Usability Assessment of an Integrated Cataloging and Metadata Services: an Exploratory Study of the OCLC Connexion System*

/ :
OCLC Connexion

(Jeong-Mee Lee)**

ABSTRACT

The goal of this study was to examine the relationships between usability and the searching experience, and to uncover where an integrated cataloging and metadata system lay the usability problems of its primary users, catalogers. This study showed that the most important aspect of usability in Connexion lay in the experience of information retrieval system. Also, it showed there are seventeen usability problems to be improved in Connexion. Needless to say, it is most important to note that usability is not an exclusive goal of such an integrated cataloging and metadata system. Other goals such as quality of catalogs, and the reliability of its cataloging and metadata system are equally its concern. This study also suggested more testing on diverse cataloging systems and specific user groups, especially catalogers.

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: metadata, usability, system evaluation, human computer interaction
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1. Introduction

The rapid growth and dissemination of online information resources, such as the World Wide Web (Gray 1997), has caused the concept of metadata to mean different things to different information communities. Fundamentally, metadata is designed to support interaction between an end-user and an online retrieval system, providing users access to the information in the system by labeling its contents consistently regardless of the format of the information object. Interest in metadata has increased significantly in the emerging digital library context since the effective organization of networked information clearly depends on the effective management, organization, and control of metadata (Burnett, Ng and Park 1999).

1.1 The Metadata

Although the term metadata emerged alongside the rapid growth of the Internet, the foundation of the metadata concept is simply " data about data" (Wendler 1999). Thus, catalogs which have for centuries led end-users to data in traditional library environments can be considered metadata. Metadata standards are ways of structuring content, and

this content is held by and delivered by one or more carriers such as various markup languages to MARC (Chapman 2002). Library catalog is one form of metadata, involving specific processes utilizing tools like the Anglo-American Cataloging Rules and USMARC.

For purposes of this study, metadata is operationally defined as: *data that characterize source data, describe their relationships, and support their discovery and effective use* (Burnett, Ng and Park 1999).

The traditional library catalog index card is a classic example of metadata, and a MARC (MAchine Readable Catalog) record is the equivalent example for automated cataloging workplaces. The author, title, DDC (Dewey Decimal Classification), etc., are metadata elements within a clearly defined metadata scheme (Shabajee 2002). Even if these elements have different formats of description, it is not difficult to accept that each of the elements is part of a larger metadata system. Cataloging and metadata are essential keys to the actualization of Digital Library construction. Current digital libraries may be understood as very complicated systems involving various technical issues and tools. Because of the complicated nature of such libraries, many technical problems

have arisen from attempts to join contrary digital repositories. The efforts of computer science and information professionals to conduct usability testing to improve various interfaces and products may eventually contribute to the construction of a successful Digital Library.

1.2 Usability Testing

The evaluation of information systems has been a widely discussed subject in the Information Science (IS) literature. No consensus has emerged, however, on the best means for conceptualizing and operationalizing such evaluations (Janes 1994; Zmud and Boynton 1991). Usability testing has become a popular means for evaluating the effectiveness of information systems from the user's point of view. For several decades before usability testing appeared, relevance and user satisfaction were the two most prominent measures for user- based performance evaluations of information systems (Gluck 1996).

The International Standards Organization (ISO, DIS and 9241- 11) defines usability as the" extent to which a product can be used by specified goals with effectiveness, efficiency and satisfaction in a specified context of

use" (p. 10). As common sense would indicate, usability typically focuses on how end users interact with a certain product or system as they perform actual tasks. With roots in computer science and engineering, usability testing has been applied most directly by researchers and practitioners seeking a user- centered approach in system and product design (Campbell 2001). This user- centered approach has been called many names, such as user- centered design, ergonomics, Human- Computer Interaction (HCI), and human factors and usability engineering.

For purposes of this study, usability testing is operationally defined as:

A method that tests how a user interacts with a system. The participant is given a list of pre- defined tasks to accomplish using the system and asked to" think out loud" about their thoughts, reactions and feelings(Campbell 2001).

Since the system and the end user may be regarded as the two most important factors in LIS research, usability testing is an important measurement tool for evaluating an information system.

1.3 Issues in the Metadata and Usability

A significant amount of research involving metadata has been conducted since 1997. A good deal of this research has focused on crosswalks, frameworks and supermetadata issues. In addition, issues related to the practitioner's use of metadata concepts, the application of metadata to empirical studies, and metadata and commercialization of the Internet have appeared more frequently in metadata studies (Burnett and Lee 2000).

Among the many metadata standards, MARC is a traditional metadata structure that has been widely adopted by the library community. First introduced in the 1960s for the exchange and communication of bibliographic data, MARC has been expanded to facilitate the communication and exchange of many formats of information, such as books, sound recordings, and even World Wide Web publications. MARC fields and subfields contain various types of bibliographic information. Its comprehensive scope and the availability of a wide range of metadata elements have made MARC one of the most distinguished features in the library environment.

The Dublin Core metadata element set was the outcome of a workshop sponsored by OCLC and the National Center for Supercomputing Applications (NCSA) in 1995. Subsequent workshops have extended the scope of the Dublin Core effort. Dublin Core is intended to be a basic collection of metadata elements - - a lingua franca for metadata (Milstead and Feldman 1999). The Dublin Core development effort is still ongoing and is expected to continue indefinitely.

Usability may be a collective term for all aspects of an activity's performance that can be affected by the use of technology (Whiteside, Bennett and Holtzblatt 1988). The individual aspects are known as usability factors or attributes and are evaluated together to measure a product's usability (Campbell 2001).

1.4 Usability Testing Design

Since the ultimate goal of this study is to evaluate the usability of a current integrated cataloging and metadata services system, it is necessary to clarify how the usability testing will be executed in this study.

