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Library Staff Tasks: A Usability Diary Study of Technology Problems and Their Effects on
Work Efficiency
by
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Abstract

Little work has been done on the usability and utility of technology tools employed by librarians in their everyday work environment. This study uses the diary method to collect data about problems experienced by academic librarians over a ten day period. Information gathered on the problems includes their severity, impact on work efficiency, and impact on services to patrons. The study investigates links between types of problems and types of librarian jobs, as well as librarian experience and impact of problems. This study hopes to be a blueprint for further research to improve the usefulness of library tools and to help librarians provide increasingly better services to their patrons.

Introduction and Problem Statement

Usability evaluation of online library services, such as OPACs and library websites, has become very popular; for just a few examples, see Aitta, Kaleva, & Kortelainen (2008) and Turner (2011). Libraries hope that by making their patron-facing systems easier and more intuitive to use, their patrons will be more willing to choose the library over alternative services.

Usability is defined in ISO 9241 as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO, 1998). *Effectiveness* is the degree to which users can perform specific tasks successfully; *efficiency* is the amount of time and resources spent on performing a task; and *satisfaction* is the measure of users' feelings and impressions of a system. These three factors form the basis of usability evaluation. In addition to usability, an important, but less well-studied, attribute of a system is *utility*, which Nielsen (2012) defines as "whether [the system] provides the features you need". Nielsen calls the combination of usability and utility *usefulness*.

Problem Statement

Usability is an essential aspect of the future of libraries; through usable systems and programs, libraries can offer higher-quality service to their patrons. While improving user experience is undoubtedly crucial, it is also important to understand the problems library staff face in the course of their work. To what degree do librarians' tools help or hinder their ability to perform their jobs? Although there is ample LIS research on user satisfaction, to our knowledge, no research has been done on the usability of technological tools used by librarians to perform daily work-related tasks. This diary study aims to gather data on routine problems faced by librarians and to understand which usability factors are involved in the most frequent and most serious problems. This study hopes to provide a starting point for other studies to develop new heuristics and other evaluation methods for library technology. By improving the usability and utility of these tools, librarians will be better able to perform their jobs and serve their audiences.

Definition of Key Terms

Throughout this study, and in our study instruments, we define a *problem* as "anything that slows down or impedes your work or prevents you from completing a task". This definition is based on problem criteria by Jacobsen, Hertzum, & John (1998). We define *technology* as "a computer- or Internet-based tool or application used for work".

Statement of Purpose

The purpose of this study is to understand and categorize the kinds of problems library staff face when using technological tools at work, in order to facilitate the future development of heuristics and usability tests for library technology. Improving the efficiency of staff tasks will free librarians' efforts to focus on user needs.

Literature Review

Usability and Utility Heuristics

One of the goals of this study is to provide a basis for creating usability heuristics specific to librarians' tools. In this section, we discuss previous work on development of heuristics.

The usability of a system or website can be evaluated using a number of different approaches. One popular, relatively inexpensive method is heuristic evaluation, in which an expert evaluates a system against a list of rules of thumb, called heuristics, in order to find potential usability problems (Nielsen, 1994). The most popular set of heuristics is Nielsen's (1995) ten general principles of interaction design. These heuristics may be applied to a wide range of systems and interfaces. One of the disadvantages of heuristic evaluation is that it may result in "false positives", problems that evaluators predict but actual users never encounter (Law & Hvannberg, 2004). For this reason, it is important to supplement heuristic evaluation with user testing and other types of evaluation.

Other sets of heuristics have been developed for more specific types of systems, e.g. for technical documentation (DeBoard, 2004), e-learning (Reeves et al., 2002), and library websites (Manzari & Trinidad-Christensen, 2006). Several studies have found that such domain-specific heuristics are more thorough and find more problems than general heuristics (Connell & Hammond, 1999; Mankoff et al., 2003; Somervell, 2004; but see Wallace, Reid, Kang, & Clinciu (2013) for less definitive results). Such heuristics may be developed based on expert opinion, literature reviews, or empirically through the results of usability testing.

