A Conceptual Framework and Open Research Questions
for Chat-based Reference Service

Jeffrey Pomerantz

Assistant Professor

School of Information and Library Science

University of North Carolina at Chapel Hill

Manning Hall, CB #3360

Chapel Hill, NC 27599-3360

Telephone: 919-962-8366

Fax: 919-962-8071

Email: pomerantz@unc.edu

Abstract

This paper is an attempt to move the literature on chat-based reference services beyond the current spate of case studies and discussions of emerging standards and best practices in providing chat-based reference, to a higher level of discussion on the creation and discussion of theoretical frameworks to unite these standards and practices. This paper explores the various steps in the process of providing synchronous, chat-based reference, as well as issues involved in providing such service at each step. The purpose of this exploration is twofold. First, this paper presents some open research questions at each step in the process of providing chat-based reference service. Second, the entire process of providing chat-based reference is viewed as a whole, and a model of the provision of chat-based reference service is developed at a high level of abstraction. It is hoped that this model may serve as a conceptual framework for future discussions of, and development of applications for chat-based reference.

Introduction

Literature on new technologies often appears in distinct phases. The first phase contains "gee whiz" types of presentations of the new technology and discussions of its potential. Literature in this phase is written primarily to introduce the technology to a new audience, and is often written by early adopters who have a vision of how the new technology may serve existing requirements, or how the new technology may be implemented in a new environment. Literature of this type concerning chat-based reference services first began to appear in the late 1990s. One of the first articles to propose that reference services would soon offer "real-time" and interactive reference service appeared in 1997 (Ferguson and Bunge, 1997, p. 260). Two years later, Lipow (1999) made the stronger argument that the development of such services are crucial to the survival of reference services in the era of web search engines, and suggested a range of technologies for such services, including chat. Coffman and Saxton (1999) propose a model for implementing such a service based on corporate call centers, and Breeding (2001) suggests that reference services make use of software developed for e-commerce

customer relationship management (CRM). McGlamery and Coffman (2000) provide a bridge between the first and second phases of this literature by discussing a proof-of-concept project for a consortium of libraries in southern California to provide reference service using CRM software.

The second phase contains case studies: discussions of specific implementations of the new technology in specific environments. This second phase describes most of the literature currently being published on chat-based reference services. Much of the research on chat-based reference services discusses recently launched and pilot services (Boyer, 2001; Broughton, 2001; Hoag and Cichanowicz, 2001; Kibbee, Ward, and Ma, 2002; Sloan, 2003), and evaluations of these services (Johnson, 2004; Nilsen, 2004). Many reference services that offer chat-based service have reported a steady increase in the number of chat questions that they have received since launching the service (Hoag and Cichanowicz, 2001; Patterson, 2001; Sears, 2001; Stormont, 2001; Foley, 2002; Ronan and Turner, 2002; Belanger, Lankes, and Shostack, 2002; Hill, Madarash-Hill, and Bich, 2003; McLaughlin and Ware, 2003; Schaake and Sathan, 2003). A few services have even reported that the number of chat questions has met or exceeded the number of email questions (Boyer, 2001; Broughton, 2001). Some studies of chat-based services describe a rise and fall in the use of the service corresponding to the academic calendar, even to the level of reflecting vacations and major assignment due dates (Sears, 2001; Sloan, 2003).

From several years' worth of such studies, some trends are evident, both in users' usage of chat services and in the practices employed by libraries offering these services. It is therefore time to move beyond what essentially amounts to a series of case studies, into a third phase of literature on chat-based reference services. This technology is no longer new, and so it is time for higher-level discussions of standards and practices in chat-based reference across service environments. This type of discussion is beginning: a number of books have been published recently that discuss emerging standards and best practices in providing chat-based reference (Meola and Stormont, 2002; Coffman, 2003; Janes, 2003; Ronan, 2003; Hirko and Ross, 2004). It is time for the creation and discussion of

theoretical frameworks to unite these standards and practices. This paper is an attempt to move the literature on chat-based reference services along this path from the second to the third phase.

Lankes (1998, 2004) and the Virtual Reference Desk Project (VRD)'s AskA Software specifications document (VRD, 1998) present a five-step process model of asynchronous digital reference (specifically, email- and webform-based reference). This model was validated by Pomerantz and others (2004), as a conceptual framework for software development and as a basis for analysis in greater depth of the various steps in the process of providing asynchronous reference service. Similar to the method employed by Pomerantz and others, this current paper explores the various steps in the process of providing synchronous, chat-based reference, as well as issues involved in providing such service at each step. The purpose of this exploration is twofold. First, this paper seeks to present some open research questions at each step in the process of providing chat-based reference service. This form of reference may no longer be new, but it is still new enough that very little research has been performed on it beyond, as mentioned above, case studies of individual services. Once the individual steps in the process of providing chat-based reference have been explored, this paper will step back and view the entire process as a whole. This is the second purpose in exploring this process: to develop a model of the provision of chat-based reference service at a high level of abstraction. It is hoped that this model may be used as a conceptual framework for future investigations of chat-based reference, as Lankes' and the VRD's model of asynchronous reference provides a conceptual framework for asynchronous reference.

Applications for Chat-based Reference

A range of applications have been used to provide chat-based reference service, from instant messaging (IM) applications such as AOL Instant Messenger, to applications designed specifically for chat-based reference. This latter category includes several applications: Tutor.com's (formerly LSSI's) Virtual Reference Toolkit (www.vrtoolkit.net), the eponymous 24/7 Reference (www.247ref.org), the Library of

Congress and OCLC's QuestionPoint (www.questionpoint.org), and Docutek's VRL*plus* (www.docutek.com), to name only a few of the most widely used. These applications bear a resemblance to commercial help desk applications, and indeed, 24/7 Reference and the VR Toolkit are extensions built on top of eGain's call center software (www.egain.com). LivePerson (www.liveperson.com) is also fairly popular as a tool for reference service, and is in fact a commercial help desk application. These applications possess similar sets of functionalities, including instant messaging, graphical co-browsing, webpage- and document-pushing, customization of pre-scripted messages, storage of transcripts, and statistical reporting. For excellent comparisons of the features of these and other applications for chat-based reference, see Hirko (2002) and Ronan (2003, pp. 31-34). As might be expected of commercial software, these applications are also fairly expensive for a library to license.

IM applications are being used by some libraries as a low-cost means of offering chat-based reference, since most IM applications are free: the AOL Instant Messenger (AIM), for example, may be downloaded for free from AOL's website (www.aim.com). A library that offers chat-based reference using an IM application therefore incurs no cost for licensing software. Some early work in the evaluation of library reference services concentrated on the determination of the cost of reference service, including such figures into calculations as the librarians' salary and cost of the reference collection. A number of studies in the late 1960s and 1970s arrived at surprisingly high cost-per-transaction figures (Murfin, 1993). Virtual reference services must add to these expenses the cost of licensing software, the cost of maintaining servers to host the software, and the cost of training librarians to use these applications. In the interests of keeping the cost of reference service down, it may therefore be an advantage for some libraries to eliminate the cost of licensing software, if not the other expenses.

Another advantage of IM applications for chat-based reference is that many younger computer users are already familiar with the technology; Janes (2002) suggests that use of IM applications may therefore attract younger users to make use of the reference service. Related to the familiarity of the technology is the advantage of ease of use: the R.

B. House Undergraduate Library at the University of North Carolina at Chapel Hill, for example, offers chat reference using AIM. All the user needs to do to use the service is install AIM – which many undergrads at Carolina have installed already – and add the service's screen name "undergradref" to his or her buddy list (www.lib.unc.edu/house/im_a_librarian.html). A drawback of using an IM application for chat-based reference, however, is that it is possible to transmit only text, hyperlinks, files, and emoticons; the more sophisticated functionality offered by applications designed specifically for chat-based reference is not available. Given the high volume of usage that the House library's AIM-based reference service receives (Suchi Mohanty, personal communication, 2004), however, it appears that limited functionality is not a disincentive for users.

Prior to a library's providing chat-based reference service to users, there are several issues involved in the decision of what application to use to offer that service. Open research questions surrounding these decisions include:

- What functionality is necessary and desirable for providing chat-based reference service?
- Which applications or media for offering reference service are appropriate for serving which user communities?
- Will a library's use of particular applications or media for offering reference service draw in new or underserved user communities?
- What methods are appropriate for computing the cost-benefit of applications for offering chat-based reference service? Of offering chat-based reference service at all?

User Login and Question Submission

The method by which a user connects to a library's chat-based reference service is essentially the same for all of the applications discussed above that are designed specifically for chat-based reference: an icon is placed on a library's website that provides a link to the service. The user clicks on that icon and is redirected to either the

login page for the service, or to a page describing the service, which itself contains a link to the login page. The login page contains a few fields for the user to fill in, which may include name, email address, telephone number, and of course the user's question. When the user submits a question, he or she enters a queue. This queue is invisible to the user, but visible to the librarian(s) staffing the service, which will be discussed in the next section. The user waits in the queue until a librarian "picks up" the user from the queue. When the librarian picks up the user, the user and the librarian connect and can conduct a chat session.

Prior to a user connecting to a library's chat-based reference service, however, that user must make the decision to connect to that particular library's service, and even prior to that, to seek information from a reference service rather than seeking information from any other source. Taylor (1968) suggests that when faced with an information need, the first decision that an individual makes is how to resolve that information need. An individual may ask a friend or colleague before conducting any search of the literature. If an individual does decide to search the literature, he or she may search his or her own personal collection and files or go to the library to use that collection. Finally, when an individual does decide to go to the library, he or she can choose to search the library's collection alone, or to ask for assistance at the reference desk. In short, asking a question at a library reference desk may be the solution of last resort, arrived at only after an individual rejects all other means of resolving an information need (pp. 181-182). It is this presumption that leads Lipow (1999) to suggest that "library reference service will thrive … only if it is so impossible to ignore – so 'in your face' – that to not use the service is an active choice" (p. 52). In other words, an online reference service must be as convenient a means for resolving information needs as asking a colleague or searching one's own personal collection.