A number of studies have introduced the creation and use of specific metadata systems, however, improvements to metadata systems can best be achieved

through the consistent maintenance of the systems. In order to make metadata systems maximally effective, information professionals must resolve some key questions such as deciding how much is enough and how much is too much in regards to the metadata element structure (Gilliland- Swetland 1998). They must also improve the usefulness of the existing metadata systems in order to better serve users. Usability testing may provide a direction for the creation and maintenance of metadata systems. Even though it may not be possible to reveal the perfect metadata element structure at this stage, usability testing can provide a starting point for improvement.

This study uses three prominent factors in usability testing: effectiveness, efficiency, and user satisfaction.

- Effectiveness in usability testing looks at whether users can accomplish tasks completely and accurately. Indicators of effectiveness in this study include the quality of solutions achieved and number of errors encountered.
- Efficiency in usability testing analyzes the amount of resources used to complete tasks effectively. Indicators of efficiency of this study include task completion time and number

of keystrokes.
- Satisfaction deals with a user's attitude towards the product. It will be measured by a questions that the researcher will provide at the end of the session.

These three prominent factors of usability will be compared with the searching experience of users to see the relationship between each factor of usability and each variable of searching experiences. Searching experience deals with previous computer experience of the participants such as familiarity with information retrieval system, experience of computerized library catalogs, experience of commercial online databases and etc. In order to extract appropriate variables for searching experiences, many other existing questionnaires are examined. After careful examination, a few variables are extracted which are relevant with cataloger's daily work. In this study, searching experiences are referred a few factors such as the experience of assisting users, experience of computerized databases, experience of computerized catalogs and etc.

Cataloging and metadata services traditionally enable catalogers or information professionals to retrieve appropriate records providing information they need to create cataloging records

to represent items in their own collections. A better system means easier access to clear data that facilitate retrieval of information appropriate to the creation of the new record. Thus, usefulness and ease of use may be the primary factors to evaluate regardless of the details of the system.

1.5 Study Goals and Problem Statements

The purpose of this study is to examine the usability of a current existing cataloging and metadata services system.

Several study objectives have been established:

1. To gain experience in conducting usability testing on an integrated cataloging and metadata services system.

2. To foster the search for knowledge and understanding of integrated cataloging and metadata services system.

3. To compare various measures of efficiency, effectiveness and satisfaction across several variations of an integrated cataloging and metadata services system.

4. To investigate and evaluate the usability issues of an integrated cataloging and metadata services system.

5. To determine how effectively the integrated cataloging and metadata services work in terms of usability issues.

This study also proposed to examine whether;

1) Effectiveness, efficiency and satisfaction from this test are related to participants' background status (educational status, searching experience etc.);

2) Overall usability from this study is related to participants' background status (educational status, searching experience, etc.);

3) There are common features in the system that cause difficulties in users searching.

1.6 Significance and Limitations of the Research Design

Information systems, regardless of whom or what they serve, must reconcile performance with the needs of users. For several decades, information professionals have sought to achieve this goal by seeking ways to better satisfy their users. This study can add to a deeper understanding of the concept and role of metadata as it relates

to the traditional concept and practice of cataloging. This study is limited to evaluating an integrated cataloging and metadata services system, and is also limted to assessing only those components that the Connexion system permits. Therefore, it will not be possible to address the usability issues of other standards and systems, or the role of different components in detail. Further, this study is limited to evaluating three usabilty factors: effectiveness, efficiency, and user satisfaction. Other factors such as system performance, cost, etc. are beyond the scope of the study.

2 Review of the Related Literature

2.1 The Function of Metadata in the Library Environment

Metadata contains the characteristics of and relationships within source data, allowing information seekers to obtain concise information about source data that may not be recorded in the source itself due to its nature (Desai 1990). The nature of metadata has been an intensely debated issue in the information communities. According to Desai (1997),

metadata should meet several requirements if it is to be considered useful in the library and information field. For example, metadata should serve as an instrument for describing the semantic content of a resource, for supporting retrieval by content, and for expressing semantic dependencies that are inherent in a collection of objects. While the Web provides a convenient venue for publishing and disseminating information, it lacks a mechanism for negotiating a publicly shared agreement about the meaning of fundamental information (Brasethvik 1998). For any metadata scheme, information professionals must decide which attributes to use, what each attribute means, and how it is to be instantiated and used. Just as with any knowledge representation scheme, a metadata scheme is subject to the user's perceived conceptualization of the domain to which the metadata statements refer (Gruber 1995). According to Wendler(Wendler 1999), cataloging can be considered metadata but not all metadata can be considered cataloging. In addition, Wendler noted that many characteristics of electronic resources make them hard to describe, such as variability of presentation, unfamiliar form of issuance, ill-defined relationships

to materials in other forms, mutability, mobilty, and absence of physical receipt. Disparate types of resources, then, must be assembled in a coherent information environment. Further, while simpler metadata formats like Dublin Core have been developed catalogers should be able to understand how metadata standards can be executed in libraries in order to enrich the library's services.

2.2 Information Overload on the Web and the Need for Metadata Standards

The dramatic growth of electronic information resources has proven to be a tremendous challenge to effective access. First, the scope and quantity of information is increasing because more information is generated in digital form or "born digital." In addition, institutions and agencies are digitizing existing analog forms of resources. Publishing this information electronically is more cost- effective, and can potentially provide improved access for citizens (Mullen 2001). As Thornely (Thornely 1998) argued, the Internet needs to have a standardized way of descrbing resources to enhance the process of resource discovery, thus, we find the re- emergence of an old concept of cataloging in the

new cyber era - metadata. According to Dempsey and Heery (Dempsey and Heery), it is inevitable that diverse approaches to metadata study will continue and new formats will be created to fit new user communities and market opportunities.

Metadata involves many hundreds of different characteristics for bibliographic cataloging and related disciplines. Of these and hundreds of other descriptive metadata, however, just a few characteristics are almost always pertinent to all information resources, such as title, author, subject, date, and place. These few characteristics are used traditionally for the citations of books and are the same characteristics now found in metadata on the World Wide Web. The use of these basic characteristics in a Web- based metadata system provides a foundation for common searching of the metadata regardless of the types and formats of the information being sought. Metadata schemes have the potential to more precisely organize electronic information, and can protect the ownership of information. Given the longstanding use of metadata in basic library cataloging, it stands to reason that librarians need to be meaningfully involved in this groundbreaking effort.

