Using participative inquiry in usability analysis to align a development team's mental model with its users' needs

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In this web site usability case study, two methods of participative inquiry are used to align a development team's objectives with their users' needs and to promote the team's awareness of the benefit of qualitative usability analysis. Findings reveal a web site that lacks integration between its components and differences between the team and its users' definitions of a "customer-focused" web site. The study produced an implementation blueprint based on a cognitive-oriented instead of an information-oriented taxonomy. This blueprint guide conveys intangible concepts that the team intuited or observed during contextual interviews and redefines its new web site usability strategies.

INTRODUCTION

Information technology (IT) development teams are interested in understanding their users' needs; however, the general participative inquiry techniques developers incorporate are characteristic of quantitative research, drawing on deductive reasoning methods, in which prior hypothesis or theory is applied to a situation that is integral to their technical disciplines. On the other hand, qualitative research draws on inductive reasoning in which theory, hypotheses, data, and recommendations emerge from the process of inquiry (2), (3). Formal and rigorous qualitative usability analysis stems from the humanities and human sciences, disciplines in which many IT developers are not well trained. Quantitative research techniques should be used to collect some types of data; however, the primary methodology used in a usability analysis study should be qualitative. Whereas quantitative research is focused on the data collection, qualitative research focuses on the data collection *process* (3). Usability analysts study end-users' work processes to determine how tools can become extensions of those processes. Because end-users' work contexts often fluctuate and contain many variables, a usability analyst must be able to adjust the research process in order to collect the appropriate type and quality of data.

Often, as in the case study described in this paper, a usability analysis consultant plays the role of an impartial design mediator. It is the consultant's task to conduct a rigorous and systematic study that engages the development team, management, stakeholders, and users. However, the development and management team, not the usability analyst or the end-users, ultimately judge the validity of findings and design recommendations. As Hackos and Redish (5) observe, "[team members] have sole responsibility for deciding whether or not to … design according to a particular task analysis" (p. 341). If findings and design recommendations are not found to be valid, they won't be implemented. This often results development teams misunderstand the long-term or systemic effects caused by their implementation decisions, and ultimately results in users working with applications that fail to meet their full usability potential. Therefore, usability analysts need to ensure that development teams understand the implications of study findings and design recommendations.

Employing qualitative methods first requires removing obstacles integral to technical developers deductive work practices and mental models. Therefore, it is the responsibility of usability analysts to educate and train IT developers about the effectiveness of using inductive techniques for analyzing tool usability.

Beyer and Holtzblatt (1) recommend building a shared understanding by engaging the development team as participants during the interpretation process that occurs after each interview. However, it can be very difficult to build a common mental model if the development team has little or no experience using qualitative usability analysis. For example, team members may be more inclined to interpret an interview within the boundaries of their shared mental model or their own opinions and experiences to or to over emphasize individual interview outcomes. Determining usability patterns that cross multiple sets requires a broad knowledge-base and deeper analysis that most IT developers are not prepared or trained to conduct.

By engaging in the participative inquiry process prior to the post-interview phase, developers partake in vicarious learning, by personally observing and perceiving their users' challenges, work practices, motivations, and goals. The developers will then be using their own methods of inductive reasoning to collect, analyze, and interpret data. Developers who engage in the participative inquiry process are quickest to buy into and implement design

recommendations. According to Hackos and Redish, "The more personal experience [the development team] have had with users, the more likely they will bring these experiences to bear on the design process" (5), (p. 342).

Although information is lost when context is removed, developers have assimilated some of the information into knowledge. Therefore, the burden of communicating findings and recommendations rationale is reduced. Usability analysts need not rely solely on using verbal or written language to explain users' behavior and perceptions, motivations, and mental models. Instead, they can concentrate on providing a context and framework conducive for developers to apply their inductive reasoning.

THE CASE STUDY

Introduction

In this usability study, a "quasi-soft systems" approach to participative inquiry was used. In soft systems methodology the participants are often members of an engineering team. An outside researcher, often a consultant, works with participants to explore and develop models of a situation in order to develop a plan of action to solve that situation (6). However, in this study, the consultant, although not a member of the team, was a member of the organization and was, therefore, able and expected to draw upon her experiential knowledge of the organization's processes, structure, and culture. Participative inquiry—where actual users are members of the inquiry and design process— was also used to collect data and provide a framework for team participants to exercise their inductive reasoning skills.

The case study's overarching usability objectives were to:

A. Ensure that the development team's design objectives align with its users needs.
B. Educate the development team (and its management) on the value and benefits of using qualitative usability analysis, which draws on inductive reasoning, as a system design tool.

In addition, objective (A) is defined according to these four obstacles which IT developers often overcome.