Chat-based reference services may not yet be this convenient to use, but as increasing numbers of users gain access to the internet and become familiar with chat technology, chat-based services may come to be increasingly convenient for at least these users. While convenience may be a predictor of increasing use of chat-based reference services

in general, however, it does not predict the use of any single service. Many chat-based reference services exist, and by dint of being online all are more or less equally accessible. Just because a chat reference service is affiliated with a user's local library does not mean that that service is the most convenient for that user, or the one to which that user will choose to submit a question.

The simple fact of existing on the internet enables potentially huge numbers of users to access a library's services that would never have been able to in the physical realm. Supporting users from outside of the primary user community has always been an issue for libraries (Lankes, 2000b). There is certainly an argument to be made that if a user comes to a library's website, then he or she is a user of that library, just as surely as if he or she had come physically to the library or called on the telephone. Still, it may be difficult for virtual reference services to justify to their funding agencies the expenditure of resources to support users from outside of the primary user community. In a study of the chat-based reference service offered by the Public Library of Charlotte and Mecklenberg County, in Charlotte, North Carolina (PLCMC, www.plcmc.org), however, the author and colleagues found that 86% of users of the PLCMC's service were from within the state of North Carolina, and 67% from users in the Charlotte area (Pomerantz and McClure, forthcoming). A further finding was that the PLCMC librarians handled 16%, and the rest of the 24/7 consortial virtual reference network of which PLCMC is a member handled 84% of the users who logged into the PLCMC chat service. In a related study of NCknows, a statewide consortium within North Carolina of libraries offering chat-based reference service, the author and colleagues found that 75% of users of the NCknows service are from within the state of North Carolina. Further, librarians in each library in the NCknows consortium handled only an average of 5% of the users who logged into that particular library's chat service, and the other NCknows libraries or the 24/7 network handled the other 95% (though over all of NCknows, NCknows librarians handled 45%, and the rest of the 24/7 network handled 55% of users). Both the PLCMC and NCknows made out well in this: for a comparatively minimal investment in supporting users outside of their primary user communities, the PLCMC and NCknows chat services increased several times over the volume of users that they were able to

handle during their hours of service, in addition to dramatically expanding the number of hours that chat-based reference service could be offered to their primary user community.

Encouraging as these results are, however, it may not be possible to know how reliable they are. Although there is little incentive to do so, it is as easy for a user of a chat-based reference service to lie about his or her location as to tell the truth. Most virtual reference services have no mechanism to determine the veracity of a user's responses to questions such as their location – short of, for example, the user specifying their state as North Carolina and their country as Bolivia. One method of verifying the location of the user is that utilized by the KnowItNow24x7 digital reference service of the Cleveland, Ohio Public Library: the user is required to enter their zip code to use the service, thus attempting to insure that the user is actually a resident of the Cleveland area. It would not, however, be difficult for a user outside of the Cleveland area to look up Cleveland area zip codes. It may be impossible to know with certainty that the user of a digital reference service is telling the truth when providing his or her location – or indeed, any other datum. This is, however, no different for any respondent of a self-administered survey; the survey designer simply has to provide as little incentive as possible for lying on the survey, and then take it on faith that the respondents are truthful.

From the user's point of view, a chat-based reference service is no different than any other one-to-one chat environment, such as a chat session with a commercial help desk, or even a chat between friends. The mechanisms by which the user and the librarian connect via the application are hidden to the user; all that the user sees is the chat application's interface. Open research questions concerning users' use of chat-based reference services, therefore, involve characteristics of the user, and the user's decision-making process in contacting the service. These open research questions include:

- What factors affect a user's decision to contact a chat-based reference service, rather than seeking information from other sources?
- What factors affect a user's decision of which of all available chat-based reference services to contact?

- What factors affect a user's decision of which medium to use to contact a reference service?

- What percentage of a chat-based reference service's users are affiliated with the library offering the service?

- How does the type of application being used to provide chat-based reference affect measures such as:
    - the volume of users using the service,
    - the demographics of users using the service, and
    - the types of questions that users submit to the service?

Librarian Login and Question Selection

As mentioned above, when a user submits a question to a service, he or she enters a queue. A queue is associated with the specific service to which the user submitted their question; in chat consortia, like those of libraries using LSSI or 24/7 Reference for example, there may be a queue for each library that is offering chat service at any given time. When a librarian comes "on shift" and logs into the chat application, he or she can monitor one or more queues. When a librarian is monitoring a queue, he or she will be alerted when a user has submitted a question, and may then "pick up" the user from the queue. When this happens, the user is alerted that a librarian has joined the session, and the two may begin to chat.

The User Queue

The queue is a carry-over into chat-based reference service from email-based service, and arguably even desk-based: if desk reference service is very busy, users may queue up to speak to a librarian, though this perhaps does not happen as often as reference librarians might like. Many email-based reference services, and applications for managing email-based reference, incorporate the queue. In their discussion of QRC, the application originally developed to manage the email questions received by the Internet Public Library (IPL), Lagace and McClennen (1998) write that "volunteer librarians are able to

log into QRC at any time and view a list of questions waiting to be answered" (p. 25). Lankes (1998) uses the term "triage area" to describe the virtual "space" where email questions are held for experts (p. 107). (Triage is the process of assigning a question to a reference or subject expert, or allowing experts to claim questions for themselves (Pomerantz et al, 2004)). This triage area is the equivalent of a queue for email questions, though there is no mechanism in QRC for insuring that questions are handled in first-in-first-out order.

Indeed, Lagace and McClennen (1998) state that "many of our volunteers have commented that the chance to choose for themselves which questions to work on is one of the best features of working with the IPL" (p. 25). This is certainly understandable; at a reference desk, a librarian must respond to any user who asks him or her a question, whether or not the librarian has any knowledge of or interest in that question. In an email-based reference service that utilizes a triage area, the librarian may select only those questions that he or she has knowledge of or interest in. The downside of this, of course, is that there will inevitably be questions that no librarian selects; Lagace and McClennen describe the IPL's policy of running daily "sludge patrols," in which a librarian answers all such "cold case" questions[1]. In a chat-based reference service, there may be more of a sense of urgency for the librarian to "pick up" a user waiting in the queue: many applications have a blinking icon or a chime when there is a user waiting, and of course there is the librarian's knowledge that behind that blinking icon or chime, there is a person waiting, right now. In this, chat-based reference is closely analogous to reference at a desk. It seems unlikely, therefore, that there would be any "cold case" chat questions; one would expect that librarians would pick up chat users in first-in-first-out order. Sloan (2003) reports, however, that some users submit questions to the service but never connect to a librarian, or are disconnected before the completion of the chat transaction. There are a number of reasons why this may happen, including technical glitches, but it also may be that the librarian does not pick up the user quickly enough (in the former case), or that the user loses patience or interest and disconnects (in the latter). This could

---

[1] Thanks to Anthony Hughes for suggesting this term.

be a new type of "sludge patrol" for chat-based reference: preventing disgruntled users from leaving the queue or the session too quickly.

Open research questions concerning the user's use of the application used to provide chat-based reference service include:

- What are the advantages and disadvantages of different methods for queuing questions, such as first-in-first-out or allowing librarians to select their own?
- For what reasons do librarians select one question over another to answer, or one user over another to interact with?
- For what reasons do some users who submit questions never connect to a librarian?
- For what reasons do some users disconnect before the completion of the chat transaction?
- How can users be discouraged or prevented from leaving the queue or the chat session before connecting to a librarian? Before the completion of the chat transaction?

The Librarian's Location when Staffing the Queue

The appropriate location for the librarian to work is a subject of some debate in the literature on chat-based reference service. The issue centers on whether a librarian staffing a chat-based reference service should be located at or away from the reference desk. Ronan and Turner (2002) found that in 36% of libraries, librarians staff the chat service while at the reference desk. Kibbee, Ward, and Ma (2002) state that the chat-based service in their library was staffed by librarians at the reference desk. Chat questions were handled by whatever librarian was available at the time, though Kibbee, Ward, and Ma also state that there were generally as many as three librarians staffing the desk at any one time; in that situation the chances of one librarian being available increases considerably. Eichler and Halperin (2000) suggest that it is possible for a librarian to staff the chat service while at the reference desk, though they acknowledge that the librarian's ability to "multitask" like this depends on how busy the service is.

Eichler and Halperin state that the chat service in their library is staffed away from the reference desk when the service is busy. Stormont (2001) relates that when the chat-based service in his library was launched, all forms of reference were handled at the desk: chat, as well as email and telephone. Stormont goes on to relate, however, that the experience in his library is that "it is preferable to provide chat reference at a location that is separate from the desk used for in-person reference" (p. 131). This is a sentiment shared by many others. Francoeur (2001) argues that "unless your library has a quiet reference desk, it is probably not a good idea to expect your staff to do chat reference while also working at the desk" (p. 199). Foley (2002) states flatly that a reference desk is too distracting an environment for a librarian to staff a chat-based reference service. Anderson, Boyer, and Ciccone (2000) and Boyer (2001), clearly in agreement with Foley, state that the librarians providing chat-based reference service in their library are located at an "off-site services desk… located in a small room in the reference area next to the traditional reference desk" (Anderson, Boyer, and Ciccone, 2000, Off-site Services Desk section, ¶ 1).