In one of the few studies on utility, Johannessen & Hornbaek (2014) developed a set of utility heuristics using the grounded theory approach. In testing these heuristics against Nielsen's usability heuristics, they found that while both sets found many of the same problems, the utility

heuristics were much better at finding problems related to the context of tasks, and identified more severe and complex problems. They concluded that while "usability is a prerequisite for utility" (p. 203), utility evaluation is an important complement to usability evaluation. Therefore, we intend to include both utility and usability in our analysis of librarians' problems; in a work situation, where a given tool is used on a regular basis, low utility may be very detrimental to overall work efficiency.

Diary Studies in Work Environments and Library Settings

The diary study approach is a naturalistic, non-intrusive way to gather real-time data on the problems stemming from technology that librarians face in their work environments. This literature review will first investigate diary studies in the work environment (including Matteson, Chittock, & Mease's 2015 diary study on librarians' emotional labor) and then diary studies in the library environment to identify best practices for structuring diary-style data collection.

Many work-related diary studies have a psychological focus. They often pertain to the interaction of personal well-being and work life or the effects of emotion experienced while at work. Table 1 compares methodology among a selection of recent diary studies pertaining to work environments; five days is the general length of these studies, and they generally have around one hundred participants. Most "diaries" participants fill out take an online format, although print diaries have not totally been discarded. Frequency of diary entries depends on the goal of the study, but is often limited to once a workday. Demerouti, Bakker, & Halbesleben (2015) explored job crafting, or "strategies that individuals use to shape their job characteristics...to regulate their motivation and energy level" (p. 457). Niessen, Sonnentag, & Sach (2012) tried to answer the question of how resources affect thriving at work. Their specific definition of "resources" included "positive meaning, relational resources, and knowledge" (p.

472). Zacher, Brailsford, & Parker (2014) investigated the effect of micro-breaks on occupational well-being. Donoso *et al*. (2015) particularly examined how nurses balance work stress and the positive feelings associated with helping people. Finally, Matteson, Chittock, & Mease (2015) studied emotional labor done by librarians, to be discussed in more detail below.

Matteson, Chittock, & Mease (2015) performed one of the few studies investigating life in the library workplace. They used a diary format and the experience sampling method to capture daily workplace interactions in which librarians felt a disconnect between their personal emotions and the emotional display expected of them as a professional, resulting in emotional labor.

Diary studies have also been used in the more general library environment for investigating topics such as how users look for information or interact in the space of the library. Academic libraries seem to be the most popular library environments for diary studies, followed by public libraries. Diary studies are often used in conjunction with other research methods, such as in-depth interviews and surveys. Photo diaries are a variety of diary study which has become popular since Foster & Gibbons's (2007) study, which was cited by many of the below studies. In academic libraries, Keller (2012) used a photo diary method to examine students' decision-making processes to utilize print or digital mediums. Gabridge, Gaskell, & Stout (2008) also used the photo diary method to inquire into what sorts of information-seeking behaviors MIT's undergraduate and graduate populations engage in. Regalado and Smale (2015) used mixed methods, including both mapping diaries and photo diaries, to explore commuter students' attitudes towards their campus library. In the realm of public libraries, Spink, Alvarado-Albertorio, Narayan, Brumfield, & Park (2007) looked into multitasking behaviors of weekend library users. McKechnie (2000) used the diary method to study preschool girls'

library usage; their mothers filled out the diary in an attempt to gain more information about a difficult group of users to evaluate. Naturalistic methods such as these varieties of diary studies help provide a realistic look into the habits of their participants.

Table 1. Comparison of Recent Diary Studies Related to Work Environments

Study	Number of Participants	Duration of Study	Frequency of Diary Entries	Diary Medium
Niessen, Sonnentag, & Sach (2012)	121	5 days	3 times a day, 2 hours after starting work, at lunchtime, at the end of the workday	Online
Zacher, Brailsford, & Parker (2014)	124	1 day	Hourly while at work (average of 6.7 per participant)	Online
Donoso, Demerouti, Hernández, Moreno-Jiménez, & Cobo (2015)	75	5 days	1 a day	Print
Demerouti, Bakker, & Halbesleben (2015)	95	5 days	1 a day, while at work	Print
Matteson, Chittock, & Mease (2015)	23	5 days	1 a day, end of workday	Online

Research Design

   This study is a quantitative study taking a critical incident approach. Fivars & Fitzpatrick describe this technique as an incident report which takes the form of a "brief, written, factual report...in response to explicit situations or problems…[which] has been used to identify '**what people do**'" (n.d., n.p., original emphasis). The critical incident technique is a kind of case study, which is defined by Yin (2008) as research which "investigates a contemporary phenomenon within its real-life context" (p. 23). In order to best study librarians' experiences in

a "real-life context," the diary method will be used to gather the "incident report." The incident report will take the form of a questionnaire to be filled out every day for ten work days, reflecting on the problems experienced at work. This approach will address our research questions, articulated below.

