Authoring of Help by End-users in an Online Community Network

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ABSTRACT

One of the key features of an online community network is that there is no central management authority; the community members themselves manage it. At the same time, for any application to be complete it must have a useful help system. So, for a community network to be completely run by the members, the task of creating and manipulating help documents must also be handled by the members/end-users. Previous studies about community networks show that extensive volunteer effort is one of the basic characteristics of a community network. Therefore a study about end-user authoring is possible in a community network.

Minimalism is an instruction design method that helps users to learn about the system by performing real tasks. This study aimed at analyzing the possibilities of guiding the end-users to create a better minimalist help document than a more traditional and comprehensive one. The users' performance and preferences were used to compare the two approaches. The study also focused on users' preference to using minimalist help documents versus traditional help documents.

The results indicated that it is possible to guide the end-users to create minimalist help documents. However, no significant results were found to conclude that the end-user authored minimalist help document would be better than an end-user authored traditional help document. The results also indicated that, although significant results were not found, the users seem to prefer a more traditional help, than a minimalist help, for a community network. The implications of the study and recommendations for future work are presented.

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Table of Contents

List of Tables

List of Figures

CHAPTER 1

Introduction

> The user, or, in other words, the master, of the house will even be a better judge than the builder, just as the pilot will judge better of the rudder than the carpenter, and the guest will judge better of the feast than the cook.
>
> \- *Aristotle, Politica*

The introduction of the World Wide Web has provided a new dimension to peer communication and co-operative activities, and having a virtual habitat has become a common practice. This new paradigm of communication has also paved the way to online communities that are created and maintained by people with common interests (Stone, 1991). Instilling full participation is one key goal of a community network. At the same time, for any application to be complete it must attract and encourage new users with a useful help system. For a community network to be completely run by its members, the task of creating and manipulating help documents must also be handled by the members/end-users. This research project explores the possibilities for users in a community network to create help for one another.

1.1 Statement of purpose

The primary purposes of this research were to determine the possibilities of creating end-user authored help document that is guided by the ideas of minimalism, and to compare the subjective reactions of individuals creating minimalist help content to those creating more traditional one. A secondary purpose was to gather subjective reactions to the help documents produced in those two forms.

1.2 Research questions

The study was designed to answer the following research questions:

1. Can end-users be guided to author help document that is "minimalist" versus more "traditional" in character? Minimalist help documents would be relatively brief, task-oriented, and would include support for error recovery. In contrast, traditional help documents would be a comprehensive, feature-by-feature listing of information.
2. If users can be guided to produce minimalist help documents, will they be more positive about the authoring experience than the users writing more traditional help documents?
3. Will end-users who read help documents written by other end-users prefer the minimalist help documents or the more traditional one?

1.3 Rationale

A place-based online community is a virtual representation of a real world community that has geographical boundaries and people with different interests. Because online communities typically do not have a central control mechanism and have extensive volunteer support (Rheingold, 1993), a place-based online community can augment the real world community through contributions of members. MOOsburg, a place-based online community for the town of Blacksburg, has been designed to augment its real world counterpart. It was designed to be a community-run network where the members of the community take the initiative to maintain, modify, and develop the network. Although it is theoretically possible to develop applications that do not need any help (Kearsley, 1988), due to varying user reactions and knowledge, in most cases help is one of the important features in an application. Even though MOOsburg has a simple help document (Carroll et al., 2001) it was created by one of the system developers; it does not exemplify the idea of making MOOsburg a self-sustaining, community-run network.

While designing help, every step must be acceptable, understandable, and convincing in order to obtain the user's cooperation (Microsoft Help Guidelines). Though a technical writer can empathize with the application user's needs and try to provide a perfect help document, a user may be in a better position to provide information to his peers. After all, co-users often experience the same kinds of problems as they learn and use a system. However, there has been no research exploring the case of users as help authors. Recently there has been considerable research about end-user programming. But end-users as authors is a step beyond end-user programming. Here the user has already learned about (or programmed) the system and the focus is on the next step – providing usage information to others.

Beam and Burke (1994) suggest that users should be given some initial training in document authoring and then provided with ownership of the document so that they can modify it as per their needs. They suggest some kind of boot strapping technique to acclimate the user to the authoring process. The article also argues that involving the user in document authoring provides them a sense of full partnership. Full partnership is one aim of a community network, and the idea of prompting the end-users to author help documents seems consistent with this aim.

Though minimalist instruction (Choose an action-oriented approach, provide an immediate opportunity to act, encourage and support exploration and innovation, and respect the integrity of the user's activity) has been found to be useful for users using a simple, non-critical application (Carlson, 1992), it has not always been a preferred approach (Carroll, 1990). In a community network such as MOOsburg, users learn through exploration. Because minimalist instruction has been used successfully to support exploratory learning (Carroll, 2000), it seems an attractive candidate for the MOOsburg system

Studies (Rosenbaum 1998) have shown that even technical writers/ communicators feel uncomfortable with some of the minimalist principles. It would be an interesting observation to see how end-users feel about following those principles. Though Carroll has claimed that there was "no useful distinction between help and training" (Carroll, 1987), a study by Lazonder (1994) concluded that minimalist instruction is an improvement over traditional instructions only during the training phase. Also prior studies (Carroll, 1990; Horn, 1992) showed that the document users sometimes preferred the traditional ISD-type of manuals over the minimalist manual. Because there is no central "management" authority in MOOsburg, enforcing a training session is not likely to be feasible. Therefore, the document should be created as a help and the document authors' preferences between minimalist and traditional approaches should be studied. In addition, the reactions of other users who work with this user-generated help should also be studied.

1.4 Reader's Guide

The remaining portion of this document has been divided into six chapters: review of literature, system study, pre-study analysis, methodology and results. A brief overview of each section follows.

Review of literature: The literature review section, which follows next, examines the current literature for information relevant to this study. It begins by examining community networks, online help, and instruction design strategies and ends with a detailed discussion about minimalism.

MOOsburg Community Network: In this section the history, development, and features of MOOsburg are discussed. The section starts with a brief introduction about MOOs and highlights the key differences of MOOsburg over other MOOs. The section ends with an explanation of the different user interface components in MOOsburg.