A consensus appears to be forming among libraries offering chat-based reference service, that the best place for a librarian to be located when staffing the chat service is away from the reference desk. But how far away? Ronan (2001) and Foley (2002) both mention the possibility of virtual reference allowing librarians to telecommute. Blake (1999) suggests that tasks suitable for telework are intellectual rather than manual, and do not require physical presence, either for interaction with other people or for use of resources. Blake goes on to suggest that reference work is this type of a task. Schneider (2000) argues that a large percentage of reference questions are answered using electronic sources, and Hill, Madarash-Hill, and Bich (2003) state that only a small percentage of reference questions received electronically by their service required the use of the print collection. Calzonetti and deChambeau (2003), going further, argue that the reference questions received by their service could be answered "accurately and completely" (p. 38) using only electronic sources. In these cases, surely questions may be answered from anywhere, including the librarian's home. Calzonetti and deChambeau state that librarians in their library's chat service "found telecommuting from home during those evening hours to be an

employment perquisite" (p. 39). Hoag and Cichanowicz (2001), taking this possibility to an extreme, relate that one of the librarians who staffs the chat service in their library was featured in a local newspaper answering questions in her own living room, in her pajamas.

The proper location of the reference desk in the library has been a topic of discussion for many years (Humphries, 1993; Larason and Robinson, 1984). The possibility of telework adds a new wrinkle to this discussion, allowing for the location of the librarian to be considered separately from the location of the reference desk. Open research questions concerning the librarian's location while providing chat-based reference service include:

- What is the optimal environment for a librarian to work in while staffing a chat-based reference service?
- Can a librarian adequately staff the chat service while outside of the library?
- Can a librarian effectively handle multiple simultaneous chat sessions, or simultaneous reference interactions in multiple media?
- What types of questions require the use of a library's print or electronic collection?
- To what, if any, print resources can a librarian reasonably expect a patron to have access?

Consortia of Chat-based Reference Services

Several consortia of chat-based reference services have been formed since the late 1990s. Some of these consortia are composed of libraries using the same software application, such as QuestionPoint (www.questionpoint.org), LSSI (www.lssi.com), and 24/7 Reference (www.247ref.org). Some of these consortia are composed of libraries within a single state or geographic region, such as NCknows, a consortium of libraries from around North Carolina (www.ncknows.org), QandA-NJ, a consortium of libraries in New Jersey (www.qandanj.org), KnowItNow, the Cleveland Ohio public library's CLEVNET Consortium (www.knowitnow24x7.net), and the Western New York Library Resources Council (www.wnylrc.org).

Since the launch of its chat-based service, the Public Library of Charlotte and Mecklenberg County (PLCMC) has been a member of the consortium utilizing the 24/7 Reference application. As discussed above, the PLCMC was able to dramatically expand both the volume of transactions that they were able to handle during their hours of service, and the number of hours that chat-based reference service could be offered to their primary user community. These are both compelling reasons for a library to join a chat reference consortium. An additional advantage is that a consortium potentially allows questions to be forwarded to the individual best qualified to answer it, regardless of where that person is located. Even a large library can only have a small number of reference librarians on duty at a given time, whereas in a consortium there may be potentially dozens or even hundreds of librarians on duty.

The downside of a library joining a consortium of chat-based reference services is that doing so obligates a library to support users from outside its primary user community. The flipside of this, of course, is that a library's users may be supported by other libraries, and that these other libraries may be of a different type: for example, public instead of academic. At the Virtual Reference Desk Conference in San Antonio, Lafrance and Smith (2003), from the Santa Clara University library, a member of the 24/7 Reference consortium, stated that librarians in their library were concerned about the quality of service that their users receive, since the librarians had little knowledge of the resources that other libraries could bring to bear to answer questions. Specifically, the Santa Clara University librarians were concerned that that their users' questions were being answered by public librarians who, they believed, might not be able to adequately answer questions posed by academic library users. Lafrance and Smith stated that their ideal consortium would be a small consortium of academic libraries.

It will be interesting to follow the Santa Clara University library's choices in providing consortial chat-based reference service over the long-term, and to see how those choices work out for that institution. It may prove to be the case that consortia of varying sizes and compositions will be appropriate for libraries of different types, serving different user

communities. It will be necessary for libraries to experiment by building consortia of different compositions, or by subdividing larger consortia into smaller "special interest groups," to discover whether or not this is so. It will also be interesting to see whether or not this "balkanization" of consortia becomes a trend, or whether standards and policies can be agreed upon and enforced in large consortia, to the satisfaction of all. There are many standards and policies that may be necessary for the smooth operation of a consortium of chat-based reference services; indeed, potentially every issue addressed in this paper may be addressed in this way, though different consortia may choose to formalize different elements of their operation. Open research questions concerning consortia of chat-based reference services include:

- What factors affect a library's decision concerning what application to use to provide chat-based reference service?
- What are the benefits and drawbacks of a library participating in a consortium of chat-based reference services?
- What mechanisms will enable a question to be forwarded to the individual best qualified to answer it?
- What is the ideal makeup of a consortium, to insure an acceptable level of service to different types of users, at different types of libraries?
- Can a librarian at one type of a library adequately answer questions from users at a different type of library?
- What policies are necessary for the operation of a consortium, to insure an acceptable level of service? How can these policies be enforced?

The Reference Transaction

Opening Questions

It is a commonplace in librarianship that a user's opening question to a librarian is often not the question to which the user wants the answer. Belkin, Oddy, and Brooks (1982) refer to a gap in an individual's knowledge as an "anomalous state of knowledge" (ASK), and suggest that individuals tend to be "unable to specify precisely what is needed to

resolve that anomaly" (p. 62). Miyake and Norman (1979) make essentially this same argument when they claim that "to ask a question, one must know enough to know what is not known." This difficulty or even impossibility of asking a question about a topic on which one knows very little has been widely accepted in librarianship as the reason that users' opening questions are frequently not their real questions.

Several authors (Eichman, 1978; Dewdney and Michell, 1996; Radford, 1999) suggest, on the other hand, that the function of the opening question asked by a user of a reference librarian "is not primarily to ask the question; rather, it is a form of phatic communication" (Dewdney and Mitchell, p. 8): communication that serves the function of maintaining social relationships (Laver, 1975). Thus, not only may a user's initial question not accurately reflect the user's information need, that question may not even be intended to serve the function of a question – it may instead be intended to establish a relationship between the user and the librarian.

The role of the reference librarian has therefore been referred to as mind-reading (Lynch, 1978). Fortunately there is a large body of literature that addresses how to approximate mind-reading, by interviewing the library user and so eliciting the user's real information need. In face-to-face reference encounters, the librarian has available all of the channels of communication associated with face-to-face conversation: verbal and non-verbal cues, pauses, body language, etc. In a chat transaction, however, many of these channels are removed, potentially making interpersonal communication more challenging – on both sides of the transaction. While some research has been conducted on the use of text-only media for interpersonal communication (Herring, 1999), and on the use of instant messaging specifically (Nardi, Whittaker, and Bradner, 2000; Isaacs, et al., 2002a, 2002b), none of this research has been conducted in the context of chat-based reference services. There is much about the dynamics of problem-solving types of interactions, such as the reference transaction, that is not understood. Open research questions concerning the user's opening question include:

- How does the medium used to provide reference service affect the types of questions the users ask?

- What is the function of the opening question asked by a user in a chat reference session?
- What conversational mechanisms are appropriate for conducting a chat-based reference interview?
- How does the lack of richness of the chat medium affect the reference transaction?

The Reference Transaction Itself

Evidence from email-based reference services indicates that asynchronous media do not lend themselves well to question negotiation: Carter and Janes (2000) report that if an expert from the IPL replies to a user's question with a request for clarification, 29.5% of users do not ever reply with that clarification. Janes and Silverstein (2003) refer to this as the "disappearing questioner" (General Characteristics for All Modes section, ¶ 2). In email-based reference, therefore, the initial question is often all that the librarian has to work with.

Reference transactions conducted via synchronous media, on the other hand, do lend themselves well to conversation between the librarian and the user and therefore to question negotiation, just as if the librarian and the user were conducting the reference transaction face-to-face. Decades of literature indicates that question negotiation occurs in face-to-face reference transactions, even if not in all of them: Lynch (1978) states that the librarian interviews the user in only 49% of reference transactions (p. 128). At present, no research has been conducted that investigates the frequency of question negotiation in chat-based reference; it is therefore an open question whether the percentage of reference transactions in which question negotiation occurs is different in chat than in face-to-face or in other forms of reference service.

The chat reference transaction, like the face-to-face reference transaction, is typically a one-to-one conversation. While nothing prevents librarians working together to answer a question, for example, or two users sharing a keyboard, chat reference applications are

designed to enable transactions between two participants. Consequently, one of the appealing aspects of chat reference is its apparent resemblance to the traditional face-to-face reference transaction. Janes (2002), however, compares chat reference not face-to-face but to telephone reference. Janes states that while chat, like telephone reference, has the appearance of being purely synchronous, it actually is not, since the librarian can "put people on hold for a few minutes to search the catalog or the stacks" (p. 14).

Radford (1999) explores the reference transaction using the tools of communication theory. Radford focuses on the reference transaction as a "process of interaction" (p. 30) between the librarian and the user, an approach which brings the interpersonal relationship between the two to the forefront. While a focus on the interpersonal relationship between the librarian and the user goes back all the way to Samuel Green (1876), much of this literature is concerned with this interaction as a means for the librarian to elicit information from the user, so as to provide the user with accurate and useful information and resources. Durrance (1989) was among the first to suggest that this interpersonal relationship was a primary source of a user's satisfaction with the service provided, and that the user's satisfaction is equal in importance to the accuracy of the information provided in the evaluation of the reference service.