2.3 Further Research on Metadata

Researchers have identified two directions for further study, both of which involve the creation of metadata systems for electronic documents. The first approach is to embed the metadata descriptions into the <HEAD> portion of an HTML document using the META tags. This is the easiest method for conveying the metadata information to the user. Weibel (1997) noted that this technique has several advantages. No additional system must be in place to use it, and because the metadata is integral to the resource it can be harvested by Web indexing agents. A second method for using metadata to organize electronic resources involves creating a database to collect and manage metadata records. In this case, the metadata is not embedded in the resource itself, but is generated by the document owners and stored separately from the resource it describes in a Web database system. Another promising area for research concerns interoperability. Over five years ago, Tennant (Tennant 1997) studied interoperability, or the capacity of a user to treat multiple digital library collections as one. Tennant believed that

interoperability was the key challenge facing digital libraries. Tennant (Tennant 2000) recently wrote of an effort to establish interoperability, the Open Archives, an initiative aiming to specify the methods by which several various individual archives can interoperate. According to his previous article, he suggested that such interoperability can be achieved by specifying: a) a protocol for gathering or "harvesting" metadata from participating archives; b) a criteria to selectively harvest metadata; and c) a common metadata format for archives to use in responding to harvesting requests (Tennant 2000). In his book, Berners-Lee (Berners-Lee 1999) described his notion of a Web populated with rich metadata that is machine-readable, semantically flexible, and derived from trusted sources. In a related vein, Medeiros (Medeiros 2000) argued that a trusted, structured mechanism is needed in order to parse context relationships across all semantic schemes.

One alternative to a single system containing both Dublin Core and MARC was CORC, an OCLC research project designed to provide cooperative cataloging of electronic resources using a variety of metadata standards. Users of CORC could choose to view records in either the Dublin Core or the MARC

format. At the Metadata Preconference in 2000, Weibel (Weibel and Koch 2000) predicted that CORC would become the prism system for the Internet. Malone noted, however, that the requirement that participating libraries devote the equivalent of a half- time staff person to the project might prevent smaller libraries from joining (Weibel and Koch, 2000).

According to Heery and her colleagues (Heery, Powell and Day 1998), interoperability can exist at a number of levels. From the user's point of view, interoperability can be more or less effective depending on how closely the various services are integrated in regard to semantics, query language, indexing, and management of results (Heery, Powell and Day 1998). Dempsey and Heery (Dempsey and Heery 1998) have noted that, metadata will assist individuals to more effectively use existing resources and prove to be essential for effective systematic use of resources. From Dempsey's point of view, metadata must not merely be considered a tool for the organization of Internet information, but a form of knowledge that allows automated as well as human users to behave intelligently.

2.4 Usability

With the unparalleled access to information made possible by the World Wide Web, library and information professionals now have a vast new information environment with which to support users. In addition to dealing with print materials, library work has come to include digitizing special collections, journals, and data sets as well as creating and managing online public access catalogs (OPACS) and World Wide Web (WWW) sites. As Web services and content increase, the complexity of the information options that must be digested and navigated by the user also increases (Palmquist 2001). Yet despite the explosion of information technology and the growing dependence on computers throughout the world, it was not so long ago that libraries began to devote serious attention and physical resources to the creation of Web sites (Battleson, Booth and Weintrop 2001). Aware that the user is one of the most important factors in the library and information science environment, information specialists have made a great effort to create easily usable Web- based interfaces and effective systems for communicating with users. One of the best ways to determine how well an

information system performs is to measure its usability. In information sciences research, usability refers to the extent to which a user can negotiate a product or system quickly and easily in order to complete the tasks given to him or her. Accordingly, the concept of usability emphasizes the user's understanding of what he or she wants and needs to achieve (Veldof, Prasse and Mills 1999). As the features and functions of products that we use at home and in our workplaces become ever more complex, the notion of usability becomes increasingly relevant. Above all, product designers must consider the needs and limitations of users. Otherwise products created with the intention of delivering some benefit can end up being more trouble than they are worth. Users are becoming more sophisticated with respect to their expectations about product performance. These expectations include ideas about a product's desired usability (Landauer 1995). With the growth of the Internet, the usability of websites has become an increasingly important area of research as well. In the words of Palmquist (Palmquist 2001), "Usability is not a new idea, but its application to the Web is relatively new" (p. 124).

Usability is one of the focuses of

the Human- Computer Interaction (HCI) field as well. As the name suggests, in Human- Computer Interaction studies, usability refers to bridging the gap between the computer's capabilities and its use by an actual individual. The notion of usability is the primary concern of a great number of books, articles, websites, conferences, and consultants. Usability is also the focus of a class of ergonomics called user- centered design (UCD), or, in the realm of computers, human- computer interaction (HCI). In order for these systems to work well, users must be able to employ them effectively. The perceived usability of a system depends on a number of factors, including how well the functionality fits user needs, how well the application fits the user's task flow, and how well the reaction of the application fits user expectations.

Within Human- Computer Interaction (HCI) circles, where user- centered design has been around for more than 20 years, the full meaning of usability extends beyond a site's intuitive virtues. In his technical writings about usability, Nielsen (Nielsen 1993) provides one of the most complete definitions around, identifying five attributes of a usable interface:

1) easy to learn;

2) efficient to use;

3) easy to remember;

4) causes few errors; and

5) pleasant to use. (p. 281)

Seen from an HCI perspective, however, the notion of usability has a meaning other than "user- friendliness." Usability is rooted in cognitive science - the study of how people perceive and process information through learning, the use of memory, and attention (Head 1999). Usability experts like Nielsen, on the other hand, tend toward simpler categorizations of user differences. According to Nielsen (Nielsen 1995), simpler, less cognitively oriented categories can be more easily identified and still account for a fairly large degree of performance variance even if a variety of factors may affect a user's performance.

