the project and thus a proper noun.

Table 1

Relationships of Participants with Others

Relationship	*f*
Very close friends	1 [a]
Good friends	1
Friends	1
Acquaintances	1
Colleagues within organization	3
Other	1 [b]

[a] This participant also noted they had known these others for a number of years.
[b] "Doctoral students" was given as an answer by one participant.

Table 2

Methods of Interaction of Participants

	Frequency		
Method	Never	Rarely	At least once a month
Face-to-face	0	4	1
Telephone	0	0	0
Postal mail	4	1	0
E-mail	2	2	1
Text chat	2	3	0
Audio / video chat	3	2	0
LibraryThing forums	4	0	1
Other online forums	4	0	1
Online social networks	3	2	0

Note: One participant did choose the "Unsure" option for "Another method," but did not give any further details.

Table 3

General Perceptions of Community-Building Support

Supported	SA	A	N	D	SD
Finding of useful contacts	1	3	0	1	0
Interacting with those who share profession	1	3	0	1	0
Interacting with those who share interests	1	4	0	0	0
Interacting with those who share learning needs	1	3	0	1	0

Note: The column headings are abbreviations for the responses *strongly agree* (SA), *agree* (A), *neither agree nor disagree* (N), *disagree* (D), and *strongly disagree* (SD).