At the 2003 Virtual Reference Desk Conference, Radford (2003) presented the methodology that was used in the analysis of chat transcripts for the Samuel Swett Green Award (www.vrtoolkit.net/greenaward.htm), to identify exemplary virtual reference transactions. (Sadly, the Green award was discontinued in December 2003, though as of this writing the Digital Reference Education Initiative (drei.syr.edu) is compiling exemplary digital reference transactions – both chat transcripts and email exchanges – to display on their website as a tool for training and research.) The methodology used for the Green Award is based on conversation analysis performed on face-to-face interactions (ten Have, 1999), and involves identifying such elements of the interaction as: factors that facilitate or hinder the relationship between the librarian and the user, use of language by both participants, and negotiation of conversational opening and closing sequences. While the Green Award was judged according to a number of criteria taken in

their totality, the elements of the interaction play a large role in this judgment. The Green Award was, at least in part, based on the premise that the interaction between the librarian and the user is a primary contributor to the exemplary chat reference transaction (Radford, 1999).

Durrance (1989) suggests that not only is the interpersonal relationship between the librarian and the user a primary source of a user's satisfaction, but that this satisfaction is of primary importance in the successful reference transaction. Durrance suggests that the user's willingness to return to ask another question of the same librarian may be used as a metric for the evaluation of the reference service. In a chat-based reference service, however, the user may have no control over which specific librarian he or she asks a question of: the librarian who responds to the user's question may simply be the librarian staffing the chat queue at that particular time. Even if the user had a preference for a particular librarian, the user has no way of controlling which librarian responds to his or her question. In the environment of chat reference services, therefore, an alternative to Durrance's criterion is the user's willingness to return to submit another question to the same service.

When a user is on the verge of asking a question at a reference desk, he or she has the opportunity to look and see which librarian is at the desk, and decide whether or not to ask that particular librarian. The user may not, however, have a choice of asking or not asking the question at that particular reference desk. The user may not have access to any other library, and so while the user may have a choice of librarians, he or she may not have a choice of reference services. This is not the case with chat-based (or other computer-mediated) reference services: as discussed above, many such services exist, and all are more or less equally accessible. In fact, just as a librarian has one chance to impress a user before that user makes a judgment about his or her willingness to return to that librarian, so too does a virtual reference service have one chance to impress a user before that user makes a judgment about his or her willingness to return to that service. And, given the ease with which a user may locate other virtual reference services, if a user is unwilling to return to a service, it is possible that the service has lost that user for

good. This is a clear indication of the need for the evaluation of reference transactions according to criteria for insuring quality.

Several sets of standards exist specifically for the evaluation of computer-mediated reference services: White's (2001) framework for analysis and evaluation of digital reference services, McClure et al.'s (2002) <u>Statistics, Measures and Quality Standards for Assessing Digital Reference Library Services</u>, and the Virtual Reference Desk's Facets of Quality (VRD, 2000, 2003). Additionally, Bertot, McClure, and Ryan's (2001) more general <u>Statistics and Performance Measures for Public Library Networked Services</u> include some measures for virtual reference. These evaluation measures, however, were all created specifically for asynchronous reference services. Standards for the evaluation of desk-based reference services also exist: some of these standards are stated explicitly in literature that describes reference assessment instruments (Murfin and Gugelchuk, 1987; Isenstein, 1992), and some are discussed implicitly in literature that discusses actual or desired best practices in reference (Dervin and Dewdney, 1986; Radford, 1999). Recent books on launching and managing chat-based reference services (Meola and Stormont, 2002; Hirko and Ross, 2004; Ronan, 2003) include suggested evaluation measures for chat-based reference services, but at present no exhaustive set of evaluation measures or best practices in evaluation has been established for chat-based reference services. A challenge as chat-based reference is implemented across service environments and standards and best practices emerge will be to select the appropriate measures from email- and desk-based reference to apply to chat-based reference, as well as to develop measures specifically for chat-based reference.

Open research questions concerning the chat reference transaction include:

- Under what conditions does a reference transaction occur in a chat reference session?
- Under what conditions is a reference transaction necessary in a chat reference session?
- What is the frequency of question negotiation in chat-based reference?

- Does the problem of the "disappearing questioner" exist in chat-based reference services? If so, why, and how can this problem be minimized?
- To what extent do the components of the chat interaction between the librarian and the user affect the user's satisfaction with the reference transaction?
- What factors affect a user's willingness to return to submit another question to the same service?
- What standards are appropriate for the evaluation of chat-based reference services?
- How should criteria such as the accuracy and completeness of the answer provided, and the user's satisfaction with the transaction be evaluated for chat-based reference?

Archiving Reference Transactions

Pomerantz and others (2004), in their analysis of a general process model of asynchronous digital reference, discuss the final two steps in this model:

- Tracking: the quantitative and qualitative monitoring of repeat questions for trends. Tracking allows the identification of "hot topics," and may indicate where gaps exist in the collection(s); and
- Resource creation: involves the use of tracking data to build or expand collections to better meet users' information needs.

Pomerantz and others (2004) suggest two specific tasks that a digital reference service may perform during these two steps: storing previously answered questions in a knowledgebase, and then utilizing that knowledgebase as an information resource by automatically searching it when a question is received by the service. Pomerantz and others state that these tasks are on the "wish lists" of many email-based reference services, but that not many services have actually implemented functionality to make these tasks possible. In chat-based reference services these tasks are equally possible and perhaps desirable, but there is no literature that indicates that any chat-based services are actually performing these tasks either.

Goetsch, Sowers, and Todd (1999) report that 62.2% of Association of Research Libraries member libraries maintain archives of previously answered questions, but only four of those libraries make those archives publicly accessible (p. 16). It is not clear, however, whether those four libraries make the "raw" questions and answers available (that is, just as they were written, without editing), or whether these questions and answers are "cleaned up" (identifying information about the user and librarian removed, spelling and grammar corrected, etc.). There are two email-based reference services that the author is aware of that currently maintain public, searchable archives of raw previously answered questions: the MadSci Network (www.madsci.org) and Ask Dr. Math (mathforum.org/dr.math). Bry (2000) explains that when the user submits a question to MadSci, a CGI script searches the archive for potential answers. Bry states that "approximately 63 percent of questions are matched with archived files" – however, "only 25 percent of users deem their questions answered by this process (15 percent of all submitted questions)" (p.118). One would expect that as the MadSci Network answers more questions on more topics, the percentage of new questions that are matched with archived files will increase. It is less clear whether a greater percentage of users will deem their new questions answered by archived files, as the MadSci Network's archive of previously answered questions grows.

Automated Question Answering

Some authors suggest that the situation and context that gives rise to a question is unique for every individual (Dervin and Dewdney, 1986). If this is true, then even if two users ask questions of a reference service that are phrased identically, these questions cannot be treated as actually being identical. Indeed, if this is true, then it may be that automating question answering is impossible, and that even creating lists of frequently-asked questions (FAQs) is not worth the time. Bry's (2000) findings indicate that this is not absolutely true, but her results also seem indicate that it is true most of the time. Coffman (2001), however, takes it as a given, even common knowledge that questions repeat, and suggests that "if we could somehow access the work another librarian had done before,

there would be no need to start over answering every question from scratch" (p. 152), and goes on to suggest using chat session transcripts as the basis for FAQ lists and knowledgebases.

The MadSci Network's script for searching their archive for potential answers is a traditional information retrieval (IR) tool, though a simple one, in that it performs document retrieval: for each successful search, a list of previously-answered questions (PAQs) is retrieved, each of which contains a link to the answer provided by the service. This sort of a tool is Coffman's (2001) notion of a reference knowledgebase: a searchable archive of questions and answer pairs. If an appropriate answer is found in the archive that will answer a new question, it can then be used verbatim or modified to answer the new question.

A possible alternative to traditional IR systems for use by digital reference services is question answering (QA) systems. While QA systems have existed since the late 1970s (Lehnert, 1977), the development of QA systems got a boost when the Text REtrieval Conference (TREC, trec.nist.gov) added a QA track in 1999. QA systems take an entirely different approach to responding to questions than had been taken by IR systems until that time. Voorhees (1999) states that:

> "The goal in the QA task is to retrieve small snippets of text that contain the actual answer to a question rather than the document lists traditionally returned by text retrieval systems. The assumption is that users would usually prefer to be given the answer rather than find the answer themselves in a document" (p. 77).

While this assumption may be debatable, the fact is that QA systems retrieve portions of documents from a corpus that (hopefully) contain answers, while traditional IR systems retrieve one or more documents from a corpus that (hopefully) contain an answer to the question put to the system. In this way, QA systems are similar to the service provided by many desk and digital reference services, in that they attempt to provide actual answers, not just sources.

It will likely take some time and development before QA systems are sophisticated enough to be able to adequately answer some of the questions received by reference services. Some reference questions "from the field," as it were, are far more complex than the questions utilized by QA systems: Voorhees (2001) states that questions used in the TREC QA track are taken from web search engine logs, and cleaned up considerably. There are of course many simple reference questions: "Where's the bathroom?" is of course a standard at reference desks, and while no user is likely to ask for the location of the bathroom online, a chat service may receive similarly simple questions such as "What are the library's hours?" and "How do I renew a book?" On the other extreme, however, are questions that would be difficult or impossible for QA systems to answer at their current level of development: questions that are poorly phrased, contain spelling or grammatical errors, are very lengthy, contain much description of the user's situation that provides context but is not part of the actual question, etc. (Sloan, 2001; Pomerantz, 2003b). Digital reference and QA systems have the potential to arrive at a highly fruitful symbiosis: digital reference services can provide a useful testbed for future QA systems implementing increasingly sophisticated functionality, and QA systems can automate some answering of reference questions, thus enabling a digital reference service to scale up to handle an increasingly large number of questions.

