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The Roles of Digital Reference in a Digital Library Environment

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ABSTRACT

Digital reference has become a significant movement in the world of traditional libraries, and increasingly, in the digital library arena. This white paper will present the background for the digital reference movement, highlight current work and research in the area, and provide some examples of how digital reference can be integrated into digital libraries.

Keywords
Digital reference, virtual reference, information systems, standards, research studies, digital libraries, intermediation

INTRODUCTION

Digital reference refers to a network of expertise, intermediation and resources put at the disposal of a person seeking answers in an online environment. The field of digital reference touches on issues of metadata, human intermediation in a networked environment and assessment of quality of networked resources. Many of these issues are shared with the field of digital libraries, and an increasing amount of research has been done to bridge these two areas of investigation. Yet digital reference has remained primarily the province of practicing librarians and educators, while digital libraries have maintained strong roots in computer science and information retrieval.

It is important for the digital library community to work closely with the digital reference community. The use of human intermediaries within an information system is more than simply a tradition in the library world. Reference, particularly the opportunity to talk with information professionals, is seen as a core function of a library. Years of practice have shown that human-to-human communication is important in helping a user identify an information need and find the most appropriate resources to answer that need (Mardikian and Kesselman, 1995). According to the Library and Information Technology Association (LITA), a division of the American Library Association, putting a human face on the virtual (digital) library is a key need (LITA, 1999).

> "It's time to put a human face on the virtual library. What's the crucial factor in the success of the nonvirtual library? The people who work there and serve the user! What do libraries emphasize on their Web sites? Resources, collections, facts with no human guidance or presence! On many library Web sites, the user is hard-pressed to identify the staff, whose names, if they're there, are five levels down. The human factor is still important."

The question in the LIS community is no longer whether to provide reference services in a digital environment, or to provide human intermediation services on the Internet, but how to provide such services in the best way.

Digital Reference Background

The digital reference field has two progenitors. The first is traditional library and information science (LIS), particularly LIS practice. The second major contributor to digital reference is the category of Internet services known as AskA services, or expert question/answer sites.

Library Reference

Digital reference as an examination of the librarian's role in a digital environment began with e-mail reference efforts. These efforts extended the traditional core reference function of the library past the reference desk to the desktop. Patrons were able to ask reference questions and consult with trained librarians through e-mail. Still & Campbell (1993) provide excellent examples of early e-mail reference studies. This thread of digital reference examined issues such as the role of the librarian in cyberspace, the impact of distance service on the traditional reference interview, evaluation (McClure and Lankes, 2001), and new skills needed by the information professional (Mardikian and Kesselman, 1995).

AskA Services

The second progenitor to the current digital reference arena is that of AskA services (Lankes, 1999). AskA services (so-called because services tend to take on names such as Ask-A-Scientist, Ask-A-Teacher and so on) are expert based question and answer services. AskA services use networked communities of experts to answer questions via the Internet. AskA services have been extremely popular on the Internet, and have given rise to a separate set of issues concerning system development and scalability.

Current Issues in Digital Reference

As previously stated, some issues are common to both the digital library community and the digital reference community. For example, in the area of metadata and standards for interoperability, both fields share related approaches to the issues of joint services and information re-use (for a discussion of metadata in digital reference see Lankes (1999a)). Certainly, questions of intellectual property and re-use of digital products are common to both digital libraries and digital reference. Technology approaches, repositories, and all manner of networking resources are also common concerns. Some aspects of digital reference, however, are unique. These aspects center on the inclusion of human expertise (be it process expertise typified by the librarian, or subject expertise typified by the AskA expert) into information systems.

The author identified two issues that are specific to digital reference in the book "Digital Reference Service in the New Millennium: Planning, Management, and Evaluation" (Lankes, et. al 2000). They are:

- Scalability - how can a digital reference service grow (scale) to handle a large number of questions given that traditional scaling mechanisms such as service hours and geographical constraints run counter to users expectations on the Internet?
- Ambiguity – how can digital reference services identify a priori the amount of context and human intermediation needed to meet a user's needs?

