An Applied Ethnographic Method for Redesigning User Interfaces

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ABSTRACT

Methods for observing software users in the workplace will become increasingly important as the number of people using computers grows and developers improve existing systems. Successful redesigns rely, in part, on complete and accurate evaluations of the existing systems. Based on our evaluation experience, we have derived a set of practical guidelines to be used by designers in preparing for the evaluation, performing the field study, analyzing the data, and reporting the findings. By providing a general framework based on ethnographic research, we hope to reduce the likelihood of some common problems, such as overlooking important information and misinterpreting observations. Examples from our ongoing work with the Maryland Department of Juvenile Justice are used to illustrate the proposed guidelines.

KEYWORDS: Ethnography, Anthropology, Participant observation, Design methods, Redesign, Evaluation, User studies

INTRODUCTION

There is currently great enthusiasm for user interface (UI) research methods in developing new interfaces. These include focus groups, surveys, scenario elicitations, cognitive walkthroughs, controlled experimentation, usability testing and usability reviews (Chin, Diehl & Norman, 1988; Karat & Karat, 1992; Dumas & Redish, 1993; Hix & Hartson, 1993; Nielsen, 1993; Shneiderman, 1992). These methods can be dramatically cost effective in speeding development, improving quality and reducing costs, but in the rich literature on processes for UI research and development it is difficult to find reports about how to evaluate user interfaces by observing users in their workplace. We recognize that Industrial/Organizational Psychology (Muchinsky, 1993) embodies organizational field studies in general but our focus here is on studying the human-computer interface and presenting practical guidelines for UI designers.

Successful redesigns depend, in part, on a thorough and accurate evaluation of the existing system. Vanniamparampil, Shneiderman, Plaisant, and Rose (1995) discusses the effort and outcomes of several reengineering projects. In our research, we have found observation, hands-on experience, and questionnaires to be useful evaluation techniques. The focus of this report is how to successfully evaluate systems by applying ethnographic methods, such as participant observation. According to Muller, Wildman, and White's taxonomy (1993) of participatory design practices, ethnographic methods are one of the earliest techniques that can be utilized in the software development cycle.

As a guide to observational approaches, we explored the ethnographic literature (Hammersly & Atkinson, 1983; Howard, 1989; Pelto & Pelto, 1978; Spradley, 1980) and have attempted to draw parallels, make distinctions, and learn from the methods developed during this century. An "ethnographer participates, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions (Hammersley & Atkinson, 1983)." As ethnographers, UI designers gather insight into the overall context of an organization. UI designers differ from traditional ethnographers in that in addition to understanding, UI designers observe systems being used for the purpose of changing and/or improving the systems. While traditional ethnographers tend to immerse themselves in cultures for weeks or months, UI designers need to limit this process to a period of days or even hours, and still obtain the relevant data needed to influence a redesign.

Today's anthropologists are broadening their research scopes to include cultures found in corporate organizations (Vaske & Grantham, 1989). Based on their own experience, Hughes, King, Rodden, and Anderson (1995) have identified several different uses of ethnography in system design. Early work by Suchman (1983) recommended a new line of ethnographic research for office systems design. More recently there have been several instances where ethnographic methods have successfully been used in the software development process. Nardi and Miller (1990) interviewed several users to understand how spreadsheets are developed. In another study, a manual air traffic control system was observed for the purpose of designing a new electronic system (Bentley, Hughes, Randall & Sawyer, 1992; Hughes, Randall & Shapiro, 1992).

We have used observation techniques in the redesign of several user interfaces (Shneiderman, 1993), including ACCESS, an on-line catalog for the Library of Congress, Corabi's telepathology workstation and the Maryland Department of Juvenile Justice's information system. While several case studies applying ethnographic methods can be found in the literature, we have not found documented methods for how to conduct these evaluations. In this report, we propose a general methodology for applying ethnographic techniques to the redesign of user interfaces.