Whether a digital reference service utilizes an IR or a QA system, however, an important issue is what documents are contained in the corpus. Both the MadSci Network's and Ask Dr. Math's archives contain PAQs. The Internet Public Library (IPL, ipl.org), on the other hand, offers a search function that allows searching of the entire contents of the IPL's many collections. Similarly, any digital reference service could offer the functionality of searching any digital collection; Ask Dr. Math could, for example, allow searching of all of the materials on the Math Forum site (mathforum.org) with which it is affiliated. The MadSci Network could, for another example, allow searching of the many digital collections of science materials on the internet, such as the Digital Library for Earth System Education (DLESE, dlese.org) and the Animal Diversity Web (animaldiversity.ummz.umich.edu). The fact that the MadSci Network is not affiliated

with these collections potentially raises issues with regard to intellectual property, but those are beyond the scope of this discussion and will not be addressed here. For a discussion of the intellectual property issues involved in utilizing digital collections in digital reference work, see Pomerantz (2003a).

The issue of whether, and which, questions received by reference services may be automatically answered, in whole or in part, is not unique to chat-based services. Indeed, this issue is applicable to reference conducted via any electronic media. Automated question-answering may, however, prove to be more important for services offering chat-based or other forms of synchronous reference than for asynchronous reference services, since, as discussed above, there is debate over how effectively a single librarian can handle more than one chat session at a time. During times when a reference service receives a high volume of questions, it may be possible to have multiple librarians on duty, staffing the chat service. This is not, however, a highly scalable solution: if a librarian indeed cannot effectively handle more than one or a few chat sessions simultaneously, even with several librarians staffing a service, no more than a small number of sessions can be handled at a time. Thus, as the volume of questions being received per unit time increases, either the time that each user will wait in the queue will increase, or the quality of the service provided to each user will decline, or both. As Lankes (2000a) and Pomerantz, Nicholson and Lankes (2003) suggest, the scalability of a reference service is directly tied to the extent of automation employed by that service.

From archiving PAQs to utilizing those PAQs for answering new questions is a logical progression. Given current technology, however, it is easier to store PAQs than it is to use those PAQs to automatically answer questions. In order to bridge that gap, considerably more research and development in QA is required. The answers to the open research questions in this area have the potential to strongly influence the future of automation in the service of digital reference. Open research questions concerning PAQ archives and automatic QA include:

- Is it possible to automatically answer questions submitted to chat-based reference services?

- Are certain types of questions more amenable to being answered automatically than others?
- What are fruitful schemes for classifying questions in order to automatically provide answers?
- How can a chat-based reference service utilize automation to increase its throughput of questions per unit time?
- What intellectual property issues are raised when searching and using materials from unaffiliated collections?
- What privacy issues are raised by searching archives of previously-answered questions?

Archiving and User Privacy

There is a long tradition in desk reference work of capturing statistics about the reference transaction, as a means for evaluating the reference service. Even the best of these statistics are, however, merely a thin representation of the reference transaction. This is not the case with digital reference: the nature of electronic media allows the entire reference transaction to be captured, verbatim, and completely unobtrusively. The transaction itself, conducted electronically, creates an artifact that may be stored until deliberately deleted.

Collection of the entire reference transaction raises many privacy issues. How much personal information about the user does the librarian need in order to answer the user's question? What is done with this personal information once the answered question is archived? One of the functions of the reference interview is to elicit some personal information from the user, in order to put the user's question in context so that the librarian can answer it appropriately. In the physical environment, the risk to the user of providing this information is minimal, since the reference transaction is transitory. Not so in the electronic environment, and so the risk to the user of providing personal information is increased.

This is particularly so in the current political climate, when librarians are rushing to the shredder to eliminate all record of transactional and operational data collected in the course of providing library services. Clymer (2003) reports a developing consensus among librarians that "even necessary records should be promptly destroyed after use" (p. A30), and Murphy (2003) reports a decision by the Santa Cruz Public Library System to shred all library records on a daily basis. Such actions are perhaps an understandable reaction by librarians – a profession that takes user privacy very seriously – to the threat of subpoenas to provide information about users. Nicholson (2003a), however, in a triumph of understatement, suggests that such destruction of library records "makes it very difficult to evaluate and justify library services" (p. 147). In the absence of data, it is not merely very difficult, but it may be impossible to draw any conclusions at all about a service's performance and the extent to which it is achieving its goals. Clearly, this "shred everything" approach is untenable.

This, however, only begs the question of what data is necessary to evaluate and justify library services, and what data should be destroyed? This issue is not unique to chat-based services, but applies to reference services in all media, and indeed to all library services and functions. Clearly, the less personal information is collected, the less risk to the user and the less fear librarians need have of subpoenas. It is probably necessary, however, for the user to provide a certain amount of personal information so that the librarian may answer the user's question appropriately. Janes and Silverstein (2003) point out that in asynchronous reference services, often the questions on a webform serve as a surrogate for the reference interview. Janes (2001) points out that there is a wide variety in the number and type of questions on asynchronous reference services' webforms, from simple forms to forms that contain questions that attempt to simulate the reference interview. The user connects to a chat-based reference service also through a webform, but these forms often ask fewer questions than those for asynchronous services, presumably on the assumption that a more traditional reference interview may be conducted during the chat conversation.

Thus it might appear that chat-based reference is less intrusive than webform-based reference, since less personal information is collected about the user. Exactly the contrary might be the case, however. Nicholson (2003a) suggests that in order to clean a library's data while still retaining enough data to enable evaluation of a library services, certain fields may be deleted, such as the user's name. A webform automatically produces fielded data; this deletion would therefore be comparatively simple. In order to clean and "anonymize" user data from a chat-based reference service, on the other hand, requires the much more labor-intensive task of reading every archived chat transcript, and deleting all personal information about the user that occurs within the transcript. Chat-based services that do not collect user data "up front" on a webform – that rely on the conversation to collect personal information – may therefore make it more difficult to clean user data. Given the current "shred everything" climate in libraries, issues of data collection and storage may turn out to be central to the success or failure – or the adoption or rejection – of new library services.

Open research questions concerning the storage of PAQs and the user privacy issues raised by such archives include:

- What data is necessary to evaluate and justify library services, and what data should be destroyed?
- What pieces of personal information about the user are necessary for the librarian to answer the user's question appropriately?
- What pieces of personal information about the user are necessary and/or appropriate for use in evaluation of a library's services, and what pieces of information should be deleted?
- What is the best venue or opportunity to collect personal information about the user?
- How can the library or the librarian weigh the risk between collecting personal information about the user, and understanding the user's context and situation?

Discussion

The first purpose of this paper was to present some open research questions at each step in the process of providing chat-based reference service. This has been the task of this entire paper up to this point. We will now step back and view the entire process of providing chat-based reference service as a whole. The second purpose of this paper is to develop a model of the provision of chat-based reference service at a high level of abstraction. This section will develop and discuss this model.

Pomerantz and others' (2004) analysis of a general process model of asynchronous digital reference was discussed briefly above. This model was originally developed by Lankes (1998) and the VRD (1998) as a conceptual framework for software development and as a basis for analysis of the various steps in the process in greater depth. This model consists of 5 steps:

1. Question Acquisition includes all issues related to the process of obtaining information from a user. This includes not only the user's question, but also question categorization and user identification information, via email, web forms, chat, or embedded applications.
2. Triage is the assignment of a question to a reference or subject expert. This step may be automated or conducted via human decision support. Triage also includes the filtering out of repeat or out-of-scope questions.
3. Answer Formulation includes all actions taken by the expert to generate a response to a question, including sending the response to a reviewer or directly to the user. Factors for creating "good" answers such as age and cultural appropriateness are included in this step.
4. Tracking is the quantitative and qualitative monitoring of repeat questions for trends. Tracking allows the identification of "hot topics," and may indicate where gaps exist in the collection(s).
5. Resource Creation involves the use of tracking data to build or expand collections to better meet users' information needs.

Pomerantz and others (2004) validated this model, and mapped out practices employed by asynchronous reference services at the various steps. Lankes (2004) utilizes this model

as a "lens" through which digital reference may be viewed as a system, and "the means by which technologies can be used to improve both the efficiency and effectiveness" of this system (p. 306). This model thus serves as a process model of the provision of asynchronous reference service, rather than as a model of the user's information seeking.

Viewed through this systems lens, chat-based reference is not significantly different from asynchronous forms of reference: technological means are utilized to offer the service, and this technology is intended to improve the efficiency and effectiveness of the service. What differs is primarily the software utilized in offering the service. However, as any computer user knows, different applications possess different functionalities, and these functionalities may enable, require, or constrain different usage behaviors. The model developed by Lankes (1998) and the VRD (1998) may thus not be appropriate for describing the process of chat-based reference service. A new model will therefore be developed here.

Based on the above discussion of the process of providing chat-based reference service, this new model of chat-based reference service must contain the following processes:

1. Question Submission: The user, having decided to contact the service, logs into the service and submits a question. The question then waits in a queue for a librarian to select it.

2. Expert selection: A librarian selects the user's question from the queue. The user and the librarian are connected and may begin a conversation via chat.

3. Question negotiation: The user and the librarian conduct a conversation via chat. The librarian may conduct a reference interview with the user. The librarian provides an answer to the user's question and/or some information resources.