Usability and Help Requirements: This section describes the requirements analysis and task analysis done prior to the help authoring study. The user interviews were very helpful in designing the final study.

Methodology: The methodology section first describes the experimental design followed by a description of the variables and measures involved. Then, an overview of the participants in this study is presented. This is followed by the explanation of the authoring user interface and an explanation of the equipments and software used for this study.

Results: The results section gives an overview of the data analyses, including a detailed view of the dependent measures used. Both objective and subjective data are analyzed in detail.

Discussion: In this section research questions are answered followed by the discussion of research implications and conclusions.

CHAPTER 2

Review of the Literature

Because the end-user authoring of help is a new area of research, there was no literature directly related to our research questions. However, several related fields of research were investigated:

- *Online Communities:* The different types of collaborative environments were analyzed to understand their interaction approaches.
- *Online Help and Instruction Design:* Several studies were researched to analyze the principles of instruction design and help design strategies.
- *Minimalism:* The heuristics and issues about minimalism were analyzed.

2.1 Online Communities

Analyzing the literature about different collaborative systems and virtual communities provided insight into the basics of online communities, their limitations and their implications for interaction approaches. MOOsburg is a comprehensive collaborative system, so understanding its relationship to other types of systems helped in selecting the features/functions on which to focus in the help authoring studies.

2.1.1 Collaborative Environments

The introduction of the World Wide Web (WWW) has provided a new dimension to co-operative activities. People in different parts of the world can work together without worrying about the transfer time factor (time needed to mail documents to and fro).

Collaborative systems are classified into three categories: asynchronous collaborative systems, synchronous collaborative systems, and full-functional collaborative systems (Qu & Nejdl, 2001). Because MOOsburg comes under the full-functional collaborative systems category, understanding the characteristics of such systems provides a clear insight into MOOsburg.

Asynchronous collaborative systems: Most of the groupware systems fall into this category. Groupware is software designed to improve the productivity of individuals with common goals or interests (http://computernetworking.about.com). Groupware relies on computer networking to open communications channels among people and to share data. The key activities in these systems are collaborative document management and collaborative document authoring (Qu & Nejdl, 2001). So these systems are also called "document-centric" (Spellman et al., 1997) systems. The advent of WWW with HTTP (Hyper Text Transfer Protocol) as the backbone has paved the base for web-based groupware systems. Web browsers also provided uniform and standard user interfaces for these groupware systems. Some of the powerful asynchronous collaborative systems are Lotus Notes, OpenText and Documentum.

Though the initial web-based systems used HTTP, since it was not collaboration- friendly in nature (Qu & Nejdl, 2001), most of the groupware systems started using proprietary extensions or client-side tools to handle documents. This resulted in poor interoperability with common desktop applications. Some of the key activities and tools (e.g., Shared files) have asynchronous collaboration properties.

Synchronous collaborative systems: These systems support real-time collaborative activities but they do not support the persistence of documents. These systems are also called “session-centric” systems (Spellman et al., 1997), because there is no trace of the collaboration once the session is over. These systems provide features like real-time presence lists to easily find the people that are currently present in that session. Some of the commonly used synchronous collaboration tools are NetMeeting, AOL IM, MSN Messenger, and ICQ. Most of these systems support synchronous activities such as text chat, audio and video conferencing, etc.

Next to persistence, one of the most important drawbacks of these systems is the lack of a uniform user management mechanism, which makes it difficult for the users to create a meaningful synchronous collaboration session (Qu & Nejdl, 2001). Qu and Nejdl also state that some systems (Eriksson, 1994, Trevor et al., 1997) support uniform user management by combining different collaborative systems. But these systems lack uniform user interface. Some commercial systems (e.g., Lotus SameTime, Microsoft Exchange Conference Server) have, to a certain level, achieved uniform user management and uniform user interface by following the standards for synchronous collaboration (e.g., H.323 for audio and video conferencing) (Qu & Nejdl, 2001). The chat tool in MOOsburg has the properties of a synchronous collaborative tool.

Full-function collaborative systems: These systems have combined the features of both synchronous and asynchronous systems and thus provide maximum support for collaboration. Because of the highly sophisticated asynchronous and synchronous collaboration techniques, these systems are hard to realize. Some applications like GroupKit (Roseman & Greenberg, 1996) provide full-function collaboration by integrating different high performance synchronous and asynchronous collaboration environments that were built based on open architectures (Qu & Nejdl, 2001).

In full-function collaborative systems, users can collaboratively manipulate documents at the same time (synchronous, session-centric activity) and they can also view the documents at a later time (asynchronous, document-centric activity). To achieve these effects full-function systems create a sense of place in their environments. So these systems are also called “place-based” systems (Spellman et al., 1997). In these place-based systems, the user goes to a place in the collaborative environment and performs the collaborative activity. After finishing the collaborative activity the user leaves the document in that place in the environment. This document remains in that place and can be viewed and/or accessed by the users (that have permission to manipulate the document) at a later time. Thus place-based systems support collaborative activity by providing a persistent copy of documents that can be accessed synchronously. These systems also can provide a history/log of activities in a place, thus yielding a kind of awareness to the users.

According to Spellman et al., some of the characteristics place-based systems have in common are the following:

Persistent: continue to exist whether anyone is “in them” or not.

Location independent: can be accessed regardless of one’s location

Location transparent: make it possible to interact with anyone without knowing his or her physical location

Stateful: provide a context within which users can interact with selected others and/ or with selected documents (Spellman et al., 1997).

MOOsburg has tools that support both synchronous and asynchronous collaboration activities. Tools such as the whiteboard and the message board, provide full-functional capabilities to MOOsburg. A user can draw in a whiteboard and later another user (with proper permissions) can edit it (i.e., asynchronous collaboration). Also two users can edit a whiteboard at the same time (synchronous collaboration). In addition, the whiteboard is also persistent. Thus the whiteboard is a perfect example of a full-functional collaboration tool.

2.1.2 Community

Because our help authoring research takes place as part of a community network, understanding the basic characteristics of a community was imperative. Literature about virtual communities was researched to find the key differences between real-world and virtual communities, and their implications for collaborative activities.