Research Questions

RQ1. What technology problems are experienced by librarians in their daily work, and how can they be categorized?

RQ2. To what extent do these problems affect their efficiency of work?

RQ3. Do these problems impact patron experience?

RQ4. What tools might benefit from future usability testing?

Hypotheses

Our primary hypotheses include the following:

- Problems encountered may pertain to usability, utility, and the technological environment within which the librarian is located. The most severe and frequent problems faced will relate to utility and efficiency.

- These problems will negatively affect librarians' efficiency.

- Some of these problems will negatively affect patron experience.

- Librarians with more years of experience resolve problems more quickly.

We also expect to find differences in type and severity of problems among different library jobs and tools, but do not have enough prior knowledge to make specific hypotheses.

Methodology

Population

      We are studying professional librarians with MLIS degrees who work in an academic library setting. Using the MLIS criterion allows for reasonable standardization, and this study is particularly aimed at studying the technological tools of librarianship.

Sample & Sampling Method

      We will be reaching out to about 150 academic librarians through professional organizations (specifically, ALA and ACRL), with the goal of ultimately having 100 participants. We will be using the quota method to finalize our recruitment and ensure we have an adequate sampling of participants with different kinds of jobs across this library setting. We will be looking to test librarians who work in cataloguing, reference, technical services, and instruction.

Measurement of Variables

      Variables to be measured can be broken into two different categories: personal information about the librarian dealing with the problem, and data associated with the problem itself. The first category, information about a specific librarian, will gather information such as job type, years of experience, and self-rated skill with technology. This information will be collected from the initial questionnaire in Questions 1-5 (Job type = Q1&2, Years of experience = Q3&4, Self-rated skill with technology = Q5).

      Variables associated with a specific problem include the impact of problems on efficiency, the impact of problems on patrons, the type of problem, the severity of problem, the ease of problem resolution, the tool used, and the task which is being attempted. Information on these variables will mostly be gathered in the daily survey. Efficiency will be measured in Q5;

impact on patrons in Q11. The severity of the problem will be measured in Q10. The ease of problem resolution is dealt with in Q6&7. The tool used and the task attempted are gathered in Q8&9. The type of problem will be identified in the data analysis stage through researcher coding. Participants will also be asked to list all the tools they used each day and to rate their satisfaction with each (Q1&2). Finally, in Q7&8 of the initial questionnaire, librarians' perceptions of the impact of problems will be gauged, which can then be compared to the actual results of the study. These variables will help illuminate a broad picture of the effects of problems on librarians' work.

Data Collection

Participants will be asked to complete an initial questionnaire (see Appendix A) at the start of the study. They will complete and submit this questionnaire electronically. They will then submit an electronic questionnaire at the end of each day for ten consecutive work days (see Appendix B). By waiting until the end of the day to report on the problems they encountered, participants will not feel inconvenienced in the middle of the work day and will be able to reflect on their (dis)satisfaction with the tools they have used. Each participant will be assigned an ID number, and his or her data will be associated only with that number to ensure anonymity.

Data Analysis

Once all data has been collected, the reported problems will be coded according to their type(s). Problems may relate to:

- Effectiveness: Participant had difficulty achieving stated task accurately

- Efficiency: Task performance was slowed down or impeded

- Satisfaction: Participant expressed dissatisfaction with tool

- Utility: Tool was missing a desired functionality

Two coders will perform this task independently, and their results will be compared to ensure

agreement. In addition, a score of 3 or lower on Q2 of the daily questionnaire (which asks

librarians to rate their satisfaction with tools used that day) will be counted as a Satisfaction

problem.