These issues are related (e.g.: by better identifying low-context questions, less human resources need be applied and more users can be served). These two issues are addressed in systems built and discussed by Janes (2000), and Kresh (2000).

Other issues being explored in the digital reference community relate to the transition from traditional in-person services to at-a-distance processes. These issues include quality measures for digital reference, the nature of the reference interview, real-time versus asynchronous intermediation, media selection in digital reference, and economics of human intermediation.

Current Research and Development in Digital Reference

A great deal of research and development is being done in the digital reference arena. These include demographic and attitudinal studies (Janes 2002), case studies (Bennett, 1998), question analyses (Carter and Janes, 2000), and system design research (Lankes, 1998). This section outlines some broad-based areas of research that have become part of the digital reference development.

The Digital Reference Research Agenda

In 2002, a symposium was organized to bring scholars and practitioners together to identify what was known about digital reference, and to propose what digital reference research still needed to be conducted. Special effort was made to include digital library researchers in the symposium. The outcome of the symposium was a research agenda (Lankes, 2004). This agenda, represented in figure 1 below, defined a series of areas for investigation (question components) and a series of "lenses" or perspectives from which these areas could be investigated.
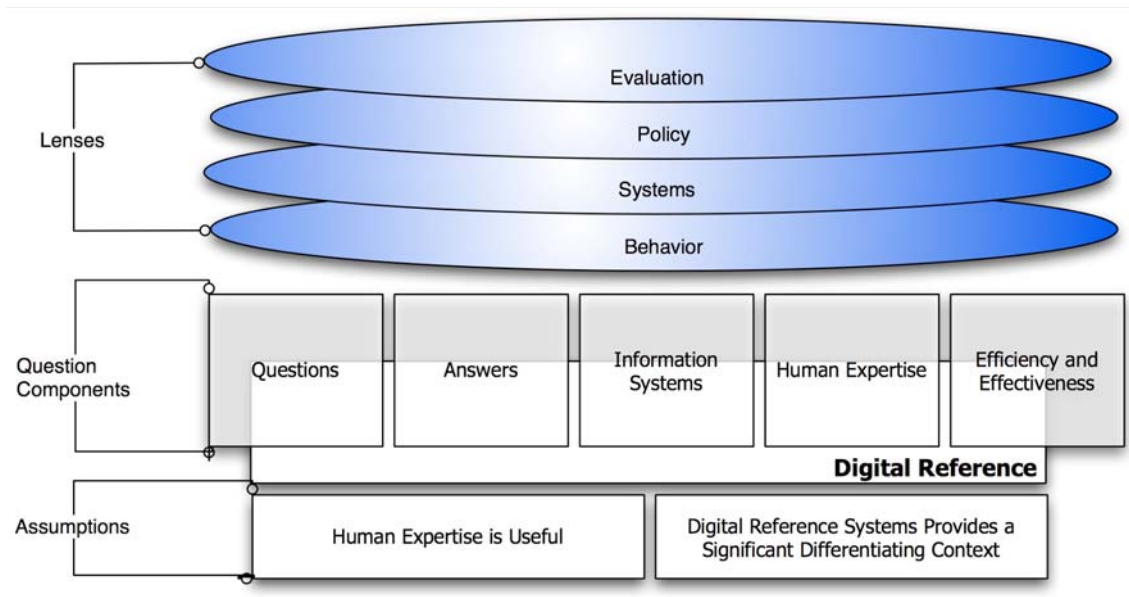
Figure 1: The Digital Reference Research Agenda

Some of the question areas have been well examined. For example,
extensive work has been done on digital reference information systems (see the General
Digital Reference Model below), questions & answers (see Pomerantz, 2003a), and
efficiency and effectiveness (see Quality Study below). A great deal of research still
remains to be done in storage and reuse of answers (so-called knowledge bases), and in
the provision of an empirical base for the appropriate role of human expertise.