PROPOSED METHODOLOGY

Successful evaluations should take a system's unique attributes into account. For instance, some systems may only have a single user while others may have thousands of users whose needs are similar (e.g., airline reservationists) or different (e.g., writers or artists). As ethnographers, designers can adapt the method used to accommodate unique situations. Our method uses an iterative approach of continually refining goals and the strategies for achieving them. It is based on principles of participatory design described by Carmel, Whitaker, and George (1993) and Miller (1993):

- Systems should be designed to support the work environment.
- Users are best qualified to determine how to improve their work.
- How users perceive a system is critical to its success.
- Opinions from all users (experts/novices, supervisors/workers) are equally valid.

The goal of an evaluation is to obtain the necessary data to influence system redesign. Unfortunately, it is very easy to misinterpret observations and overlook important information. Providing a general ethnographic framework reduces the likelihood of these problems. Based on our experience, we have derived guidelines for preparing for the evaluation, performing the field study, analyzing the data, and reporting the findings:

<u>Preparation</u>
- Understand organization policies and work culture.
- Familiarize yourself with the system and its history.
- Set initial goals and prepare questions.
- Gain access and permission to observe/interview.

<u>Field Study</u>
- Establish rapport with managers and users.
- Observe/interview users in their workplace and collect subjective/objective quantitative/qualitative data.
- Follow any leads that emerge from the visits.
- Record your visits.

<u>Analysis</u>
- Compile the collected data in numerical, textual, and multimedia databases.
- Quantify data and compile statistics.
- Reduce and interpret the data.
- Refine the goals and the process used.

<u>Reporting</u>
- Consider multiple audiences and goals.
- Prepare a report and present the findings.

These guidelines are presented from the perspective of outsiders evaluating a system. While inside evaluators may require a shorter preparation time, it is generally easier for outsiders to remain objective. To illustrate these guidelines, examples from our work with the Maryland Department of Juvenile Justice (DJJ) are used throughout this report. We are currently under contract with DJJ to make recommendations on how to improve ISYS (Information System for Youth Services), a terminal-based system to support the processing of approximately 50,000 case referrals per year for delinquent youth behavior. ISYS is used by approximately 600 DJJ employees in offices and facilities across the state.

In a six month time frame, we conducted 22 field visits. Multiple interviews took place during many of the visits. Each interview lasted anywhere from 30 minutes to several hours. Prior to the interviews, the Questionnaire for User Interaction Satisfaction (QUIS) was customized to evaluate ISYS and administered to 332 personnel (Slaughter, Norman & Shneiderman, 1995).

Preparation

Adequate preparation can be the key to a successful evaluation. Preparation not only makes a designer more familiar with the intricacies of a system, it also enhances credibility during the field study and promotes productive field visits.

Understand organization policies and work culture.

Learning how an organization operates provides a basic understanding of the user's work environment. This can be initiated by talking with managers and reading organization literature. Annual reports and multi-year plans are useful for getting an overview of the organization and its future directions. Find out how management measures the organization's success, how information is communicated, who is responsible for making decisions, what the policies are for promotion, how employees are motivated, and what the consequences are for not using the system correctly. All of these play a role in how users interact with the system. While management can help in understanding the organization, do not assume that management necessarily knows what is really going on in the company.

Example: The primary ways we learned about DJJ were through discussions with upper management and reading their three year plan. We learned several things that helped us during our field study. First, communication is a big problem for DJJ since its employees are scattered around the state. Another problem we discovered is that most DJJ employees are severely overworked due to the large volume of case referrals. Our research also suggested that motivation and data accuracy might be a problem since DJJ employees were constantly being reminded that "information systems are only as good as the data put in them."

Familiarize yourself with the system and its history.

Before the field study, the designers should become as familiar with the system as novice users. Start learning about the system by reading the available documentation, like the user's guide and any records of user suggestions and/or complaints. Better yet, play the role of a novice user by attending training sessions and getting some hands-on experience. Hands-on experience is one of the better ways to become familiar with a system.