It will also be necessary to generate a set of general task types based on the task

descriptions reported in the questionnaire.

Once the data is processed, we will perform analyses using descriptive and inferential

statistics to look for correlations between variables. These tests are outlined in Table 2.

Table 2. Planned Data Analysis

Descriptive Statistics	Planned Calculations	Inferential Statistics	Planned Calculations
How severe were the problems?	Mean, mode, range	Efficiency of problem tasks vs. normal efficiency	T-test
How easily resolved were the problems?	Mean, mode, range	Does job correlate with number of problems?	Chi-square test
How much of an impact on patrons did these problems have?	Mean, mode, range	Do years on the job correlate with ease of problem resolution?	Chi-square test
How many problems were encountered with each tool?	Mean, mode, range	Does self-rated skill with technology correlate with number of problems?	Chi-square test
How many of each type of problem did each librarian experience?	Mean, mode, range	Do different tools used for the same task have different numbers of problems reported?	T-test
		Which types of problems occur significantly more frequently?	Chi-square test

		Does frequency of problem types vary by job?	Chi-square test
		Is ease of problem resolution correlated with type of problem?	T-test
		Is severity of problem correlated with type of problem?	T-test
		Do different tools used for the same task have different types of problems reported?	Chi-square test

Anticipated Results

We anticipate the results will support our hypotheses, namely that technology problems encountered will have a negative impact on efficiency and services to patrons. We hypothesize that librarians who have greater years of experience (both at their current job and in their field) will be less negatively affected than less experienced librarians. We can guess that problems related to efficiency and utility will be rated most severe, as they are likely to slow down a librarian's work. We are interested to discover if different library job types encounter different types of problems or severity of problems, and if any specific tools are particularly problematic. As a result of this study, it is hoped that specific heuristics can be developed for better evaluation of librarians' technological tools. Such heuristics can focus on the most frequent and severe problem types discovered, in the context of the types of tasks performed by librarians. It may even be necessary to develop different sets of heuristics for different library job types. Our results should also be useful to librarians and product vendors who wish to know what tools are prone to problems.

Strengths and Limitations of the Study

The strengths of this study relate largely to the diary study technique and its naturalistic method of data gathering to report real-world problems (in contrast to a lab setting). Since a questionnaire will be filled out every day, problems will ideally be reported in a timely, accurate fashion.

One of the greatest weaknesses of diary studies is their reliance on self-reporting. We are not gathering an objective picture of these library environments; any problems that go unrecognized or unreported by the participants will not be included. We are also relying on librarians' perceptions of patron experience. In addition, we are only performing this study for ten days. Not all problems routinely experienced by librarians will occur during this time period. Finally, in this study, it is hard to capture satisfaction as an aspect of usability. Question 2 in the daily survey is designed to gauge satisfaction, but otherwise the focus of the diary on specific problems encountered may not capture general dissatisfaction in a comprehensive manner. Further studies could be designed to better assess librarians' satisfaction with their tools and work environment.

Conclusion

We hope that this study will inspire further research in many areas, including the effectiveness of any heuristics developed, specific usability tests of certain products, and more general surveys across the LIS field to further identify work problems and specific needs. If technology problems are found to have a significant impact on patrons or librarian efficiency, this study will be shown to be very important and a guideline for further research in this area about which research is lacking.

Bibliography

Aitta, M.-R., Kaleva, S., & Kortelainen, T. (2008). Heuristic evaluation applied to library web services. *New Library World, 10*(1/2), 25-45.

Connell, I. W., & Hammond, N. V. (1999). Comparing usability evaluation principles with heuristics. In M. A. Sasse & C. Johnson (Eds.), *Human-Computer Interaction INTERACT'99* (pp. 621-629). Amsterdam: IOS Press.

DeBoard, D. (2004). Heuristics to evaluate online help. *Usability Interface, 10*, 18-27.

Demerouti, E., Bakker, A.B. & Halbesleben, J.R.B. (2015). Productive and counterproductive job crafting: A daily diary study. *Journal of Occupational Health Psychology, 20*(4)*,* 457-469.