According to Ogdin, a group or an organization or a party can be called a community if it possesses the following characteristics:

Boundary and exclusivity: some definition of who is a member and who is not.

Purpose: some reason for the community to exist, beyond just 'having community'.

Rules: some limits on community member behavior, with a threat of ejection for misbehavior.

Commitment to other's welfare and/or some responsibility of individual members toward the community.

Self-determination: the freedom to decide for themselves how they will operate and whom they will admit to membership. (Ogdin, 1998).

A real world community is geographically bounded (place-based); based on the culture in that area it has its own rules. People in a real world community form organizations within the community and take responsibility over things. Most of these organizations work independently. However, in a virtual world, some of these characteristics have different definitions; for example, in the virtual world it is hard to define community boundaries. In MOOsburg, for instance, there is no pre-defined “help” group; support for online communities must emerge as a side-effect of usage or as a personal responsibility taken for community development.

2.1.3 Virtual Communities

Virtual communities are communities formed through computer-mediated communications (Jones, 1995). They can be defined as “incontrovertibly social spaces in which people still meet face-to-face, but under new definitions of both ‘meet’ and ‘face’. Virtual communities are passage points for collections of common beliefs and practices that united people who were physically separated” (Stone, 1991). Virtual communities are generally created and maintained by people with common interests. Rheingold (1993) lists the following as the basic characteristics of virtual communities: freedom of expression, lack of central control, many-to-many communication and extensive volunteer effort.

A key issue for virtual communities is, as the name suggests, that they are ‘virtual’ societies that do not exist in real world. So it may be difficult for these communities to create a real sense of community. Because these groups do not have a physical existence, creating an infrastructure for the community could be very difficult. Online communities, in contrast, are the virtual representations of real communities. The difference between virtual communities and online communities is that online communities have a sense of place that exists geographically. The structure of real world community can be easily imported into online community; therefore users will also find it easier to adapt. In MOOsburg, for instance, people might expect to find “help” about town services at the virtual town hall, simply by analogy to the real world.

2.1.4 MOO

A MOO is a multi-user domain (MUD) object-oriented system. MOOs are internet accessible, text mediated virtual environments well suited for collaborative activities. In a MOO the user can construct spaces and objects and write code to extend the functionality of these virtual spaces. In this sense, MOOs are constructed social spaces in a dynamic process of continual evolution.

MOOs can be described as groups of interconnected spaces, or "rooms", within which multiple individuals can meet and interact. Movement from one room to another room in a traditional MOO is possible by typing in cardinal directions (“go south”), or via "teleporting", which allows the user to immediately go to rooms not adjacent to his/ her present location (http://moolano.Berkeley.edu). Because of its simulated physical structure, a MOO can be used in support of an entirely virtual community (e.g., LambdaMOO, Curtis, 1992), or an online community (e.g., MOOsburg, Carroll &Rosson, 2001).

2.2 Online Help and Instruction Design

Several studies of design and use of online help systems were researched. The research of user’s learning/performance methods was used to select evaluation parameters for our study. Differences and similarities between documentation, tutorial, and help were analyzed. Many of the reviewed articles stated that there was no significant difference between an online tutorial and online help. This proved to be an interesting issue.

User documentation for software systems might include tutorials, reference, and training manuals, links to information databases, web pages, and online help systems. Brockman (1986) suggested that “manual-less” software would be in common use by the year 2000 because software would become increasingly intuitive. Though theoretically it is possible to design computer applications in such a way that no help document is needed, it is hardly possible to develop such an application because each user is different (Kearsley, 1988). Each individual reacts differently to a program based on factors such as computer background, task experience, assumptions and expectations about the program, reading speed, attention span, learning style, etc. Building a "safety net" (Kearsley, 1988) for the application improves the usefulness of the application.

Pratt suggested that online help could be used to teach new users how to use software, an instructional role typically reserved for tutorials and training manuals. Several publications have been released to provide general and specific guidelines for producing online documents and for providing specific emphases on the technical aspects, standards, and conversion from paper media to digital (Brockman, 1986). A prevailing assumption in these publications is that the same guidelines can be applied across the various forms of online documentation (both informational and instructional).

2.2.1 User performance and learning

Research in the field of cognitive psychology has articulated several principles about human behavior with respect to users who are learning and performing tasks. Some of the principles are the following:

- Over a short period of time, a normal person's memory is limited to remember about seven things.
- People tend to relate their learning experience to what they already know.

- If the object being learned is similar to something already known, the familiar knowledge may "interfere" with the new.
- While solving a problem, breaking it into smaller parts produces better results. (Kearsley, 1988 p.50)

Based on these principles, Kearsley has come up with a list of assumptions about the situation in which users may need help when learning or using instructive software:

- Any sequence or screen that requires the user to remember or attend to more than five items simultaneously is likely to need help.
- Any complex sequence or program that is learned in a single session rather than across multiple sessions is likely to require help.
- Any program that works significantly differently from the way a task is done manually or the way other programs work is likely to need help.
- If different functions in a program resemble each other but work differently (or similar functions do not resemble each other), help is likely to be required.
- Any program that combines a number of steps together instead of allowing the separate steps to be completed individually is likely to require help.
- Displays or commands in which the exact format of the information is more important than the content are likely to need help.

Merrill's article (Merrill, 2001) about "First principles of Instruction Design" is consistent with Kearsley's proposed principles about human learning and performance. Merrill also emphasizes that learning is facilitated when learners are engaged in solving real-world problems. He argues that providing the learner with a solvable real task or problem will be more effective than stating abstract learning objectives. While discussing instruction strategies, Merrill states that the student's (i.e. learner's) learning style is not as important as the instructional strategy (Merrill, 2000). He discusses the content-by-strategy approach of Gagné (Gagné, 1979) and states that regardless of the learning style of the student, when the goal of the instruction is consistent with the strategies used to teach the goal, then learning is optimal (Merrill, 2000, p.4). Merrill concludes that

> If a learner (whatever the context of learning) does not engage in the learning activities that are appropriate for, and consistent with, a given kind of knowledge or skill then there will be a decrement in the learning effectiveness, efficiency, and appeal.(Merrill, 2000).