The General Digital Reference Model

The General Digital Reference Model, pictured in Figure 2, is a general process model
developed through an empirical study of high-capacity digital reference services,
primarily in the math/science area (Lankes, 1999b). The model provides a means of
understanding digital reference services as information systems (either as part of a digital
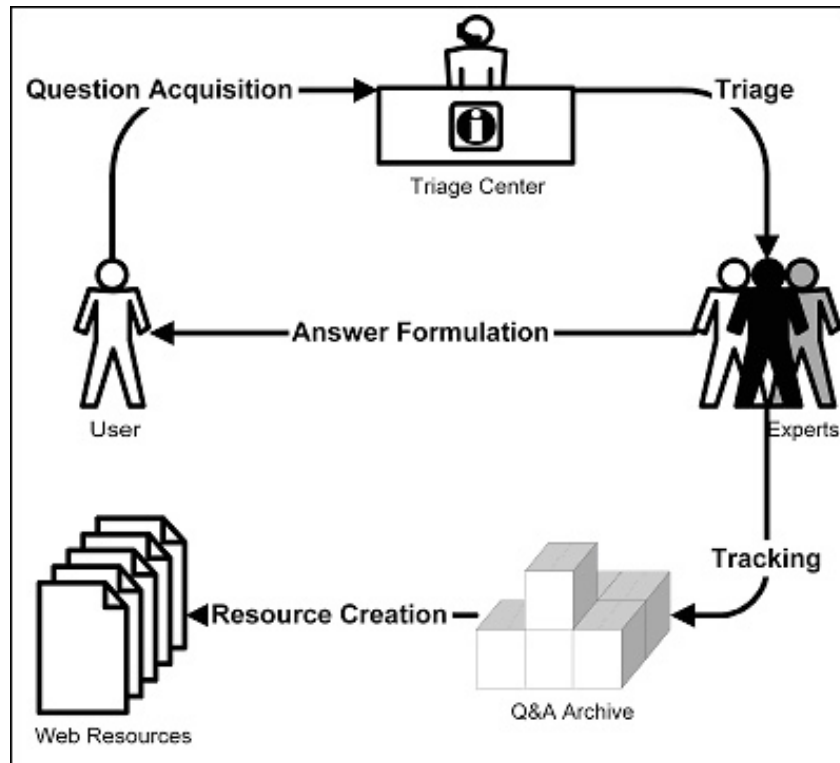library or as a separate, self-contained service).

Figure 2: General Digital Reference Model

The model consists of 5 steps:
1. Question Acquisition refers to the taking of a user's questions from e-mail, web forms, chat, or embedded applications. This area of the model concerns best practice in "online reference interviews" and user interface issues.
2. Triage is the assignment of a user's question to a process or topic expert. This step may be automated or conducted via human decision support. Triage also includes the filtering of repeat questions or out-of-scope questions.
3. Answer Formulation includes the expert's determination of factors for creating "good" answers such as age and cultural appropriateness. Answers are also sent to the user at this point.
4. Tracking is the quantitative and qualitative monitoring of repeat questions for trends. Tracking allows the creation "hot topics", and may indicate where gaps exist in the collection(s).
5. Resource Creation concerns the use of tracking data to build or expand collections and better meet users' information needs within and outside of the digital reference process.

Every digital reference system uses this simple model. The important question, however, is how efficiently and effectively can the digital reference model be automated to deal with ambiguity and scalability in a distributed environment?

Work on this model has lead to both the analysis of digital reference services (Lankes, 1998) and the development of digital reference software. The Information Institute is currently developing the third version of QABuilder for the National Science Digital Library. QABuilder is a digital reference software package that allows users to ask questions through the web, and manages experts who answer these questions. The questions and answers then become part of a hierarchical question archive that anyone can browse.

The current version of the software includes the use of XML and schema for extensibility and linkage to other digital library services. For example, services can create "answer schemas" that structure responses in XML. The XML files can then be exported from the system to another digital reference service (see Technical Standards below) or into digital library management systems. Service configurations can also be exported as XML files that can then be used to set up new services quickly.