Donoso, L.M.B., Demerouti, E., Hernández, E.G., Moreno-Jiménez, B., & Cobo, I.C. (2015). Positive benefits of caring on nurses' motivation and well-being: A diary study about the role of emotional regulation abilities at work. *International Journal of Nursing Studies, 52*(4)*,* 804-816.

Fivars, G. & Fitzpatrick, R. (n.d.). *The critical incident technique bibliography*. Retrieved from http://www.apa.org/pubs/databases/psycinfo/cit-intro.pdf

Foster, N. F., & Gibbons, S. (Eds.) (2007). Studying students: The undergraduate research project at the University of Rochester. Chicago: Association of College and Research Libraries.

Gabridge, T., Gaskell, M., & Stout, A. (2008). Information seeking through students' eyes: The MIT photo diary study. *College & Research Libraries, 9(6),* 510-522.

ISO. (1998). ISO 9241-11, *Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11: Guidance on usability.* Geneva, Switzerland: International Organization for Standardization (ISO).

Jacobsen, N.E., Hertzum, M., & John, B.E. (1998). The evaluator effect in usability tests. In *Proceedings of ACM CHI'98 Conference Summary* (pp. 255-256). New York: ACM Press.

Johannesson, G. H. J., & Hornbaek, K. (2014). Must evaluation methods be about usability? Devising and assessing the utility inspection method. *Behaviour & Information Technology, 33*(2), 194-205.

Keller, A. (2012). In print or on screen? Investigating the reading habits of undergraduate students using photo-diaries and photo-interviews. *Libri: International Journal of Libraries & Information Services, 62(1),* 1-18.

Law, E. L.-C., & Hvannberg, E. T. (2004). Analysis of strategies for improving and estimating the effectiveness of heuristic evaluation. *NordiCHI 2004* (pp. 241-250). Tampere, Finland.

Mankoff, J., Dey, A. K., Hsieh, G., Kientz, J., Lederer, S., & Ames, M. (2003). Heuristic evaluation of ambient displays. In *Human Factors in Computing Systems* (pp. 169-176). ACM Press.

Manzari, L., & Trinidad-Christensen, J. (2006) User-centered design of a web site for library and information science students: Heuristic evaluation and usability testing. *Information Technology and Libraries, 25*(3), 163-169.

Matteson, M.L., Chittock, S., & Mease, D. (2015). In their own words: Stories of emotional labor from the library workforce. *Library Quarterly, 85*(1)*,* 85-105.

McKechnie, L.E.F. (2000) Ethnographic observation of preschool children. *Library & Information Science Research, 22(1),* 61-76.

Nielsen, J. (1994). Heuristic evaluation. In J. Nielsen & R. Mack (Eds.), *Usability inspection methods* (pp. 25-62). New York: John Wiley.

Nielsen, J. (1995, January 1). *10 usability heuristics for user interface design.* Retrieved from https://www.nngroup.com/articles/ten-usability-heuristics/

Nielsen, J. (2012, January 4). *Usability 101: Introduction to usability.* Retrieved from https://www.nngroup.com/articles/usability-101-introduction-to-usability/

Niessen, C., Sonnentag, S., & Sach, F. (2012). Thriving at work--A diary study. *Journal of Organizational Behavior, 33*(4)*,* 468-487.

Reeves, T. C., Benson, L., Elliott, D., Grant, M., Holschuh, D., Kim, B., ...Loh, S. (2002). Usability and instructional design heuristics for e-learning evaluation. In *Proceedings of ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications* (pp. 2-8). Association for the Advancement of Computing in Education.

Regalado, M. & Smale, M.A. (2015). "I am more productive in the library because it is quiet:" Commuter students in the college library. *College & Research Libraries, 76(7),* 899-913.

Somervell, J., (2004). *Developing heuristic evaluation methods for large screen information exhibits based on critical parameters* (Doctoral dissertation). Virginia Polytechnic Institute and State University, Blacksburg, VA.

Spink, A., Alvarado-Albertorio, F., Narayan B., Brumfield, J. & Park, M. (2007). Multitasking information behavior in public libraries: A survey study. *Journal of Librarianship & Information Science, 39(3),* 177-186.

Turner, N. B. (2011). Librarians do it differently: Comparative usability testing with students and library staff. *Journal of Web Librarianship*, *5*(4), 286-298.