2.5 Usability Testing and Library and Information Science

With the predominance of information technology (e.g. tools, gadgets, hardware, software, and program applications) in the library and information environment, information professionals have begun to turn more to the evaluation of systems using usability testing. Because usability focuses on the

users and an understanding of what they want and need to accomplish when they use the product, usability simply means that the people who use a product can complete their tasks quickly and easily (Oulanov and Pajarillo 2001; Veldof, Prasse and Mills 1999).

Many studies of usability in the library and information environment have focused on end- user behavior in automated systems, online catalogs, networked databases, and CD- ROMs (Borgman 1996; Hert 1996; Nahl and Tenopir 1996). The overall focus of these studies has been the ease with which users are able to employ the tools at their disposal, and in what ways library systems can be improved to help users better achieve their aims. Other related usability studies have examined Web usability and user- computer interfaces. The LIS literature also contains studies in which usability testing methods have been employed to assess users. This research has dealt with user factors such as the human cognitive process in information seeking in the library and information environment.

Despite the relatively long history of studying and responding to user behavior through end- user studies, the relative lack of literature on the topic reveals that libraries are only beginning

to apply usability testing to their websites. Several studies have examined the use of library websites in order to explore usability issues in the library and information field. Eliasen, McKinstry, and Fraser (Eliasen, McKinstry and Fraser 1997) tested students' ability to navigate online menus and correctly select databases from the library homepage at the University of Washington.

Within the last decade, researchers in library and information sciences, as well as other areas, have sought to adopt a user- centered approach to the investigation of information seeking behaviors and the development of better information tools (Dervin and Nilan 1986). Hjorland and Albrechtsen (Hjorland and Albrechtsen 1995) and Albrechtsen (Albrechtsen 1993), for example, focused on the need for a user- centered approach to the development of representational structures. They argued that the development of effective organizational tools (such as indexes and thesauri) depends upon an analysis of language usage within a particular discourse community or knowledge domain. A library website, then, might be considered a complex application integrating access to and interaction between a diverse set of information products and services and various user groups. Usability testing

represents a means to ensure that the satisfaction of the user in the library setting can be achieved.

2.6 Issues for Further Research on Usability Testing

Although studies of metadata and usability testing do exist, researchers need to continue to address related issues for further theoretical and applied development in both of these areas. In the words of Spool (Spool 1997)", The Web is a whole new ball- game, and we're still learning how to play. We don't know how to design for finding information" (p. 12). Veldof (Veldof, Prasse and Mills 1999) has argued that the ongoing application of usability testing in libraries is one way to ensure the development of electronic services and resources "chauffeured" by the user. Veldof's discussion was offered in the hope that LIS (Library and Information Sciences) faculty considering the prospect of developing usability courses or modules will find this information useful in furthering their efforts. As the LIS field continues to improve an understanding of Web- based delivery of information services and resources, the effort to provide some degree of user testing can

produce better Web- design effort. This clearly has been a high priority for many in the e- commerce and for- profit business community for a while. In the nonprofit sector as well, such as in libraries as well, the Web has given real meaning to the importance of applying user- centered design practice.

The Web certainly provides a valuable communication channel between the user and LIS professionals who seek to serve the user's information needs from beyond the physical environment of the library or information center. Web sites have become an integral part of the information access mission of academic libraries. It is challenging to develop a usable and effective site as well as maintain and redesign that site to meet the constantly changing needs of the user. Usability testing is very appropriate for this task since it not only identifies user- interface problems, but also suggests ways for attacking those problems. As Battleson (2001) argued, the importance and applicability of usability testing to library websites cannot be understated. Whether through simple inspection, inquiry, or formal usability testing, libraries can employ usability testing methods to inform and evaluate design changes, especially as librarians strive to meet the increasing information

demands of users.

Usability testing can lead library and information science professionals to better understand the user and make contributions as designers or trainers for nonprofit information services or for- profit information product developers (Palmquist 2001). Further, usability testing can be applied as an inexpensive means for assessing important library systems and products, and the results can lend credibility to the creation or updating of more user- friendly library OPACs, websites, and the like (Walbridge 2000). Usability testing should be applied to all the many facets of the library and information environment because of this very premise. If barriers to effective information seeking are continuously confronted and overcome, then information professionals can feel satisfied that they are doing their jobs.

3. Data Collection and Analysis Methods

The overarching goal of this study is to explore usability issues and problems related to integrated cataloging and metadata services.

Usability testing is established as a compounding of a variety of methods

and techniques. Because methods of data collection and analysis should be correlated in order to answer research questions, researchers agree that the ideal approach is a combination of quantitative and qualitative methods.

3.1 The System under Study: OCLC Connexion

Connexion is a production system that was developed by OCLC to provide access to cataloging records through WorldCat, the world's largest online union catalog and bibliographic database. Libraries use Connexion to create and edit quality bibliographic and authority records, which help users find the materials they need more quickly. Connexion facilitates sharing of records with the entire OCLC cooperative, which benefits libraries worldwide (http://www.oclc.org/connexion/). Connexion combines the most useful features of OCLC's web browser-based system. OCLC Connexion is based on CORC, CatExpress, CatMe, and Passport, and the knowledge that OCLC has gained from working with users over many years. Connexion also automates input of data, and aligns records with the authoritative WorldCat database. First released in July 2002, Connexion provides general cataloging

functionality for all types of library materials (Lindlan and Mering 2002). Connexion reflects OCLC's intention to take the best features of each of the aforementioned tools and integrate them into the new cataloging service. According to OCLC, Connexion is OCLC's flagship cataloging service, a powerful, flexible suite of tools with built-in access to WorldCat, the world's largest bibliographic database. The Connexion provides several mechanisms for getting in; the main menu composed of five different search options with a few sub categories (see <Figure 3.1>). Such a variety of options is helpful when observing users' diverse interactions with the system.