Current plans call for the use this schema capability to export question/answer sets into a Digital Reference Electronic Warehouse (DREW). DREW, already containing 350,000

question/answer sets will provide a research data set that can be mined for question trends, user demographics, and testing of new knowledge base systems. The need to transfer questions from one digital reference service to another digital reference service, or from a digital reference service to another digital library application has lead to the development of technical standards for digital reference.

Digital Reference Technical Standards

With the emergence of multiple digital reference software solutions (QABuilder, 24/7 Reference, QuestionPoint, Docutek, LivePerson, Virtual Reference Toolkit, etc) there comes the need for a technical means of passing a question or answer from one system to another in a vendor agnostic method. Work on this began with the Question Interchange Profile (QuIP), and has since been continued as the NISO NetRef standards effort (http://www.loc.gov/standards/netref/).

This standard bundles a question and associate metadata for transport from one digital reference system to another. The information may be transferred in a web services model (i.e., SOAP), as an e-mail attachment, or as any other desired transport protocol. The draft standard is currently available, and a test-bed has been established to refine the standard. Work is also underway to extend this standard for archiving question/answer sets.

Quality in Digital Reference

Of course, having a functioning system that can interchange digital reference transactions does not ensure that these systems are doing a "good" job. In other words, builders of these systems must understand the criteria for quality, and performance measures. The Information Institute of Syracuse at Syracuse University and the Information, Policy, Management and Use Institute at Florida State University conducted a study to develop quality criteria for digital reference. This study developed digital reference measures, and tested and refined these measures and quality standards in order to describe digital reference services.

The impetus for this study began at the October 2000 Virtual Reference Desk (VRD) Conference in Seattle, when the growing digital reference community identified assessment of quality as a top research priority. As patrons demand more services online, and as reference librarians attempt to meet patrons' information needs better through the Internet, it has become essential that common standards of quality be determined. Library administrators need strong, grounded metrics and commonly understood data to support digital reference services, assess the success of these services, determine resource allocation to services, and determine a means for constant improvement of digital reference within their institutions.

A quality standard is a specific statement of the desired or expected level of performance that should be provided regarding a service or some aspect of that service. A quality standard can be measured to determine the degree to which that standard is in fact being

met (Kasowitz, et. al. 2000). A quality standard defines the level of performance that an organization is willing to accept for a particular service or activity. Quality standards are important because they:

- Encourage library staff and administration to discuss and come to agreement on what constitutes "quality" for a specific service;
- Provide clear guidance as to the expected quality that a particular service or activity should offer;
- Educate staff – and especially new staff – as to the expected quality of service that should be provided;
- Recognize that there may be differing acceptable levels of quality for different aspects of digital reference services; and
- Provide a basis for rewards and demonstrating/reporting accountability.

Quality standards are *not* performance measures. A performance measure might be "correct answer fill rate" whereas the quality standard might be "the digital reference service will have a correct answer fill rate of 65%."

The assessment study specifically states that there is no "correct" standard for any specific digital reference service. Rather, the correct standard will depend on the goals and objectives of the library, the amount of resources that can be committed to reaching a particular standard, local situations affecting digital reference services, and the relative importance of one quality standard versus another. For one library, an awareness level of digital reference services of 30% among faculty (for example) may be acceptable; for another, the standard might be 60%.

While not specifically spelling out all possible quality standards, the study proposes six Quality Standards that appear to span specific circumstances and domains:

1. Courtesy: The behavior of the library or institution's staff
2. Accuracy: The "correctness" of answers provided by a digital reference staff
3. Satisfaction. Users' determination of their success in interacting with the digital reference service
4. Repeat Users: The percentage of users that re-use a service after first encounters
5. Awareness: The population user group's knowledge that the service exists
6. Cost: The cost per digital reference

The study assumes that each of these standards will have a strong qualitative component. However, to fully define these standards, the study created five types of performance measures that can be used to determine success in meeting quality standards better:

1. Descriptive Statistics and Measures: Statistics and measures to determine the scale and scope of a digital reference service.
2. Log Analysis: Statistics that can be derived from analysis of logs generated by web and digital reference software packages