Wallace, S., Reid, A., Kang, J.-S., & Clinciu, D. (2013). A comparison of the usability of heuristic evaluations for online help. *Information Design Journal, 20*(1), 58-68.

Yin, R.K. (2008). *Case study research: Design and methods.* London: Sage.

Zacher, H., Brailsford, H.A., & Parker, S.L. (2014). Micro-breaks matter: A diary study on the effects of energy management strategies on occupational well-being. *Journal of Vocational Behavior, 85*(3)*,* 287-297**.**

Appendices

Appendix A: Study Introduction and Initial Questionnaire

Study Introduction for Participants

Welcome to our diary study investigating the technology-based problems you encounter in your daily work environment, and how these problems affect your work efficiency and your patrons. We appreciate your time and thoughtful input, and thank you very much for participating in our study.

We want you to have a firm understanding of what we are considering problems, and what technology we are interested in. We define a *problem* as "anything that slows down or impedes your work or prevents you from completing a task". We define *technology* as "a computer- or Internet-based tool or application used for work".

Examples of problems may include when you search for something in your OPAC or OCLC Connexion and do not get results even when you know there should be results. Maybe you are trying to use Google Hangouts or another video-conferencing tool and you can't get it to connect properly. You may encounter a button in a program whose function you don't understand. Maybe you can't intuitively figure out the way something works, such as a tool in Photoshop. Your problems will probably not be limited to these examples, but it is hoped that these examples give you an idea of what we're looking for.

During the course of this study, we will ask you to fill out a survey at the end of every work day. On the first day of the study period, you will fill out our initial questionnaire as well as your first daily survey. After the first day, you should be filling out only one questionnaire per day. However, it would be very helpful if you could take screenshots of any problems you encounter throughout the day, to be reported in the end-of-the day survey. Please contact one of the researchers (mary.rogers@simmons.edu or alison.fisher@simmons.edu) before you begin if you have any questions. The testing period will last for ten work days starting October 17, 2016.

Initial Questionnaire

1. What is your job title?

_____

2. Please briefly describe your major responsibilities at your job.

_____

_____

3. How many years have you worked at your current job?_____

4. How many years have you worked in your current field? _____

5. How would you describe your skill with technology?

Please circle a number on the scale below.

1	2	3	4	5	6	7

Not very skilled   Very skilled

6. Please list all technologically-based tools you use in your daily work environment.

_____

_____

_____

7. To what extent do technology problems impact on the efficiency of task performance in your daily job?

_____

_____

8. To what extent do technology problems affect your services to patrons?

_____

_____

Appendix B: Daily Questionnaire

1. Please list all the technological tools you used in your work today.

Technology Tools You Used Today Without a Problem	Satisfaction Rating	Technology Tools You Used Today Upon which You Experienced a Problem	Satisfaction Rating

2. For each tool you used today, please rate your satisfaction with the tool on a scale of 1 (very dissatisfied) to 7 (very satisfied). Please input your rating in the above chart.

3. Did you experience any problems in your daily work today?
> [ ] Yes
> [ ] No

4. Please briefly describe your problems encountered today and include a screenshot of issues if possible.

_____

_____

_____

_____

_____

5. For each problem you experienced, please note about how long you expected the task to take in the table below. Then, please note about how long the task actually took. Please report in seconds, minutes, or hours.

Problem	How Long You Expected the Task to Take	How Long the Task Actually Took

6. Please fill out this chart pertaining to the resolution of any problems experienced in your workday today. Put a brief description of problems encountered, and a check in the appropriate column to the right.

Problem	Resolved?	Not Resolved?

7. For each of the problems that were resolved, how easily they were resolved on a scale of 1 (with great difficulty) to 7 (very easily)?

Problem	Ease of Resolution

8. For the problems experienced, what program or tool were you using?

Problem	Tool

9. What was your attempted goal or task when you experienced the problem?

Problem	Task

10. How severely would you characterize your problem on a scale of 1 (not severe) to 7 (very severe)?

Problem	Severity Rating

11. Please rate the impact of any problems you experienced on patrons at your library, on a scale of 1 (not problematic for patrons) to 7 (very problematic for patrons).

Problem	Problem for Patrons?