1. IT teams tend to engage users through the use of quantitative questionnaires and non-rigorous qualitative focus groups.

Both qualitative and quantitative researchers desire to understand the individual's point of view. However, qualitative research studies people and their activities in their natural, real-life settings. In comparison, quantitative methods rely on inferential material and abstract from real life context (2). Usability analysis is primarily concerned with understanding users, their work, goals, and tasks (5). Observing users in action becomes as important as listening to their input. *Truth* emerges only when actions are synchronized with verbal feedback. Memory impediments occur when an individual is asked to reconstruct an action abstracted from the situational context, as when an individual participates in a mediated focus group or completes a questionnaire.

2. IT developers tend to use deductive reasoning to research social interaction issues.

Deductive reasoning produces theory based on prior assumptions. These assumptions may not apply or be relevant to the situation or context to be researched (3). In contrast, qualitative research views theory as process. The data becomes the context from which most hypotheses and concepts emerge and are systematically worked out during the course of the research process (3), (7). Often, IT developers' assumptions on improving usability are based on viewing an application's functional components, rather than their users' tasks. In contrast, users view an application as only one of many tangible and intangible components that comprise their work structures, processes, relationships and experiences. Changing these contrasting perspectives, i.e., comparing "apples and oranges" requires creating a context in which one perspective can be shared by both developers and users.

3. IT teams focus application development on tool functionality and features, rather than on users' tasks and work patterns.

As Landauer (4) describes, "Programmers adore computers, know them intimately and interact with them comfortably. It's hard for them to empathize with the ordinary users" (p. 170). Many IT developers wear two hats: developers and casual users of their own products. However, because their *primary* task is technology development their perception of how users employ a tool often doesn't match up with how it is actually used. In contrast, a user's locus of attention is on performing a task and moving it to the next stage of the workflow. Attention is shifted to the tool's functionality only when it doesn't meet their needs.

4. Many IT teams believe qualitative research isn't rigorous and explicit enough to be taken seriously.

Emergent outcomes are integral to qualitative research. Similarly, IT teams will take qualitative research seriously if they are satisfied with its results and feel that

their study objectives were met. Therefore, this outcome is the aggregate of the other three obstacles.

Background

From July to August 2002 a usability study of a technical organization's business web site was conducted. This would be its third major redesign in four years. The web site provides direct access to over 30 institutionally developed web-based and Oracle business applications, ranging from timekeeping and project accounting, to shipping and receiving. In addition, it provides access to support material ranging from help desk information, application status, training, and other related information. The web site's user community comprises over 5000 individuals that can further be subdivided into multiple user groups.

This business web site is supported by the Institutional Business System division. Different development teams are cognizant over different web site components. The development team participating in this study is responsible for the support material component, while another team—not involved in this study—is cognizant over the web site's primary function, the toolkit page, which provides access to the business applications. The toolkit page is the threshold to the business applications; therefore, it is usually the first place users go when they enter the web site. It is access controlled and structured by user role, whereas the support material component is open to all users. Early in the study it was decided to conduct two study phases to address different information architecture issues. This paper discusses the first phase only, usability of the web site.

The web site development team comprises approximately 10 individuals responsible for the design, development, and maintenance of the web site and support material content. Team member's functional areas include programming, web design, content editing, help desk, and training support.

Pre-interview phase

Team members had limited knowledge of usability analysis. Prior to this study, the team had conducted an informal user survey but had not included their primary user groups. Consequently, the team was dissatisfied with the results and decided to bring a specialist in to conduct a formal usability analysis study.

The web site development team's initial objective was to redesign the web site to meet its top 10 redesign guidelines:

1. Better organization (by role)
2. Self Service /Self Help (Status, training, manuals, downloads, getting started documentation)
3. Place where business and technology merge
4. Help users make best use of the Applications and features and resource process
5. Search Engine/Index
6. Real time support (chat window)
7. Site Map
8. Front door to business Apps.
9. Geared towards the general user
10. Attractive colors and layout (Maximize Real Estate)

This list was presented as the study's baseline; however, it was based on deductive reasoning, included minimal informal user input, and lacked applicable context. Educating the development team on the value of using a different usability methodology and shifting its perspective first requires learning and understanding that team's perspectives. Therefore, the pre-interview phase was devoted to:

- Engaging team members, managers, and stakeholders as knowledgeable and valuable study participants
- Getting team members' and managers' "buy-in" to use an inductive contextual interview method (*IT developers' obstacle 1*)
- Training team members and managers on the value of asking questions devoid of prior assumptions or expected answers as a method of inquiry (*IT developers' obstacle 2*)

Outcomes.

The pre-interview phase lasted approximately six weeks. Team members and managers openly participated in this exploration and scoping phase. Of the ten-team members, five individuals volunteered to provide in-depth information about their users, tasks and application usability issues.