Gagné also concurs with this opinion in his statement that "[w]hen goals are matched with societal needs, the ideal condition exists for the planning of a total program of education" (Gagné, 1979, p. 56).

2.2.2 Help systems

Kearsley (1988) argues that a help system is more important than documentation or training, because documentation is not conveniently available and training might not have been completed or might not have been very general in nature.

These issues are handled by online documentation and training programs and they can be used interchangeably with online help systems. Kearsley suggests that a user may need help for a specific operation, need an explanation of how an application works, or may want to learn about using the application. Because the difference between online help, documentation, and training is a matter of the user's purpose (Kearsley, 1988), he argues that documentation authors should not distinguish among them.

Kearsley cites Relles's (Relles, 1979) experiment that demonstrates that the availability of online help increases the confidence of users that they could use a system without a manual. Another study (Cohill & Williges, 1985) with 72 novice users showed that user-initiated help requests were more useful than system-initiated helps. This result shows that the user's actual needs and the system's guess about the user's needs may not match. Further, studies by Magers (1983) and Borenstein (1985) have shown that a well-designed online help system can be effective even with novice users and also more productive than offline help.

2.2.3 Instruction architectures/ strategies

Four different instructional architectures are suggested by Clark (1998). They are receptive instructions, directive instructions, guided discovery instructions and exploratory instructions. In receptive instruction architecture definitions and examples are provided to facilitate the understanding of the student. But the student is not given any practice. In directive instruction architecture, in addition to definition and examples, the student is provided with proper practice. Receptive and directive architectures are best suited for novice users. Guided discovery instruction architecture is similar to a computer simulation that helps the student learn about the system by manipulating it (Merrill, 2000). This architecture is best suited for frequent users who do not have much expertise with the system. In exploratory instruction architecture the learner is provided with a variety of means of help and the onus of finding the correct approach is on the learner. Exploratory instruction architecture is well suited for expert users.

Gagné (1979) stresses the importance of self-instructing and self-learning. He claims that "any or all of the effects of instruction may be put into effect by the learner himself when he is self-instructing" (Gagné, 1979, p. 152). He states that exposure to various learning activities increases the capabilities of a self-learner, and self-learning characteristics become more prominent with age.

2.3 Minimalism

Because minimalism was a central feature of the authoring studies, several studies about this instructional model were reviewed. The basic principles of minimalism and the pros and cons of the minimalist approach (cited by several researchers) were analyzed. Research on self-study manuals was analyzed in detail to understand the user's reaction to minimalist documents.

Carroll's books, *Nurnberg Funnel: Designing Instructions for Practical Computer Skill* and *Minimalism: Beyond the Nurnberg Funnel*, provided the basis for research on minimalism. However, because most of the articles in these books are about manuals and simulation software, other articles were also used to aid in the application of the principles of minimalism to online help. Such articles were comprised mostly of research on computer-based instruction/training.

Minimalism was first introduced in the early 1980s (Carroll, 1984) and since then the technical documentation communities have examined its application to user documentation. Microsoft has adapted minimalism in its help documentation process and it has become one of the key instructional design methods.

According to Carroll:

> The key idea in the minimalist approach is to present the smallest possible obstacle to learners' efforts, to accommodate, even to exploit, the learning strategies that cause problems for learners using systematic instructional materials. The goal is to let the learner get more out of the training experience by providing less overt training structure. (Carroll,1990, p.77):

Minimalism was developed by Carroll and his colleagues at the IBM Watson Research Center as a "less is more" approach to address problems users encountered while learning a new software application via self-instruction. Minimalism was presented as a contrast to the traditional instructional systems design (ISD) approach proposed by Gagné (1985) and used by most instructional designers in the development of training materials. Carroll argues "the ISD process is designed with little consideration of the learners and no consideration for the context within which learning will occur" (Carroll, 1990, p. 74). However, both minimalism and the ISD process prescribe an iterative design based on analysis of user needs, learning environment, and content/tasks to be learned (Horn, 1992). Carroll argues that in the ISD process, the task is broken down into very small and detailed sub tasks that are sandwiched between lengthy descriptions and explanations (Carlson, 1992; Hallgren, 1992). In contrast to this approach, Carroll suggests providing users with just enough information to learn the application as they solve their own problem tasks with the system.

2.3.1 Minimalist principles and heuristics

The presentation of the specific principles of minimalism has changed over the years. The listing by Van der Meij and Carroll condenses minimalism into four principles and eleven "heuristics":

- Choose an action-oriented approach.
- Provide an immediate opportunity to act.
- Encourage and support exploration and innovation.
- Respect the integrity of the user's activity.

Table 1. Minimalist principles

• Anchor the tool in the task domain. • Select or design instructional activities that are real tasks. • The components of the instruction should reflect the task structure. • Support error recognition and recovery. • Prevent mistakes whenever possible. • Provide error information when actions are error prone or when correction is difficult. • Provide error information that supports detection, diagnosis, and recovery. • Provide on-the-spot error information. • Support reading to do, study, and locate. • Be brief; don't spell out everything ("slash the verbiage"). • Provide closure for chapters.

Table 2. Heuristics for minimalist approach

2.3.2 Issues for minimalist instruction

The main problem with minimalism as an instructional model is that there are no specific application guidelines for *how* to implement the principles and heuristics. Though there has been strong criticism about not providing any guidelines (Hallgren 1992), Carroll has not been inclined towards prescribing a specific method for creating instruction. He argues that a "check-box mentality" would work against the user-centered design goals of the method.

Without specific "how to" guidelines, practitioners are left on their own to implement minimalist principles. Farkas (1993) suggested that balloon help, especially with a "layering" or "filtering" option for providing different levels of balloon help for different needs, is an implementation of minimalism. Brockman (1990) proposed that adopting the minimalist philosophy, using five tips and four case studies should be part of the first step in the documentation process. Boggan et al. (1996) integrated what they believe are the applicable minimalist principles throughout their guidelines.