The purpose of the Connexion system is to provide an integrated cataloging service to its members. Thus, the primary users are cataloging experts who catalog materials on a daily basis. Therefore, it would be fair to state that Connexion's

<Figure 3.1> Homepage of the OCLC Connexion (http://connexion.oclc.org/)

representative users are mainly those who work in general area of cataloging, including faculty teaching cataloging classes, catalogers, and technical services librarians.

3.2 Data Collection

A thought provoking question in usability testing is: What number of subjects will be sufficient for this study? Generally, it is assumed that the major advantage of usability testing is that very few test subjects are actually required. According to Nielsen (Nielsen 1989, 1993) approximately five subjects may uncover roughly 90% of the global usability problems inherent in any design. However, the "proper" number of required test subjects for establishing a minimum level of statistical confidence in usability testing is often a source of controversy.

In the Tallahassee area, where there are approximately 12-15 cataloging experts in the field, and this research recruited 10 of them for the test. Participants were recruited throughout the Tallahassee are by letter. The invitation letters were sent to all local cataloging related sectors. A $10.00 honorarium was offered for participation. All of the subjects participated on a voluntary basis.

A total of 10 cataloging experts participated in the study, 6 women and 4 men. Most of the participants know how to use commercial online databases such as Dialog or FirstSearch even if they do not use them in a daily basis. Only one participant had never used OCLC Passport or Connexion. However, it turned out from the test that most of them have used Passport or other products of OCLC rather than Connexion.

The pre-search questionnaire gathered information about the participants' computing and searching experience. Their searching experience with different information systems ranged from 1 to 7 (1 = Never; 2 = Once a year; 3 = Quarterly; 4 = Once a month; 5 = Once a week; 6 = 2 to 3 time a week; 7 = Daily) with a mean of 6.10 ($SD=.59161$). In detail, the participants declared that they had the most experience with Search Engines (M= 6.80, $SD=.422$), Computerized Library Catalogs (M= 6.80, $SD=.632$), OCLC Passport or Connexion (M= 5.60, $SD=2.271$), and had the least experience in Commercial online databases (M= 5.20, $SD=1.317$), in that order. It is of particular value to note that most participants have experienced a variety of databases and information retrieval systems and they rated themselves as

better than intermediate users.

There were four phases for the test: pretest phase, introduction, testing phase, and debriefing phase. All the sessions were videotaped with the participants' consent. The entire test for each participant took about an hour in general.

<Table 3.1> Participants Profile

Participant's Profile	
Demographics (Gender and Age)	Female = 6 (60%); Male = 4 (40%) 31- 40 = 3 (30%); 41- 50 = 3 (30%); Over 51 = 4 (40%)
Hours spent searching for information per week	Less than 2 hours = 1 (10%); 2 – 5 hours = 2 (20%); More than 5 hours = 7 (70%)
Hours spent searching in one setting	30 mins – 1 hour = 2 (20%); More than 1 hour = 8 (80%)
Familiarity with an Information Retrieval System (Self-evaluated)	Intermediate = 10 (10%); Expert = 9 (90%)
Experience meeting end users	YES = 8 (80%); NO = 2 (20%)
Frequency of use of computerized library catalogs	Once a week = 1 (10%); Daily = 9 (90%)
Frequency of use of commercial online databases (e.g. Dialog, FirstSearch)	Quarterly = 2 (20%); Once a week = 3 (30%); 2 to 3 times a week = 4 (40%); Daily = 1 (10%)
Experience with OCLC Passport or Connexion	Never = 1 (10%); Once a year = 1 (10%); Once a week = 1 (10%); 2 to 3 times a week = 1 (10%); Daily = 6 (80%)

3.2.1 Tasks

Two important things were considered in the design of these searching tasks. First, the tasks should reflect the users' real information needs in their workplaces. Second, the type of the tasks was considered. For this research, Spool's task types were adapted to create four tasks as well as careful review of cataloger's daily work.

A set of four tasks was created (See <Table 3.2>) based on these two considerations. Tasks 1 and 2 were judged to be simple fact- finding questions and tasks 3 and 4 were considered as the questions asking a comparison and judgment from the users. Tasks 1 and 2 were to find a book record using the information provided by the question. For tasks 3 and 4, the participants were expected to find a few records which would help in creating a catalog record related to the topic and to make a judgment from the records they found. In addition to the consideration of the task types, Task 3 also included searching different format of metadata, in this case online resources.

<Table 3.2> Types of Questions, Topics and Provided Tasks

Question Type	Topic	Task
Simple fact finding	Standard book search	T1. Your library recently bought new editions (2003-2004) of some books. Among them, there is a book written by Ben Shneiderman. Your boss told you that you must create a cataloging record for this book before it can be shelved. Prior to creating this catalog record using the Connexion system, you will need to explore Connexion to locate an appropriate record. You have only the following limited information on the book to use when searching for this record. Title: Designing the User Interface Author: Ben Shneiderman Publication Year: not sure but you are sure it should be 2003 or 2004 Using this information, please explores the Connexion system and find most appropriate existing record to use as a basis for creating a record for your library. Which search terms and fields will you use? Please write down the search terms and fields you intend to use in detail.

Simple fact finding	Standard book search	T2. You were walking around the library and found a book written by Dagobert Soergel that has been missing for years. Since it has been presumed missing for such a long time, the record has been removed from your library catalog. Your boss told you that you need to create a new catalog record for the book using the Connexion system. Title: Organizing Information. Author: Dagobert Soergel. Publication Year: not sure but you are sure it is more than 10 years ago. Using this information, please explore the Connexion system and find most appropriate existing record to use as a basis for creating a record for your library. Which search terms and fields will you use? Please write down the search terms and fields you intend to use in detail.
Comparison of facts	Electronic information search	T3. Recently, your library has undertaken the challenge of cataloging electronic information to make it more accessible to the patrons of the library. This week, your assignment is to create some records for electronic information about metadata and especially about the Dublin Core. Your boss wants you to find information about the metadata element set of Dublin Core to create records. Please explore the Connexion system and find the information that you believe will be most helpful to your patrons on this subject. You may find a record that you can copy or modify to create your own record. Which search terms and fields will you use? Please write down the search terms and fields you intend to use in detail.
Comparison of judgment	Search for records for an original cataloging	T4. It is graduation season. As usual, your library has many dissertations to be cataloged. A dissertation comes to you today and your boss tells you that you have to create a catalog record for the dissertation. You know that his particular dissertation will not appear in the Connexion system since it is a new dissertation approved by your university only recently. Thus, you decide to try and locate a similar record for a different dissertation that will help you to begin the process of creating an original record for this dissertation. You have the following information regarding the dissertation for which you need to created an original record: Title: Child abuse living with single parent: a case study of Orlando regional area. Author: Angela McKenny. Publication Year: surely it is 2004. Please explore the Connexion system and find the record that you feel will be most helpful in creating your original record. You may find one that you can modify for your new record. Please write down your search terms and fields for use for same in detail.