Members readily agreed to conduct contextual interviews, not because they explicitly understood its benefits but because they were dissatisfied with results from surveys they had previously conducted. In addition, an objective consultant (not a team member) would be conducting the study, eliminating bias that might be perceived by team members. In deciding to use qualitative analysis, team members were asked to set aside their list of redesign guidelines and shift their focus to exploring their users' needs.

All members were encouraged to phrase their issues as questions, without answers. However, it has been the usability analyst's experience that many individuals trained in deductive reasoning rarely pose a query without including a solution. According to Glaser and Strauss (3), emergent perspectives are suppressed when a solution as theory is generated by logical deduction from *a priori* assumptions. Therefore, individuals need to feel that asking a question does not reflect their intelligence

level and that asking a question does not require concurrently providing an answer or an assumption.

Throughout this phase the usability consultant reiterated the phrases, "We should ask the users that question" or "We'll find that out from our users." Consequently, team members began to show curiosity in learning from their users, which suggests that they were beginning to tacitly understand characteristics of inductive reasoning.

The web site in its current state would provide an appropriate baseline to evaluate interface design and content. By the end of this phase team members and managers agreed to focus the interview sessions on the following questions:

1. How do users currently use the web site?
2. What content is regularly useful or not useful?
3. How effective is the web site's architecture and interface design?

In addition, the usability analyst hoped these questions would provide finding to her question on how well the web site's support material was integrated with the toolkit. This question stemmed from team members input, the outcomes from the analyst's cognitive evaluation of the web site, and informal user feedback.

For example, if users don't use the support material, is the reason because the web site components aren't well integrated or because the information isn't useful? The analyst felt that if this proved to be an issue, solutions driven by substantiated findings would influence the team more then pre-analyzing the issue.

Interview phase

Ten contextual interviews were conducted, lasting approximately one hour and included an interviewer and recorder. Three individuals from the development team volunteered to participate as recorders. Each recorder participated in two trial interviews and at least three formal interviews.

Only one broad user group would be studied, with the criterion that each user participant must regularly use at least one business application except timekeeping, which is used by all employees. Armed with this information, the development team leader pre-screened user participants. Most user participants came from the business and infrastructure areas of the organization and had no previous contact with the interview team.

From the soft-systems approach to participative inquiry, the interview phase was devoted to ensuring development team participants' locus of attention was on the users work challenges, motivations, and goals. (*IT developers' obstacle 3*)

The recorders were instructed to observe and record non-verbal behavior, paying special attention to verbal feedback contradictions and to submit their notes for the analysis process. The interviewer would record and conduct the interview sessions to meet the usability objectives and, in addition, would conduct in-depth analysis of the data. Recorders were given the opportunity at the end of each interview to ask the interviewee questions. After each session, the interviewer and recorder would generally spend 10 to 15 minutes in an informal debriefing session.

Outcomes.

None of the developer participants were formally trained in usability analysis. The written records confirmed this; many included sparse data from the interview sessions, while others revealed insightful non-verbal behavior observations. During one interview in which three members of the interview team attended (two recorders and one interviewer), one of the recorders asked the interviewee a question that required a yes/no response. Each of the two recorders recorded a different response.

However, from the participative inquiry perspective, producing accurate interview notes was a secondary objective. The interview and debriefing sessions proved to be effective in providing a contextual framework for which developers could apply their inductive reasoning. The interview structure forced recorders to focus on how users interacted with the web site to perform a task, rather than on the web site mechanics. Because recorders had one interview task—to record non-verbal communication and note verbal contradictions—by their third interview, they could quickly identify and articulate contradictions between nonverbal behavior and verbal feedback.

During the debriefing sessions, the interviewer tried not to validate or invalidate data point findings. Frequently, the recorders expressed how the interview sessions confirmed their earlier assumptions on particular web site objectives. During many debriefing sessions, recorders suggested design changes based on findings from up to three interviews. Fortunately, during the study an implementation freeze was in effect or that web site might have been evaluated during a constant state of change. Recorders were also cautioned not to conduct in depth analysis on a few interviews (data points), particularly with other team members and that the full set of findings and recommendations might bear little resemblance to their observations of three interviews. These precautions were meant to introduce, without trying to explicitly describe, the emergent quality that is integral to qualitative research.

During this interview phase, recorders openly, and often enthusiastically, shared their interview observations with

other team members. In addition to vicariously including like-minded team members in the interview process, the recorders were using these non-threatening forums to introduce faults in the team's shared mental model.

Reporting and debriefing phase

The development and management team gathered for an oral findings and recommendation presentation, including rough conceptual storyboards. In addition, a final report was distributed to the team and managers (see Table 1).