3. User Satisfaction Measures: Statistics and metrics seeking to understand the user view of a digital reference service.
4. Cost: Measures that gauge outlay of financial resources to run an ongoing digital reference effort.
5. Staff Time Expended: Measures to determine staff time dedicated to digital reference

Each of these classes of measures is then further refined into specific metrics and statistics as seen in table 1:

Table 1: Utilization Standards by Class

Descriptive	Log	User	Cost	Staff
Number of digital reference questions received	Number of digital reference sessions	Awareness of Service	Cost of digital reference service	Percent of staff time spent overseeing technology
Number of digital reference responses	Usage of digital reference service by day of the week	Accessibility of service	Cost of digital reference service as a percent of total reference budget	Percent of staff time spent assisting users with technology
Number of digital reference answers	Usage of digital reference service by time of day	Expectations for service	Cost of digital reference service as a percent of total library or organizational budget	
Total reference activity	User's browser	Other sources user tried		
Percentage of digital reference questions to total reference questions	User's platform	Reasons for use		
Digital reference correct answer fill rate		Reasons for non use		
Digital reference completion rate		Satisfaction with staff		
Number of unanswered digital reference questions		Delivery mode satisfaction		
		Impact of service on user		
Total number of referrals		Additional services that need to be offered		
Saturation rate		User demographic data		
Sources used per question				
Repeat users (return rate)				

Further refinement within these measures is also possible. For example, the assessment study associated data collection methods to each measure, but such refinement is too specific for the discussion in this paper.

These efforts (the research agenda, the General Digital Reference Model, technical standards, and the quality study) do not represent the whole of digital reference research. Rather they serve as exemplars of the type of work already accomplished. Other current large-scale research efforts are underway to develop digital reference competencies, and extension of digital reference to disabled populations. The argument in this paper is that digital reference is a mature and well examined digital library service. It has left the laboratory and has been integrated into both traditional and digital library settings.

Integrating Digital Reference into the Digital Library

The author is writing this white paper for a digital library conference, but it is insufficient to simply say that digital reference is a type of digital library service and leave it at that. There are specific means for integrating a digital reference service into a larger digital library (Pomerantz, 2002). It is proposed that there are 5 means of integration:

- Human Intermediation as Guide: What separates digital reference from other question answering systems is the inclusion of human expertise. In this role (the predominant role in current digital reference systems), the human intermediary guides users through resources and services provided by a digital library. The human intermediaries act as experts in the digital library itself. This is the closest analogy to traditional face-to-face library reference. The output of the digital reference system is a series of references and referrals.
- Human Intermediation as Synthesizer: This role is similar to intermediary as guide, but here the expert is drawing data from the digital library (and beyond) and creating a new product in the form of a synthesis (or pathfinder). Unlike intermediary as guide, here the expert is exerting judgment and content level skills (rather than simply pointing a user to a resource). Here the output of the digital reference system is an answer.
- Digital Reference as Collection Developer: This role works in conjunction with the other roles. Here the intermediary, in the process of responding to a user question, identifies gaps in the digital library collection. By pointing out what resources are not available to answer a given question, the intermediary can begin a process of resource creation by some other entity within the digital library. In this role, the output of the digital reference system is a list of needed resources.
- Digital Reference as Resource Creator: The intermediary can also go beyond simply identifying gaps; the intermediary can fill those gaps. Through the creation of a pathfinder, original research, or some fully developed resource creation process, the intermediary can help in populating the digital library itself. Referred to as "reference authoring," the reference function drives the digital libraries growth and scope. This model was used in the AskERIC service, and can be seen in the QABuilder software discussed above. The output of this role is digital library objects that can be used independently of the digital reference service.

- Digital Reference as Annotator: This is a similar role to resource creator, but here the objects created are not independent, but are comments and annotations to extend digital library objects.

This list is not meant to be exhaustive. What is clear, however, is that there is a role for human intermediation (i.e., digital reference) in the digital library.

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