4. Searching resources: During the reference interview, the librarian may have to search within online or print information resources. These resources may be information sources such as books, databases, or websites, or may be an archive of previous chat transcripts.

5. Archiving: All chat transcripts may be stored in an archive. Depending on the chat application, this archive may be internal or external to the application itself.

6. Tracking and evaluation: Quantitative and qualitative analyses may be conducted of the questions received and answers provided, chat interactions, user demographics, or other elements of the service provided. These analyses may be used to identify trends and "hot topics," as well as to evaluate the service for quality control.

7. Resource creation: Tracking and evaluation data may be used to develop or expand collections and other resources provided by the reference service.

This model of chat-based reference service is represented graphically in Figure 1. This model is strongly reminiscent of the five-step process model of asynchronous digital reference, discussed above. This should not come as a surprise, since many of the same steps are performed in both asynchronous and synchronous reference: the user must first submit a question, whereupon some means must exist for the librarian to receive or claim the question, and finally the librarian replies to the question. The fact of the reference transaction having been conducted via electronic media allows the entire transaction to be captured, and stored in an archive or searched as an information resource. Viewed in this way, Lankes' (2004) use of this five-step model as a "systems lens" rings true: digital reference involves a set of processes, which may be performed via technology.

[INSERT FIGURE 1 ABOUT HERE]

This new model also contains entities and steps that are not included in the process model of asynchronous digital reference. The author suggests, however, that this reflects the fact that the synchronicity and the software used for chat-based reference emphasize certain processes in providing reference service that are not emphasized in asynchronous reference. Chat-based reference possesses some of the same features as asynchronous reference, and some of the same features as desk reference, but few if any features that are unique unto itself. Indeed, as this new model builds on the process model of asynchronous digital reference, the author suggests that it may serve as a more general process model of reference in all its forms. Different services may employ variations of the processes at each step, and some services may even skip steps. This new model,

however, captures processes that are performed in all types of reference service, not just chat-based services. It is hoped that this model may be utilized as a conceptual framework for future investigations not only of chat-based reference, but of asynchronous and desk reference as well.

Conclusion

This paper is to a certain extent disingenuous. On the one hand, the purpose of this paper has been to explore the processes involved in providing chat-based reference specifically. Where issues in asynchronous or desk reference were discussed, it was because they are also issues in chat-based reference. On the other hand, the author agrees with Lankes (forthcoming) that it is a fallacy that synchronous and asynchronous forms of digital reference are fundamentally different. Indeed, the author would go a step further and suggest that it is a fallacy that reference conducted at a physical desk and reference conducted online are fundamentally different. While the medium by which a service is offered may differ (the term "medium" is used loosely here, to include face-to-face as well as computer-mediated services), fundamentally the purpose of reference service in all its forms is the same: to assist users in fulfilling their information needs. Thus, to explore chat-based reference to the exclusion of other forms of reference – offered asynchronously online, on the telephone, or at the desk – is, from one point of view, to deliberately ignore the forest for the trees.

The trees in this part of the forest do, however, have some unique features. That is to say, there are aspects of chat-based reference that set it apart from other forms of reference. Chat-based reference takes place online, which sets it apart from reference that takes place at a desk or via the telephone. And chat-based reference is synchronous, which sets it apart from email- and webform-based reference. Viewed in this light, chat-based reference is a middle ground between desk and asynchronous reference. But chat-based reference does have some characteristics possessed by neither desk nor email reference. Daft and Lengel (1986) discuss the capacity of media to convey information of varying degrees of "richness," and suggest that different media are "richer" than others. Daft and

Lengel list various media, with face-to-face being the richest and documents being the least rich, with the telephone being in between (p. 560). This author suggests that a reference transaction conducted via email or the web falls along Daft and Lengel's spectrum of richness near to "documents such as letters or memos," while chat falls towards the richer end of the spectrum – perhaps, as Janes (2002) suggests, near to the telephone. Daft and Lengel suggest several criteria for determining the richness of a medium; it would be an interesting avenue for future research to determine the richness of the various media utilized for offering reference, as a way of evaluating the usefulness of various media for different forms of reference service.

Another unique feature of chat-based reference is, again, a result of its being a middle ground between desk and asynchronous reference. Each chat reference session produces a document that is archivable (as does email- or web-based reference), but that document is a transcript of an entire conversation (like desk reference). Thus, for the first time in the history of reference work, it is possible to capture the entire conversation that is the reference transaction. Two overarching methods have traditionally been used to evaluate reference work: obtrusive and unobtrusive. Obtrusive evaluation involves observing a reference librarian while he or she is working with a user, so that the librarian knows that he or she is being observed. Unobtrusive evaluation involves the "secret shopper" method where the researcher or a proxy asks a question as a user, so that the librarian does not know that he or she is being observed. With access to an archive of chat reference sessions, however, it becomes possible to conduct unobtrusive evaluation without the evaluator posing as a user – that is, with real questions from real users. The evaluators of chat reference sessions could even be other librarians, thus allowing the evaluation of chat sessions to be performed by those who have first-hand experience with offering this service themselves. In this way, chat reference sessions could be peer reviewed for accuracy and completeness, as well as for quality of the interaction. To date there have been no published studies of chat-based reference where peer review of chat transcripts has been employed as an evaluation method; this would be an interesting avenue for future research, which would provide a unique insight into the reference interaction in

general, and this interaction as conducted via chat specifically, as well as the usefulness of chat for the various tasks involved in performing reference work.

Synchronous communication media have been utilized for reference services since the first telephone appeared at a reference desk. Indeed, face-to-face reference service offered at a desk is synchronous. The bulk of the literature on the latest form of synchronous reference service, chat-based reference has, however, appeared only since the turn of the millennium. As discussed at the outset, much of this literature consists of discussions of the potential of this technology, to introduce the technology to a new audience. Much of this literature also consists of discussions of specific implementations of the new technology in specific environments.

This paper has been an attempt to move the literature on chat-based reference services beyond these types of presentations to a higher level of discussion. A process model of chat-based reference service was presented. Like Lankes' and the VRD's model of asynchronous reference, it is hoped that this model might serve as a conceptual framework for future discussions of, and development of applications for chat-based reference. Some issues were discussed and open research questions were posed at each step in this process model. The author does not claim that these issues and research questions are exhaustive: other research questions may present themselves as chat-based reference services continue to develop, and as some questions are answered and new issues are identified. Furthermore, many, if not most of the research questions posed above likely have no single, definitive answer. Instead, it is likely that they have answers that are highly context-dependent, varying between types of libraries or services, or between specific services. These are, however, the author believes, the most important issues and unanswered questions in chat-based reference service at this point in time.

As the technology for providing chat-based reference service develops, and some questions are answered, additional issues and questions will undoubtedly be identified. As that happens, it is the author's hope that the process model presented above will be refined. In time, perhaps an overarching model of all reference, regardless of medium of

delivery, will be developed. It is a common and growing sentiment among scholars and practitioners of reference work these days that the distinctions between chat-based, email-based, telephone-based, and desk-based reference are becoming decreasingly important. The author joins in the hope that, in time, the terms "virtual reference" and "digital reference" will fall out of use, and such forms of reference will come to be thought of simply as "reference."

References

Anderson, E., Boyer, J., & Ciccone, K. (2000, 16-17 October). Remote Reference Services at the North Carolina State University Libraries. Paper presented at the Virtual Reference Desk 2nd Annual Digital Reference Conference: Facets of Digital Reference, Seattle, WA. Retrieved 5 March 2004 from http://www.vrd.org/conferences/VRD2000/proceedings/boyer-anderson-ciccone12-14.shtml.

Belanger, Y., Lankes, R. D., & Shostack, P. L. (2003). Managing Data Collection for Real-Time Reference: Lessons from the AskERIC Live! Experience. Internet Reference Services Quarterly, 8(1/2), 137-148.

Belkin, N. J., Oddy, R. N., & Brooks, H. M. (1982). ASK for Information Retrieval: Part I. Background and Theory. Journal of Documentation, 38(2), 61-71.

Bertot, J. C., McClure, C. R., & Ryan, J. (2001). Statistics and Performance Measures for Public Library Networked Services. Chicago: American Library Association.

Blake, M. (1999). Teleworking for Library and Information Professionals. London: Aslib.

Boyer, J. (2001). Virtual Reference at the NCSU Libraries: The First One Hundred Days. Information Technology and Libraries, 20(3), 122-128. Retrieved 5 March 2004 from

http://www.ala.org/Content/NavigationMenu/LITA/LITA_Publications4/ITAL__Informa
tion_Technology_and_Libraries/2003_Boyer.htm.

Breeding, M. (2001). Providing Virtual Reference Service. Information Today, 18(4), 42-
43.

Broughton, K. (2001). Our Experiment in Online, Real-Time Reference. Computers in
Libraries, 21(4), 26-33. Retrieved 5 March 2004 from
http://www.infotoday.com/cilmag/apr01/broughton.htm.

Bry, L. (2000). Simple and Sophisticated Methods for Processing Large Volumes of
Question and Answer Information through the World Wide Web. In R. D. Lankes, J. W.
I. Collins & A. S. Kasowitz (Eds.), Digital Reference Service in the New Millennium:
Planning, Management, and Evaluation (Vol. 6, pp. 111-123). New York: Neal-Schuman
Publishers Inc.

Calzonetti, J. A., & deChambeau, A. (2003). Virtual reference: a telecommuting
opportunity? Information Outlook, 7(10), 34-39.

Carter, D. S., & Janes, J. (2000). Unobtrusive Data Analysis of Digital Reference
Questions and Service at the Internet Public Library: An Exploratory Study. Library
Trends, 49(2), 251-265.