3.3 Introduction to the Data Analysis

<Table 3.3> contains data collection, methods of data analysis, and a result presentation for each research question. Content Analysis and Classification method is used to analyze the qualitative data gathered from videotaped records, recorded think-aloud remarks, and videotaped logs of the participants'

interaction with the system.

<Table 3.3> Data Collection and Analysis Methods

Research Questions	Data Collection	Data Analysis	Presentation
RQ 1. Effectiveness	Accuracy and Number of Errors	Correlation	Pearson's Correlation Matrix
RQ 2. Efficiency	Completion Time and Number of Keystrokes used	Correlation	Pearson's Correlation Matrix
RQ 3. Satisfaction	Exit Interview	Descriptive Statistics	Descriptive Statistics Table
RQ 4. Usability of different format of metadata	Effectiveness, Efficiency and Satisfaction	Descriptive Statistics	Descriptive Statistics Table, Correlation Metrix
RQ 5. Identification and classification of Usability Problems of the Connexion.	Combined Logs and Exit Interview	Content Analysis and Classify Usability Problems	Coding Table of User Perception of Usability Problems and Classification Table of Usability Problems

4. Data Analysis and Results

4.1 Overview of Collected Data

Accuracy and number of errors are evaluated to measure effectiveness. Participants who spent more time in one setting tended to get better accuracy rates and participants who thought they were more familiar with an information retrieval system made fewer errors during this research.

Efficiency was measured by evaluating completion time and the number of keystrokes used in this test by each participant. Participants who thought they were familiar with information retrieval systems in general tended to

use less time and fewer keystrokes to complete their tasks.

The satisfaction measures included participants exit interview responses as reported on a 1 to 9 Likert Scale. Only one experience that of working with computerized library catalogs, had significant relationships with easy of use and understandability, but it did not seem to affect overall satisfaction.

Among the three main categories, effectiveness and efficiency seem to have been related in some ways but the satisfaction measure were not dependent with either effectiveness or efficiency. Ccorrelation matrices were provided for usability in searching different metadata formats.

A content analysis was performed after identification and classification of usability problems, and the results were presented. Seventeen coded usabilty problems were divided into six classifications, which were in turn presented and analyzed.

4.2 Effectiveness, Efficiency and Satisfaction

In order to see the relationships between the three measures, another Pearson's correlation analysis was conducted. As presented in <Tables 4.7> through

<Table 4.1> Pearson's Correlations between Effectiveness and Efficiency (N=10)

Research Questions	Data Collection	Data Analysis	Presentation
RQ 1. Effectiveness	Accuracy and Number of Errors	Correlation	Pearson's Correlation Matrix
RQ 2. Efficiency	Completion Time and Number of Keystrokes used	Correlation	Pearson's Correlation Matrix
RQ 3. Satisfaction	Exit Interview	Descriptive Statistics	Descriptive Statistics Table
RQ 4. Usability of different format of metadata	Effectiveness, Efficiency and Satisfaction	Descriptive Statistics	Descriptive Statistics Table, Correlation Matrix
RQ 5. Identification and classification of Usability Problems of the Connexion	Combined Logs and Exit Interview	Content Analysis and Classify Usability Problems	Coding Table of User Perception of Usability Problems and Classification Table of Usability Problems

* Correlation is significant at the 0.05 level(2- tailed).
** Correlation is significant at the 0.01 level(2- tailed).
(Sig.) Significance level

<Table 4.2> Pearson's Correlations between Effectiveness and Satisfaction (N=10)

	Overall Satisfaction	Accuracy	Number of errors
Overall Satisfaction	1	.375	-.122
(Sig.)		(.285)	(.736)
Accuracy		1	-.584
(Sig.)			(.076)
Number of errors			1
(Sig.)			

* Correlation is significant at the 0.05 level (2- tailed).
** Correlation is significant at the 0.01 level (2- tailed).
(Sig.) Significance level

<Table 4.3> Pearson's Correlations between Efficiency and Satisfaction (N=10)

	Overall Satisfaction	Time	Keystrokes
Overall Satisfaction	1	-.376	-.471
(Sig.)		(.285)	(.170)
Time		1	.442
(Sig.)			(.201)
Keystrokes			1
(Sig.)			

* Correlation is significant at the 0.05 level(2- tailed).
** Correlation is significant at the 0.01 level(2- tailed).
(Sig.) Significance level

<Table 4.9>, only effectiveness and efficiency show in between correlations.

However, accuracy is independent from all other factors. Among three measures such as effectiveness, efficiency and satisfaction, the satisfaction measure appears to be independent from others, which means satisfaction is not related to any effectiveness or efficiency factors.

4.3 Identification and Classification of Usability Problems

From the combined logs, the participants' perceptions of usability problems were coded. Coding rules were set prior to coding. Problems caused by a simple mistaken click or typing error, etc. were not included in the coding. The code covered only problems that resulted from some feature or function of Connexion itself. For example, one of the participants was trying to use the " Pathfinder" option rather than the " Search" option for Task 1. She was not conscious of her mistake because the option was set to " Pathfinder." That mistake was caused by a clicking error during her exploration of the interface at the beginning. She said " what am I doing?...it looks so different from what I want to do"...(and looking at the researcher and she said)" I didn' t mean to...I thought I was under the

Search option." This kind of problem is eliminated from usabilty problem coding. From the combined logs and the exit interview data, a total of 172 usability problems were found. Among them, 17 unique usability problems were identified. Following identification, the usability problems were classified with reference to several areas of Connexion features, in order to summarize overall usability problems.