Practitioners on the HATT (a 'yahoo groups' community for Help Authoring Tools and Techniques) listserv suggested that they would advise minimalism only for users who are familiar with the system. This brings up another issue with minimalism, namely that it is targeted toward one type of learner (relatively confident and self-directed) and may not provide the flexibility necessary to reach a spectrum of learners with varying degrees of experience. Carlson et al. (Carlson, 1992; Horn, 1992) argue that minimalism is good for an independently exploring learner/ user using a simple, non-critical application, but is not applicable for all types of learners in all types of situations. Jansen (1994) says that "manual-oriented subjects were often confused by the deliberate incompleteness of the instructions and by the absence of introductory sections." (p. 236). Even Carroll reported that some of his experimental subjects complained that they wanted the structure of a self-instruction manual (Carroll, 1990). In another study, Carroll had to provide his experimental subjects with a typical ISD-type of reference manual to complete the experiment (Horn, 1992).

Minimalist instructions can support guided exploration, which is a self-discovery type of learning. According to Clark (1998), guided exploration is best suited for intermediate users, and may not be very effective for novice users. Brockman (1990) says that the self-discovery type of learning is less predictable and may result in shallow learning. Brockman also argues that users normally lack the prerequisite knowledge about the system and background knowledge to set effective learning goals. Furthermore, slashing the verbiage (the usual presumption about minimalism) could make the document useless as a guide for novices. Rosenbaum's (1998) survey of technical communicators who had taken a minimalist course revealed that practitioners were uncomfortable with the minimalist principle to specify information incompletely. One of the drawbacks of this study was that most of the practitioners who participated in the study had neither the time nor the budget to implement iterative testing. Thus they had to rely on their own heuristics deciding on what information to leave out and what to include. In another study, Draper (1996) identified conflicting purposes of minimalism: task completion (job aid) and learning (tutorial). The lack of detail could be frustrating to users who lack the prerequisite knowledge.

2.3.3 Self-study manuals using a minimalist approach

In a research aimed at producing a more refined set of minimalist principles, Lazonder (1994) conducted a series of four tests on the principles of minimalism. In his first experiment he compared minimalist and traditional training manuals. His results confirmed that minimalism is very useful in designing instructions for software applications. But it was effective only during the training phase of the experiment. In fact, quantitative measures showed that users were able to complete the task more effectively with the traditional manual than with the minimal manual, though the difference in the measures was insignificant. The test also revealed that novice users required more time and were less successful, less capable of recovering from errors, and less efficient at transferring knowledge than more experienced users.

Lazonder's second test was designed to analyze the effectiveness of error information for detecting, diagnosing, and correcting errors. This test did not provide any statistically significant results about handling errors. So he followed up this study with the third test to see if new users made enough errors in learning the software to warrant further study of error information. This test calculated that 25% of user actions involved an error of some sort. Lazonder's fourth experiment was a modified version of the second test (error information) where the manual contained clear headings and error information was faded gradually. Error-prone tasks were removed from the test and only the immediate performance values were noted. In this test, although there were some statistically significant differences in speed and quantity of detected and corrected errors, there were no statistically significant differences between the minimalist and traditional manuals during the test. Lazonder concluded, "Subjects from both conditions were equally skilled at detecting and correcting their own errors".

In Lazonder's first test subjects used the training manuals during the assessment phase. This caused the test to evaluate the ability to complete the basic tasks using a minimal manual rather than the ability to learn tasks with it. Immediate performance tests assessed the ability of users to recall and apply procedural information from short-term memory, but did not assess the more practical issue of remembering the information beyond the initial training. Although in a normal work environment retaining information over the course of time is more important than immediate usage, there were no statistically significant differences in measures between the immediate and delayed post-test.

2.3.4 Other studies and results

A study by Warner (1989) showed that subjects using training manuals with low verbiage completed their tasks more quickly, and had less anxiety while performing the tasks. Subjects using the training manuals with learning activities distributed throughout the lesson scored higher on the performance achievement test and had less anxiety. But the subjects using the training manuals with high verbiage had a more positive attitude toward the learning experience than the subjects using a low-verbiage manual. His study also reported that providing the practice activities at the end of the manual was more effective than providing the practice activities throughout the manual.

A study by Carroll (1995) reports that subjects using a minimal manual completed tasks 40% faster than subjects using a traditional manual. However, others have claimed that minimalism is not an effective approach at all times (Jansen 1994). For the most part these studies focused on the minimalist approach applied to training manuals, not in online help systems. The application of minimalist principles to online help systems (as proposed in this masters thesis) is a relatively new area of research.

Carroll (1987) stated that there was “no useful distinction between help and training”. He suggested that the hypertextual nature of online help made it an effective media to provide different levels of detail for different users. One of the key advantages of hypertext media was pointed out by Farkas (1993) in his research on layered help structures. He suggested providing different layers of information to support different user needs. The layering approach is also based on the guided exploration approach that is followed in minimalist manuals. Carlson (1992) also accepts layering as a modification of minimalism to address different types of learners, referring to it as “intelligent hypertext.” She suggested an intelligent system that would decide on the amount of information to be present, by learning from the user’s prior actions.

In summary, the minimalist principles are aimed at providing a self-instruction type of manual to the user. Though there has not been much research on the effect of minimalist principles in online help, the research about paper-based manuals has provided a number of insights into the approach and its pros and cons.

CHAPTER 3

The MOOsburg Community System

MOOsburg is a place-based community-oriented multi-user domain. It is a real-time place-based model for community interaction (Carroll et al., 2000), created to enhance the Blacksburg Electronic Village (BEV) – an online community network for the town of Blacksburg located in southwest Virginia.

3.1 MOOsburg Overview

According to Carroll and his colleagues (Carroll et al., 2001) the initial purposes of the MOOsburg project were to study the creation and use of the MOO concept in a community and to support end-user programming to improve co-operation and commitment in the community. MOOsburg seeks to support the activities of the residents of the town of Blacksburg and surrounding area. Thus Carroll states that MOOsburg is not merely spatial; it is *place*-based and *community*-oriented.