Learn who the designers of the current system were, where they are now and whether there have been prior redesign efforts. Being familiar with previous efforts helps prepare the interviewer for any preconceived notions that employees may have about the current effort. Extra steps may need to be taken to overcome worker skepticism if there have been failures. To avoid the same mistakes, take the time to understand why a particular effort failed. Be sensitive to the fact that the failed attempt might have been undertaken in house by current employees.

Example: To familiarize ourselves with ISYS, first we read the user's guide. This clearly demonstrated to us that the current user's guide does not provide adequate information for a new ISYS user. From our own hands-on experience with ISYS, we immediately found several sources of user frustration, such as the 11 steps required to log in and the numerous breakdowns. From discussions with the MIS staff, we learned about their frustrations regarding outdated software/hardware, limited documentation, no access to the original external implementor, and limited personnel.

Set initial goals and prepare questions.

The goals set the focus of the field study. They might include finding ways to improve data accuracy, increase system usage, or reduce user workload. Keeping the goals in mind, prepare some questions to ask the users during the field visits, such as:

- How long have you used the system?
- How were you trained to use this system?
- What do you think about the organization's policies with respect to the system?
- What do you do with the system? Data entry? Information retrieval?
- How does the system help you do your job?
- What do you like about the system?
- What do you dislike about the system?
- Do you have any suggestions for how to improve the system?

If one of the goals is to improve data accuracy, some additional questions might include:

- Where do you get the information that you enter into the system?
- What do you believe contributes to the poor accuracy of the data and how could it be improved?

Example: In the DJJ project, our initial goals were to improve user satisfaction, increase data accuracy, increase system use, and improve productivity. Our questions were phrased accordingly.

Gain access and permission to observe/interview.

When identifying the users to interview, consider the complexity of the system, the various functions of the users, and the time available. For complex systems, it may be necessary to observe some areas several times. Multiple visits can help resolve contradictions, clarify misunderstandings, and obtain different perspectives. It is easier to decide which areas to observe multiple times once the field study has started. Having a central contact who is both familiar with the system and has a lot of user contacts is essential when studying complex systems. This contact can help coordinate the interviews, ensure adequate coverage of important system aspects, and provide immediate feedback on the findings.

Permission to perform the field visits needs to be granted. Do not assume that all users will want to be observed. Convincing workers that your study is not a threat can be far from easy (Howard, 1989). It helps to explain the goals of the project, what the interview involves, and how the success of the project can benefit them personally. Management can encourage employees to participate by giving them permission to take time from their work schedules. However, participation should be voluntary. If workers are forced to participate, they may not be very cooperative.

Before the field study begins it must be decided whether or not the identity of the users observed/interviewed will be kept confidential. Management may want to hold workers accountable for what is said, while the users may not be as cooperative if their anonymity cannot be maintained.

Example: Because of the complexities of ISYS, having a central contact with a good overall understanding of the system has been critical to our effort primarily due to the fact that different DJJ offices have varying procedures for using ISYS. Our contact has also played a key role in assuring employees that our team was cleared to view sensitive youth records.

Field Study

Performing the field study can be the most rewarding part of the evaluation process. One of the keys to a successful field study is recognizing that workers are intelligent, creative, and productive contributors to the development process (Miller, 1993). Since users are the people most familiar with the system being redesigned, their opinions and insights are invaluable.

Establish rapport with managers and users.

At the start of each field visit, convey the project goals and how they are going to be achieved. As an agent of change, be careful to provide enough information to motivate the participants without being deceptive. Give realistic examples of how the redesigned system could benefit the person in terms of reduced workload, increased satisfaction, and so on.

Taking the time to address any concerns that users have regarding the interview process will help put them at ease. It also helps to emphasize that the objective is to evaluate the system not its users. Users will also be interested in the backgrounds and qualifications of the designers.

Try to remove any obstacles that might interfere with an open interview. This can be accomplished through some "impression management" (Hammersley & Atkinson, 1983), such as dressing appropriately and being familiar with the terminology used. The contact person can be useful in determining the unwritten rules of the workplace. Being familiar with the language used not only facilitates communication, it also conveys credibility. Also, be aware of differences in professional, organizational, and educational backgrounds that might interfere.