More problems were found in Task 1(n=38) and Task 3(n=37), as compared to Task 4(n=26) and Task 2(n=14). The usability problems found in Task 2 are mostly duplicated in Task 1 since the tasks are very similar in type.

The top six most frequently found usability problems were;

- The error message is not easily recognized;
- Only one term per one search box seems inconvenient;
- Quick tips are too vague or not specific enough;
- It is hard to understand the terminology or syntax;
- Help is not helpful; and
- Options for manipulation of results are limited.

4.4 Usability Problems

Based on the identification of usability problems in the test, six areas are emerged in the classification of usability problems. The six areas are: User Assistance, Error Prevention and Correction, Color and Visual Clarity, Navigation, Information Grouping and Structure, and Language Usage. Summary of the problems of the each area was provided from the following.

Usability problems in user assistance.

<Table 4.4> Usability Problems in User Assistance

Usability Problems in User Assistance
Quick tips are too vague or not specific enough (UP 11)
Help is not helpful (UP 10)
Lack of instruction on how to use each option (UP 03)
Lack of explanation of the main options on the top (UP 01)

Two of the problems were about lack of information on options. The examples include" I am curious about what the main option can do for each... about what Pathfinder means". (Participant 005) Help and Quick tips are the other two codes identified in this area. These areas are specific and helpful enough when the cataloger had been trained well before using the Connexion. However, when they were not accustomed to use Connexion frequently, even a skillful cataloger showed irritation.

Usability problems in navigation.

<Table 4.5> Usability Problems in Navigation

Usability Problems in Navigation
Labels are not insightful (UP 02)
It is hard to understand the organizing scheme (UP 04)
The submenu is hard to fine and lacks description (UP 05)
Authority files are very cumbersome and confusing (UP 16)
The location of search is unclear (UP 07)

The navigation area is central to the actual searching process of the test. The most important problem is summed up by this statement." It's hard to understand how to do something." For example, one participant said," I was under" Cataloging" and there are " Search, Browse, Create and Show" options...I thought I was using Search since that option was what I was used for Task 1 and for searching the WorldCat database, but suddenly a different interface came and I found out I was in a different database. (Looking at the researcher, he grumbles) I went too far, I guess."(Participant 101)

Usability problems in information grouping and structure.

This area is related to the final results structure because it contains features which might affect the final result and the manipulation of it. As may be seen in <Table 4.6>, two of the problems are about final result and the manipulation

of it. For example," I got more than 80 electronic records. Wow...it's too many. OK, is there anything to help me set the limit using this set? Something.. putting more keywords or...Oh oh.. I think they don't, (looking at the researcher) Do they?" (Participant 009)

Too many complicated field option buttons are another usability problem coded in this area. Sometimes, it is helpful for users to have access to as many field options as the information system developer can provide. However, sometimes having too many brings difficulties of use. For example," I am using Keyword searching. OK, what kind of options do I have? Author, title, LCSH, Library of Congress Classification Number...There is another search option, using numeric numbers only, right under this keyword search... They may want to cut and simplify these options. It is taking long time to find the right option and click it." (Participant 006)

<Table 4.6> Usability Problems in Information Grouping and Structure

Usability Problems in Information Grouping and Structure
Limited options for manipulation of results (UP 14)
Hard to distinguish next record vs. next record groups (UP 15)
Field option buttons are too complicated (UP 08)

Usability problems in color and visual clarity.

Two usability problem codes were classified into the Color and Visual Clarity area <Table 4.7>. For example, " I may be out of the line but they could use different colors for different searching options. Every part has the same color, blue or navy, whatever... It looks consistent but it is little bit confusing - hard to know which one I am using". (Participant 009)

<Table 4.7> Usability Problems in Color and Visual Clarity

Usability Problems in Color and Visual Clarity
Reading is difficult (UP 06)
Features for each search options are too similar (UP 09)

Usability problems in error prevention and correction.

Two usability problem codes were designated in the Error Prevention and Correction area of the system. For example," In Task 1, I made two errors. I didn't know what I did wrong. After the two errors, I saw the message on the top of the keyword search option part saying I have to use only one keyword in each box. I also noticed that it was in the Quick Tips a long time later when I was doing Task 3. This is not good. Most other information retrieval systems let the user put in more than two terms.

I think I am too used to using a general information system rather than a cataloging systems." (Participant 005) <Table 4.8> contains the usability problems in Error Prevention and Correction.

<Table 4.8> Usability Problems in Error Prevention and Correction

Usability Problems in Error Prevention and Correction
The error message is not easily recognized (UP 17)
Only one term per one search box seems so inconvenient (UP 12)

Usability problems in language usage.

There is one usability problem code in the Language Usage area as presented in <Table 4.9>. For example," I read the Quick Tips and typed something in the command search. It didn't work. I have used another cataloging system. It seems to be using different words… or am I confused?" (Participant 005)

<Table 4.9> Usability Problems in Language Usage

Usability Problems in Language Usage
Hard to understand the terminology or syntax

5. Conclusions and Implications

5.1 Overall Results

Effectiveness is related to participants' familiarity with information retrieval systems. Other factors such as experience of computerized library catalogs, experience of search engines, experiences of OCLC Passport or Connexion, etc. are not related with effectiveness in this test. This conclusion leads toward another discussion on training and learning issue in integrated cataloging and metadata systems, which is addressed in this paper.

Efficiency is related to familiarity with the information retrieval systems both in completion time and number of keystrokes used in this test. Participants who thought they were familiar with information retrieval systems in general tended to use less time and fewer keystrokes to complete their tasks. Other factors of searching experience were not significant in this test. A careful decision was made that familiarity with information retrieval systems is the one most important factor related to both effectiveness and efficiency. This also leads to another discussion on learning issues within integrated cataloging and metadata systems, which will be found later.