Clymer, A. (2002, December 12). Librarians Get Advice on Handling Government
Requests for Information on Readers. New York Times, p. A30.

Coffman, S. (2001). We'll Take it from Here: Developments We'd Like to See in Virtual
Reference Software. Information Technology and Libraries, 20(3), 149-153. Retrieved 5
March 2004 from
http://www.ala.org/Content/NavigationMenu/LITA/LITA_Publications4/ITAL__Informa
tion_Technology_and_Libraries/2003_Coffman.htm.

Coffman, S. (2003). Going Live: Starting & Running a Virtual Reference Service. Chicago: American Library Association.

Coffman, S., & Saxton, M. L. (1999). Staffing the Reference Desk in the Largely-Digital Library. The Reference Librarian, 31(66), 141-163.

Daft, R. L., & Lengel, R. H. (1986). Organizational Information Requirements, Media Richness and Structural Design. Management Science, 32(5), 554-571.

Dervin, B., & Dewdney, P. (1986). Neutral Questioning: A New Approach to the Reference Interview. RQ, 25(4), 506-513.

Dewdney, P., & Michell, G. (1996). Oranges and Peaches: Understanding Communication Accidents in the Reference Interview. Reference & User Services Quarterly, 35(4), 520-534.

Durrance, J. C. (1989). Reference Success: Does the 55 Percent Rule Tell the Whole Story? Library Journal, 114(7), 31-36.

Eichler, L., & Halperin, M. (2000). LivePerson: Keeping reference alive and clicking. EContent, 23(3), 63-66.

Eichman, T. L. (1978). The Complex Nature of Opening Reference Questions. RQ, 17(3), 212-222.

Ferguson, C. D., & Bunge, C. A. (1997). The Shape of Services to Come: Values-Based Reference Service for the Largely-Digital Library. College & Research Libraries, 28(58), 252-265.0
.

Foley, M. (2002). Instant Messaging Reference in an Academic Library: A Case Study. College & Research Libraries, 63(1), 36-45. Retrieved 5 March 2004 from http://www.vrd.org/conferences/VRD2001/proceedings/foley.shtml.

Francoeur, S. (2001). An Analytical Survey of Chat Reference Services. Reference Services Review, 29(3), 189-203.

Goetsch, L., Sowers, L., & Todd, C. (1999). Electronic Reference Service (SPEC Kit No. 251). Washington, DC: Association of Research Libraries Office of Leadership and Management Services.

Green, S. S. (1876). Personal Relations between Librarians and Readers. American Library Journal, I(2-3), 74-81.

Herring, S. (1999). Interactional Coherence in CMC. Journal of Computer-Mediated Communication, 4(4). Retrieved 5 March 2004 from http://www.ascusc.org/jcmc/vol4/issue4/herring.html.

Hill, J. B., Madarash-Hill, C., & Bich, N. P. T. (2003). Digital Reference Evaluation: Assessing the Past to Plan for the Future. Electronic Journal of Academic and Special Librarianship, 4(2-3). Retrieved 5 March 2004 from http://southernlibrarianship.icaap.org/content/v04n03/Hill_j01.htm.

Hirko, B. (2002, Fall). Live, Digital Reference Marketplace. Library Journal netConnect, 16-19. Retrieved 5 March 2004 from http://slj.reviewsnews.com/index.asp?layout=article&articleid=CA251679.

Hirko, B., & Ross, M. B. (2004). Virtual Reference Training: The Complete Guide to Providing Anytime, Anywhere Answers. Chicago: American Library Association.

Hoag, T. J., & Cichanowicz, E. M. (2001). Going Prime Time with Live Chat Reference. Computers in Libraries, 21(8), 40-44.

Humphries, A. W. (1993). Designing a functional reference desk: planning to completion. RQ, 33(1), 35-40.

Isaacs, E., Kamm, C., Schiano, D. J., Walendowski, A., & Whittaker, S. (2002a). Characterizing instant messaging from recorded logs. Paper presented at the CHI '02 extended abstracts on Human factors in computer systems, Minneapolis, MN.

Isaacs, E., Walendowski, A., Whittaker, S., Schiano, D. J., & Kamm, C. (2002b). The character, functions, and styles of instant messaging in the workplace. Paper presented at the 2002 ACM conference on Computer supported cooperative work, New Orleans, LA.

Isenstein, L. J. (1992). Get Your Reference Staff on the STAR Track. Library Journal, 117(7), 34-37.

Janes, J. (2001). Digital Reference Services in Public and Academic Libraries. In C. R. McClure & J. C. Bertot (Eds.), Evaluating Networked Information Services: Techniques, Policy, and Issues (pp. 175-195). Medford, NJ: Information Today, Inc.

Janes, J. (2002, Fall). Live Reference: Too Much, Too Fast? Library Journal netConnect, 12-14. Retrieved 5 March 2004 from http://slj.reviewsnews.com/index.asp?layout=article&articleid=CA251681.

Janes, J. (2003). Introduction to Reference Work in the Digital Age. New York: Neal-Schuman Publishers, Inc.

Janes, J., & Silverstein, J. (2003). Question Negotiation and the Technological Environment. D-Lib Magazine, 9(2). Retrieved 5 March 2004 from http://www.dlib.org/dlib/february03/janes/02janes.html.

Johnson, C. M. (2004). Online Chat Reference: Survey Results from Affiliates of Two Universities. Reference & User Services Quarterly, 43(3), 237-247.

Kibbee, J., Ward, D., & Ma, W. (2002). Virtual Service, Real Data: Results of a Pilot Study. Reference Services Review, 30(1), 25-36.

Lafrance, H., & Smith, M. (2003, 16-17 October). The Ups and Downs of Virtual Reference in a Collaborative Environment. Paper presented at the 5th Annual Digital Reference Conference, San Antonio, TX. Retrieved 5 March 2004 from http://www.vrd2003.org/proceedings/presentation.cfm?PID=191.

Lagace, N., & McClennen, M. (1998). Questions and Quirks: Managing an Internet-Based Distributed Reference Service. Computers in Libraries, 18(2), 24-27. Retrieved 5 March 2004 from http://www.infotoday.com/cilmag/feb98/story1.htm.

Lankes, R. D. (1998). Building & Maintaining Internet Information Services: K-12 Digital Reference Services. Syracuse, NY: ERIC Clearinghouse on Information & Technology.

Lankes, R. D. (2000a). The Foundations of Digital Reference. In R. D. Lankes, J. W. I. Collins & A. S. Kasowitz (Eds.), Digital Reference Service in the New Millennium: Planning, Management, and Evaluation (Vol. 6, pp. 246). New York: Neal-Schuman Publishers Inc.

Lankes, R. D. (2000b). The Growing Support Crisis in Federal STI. In P. D. Fletcher (Ed.), World Libraries On the Information Superhighway : Preparing for the Challenges of the New Millennium. Hershey, PA: Idea Group Publishing.

Lankes, R. D. (2004). The Digital Reference Research Agenda. Journal of the American Society for Information Science and Technology, 55(4), 301-311.

Larason, L. & Robinson, J. S. (1984). The Reference Desk: Service Point or Barrier? RQ 23, 332-38.

Laver, J. (1975). Communicative Functions of Phatic Communication. In A. Kendon, R. Harris & M. R. Key (Eds.), Organization of Behavior in Face-to-Face Interaction (pp. 215-238). Chicago: Aldine.

Lehnert, W. G. (1977, August 22-25, 1977). A Conceptual Theory of Question Answering. Paper presented at the 5th International Joint Conference on Artificial Intelligence - 1977, Massachusetts Institute of Technology, Cambridge, MA.

Lipow, A. G. (1999). 'In Your Face' Reference Service. Library Journal, 124(13), 50-52.

Lipow, A. G. (1999, 19-21 January). Serving the Remote User: Reference Service in the Digital Environment. Paper presented at the Ninth Australasian Information Online and On Disc Conference and Exhibition, Sydney, Australia. http://www.csu.edu.au/special/online99/proceedings99/200.htm.

Lynch, M. J. (1978). Reference Interviews in Public Libraries. The Library Quarterly, 48(2), 119-142.

McClure, C. R., Lankes, R. D., Gross, M., & Choltco-Devlin, B. (2002). Statistics, Measures and Quality Standards for Assessing Digital Reference Library Services: Guidelines and procedures. Syracuse, NY: Information Institute of Syracuse. Retrieved 5 March 2004 from http://quartz.syr.edu/quality/.

McGlamery, S., & Coffman, S. (2000). Moving Reference to the Web. Reference & User Services Quarterly, 39(4), 380-386.

McLaughlin, M. F., & Ware, S. (2003). Penn State Virtual Reference Service: Annual Statistics (webpage). University Park, PA: Penn State University Libraries. Retrieved 5 March 2004 from http://www.de2.psu.edu/faculty/saw4/vrs/stats/.

Meola, M., & Stormont, S. (2002). Starting and Operating Live Virtual Reference Services: A How-To-Do-It Manual for Librarians. New York: Neal-Schuman Publishers, Inc.

Miyake, N., & Norman, D. A. (1979). To Ask a Question, One Must Know Enough to Know What is Not Known. Journal of Verbal Learning and Verbal Behavior, 18(3), 357-364.

Murfin, M. E. (1993). Cost Analysis of Library Reference Services. Advances in Library Administration and Organization, 11, 1-36.

Murfin, M. E., & Gugelchuk, G. M. (1987). Development and Testing of a Reference Transaction Assessment Instrument. College & Research Libraries, 48(4), 314-338.