> <u>Example</u>: DJJ employees have a strict dress code so we were careful to dress appropriately (instead of wearing our usual jeans) and act in a professional manner. Because we did not learn all the DJJ terminology ahead of time, it became obvious in the initial interviews that we were only able to record what was being said and what was being done. Once we started to understand more of the terminology we were able to be much more active during the interviews.

Observe/interview users in their workplace and collect subjective/objective quantitative/qualitative data.

Various types of data can be collected during the field visits:

- subjective quantitative (results from Likert-like questionnaire items),
- subjective qualitative (impressions of ease of use, opinions about data reliability),
- objective quantitative (number of terminals available, task times, error rates), and
- objective qualitative (type of hardware supported, existence of documentation).

This data is collected by watching, listening, and questioning users. Plan to spend approximately at least an hour for each visit. Complex aspects of the system may require more time. The goal is to spend enough time to get a good overview of how the system is normally used. If the visit is too short, important information may be missed. Subsequent visits can be used to confirm the importance/frequency of findings from earlier visits. A thorough field visit gathers data pertaining to the users, their work environment, and the tasks they perform.

One of the basic principles of design is "know your audience." Begin by getting an overview of the user's daily routine. Inquire about their educational and professional background, including how long they have been with the organization. Learn about the user's experience with computers (e.g., other applications they use, whether or not they have a computer at home, etc.), record how long they have used the current system, and classify how they learned it (e.g., self taught, formal training, peers).

A user's physical work environment directly influences system use. Physical objects in the work environment may hint at inadequacies of the system. Look for things on the walls, like cartoons or instruction sheets, "cheat" sheets, the availability of documentation and their age, paper files, the amount of desk space available, the quantity and quality of the hardware, the lighting, etc. Also, watch for interruptions, like the phone ringing or people stopping by to ask questions.

In order to get a realistic picture of how a system is used, it is important to observe users doing actual work not just performing demonstration tasks. Look for repetitive tasks, evidence of duplicate work (e.g., parallel paper system), problem driven solutions, instances when the system is slow or crashes, and functionalities that are rarely used. Also watch for cases when the user has to make notes to remember something or makes a print out simply to fax it somewhere else.

Several things can be done to promote more productive field visits. Suggest that the users think aloud as they work and encourage them to give honest feedback. Using anecdotes from previous visits helps elicit comments. It may be necessary to reassure users more than once that what is disclosed will not affect their job. Emphasize the importance of user opinions. Users are the best qualified to know what their jobs require and how to improve them. When a person says "I'm not a computer expert so I can't help", explain how the system should be designed for both novices and experts. Also, encourage creativity. Often, users hesitate to share ideas because they think the ideas are unrealistic or too trivial. For users not familiar with the available technology, help by prompting them with questions like "If you could do this, would it help?"

During the visits, try to measure aspects of the system that are relevant to the project goals, such as the frequency and duration of particular tasks, the most common errors, system reliability, etc. These limited measurements can be complimented with automatic data collection that can cover a longer period of time (Shneiderman, Brethauer, Plaisant & Potter, 1989). One possibility is to request that counters be installed in the system. This data can be compared with the user's impressions of the system and to the estimates collected during the visits.

> Example: The majority of data we collected during our interviews was subjective qualitative. We watched users scribble down notes to remember information in between screens, use "cheat" sheets to log in to the system, and pound the keyboards when the system crashed. We also observed frustrated users trying to understand cryptic error messages, numerous instances of duplicate work, and several cases where users entered incorrect data. We recorded the number of times the system crashed, how many terminals were available, and the estimated number of screens used. The field visits also illustrated the role ISYS played in the worker's daily routine.

Follow any leads that emerge from the visits.

Some of the best field visits are often the result of chance encounters. Keeping a flexible schedule allows any leads that come up to be followed up on as soon as possible. Flexibility also allows users to focus on what is most important to them.