More than 90% of the Blacksburg population, over 30,000 people, have network access and the town has over 150 community groups and more than 400 local businesses that maintain web sites (Carroll et al., 2001). There are many unique community activities, such as a senior citizen's on-line nostalgia archive (Carroll et al., 1999). The population in Blacksburg makes extensive use of the BEV (Blacksburg Electronic Village) web site for online surveys and information sharing. Being a website, the BEV provides only information about the different organizations and communities; it does not provide any spatial sense as to “where” these organizations are located in Blacksburg. In contrast MOOsburg provides a spatial view of these elements; for example, library services are “at” the library, and school activities are “at” the schools (Carroll et al., 2001).

A variety of organizations and user communities, that include members of various age groups and social status, may use MOOsburg for their activities. The original MOOsburg system had a broad spectrum of users: 18% of users were female, and 43% were non-college students (Carroll et al., 2001). Though the groups in the community have different goals, because they share community resources such as buildings (schools, library, etc.,) or other infrastructure, or the time and expertise of community participants, dependencies do exist between many groups (Carroll et al., 2001).

Carroll claims (Carroll & Rosson, 2001) that “the success of community network depends on genuine motivation and individual initiative taking. Since community residents are not paid for participating, participation itself must be a reward” (p. 726). Innovative development within these systems usually occurs within a single, semi-autonomous pocket of the user community, initially serving local interests and needs. A key objective of the MOOsburg project is to promote such efforts for community improvement.

3.2 History of MOOsburg

The first MOOsburg was created as a course project in Fall 1995 at Virginia Tech. The goals of the project were to increase collaboration within the BEV and to provide a spatial view of BEV. At the time, the BEV included asynchronous collaboration support media such as email lists, newsgroups, and web pages, but there was no synchronous communication channel. In the first few months, MOOsburg attracted several hundred users, and a variety of collaborative activities.

A typical MOO has a sharp distinction between ordinary users and expert users (Carroll et al., 2001); ordinary users just manipulate already existing objects but expert users can create new objects. In MOOsburg this difference was completely removed from the beginning. Except for a very few administrator functions, such as the power to remove user accounts after persistent misbehavior, all users were provided with equal rights.

Because no single organization is the owner of MOOsburg, it grew through the collective interest of various organizations and communities that were interested in the project. Early MOOsburg users initiated activities that attracted the cooperation and participation of others. The interest shown by the initial users also provoked the new users to engage actively in collaborative activities. For example, members of the Science Fiction and Fantasy club had a regular online meeting in a MOOsburg pub. Residents of several Blacksburg neighborhoods built their own homes in the MOO, so much so that a community steering committee was formed to manage MOOsburg real estate (Carroll et al., 2000). People with programming expertise and community interest started developing objects of their own that would help them in using MOOsburg more effectively. Students at Virginia Tech also used MOOsburg for their projects and because most of the projects involved community members as clients, use of MOOsburg became widespread. Former residents of Blacksburg logged in from places as far away as Australia to stay in touch.

Later a web interface for MOOsburg was created using the CupOmud Java client for real-time communication (http://www.du.org/java/CupOmud). MOOsburg was presented in a framed multi-pane web user interface, but retained the normal real-time functionality of a text-only MOO (Carroll et al., 2000). Use of Java was very successful because of the diverse computing platforms used throughout the community. Support of Java by popular web browsers enabled the users to use the MOO, eradicating the necessity to install new software components. Users were able to access existing BEV Web pages, but now via the MOO location to which they refer; they could meet and interact with other users as they visited these places.

MOOsburg's new graphical user interface was improved over the next years by adding new and useful components to it. An interactive map was designed to provide spatial orienting information and hyperlink navigation. Images were also associated with locations in the MOO. For example, one could “walk” down Main Street by repeatedly moving north or south and see characteristic views of the center of Blacksburg (Carroll et al., 2000). The graphical interface was attractive and engaging to many of the community groups. Different organizations were interested in developing and using different objects. For example, the town wanted to run their bimonthly forum using the MOO instead of a chat. They were particularly interested in the MOO slide projector object that they saw as a convenient display for maps and plans under discussion by committees and residents. The public library was interested in developing a collaborative story-writing tool for the children's reading room in the library’s MOO site (Carroll et al., 2001). Thus the graphical web-based interface has played a key role in motivating the users to build and use such objects.

The outcome of previous projects has underlined the importance of community network services that encourage interaction with local features and issues, and improve collaboration within the community. MOOsburg was designed as a novel collaborative environment by involving community groups. The direct representation of community activities has helped in developing the infrastructure based on realistic usage scenarios.

3.3 Participatory Development of MOOsburg

MOOsburg application development is fundamentally community and end-user oriented. The ultimate goal of this project is to provide a self-sustaining, community-run collaborative environment. But, for the moment, MOOsburg development has been bootstrapped with participatory design methods (Carroll et al., 2000). Several community groups interested in MOOsburg have been involved in the participatory design. The resulting user community is very different from business or workgroup populations. Some of these groups have a strong, closely knit structure and some others are pretty fluid.

The diversity of user communities and the constantly varying nature of many of their members demand diverse but focused applications and environments. For example, one of the projects is a virtual museum service in MOOsburg for the local natural history museum. In the museum project, a major goal has been to use MOOsburg activities as an enhancement to the "real" museum (Carroll et al., 2000). The basic difference between the MOO based virtual museum and the museum website is that a sample database of the museum is presented in the virtual museum and instances (copies) of the database can be placed at other places in MOOsburg. This feature increases the accessibility of the database and the user need not be present "at" the online location of the museum to view the contents. Also keeping a copy of the museum database at a place will implicitly tell the visitors that the owner of that place is interested in science and thus help people with the same interest collaborate on science investigation.

Two other groups that have participated in the project with enthusiasm are the BEV Seniors organization and the League of Women Voters. Though the members of these groups are very much involved in this project, the groups themselves meet only on special occasions.

Because most of the seniors have limited physical abilities, developing special tools for them (e.g., a magnifying lens to read text without much strain) could become an important issue; this would lead naturally to an increase in the features of MOOsburg.

One of MOOsburg's key goals is to integrate community information and activities within a single shared infrastructure (Carroll et al., 2000). Thus, it is assumed from the start that groups will be interested in integrating existing systems that are already a part of their practice. The distributed architecture of the MOOsburg system was designed explicitly to support such efforts. A good example is the museum specimen database described earlier.