There is only one experience, that of computerized library catalogs, which has shown significant relationship with easiness and understandability satisfaction

measures. This relationship was not shown with regard to overall satisfaction. This means that the participants who felt Connexion was easy and understandable did not necessarily feel comfortable and satisfied in this test. Regarding those results from effectiveness and efficiency, it appears that even for those participants who felt Connexion was easy and understandable, the most powerful factor was familiarity with information retrieval system. The experience with computerized library catalogs helped the participants to feel more at ease with understanding Connexion, but this did not effect their searching. Those who had been used to computerized library catalogs knew what the ordinary features of a cataloging system might be, but there was no evidence in the tests that this helped the participants to be effectiveness and efficient in searching. Once again, this finding has implications for learning and training.

Through this study, 17 coded usability problems of consideration were developed. Six classified usability problems containing the 17 usability problems were presented and analyzed. Connexion should make improvements in at least six of those areas in order to be more usable as an integrated cataloging and metadata

system for its primary audience.

In terms of Error Prevention and Correction, there is a need for more easily recognizable messages for users. A pop- up window letting users know that they have made a mistake and should correct it would be most useful. Generally, a somewhat more simplified structure would be helpful for Navigation and Information Grouping & Structure; perhaps more obvious color differentiation among options would prevent some errors. Finally, instructions and explanations of each option need to be improved to reduce the costs of training and searching the database.

5.2 Implications for the Connexion Usability

The integrated cataloging and metadata system, Connexion, used in this study is still changing. OCLC is planning to quit other services such as Passport and services will be integrated into a single service using Connexion (http://www. odc.org/connexion/migarting/default.htm)

In order to serve better to its users, OCLC will need to implement two recommendations arising from this study.

First, there need to be major corrections made to the interface of Connexion.

Most important among these are improving the user assistance and navigation aspects. Searching and creating catalogs are activities that are essential to intellectual work in Library and Information Studies. More useful instruction and explanation of the interface will help to reduce searching efforts and save in training costs.

Second, the training for Connexion use needs to be redirected and refocused. Current training focuses on the features of the Connexion without placing these in the context of searching. Training only in the features of the Connexion is not currently enough for learning to make a better search in Connexion. Users also need to be trained in every aspect of the information retrieval system to increase their understanding of how such systems work. The results of this test demonstrate that users who were already familiar with information retrieval systems more satisfied with Connexion. The continued development of Connexion and its further integration with other databases affords a unique opportunity for such improvements to be implemented.

5.3 Usability issues

The results of this study provide two suggestions for usability studies of a cataloging system.

First, used along the effectiveness by completion time is a problematic in evaluating cataloging systems. In order to get the correct record, a cataloger searches through databases and make decisions regarding which record is the proper one for his/her work. It is clear that completion time is directly related to the type of task the searcher engages in (simple fact finding vs. judgment task). Cataloging work, for example, is always subject to the decision-making process, deciding whether a record is right or wrong, and therefore completion time may not be the best measure for evaluating the usability of a cataloging system. Therefore, completion time should be split into two categories; time taking to search the information and time taking to evaluate and make a judgment especially when it used a measure of usability testing with cataloging systems.

Second, results of this study suggest that developers of cataloging systems need to be more active in soliciting and supporting usability studies designed to test the usability of the particular system for particular users. There have been many usability studies that test usability of a system in general as

described in this paper. There have also been usabilty studies of specific metadata systems. However, there have been no studies specifically designed to test the usability studies of cataloging and metadata systems for catalogers, their primary user population. It would be advisable to move the focus of usabilty testing into more specific systems at this point, with specific users in view.

5.4 Future Research Directions

The findings of this study provide a platform for expansion and establishment of a future research agenda.

First of all, testing of all other currently existing cataloging systems is necessary comparison with integrated cataloging and metadata systems. Such efforts may support generalization of the results of this study. In addition, such efforts may provide better and more detailed understanding of usability problems encountered in cataloging systems.

Since the usabilty studies are grounded in user behaviors, it would be interesting to investigate these, with the goal of establishing possible models of specific user-group behaviors in our field, especially those of catalogers.

During the test, individuals used various numbers of keywords. Some used only two or three, but others used more than six keywords, including all the qualifiers located in the option box. An interesting topic for future research would be to see if catalogers demonstrate consistent patterns of keyword usage.

For future study, it would be recommended to carefully consider the task types and arrangement of the tasks. In order to solve this problem, it would be recommended to adapt a few different sets of similar types of tasks to see the differences in terms of the types of tasks.

Last, but not least, the study of catalogers searching behavior is another interesting topic for future research. During this test, catalogers preferred to use Command search or Derived Search when they thought they knew how to use them. There are many information retrieval systems and search engines currently in popular use and more will certainly be developed for a wide range of user groups. Study of catalogers' searching behavior might provide illuminating contrast with the searching behavior of ordinary end-users.

5.5 Conclusion

The goal of this study was to examine usability issues and to uncover where an integrated cataloging and metadata system lay the usability problems of its primary users, catalogers.

This research started by looking at three usability measures and their relation to users' searching experience, and went on to examine the usability problems that Connexion, an integrated cataloging and metadata system was faced with.

This study showed that the most important aspect of usability in Connexion is the users' prior experience with an information retrieval system. Also, it showed there are seventeen usability problems with Connexion, and that these can be grouped into six categories.

Needless to say, it is most important to note that usability is not an exclusive goal of such an integrated cataloging and metadata system. Other goals such as quality of cataloging records, and the reliability of its cataloging and metadata system are equally its concern.

This study also suggested testing on more diverse cataloging systems and their use by specific user groups, especially catalogers, would be beneficial to increasing our understanding of the role that integrated cataloging and metadata system will play. Although application of the recommendation of this study will improve the usability of the Connexion system for its primary user group, much work remains to ensure that as this system develops its users are well served.

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