> Example: One of the most dramatic interviews we had happened as a result of a chance encounter. We were interviewing someone else when they suggested that we talk to one of their colleagues, so we did. During the interview, we observed the worker doing a routine task which caused the keyboard to lock up. The worker proceeded to pound on the keyboard which caused the system to crash which caused all their work to be lost. The worker got up and left the room disgusted with ISYS.

Record your visits.

It is very important that what is seen and heard during a field visit is objectively recorded. There are several ways in which a visit can be recorded. One possibility is to tape or video record the visit, assuming permission is given. However, recording makes some people uncomfortable. While traditional ethnographers want to record visits in their entirety for archival purposes, designers are more interested in summarized reports. The more suitable approach is to use pen and paper, or possibly a laptop computer. Taking pictures or videos are useful for realistically depicting aspects of the system that are hard to capture in written text, such as the work environment.

It is important to be as descriptive as possible when recording the interviews because the interview notes contain the data needed for the analysis. The contents of the notes can be verified by showing them to the person interviewed, or preferably, to an unbiased system expert.

> Example: In the DJJ project, it has proved useful to jot down notes during an interview and then type them up later in more detail. This approach seems to allow us to better organize our observations plus it helps re-emphasize what we observed. The interview notes have also been a good medium through which to communicate our findings to members of our team who could not participate.

Analysis

Begin analyzing the data collected as soon as possible. Starting the analysis before the field study is completed allows refinements to be made. The guidelines in this section are for a simple, low-cost, rapid analysis technique. Nayak, Mrazek, and Smith (1995) describe several other techniques including affinity diagramming, data visualization, prioritizing problems, scenarios of use, usability specifications, and style guides.

Compile the collected data in numerical, textual, and multimedia databases.

When identifying how to best organize the data, it is important to consider the project goals and how they are going to be achieved. For instance, if statistical information is going to be used to evaluate some aspect of the current system, the numerical data needs to be compiled. The large amount of textual data can be made more manageable if it is organized in categories like scenarios, anecdotes, complaints, and suggestions. Multimedia data, like pictures, videos, and documents, that will influence the redesign should also be compiled (Goldman-Segall, 1994).

> Example: We organized our textual data primarily by complaints and suggestions. Since our primary goal was to improve the user interface, we were careful to separate environmental issues from user interface issues. We also compiled the forms that were filled out manually, as input and output documents, since we were interested in improving data accuracy and user productivity.

Quantify data and compile statistics.

How the data is organized will suggest what needs to be quantified and the statistics to be calculated. The number of times a particular problem was observed or the number of people who made the same suggestion are examples of data to quantify. Later on in the development process, statistics, like the average time to perform a particular task, can serve as benchmarks for measuring the effectiveness of the redesigned system.

> Example: We did not calculate any statistics in the DJJ project. In a few cases, we did count the number of times we observed a particular problem, like users with expired accounts, or heard a particular complaint. In hindsight, it might have been useful to measure the time required to perform some standard tasks, like logging in to ISYS and adding a new case.

Reduce and interpret the data.

Because the interpretation of the data can be used to support the redesign, care should be taken to remain objective. One way around "observer bias" is to provide the chain of reasoning used (Nayak et al., 1995). Having an informant is also helpful. An informant is a person who can help explain those aspects of the system that were not able to be directly observed and can check any inferences that have been made (Hammersly & Atkinson, 1983).

Identify problem areas by looking for common threads in the data. Possible solutions may be found in the user's suggestions. Exploring how information was communicated can also suggest possible design strategies.

Discuss these interpretations with the users. Ask them whether or not the findings make sense to them. The users can provide valuable insight needed to interpret the data.

> Example: From the data, we noted that every single person interviewed complained that the log in procedure was too long. Over a third of the interviewees expressed that they used the system solely for data entry without being benefited personally. Poor communication and training was an another overriding theme. The data indicated that ISYS is the first experience many of its users have had with a computer. Poor access due primarily to a lack of functioning equipment was also identified as a major problem.

Refine the goals and the process used.