The diversity of the user communities implies diverse goals and motivations for the users of MOOsburg. However, unlike business situations, the motivation for using MOOsburg must be largely self-developed. There will be no external salary or reward system to facilitate use of the system (Carroll et al., 2001). Rather, local innovations, interests, and existing programs and resources are emphasized to drive MOO development and use. Members of the League of Women Voters may wish to create, organize, and conduct on-line meetings or forums with political candidates. Teachers may wish to create interactive displays for student work. The motivational strategy is to blur the distinction between users and developers by providing user communities the ability to create, modify, equip and populate virtual spaces for their unique purposes and needs (Carroll et al., 2001). This leads to a natural blurring of the distinction between content developers and associated help or support authors.

3.4 MOOsburg interaction components

Because it is a community network with all users having the power to create their own tools, MOOsburg has been an ever-evolving system. But there are a few key components in

MOOsburg that are extensively used by most users. Explaining the structure of the user interface of MOOsburg may provide clear insight into it.

3.4.1 Inner windows

The MOOsburg user interface is a container window with five inner windows and an evolving set of tools (see Figure 1).

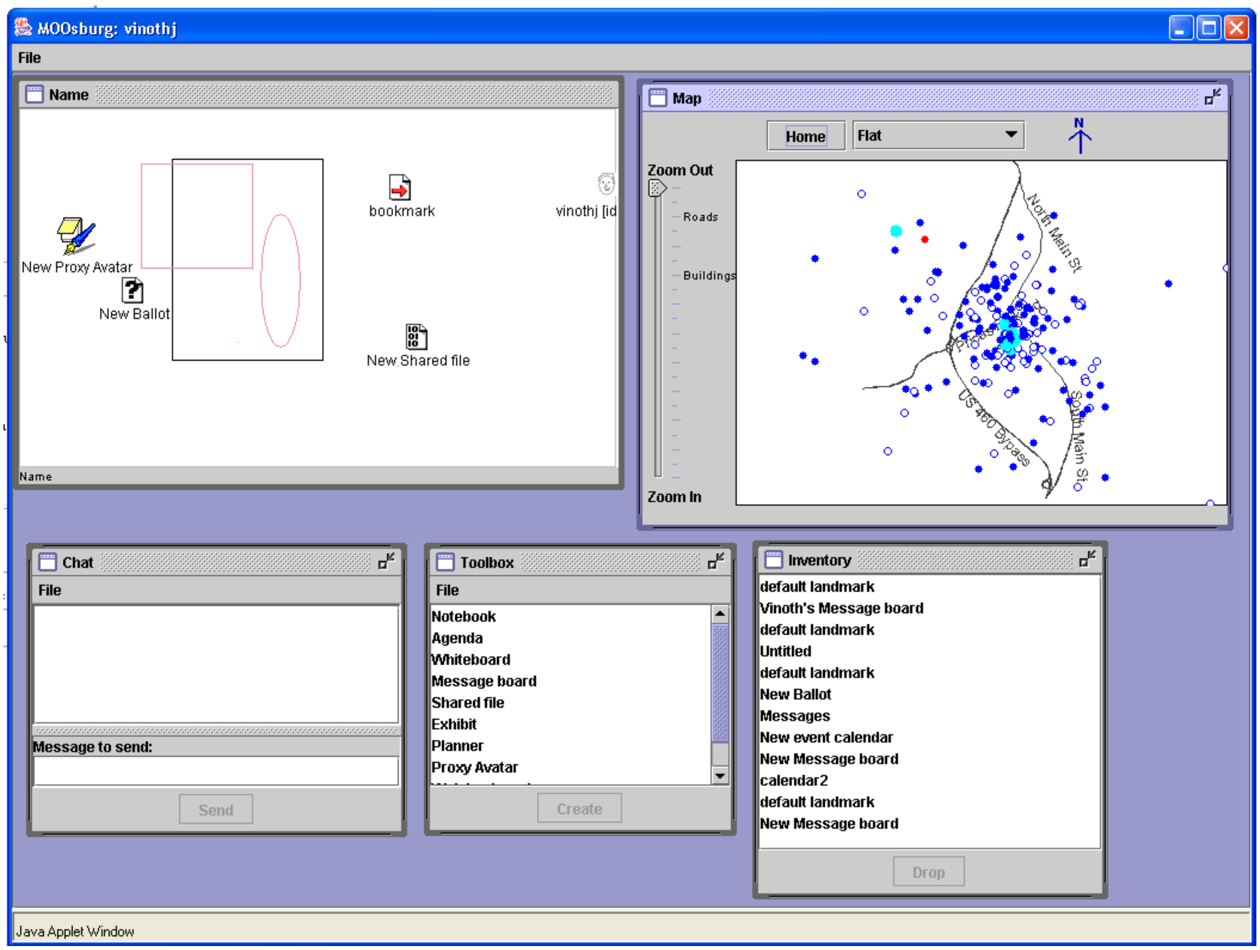

Fig 1. MOOsburg user interface

Map window: The map window (upper right in Figure 1) contains a zoom-able map of Blacksburg. The map can be zoomed-in or zoomed-out by using the vertical scroll bar on the left side of the map. When the MOOsburg application loads, the map is completely zoomed-out. The scroll bar has markers that help in viewing the roads or buildings on the map. The name of a landmark is shown (near the mouse pointer) when the mouse is moved over that landmark. Similarly the name of a road is displayed at the bottom of the window when the mouse is moved over the road. The map tool provides five different views of the map: flat, parabolic, hyperbolic, arc-tan, and parabola-like. User studies have shown that most people prefer the familiar flat view.

Landmark window: The landmark window (upper left in Figure 1) shows the landmark that has been selected through the map. This window shows the landmark's background image (drawn or uploaded by the owner) along with the tools present in that landmark. The landmark's name is displayed on the top portion of the window and the description of the landmark (if any) is displayed at the bottom. Icons of the users that are present at the landmark are also shown.