Murphy, D. E. (2003, April 7). Some Librarians Use Shredder to Show Opposition to New F.B.I. Powers. *New York Times*, p. A12.

Nardi, B. A., Whittaker, S., & Bradner, E. (2000). Interaction and outeraction: instant messaging in action. Paper presented at the Proceedings of the 2000 ACM conference on Computer supported cooperative work, Philadelphia, PA.

Nicholson, S. (2003a). The Bibliomining Process: Data Warehousing and Data Mining for Library Decision-Making. Information Technology and Libraries, 22(4). Retrieved 5 March 2004 from http://www.ala.org/ala/lita/litapublications/ital/2204nicholson.htm.

Nicholson, S. (2003b). On My Mind: Avoiding the Great Data-Wipe of Ought-Three. American Libraries, 34(9), 36.

Nilsen, K. (2004). The Library Visit Study: user experiences at the virtual reference desk. Information Research, 9(2). http://informationr.net/ir/9-2/paper171.html.

Patterson, R. (2001). Live Virtual Reference: More Work and More Opportunity. Reference Services Review, 29(3), 204-209.

Pomerantz, J. (2003a). Integrating Digital Reference Service into the Digital Library Environment. In R. D. Lankes, S. Nicholson & A. Goodrum (Eds.), The Digital Reference Research Agenda (pp. 23-47). Chicago: Association of College and Research Libraries.

Pomerantz, J. (2003b). Question Taxonomies for Digital Reference. Unpublished doctoral dissertation, Syracuse University, Syracuse, NY.

Pomerantz, J., & McClure, C. (forthcoming). Evaluation of a Statewide Collaborative Chat-based Reference Service: Approaches and Directions. Paper presented at the ASIST Annual Meeting, Providence, RI.

Pomerantz, J., Nicholson, S., Belanger, Y., & Lankes, R. D. (2004). The Current State of Digital Reference: Validation of a General Digital Reference Model through a Survey of Digital Reference Services. Information Processing & Management, 40(2), 347-363.

Pomerantz, J., Nicholson, S., & Lankes, R. D. (2003). Digital Reference Triage: Factors Influencing Question Routing and Assignment. The Library Quarterly, 73(2), 103-120.

Radford, M. L. (1999). The Reference Encounter: Interpersonal Communication in the Academic Library (Vol. 52). Chicago: Association of College and Research Libraries.

Radford, M. L. (2003, 16-17 October). In Synch? Evaluating Chat Reference Transcripts. Paper presented at the 5th Annual Digital Reference Conference, San Antonio, TX.

Retrieved 5 March 2004 from

http://www.vrd2003.org/proceedings/presentation.cfm?PID=231.

Ronan, J. (2001). Chat Reference: An Exciting New Facet of Digital Reference Services.
ARL Bimonthly Report(219), 4-6. Retrieved 5 March 2004 from
http://www.arl.org/newsltr/219/chat.html.

Ronan, J. S. (2003). Chat Reference : A Guide to Live Virtual Reference Services.
Englewood, CO: Libraries Unlimited.

Ronan, J., & Turner, C. (2002). Chat Reference (SPEC Kit No. 273). Washington, DC:
Association of Research Libraries Office of Leadership and Management Services.

Schaake, G., & Sathan, E. (2003). We Jumped on the Live Reference Bandwagon and
We Love the Ride! Computers in Libraries Magazine, 23(4), 20-25. Retrieved 5 March
2004 from http://www.infotoday.com/cilmag/apr03/schaake_sathan.shtml.

Schneider, K. G. (2000). The Untethered Librarian. American Libraries, 31(7), 72.
Retrieved 5 March 2004 from
http://www.ala.org/ala/alonline/inetlibrarian/2000columns/august2000untethered.htm.

Sears, J. (2001). Chat Reference Service: An Analysis of one Semester's Data. Issues in
Science and Technology Librarianship(32). Retrieved 5 March 2004 from
http://www.library.ucsb.edu/istl/01-fall/article2.html.

Sloan, B. (2001). Ready for Reference: Academic Libraries Offer Live Web-Based
Reference. Evaluating System Use (webpage). Urbana-Champaign, IL: Graduate School
of Library and Information Science, University of Illinois at Urbana-Champaign.
Retrieved 5 March 2004 from http://www.lis.uiuc.edu/~b-sloan/r4r.final.htm.

Sloan, B. (2003). My Web Librarian: A Report on Patterns of System Use and User Satisfaction (webpage). Urbana-Champaign, IL: Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign. Retrieved 5 March 2004 from http://www.lis.uiuc.edu/~b-sloan/mwl-report.htm.

Stormont, S. (2001). Going Where the Users Are: Live Digital Reference. Information Technology and Libraries, 20(3), 129-134.

Taylor, R. S. (1968). Question-Negotiation and Information Seeking in Libraries. College & Research Libraries, 29, 178-194.

ten Have, Paul. (1999). Doing Conversation Analysis: A Practical Guide. Thousand Oaks, CA: SAGE Publications.

Virtual Reference Desk Project. (1998, 29 September). Virtual Reference Desk AskA Software: Decision Points and Scenarios. Retrieved 5 March 2004 from http://www.vrd.org/Tech/AskA-sw.PDF.

Virtual Reference Desk Project. (2000, 27 October). Facets of Quality for Digital Reference Services, Version 4. Retrieved 5 March 2004 from http://www.vrd.org/facets-10-00.shtml

Virtual Reference Desk Project. (2003, 27 June). Facets of Quality for Digital Reference Services, Version 5. Retrieved 5 March 2004 from http://www.vrd.org/facets-06-03.shtml

Voorhees, E. M. (1999, November 16-19). The TREC-8 Question Answering Track Report. Paper presented at the Eighth Text REtrieval Conference (TREC 8), Gaithersburg, MD. Retrieved 5 March 2004 from http://trec.nist.gov/pubs/trec8/papers/qa_report.pdf.

Voorhees, E. M. (2001, November 13-16). Overview of the TREC 2001 Question Answering Track. Paper presented at the Tenth Text REtrieval Conference (TREC 10), Gaithersburg, MD. Retrieved 5 March 2004 from http://trec.nist.gov/pubs/trec10/papers/qa10.pdf.

White, M. D. (2001). Digital Reference Services: Framework for Analysis and Evaluation. Library & Information Science Research, 23(3), 211-231.
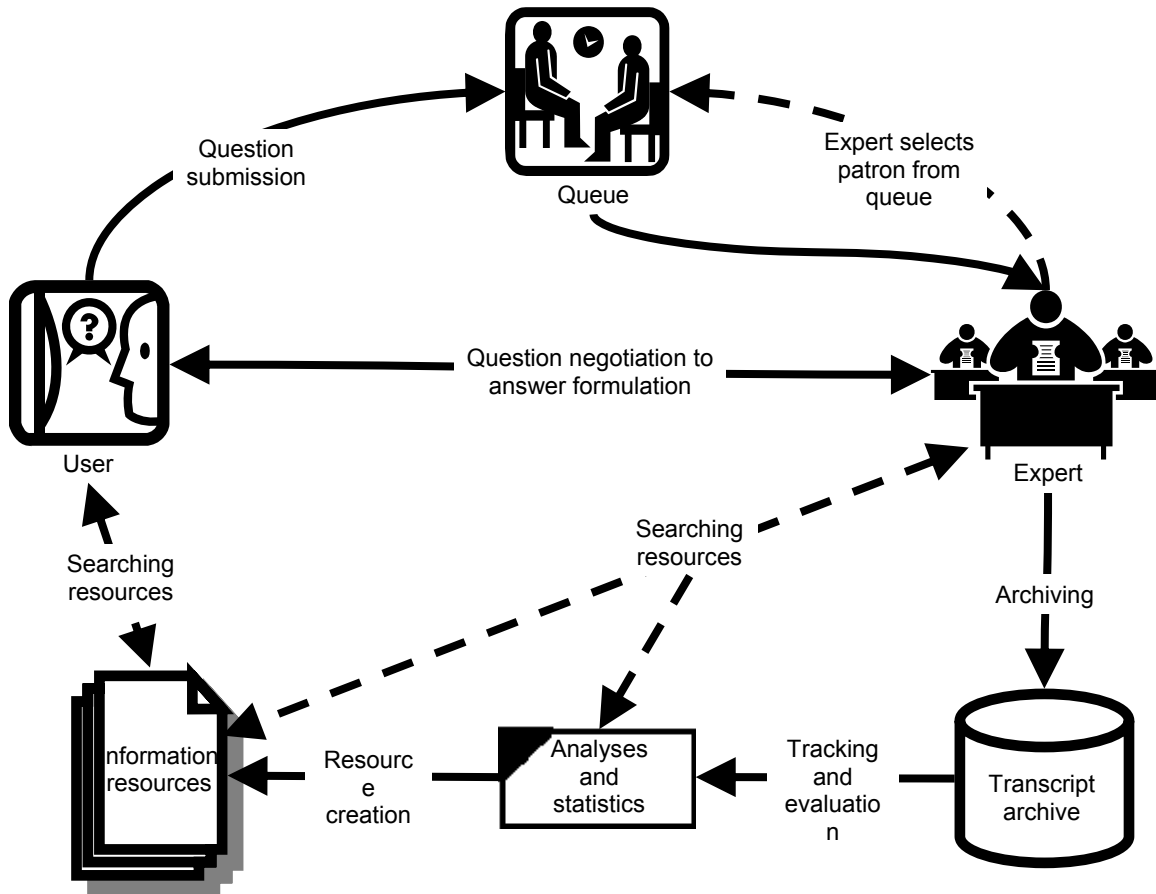
Figure 1: Process model of chat-based virtual reference