As the field study proceeds and the initial analysis begins, the goals of the project and the process for achieving them should be refined. Changes might include the number of users to interview, the questions to ask, the system aspects to focus on, and the types of data to collect. The increased knowledge of the system and its problems allows the interviewers to better empathize with the user's difficulties, suggest possible solutions, and elicit user reactions. This usually allows a more active dialogue between the interviewer and the participants who are more likely to express their ideas.

> Example: Originally, we thought the data was inaccurate primarily because it was not being entered in a timely fashion. After a few visits, we realized that the data inaccuracy problem was also due to duplicate youth records and incorrect data entry. In subsequent visits, we paid more attention to identifying the sources of these two problems. Our primary contact read our visit reports right after the visits and provided clarifications. Our early findings were discussed with users during the later visits.

Reporting

Once the data has been analyzed, the finding should be reported to the organization. Reporting the findings helps keep the organization involved in the redesign process.

Consider multiple audiences and goals.

Multiple audiences will be interested in the findings for different reasons. Management will be interested in learning how their system "measures up" and may use the findings as justification for further action. Some people will simply be curious to hear what was learned. Others may use the report to measure the design teams' understanding of the system.

> Example: When we reported our initial findings to DJJ, our audience consisted primarily of supervisors including the head of DJJ, the executive directors, and one member of the software staff. Since the majority of our audience was not very computer literate, we were careful to use appropriate terminology in our report.

Prepare a report and present your findings.

Findings presented in an objective report allow the audience to draw their own conclusions. Nayak et al. (1995) also suggests presenting the findings in a positive tone to avoid finger pointing. Illustrating specific problems using quantitative data and anecdotal evidence is also helpful.

Presenting the findings is an opportunity to educate the audience about their own organization. It is likely that the audience has not heard everything that will be presented. In the case of large complex systems that are distributed over multiple offices, it is possible that the design team is among the few people with a good overview of the system.

> Example: We tried to stay as objective as possible when we reported our findings. We used anecdotal evidence and specific numbers to emphasize important issues. Anecdotal evidence definitely had a strong impact on the audience. Some of what we reported was already known and some of the information was new. Even reporting information that was already known seemed important to our audience since we were viewed as an objective third party.

INFLUENCES ON REDESIGN

Based on our findings, we proposed 28 short term recommendations to DJJ that required no hardware changes and minimal software changes (Rose & Vanniamparampil, 1994). These recommendations were chosen based on the severity of the problem and the frequency of the complaint. DJJ employees added a few of their own recommendations which indicated that we missed some critical issues during our interviews. It was difficult to decide what fixes to recommend for the current interface while the new system is being developed. For each recommendation, we estimated the payoff and the effort required to implement. Based on these estimations, DJJ decided to take action on all of our recommendations.

Our observations confirmed that several of DJJ's business practices need to be changed. DJJ has created several focus groups to generate process maps of their current business procedures. These maps will be used to evaluate their current procedures and make necessary changes. These changes will directly influence the new system design. DJJ is also investigating their hardware needs as a result of our observations.

We are currently developing three prototypes for their new system and getting feedback from users. These prototypes are in direct response to needs voiced during the interviews. We have shown the prototypes to approximatly 60 DJJ employees ranging from high level supervisors to case workers. Initial reactions have been very positive. We plan on continuing to work with the users to refine these prototypes.

Using an applied ethnographic method has facilitated our design process in several ways. It has increased our trustworthiness and credibility since we learned about the complexities of DJJ firsthand by visiting their workplace. The visits allowed us to develop working relationships with several end users with whom we continue to discuss ideas. Most importantly the users have become increasingly active participants in the design of their new system.

CONCLUSIONS

Ethnographic methods based on principles of participatory design have proven to be an effective tool in user interface redesign. Our method is based on an iterative approach that begins with good preparation. The data needed for analysis is collected during the field visits. The data analysis is started as early as possible to allow refinement of the project goals and the strategies for achieving them. The results are then objectively reported to the organization.

As the number of existing systems grows, so will the number of systems being redesigned. Good designers may also need to become effective ethnographers. Providing practical guidelines for evaluating systems will assist designers in their efforts to perform comprehensive and accurate evaluations in a timely manner.

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