Web site objectives	Major findings	Summary of recommendations
1. *How do users currently use the web site?*	Users don't use 75% of the web site	Contextualize content to tools
2. *What content is regularly useful or not useful?*	Users found most content useful but didn't know it was available	Reduce categories from 7 to 3 so that users are more likely to see most content
3. *How effective are the interface and architecture*	Architecture and interface design are ineffective	Architecture and design need to support users' cognitive needs

Table 1: Major findings and recommendations corresponding to the interview session questions.

Outcomes.

During the presentation, recorders were encouraged to share their observations and experiences. Recorders validated many of the findings. While they presented some shared perceptions, their comments revealed many different perceptions. This suggested that the range of interviewed users, their tasks and experiences with the web site had left each recorder with a unique perspective. It also revealed differences in what the recorders paid attention to during their first field study experience.

However, most development team members (including the recorders) were surprised when major design changes were recommended. Generally, the team was not surprised with the findings from question 2 (see Table1); however, most members did not anticipate the findings from questions 1 and 3. The study revealed that although users found most support material useful, they didn't know what was available. In fact, study findings validated the usability analyst's concern that the web site suffered from an integration problem. Results showed that participant users had never accessed 75% of the web site. This and other supporting findings confirmed some team members' (primarily help desk analysts) suspicions of the low web site use. In addition, it helped the team to *see* the web site's two major usability impediments: lack of integration between the support material and toolkit components, and misalignment between its and its users definition of the term *customer focused* web site.

Because of department roles and responsibilities, this development team designed the support material taxonomy while another team designed the toolkit taxonomy. Neither team had considered how well the support material was integrated with the toolkit. In essence, the web site had been structured to reflect the teams' organizational responsibilities, resulting in a disconnected, instead of an integrated site.

In addition, the study provided a different definition for the term "customer-focused", causing the team to shift their cognitive model. The development team had concentrated on providing an information-oriented taxonomy. In contrast, the study revealed a production-oriented and *bridge* web site; users typically spend fractions of a minute on it to access web-based tools from the toolkit page. Users rarely browse the web site to find out what it offers. If they need assistance, they are more likely to call the help desk than to *think* to look through the web site for a solution. Consequently, to be usable, the taxonomy needs to be based on cognitive need, locating information where and when users need it. This requires understanding applicable user and task situations and cognitive factors, determining when an applicable need will occur, and identifying where users expect or don't expect to find the information. In fact, the study revealed that some information would be better utilized if located on a different information communication medium.

Conclusion

The overarching study objective (A) *was to ensure that the development team's design objectives align with their users needs*. As this paper is being published, the web site team is redesigning the web site; rollout is planned for March 2003. To the team, the usability study produced a valuable blueprint that replaced their original redesign guidelines. Their strategy is now to provide a web site that integrates information while supporting cognitive needs. Over 90% of the recommendations will be implemented in the March rollout. Technical issues and resource limitations account for the 10% recommendations that will not be included.

Determining the outcome of IT developers' obstacle (4) is difficult to assess after only one study: *Many IT teams believe qualitative research isn't rigorous and explicit enough to be taken seriously*. During the post-usability phase, the team recognizes the value of user feedback and is very conscious of diverging from its implementation blueprint. However, although usability monitoring will be incorporated into the web design lifecycle, it is during this design phase when the desire to implement new ideas is high, that the team is at its

highest risk of producing a disconnected informational and functional product. Since the usability consultant is now minimally involved, it has become the team leader's responsibility to keep the team on track with the blueprint. In addition, the team also feels that the usability analyst now represents their users' needs. Therefore, a team member can contact the analyst at any time to determine whether a functional implementation will comply with the users' cognitive needs. In addition, the team has requested that the consultant review the storyboards before they complete the web site implementation.

The depth of findings and comprehensive recommendations resulting from qualitative research far exceeded all team members' expectations and had an impact on their cognitive perceptions. To the team, the three products—a written report, an oral presentation, and conceptual design storyboard—have represented a rigorous study with explicit outcomes. However, from the team members' perspective, the most valuable product is the conceptual storyboards; these have become their blueprints and aid them from diverging from their objective. Although roughly depicted, the storyboards support the interview outcomes, while tangibly conveying some tacit perceptions and intangible concepts. In essence, the mockups visually communicate to the team its redefinition of the term customer-focused and its new strategy to produce a web site that integrates the support material and toolkit to meet its users' cognitive needs.

The usability analyst measures the study's usability objective outcomes by the high percentage of recommendations that the development team plans to implement, which exceeded her expectations. In addition, that the team buried and never resurrected or even considered readdressing their original redesign objectives and, finally, that the Toolkit development team plans to use qualitative methodology for the second study phase.

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