Chat window: The MOOsburg chat system supports only public chat, i.e. users present at a landmark can all view the chat log at the landmark. The chat window has two text areas; one to type the text and the other to view the chat log. When a user is typing in the chat window, a bubble pops up near the user's icon and displays the text being typed by him (similar to the cartoons in the newspaper). This also helps the users become immersed in the system.

Toolbox window: This window contains the names of tools that can be instantiated and placed in the landmarks. Some of the standard tools that are listed are the following: Whiteboard, Message board, Shared file, Planner, Web bookmark and Ballot.

Inventory Window: This window acts like a temporary storage place. When the user wants to move an object from one landmark to the other, he or she *takes* the object from its current location. This action will place the object in the inventory window. Then the user can go to the landmark to which the object has to be moved and then *drop* the object from the inventory window.

3.4.2 Tools

Some of the widely used tools are explained below.

Whiteboard: A white board is a simple drawing application with collaboration support. Lines, rectangles, ovals, free-hand drawings and text are supported in the whiteboard.

Message Board: A message board displays the messages with the time they were posted. This tool acts as a discussion forum; users can have different message boards for different issues of interest.

Web bookmark: A web bookmark is similar to a hyperlink in a web page. This tool acts as a bridge to the World Wide Web from MOOsburg.

Shared file: Users can upload text or html files to MOOsburg using this tool. When uploading a file, a copy of the file is saved in the MOOsburg database and this can be accessed at a later time. This is similar to placing a file in a web server and accessing it using the URL.

Planner: This tool is used to organize project activities. Using this tool the users can specify project deadlines, add sub-tasks, and update and monitor project status. The progress can be viewed as a gant chart.

Ballot: Because MOOsburg is a community-oriented system a tool to obtain the views of community members on various issues is an important system offering. Using the ballot tool, the user can generate a question of interest and provide up to 10 choices. The results of the survey can also be viewed with this tool.

3.4.3 Spaces and places

A location created by the user in MOOsburg is either a "place" or a "space". MOOsburg has a hierarchical design of places and spaces. A space is a container that contains other places and spaces. In the map window a space is denoted by a open circle. A place is a visible location that is shown as a filled circle in the map. This is analogous to the familiar hierarchy of files and folders, where folders contain other files and files are the actual documents. Because a space can contain multiple spaces or places, the space has a specialized map feature using which the location of other spaces and places in that particular space can be specified. This map object has a simple whiteboard editor, with which the user can draw the plan for the map. When a user enters inside a space, the map window changes to show the map (that was created by the owner) of the current space. The Blacksburg map is iconized and shown on the top left corner of the map window. The user can move around the current space by selecting places or spaces in the map (as he or she did in the Blacksburg map). Whenever the user wants to go to another place or space in the main map, clicking on the Blacksburg map icon will show the Blacksburg map and the user can select a different location.

3.5 Authoring in MOOsburg

Support for end-user authoring is the key feature of MOO technology that makes it well suited for community computing. In traditional MOOs, the interaction is mainly text based and these text-based environments could be used only after learning the vocabulary for that MOO. This restriction of text-based MOOs hinders end-user authoring to a great extent. The MOOsburg interface alleviates the restrictions posed by the textual interface. The graphical user interface of MOOsburg attracts users by providing the geographical view of the town of Blacksburg and thus reinforcing the sense of community.

Users can go to different landmarks or create new landmarks using the map. The landmarks can be named (e.g., "Blacksburg High School") so that it will be easy to recognize them in the future. The users can also create custom maps or floor plans for their spaces. The positioning of a landmark can also be moved in any direction by "nudging" it.

By default all the objects in MOOsburg are open to be viewed and manipulated by all. However, while creating an instance of a tool, the creator of the tool can assign security permissions to the tool so that not everyone can access it in the same way. The user can even create his/her personalized object and hide it from all other users. If access has been granted, a user can move an object from one landmark to another landmark. This feature enhances activities similar to real-world tasks such as carrying a photo album to a friend's place.

Because MOOsburg objects are replicated and shared through CORK (Isenhour, Rosson & Carroll 2001), they support both synchronous and asynchronous collaboration: changes made to an object are visible in real time to others currently viewing or editing the object, and are also preserved for users who encounter the object at a later time. This support for collaboration helps much in end-user authoring because it removes boredom from the authoring tasks and makes the tasks more interesting.

One of the basic activities in MOOsburg is to manipulate existing objects. Users can create a landmark (a place or space); They can either draw a background image (by using the white space editor) or upload a background image. Users can even upload a panoramic image and provide a 360° view of the place. They can populate their room by adding instances of tool present in the toolbox (e.g., whiteboard, message board, etc.). They can also "take" objects from other places (with proper permissions) and "drop" them in their place.

MOOsburg provides end-user authoring support to a great extent. Users can create instances of standard tools (that are present in the toolbox), and can also develop their own tools and add them to the MOOsburg database. Although this requires some expertise in Java programming, advanced users are not limited to the existing tools; they can implement new kinds of objects. The mechanism for building and installing user-defined MOO objects is similar to creating Java applets; developers implement a new kind of MOO object in Java, and put the compiled object code on the Web. They then create and configure a machine object in the MOO that connects their code to the MOO so that instances of the new kind of object can be created in MOOsburg. Each machine has a URL for downloading the code, a name for the object that this machine creates, and the object's Java class name. The developer maps the methods defined in the object class to actions that will be offered to MOO users. As users create or manipulate these user-defined objects, the code that defines object behavior is downloaded as needed (Isenhour, Rosson & Carroll 2001).

The machine mechanism provides a simple means for integrating diverse types of objects into the MOO – any Java class, stored at an arbitrary location, can be instantiated and operated through a machine placed at a MOO location. If these user-defined extensions make use of CORK for object replication, they will also support synchronous and asynchronous collaboration.

CHAPTER 4

MOOsburg Usability and Help Requirements

Prior to the help authoring studies requirements and task analyses were done. These were carried out as a two-phased study. In the first phase, community members were interviewed to discuss their experience and expectations concerning MOOsburg. These interviews provided an initial understanding of general user characteristics and knowledge. Then a task analysis was performed to analyze the most typical tasks that would be performed with the system. This analysis was used in designing the second phase of the study. In this phase, six participants were asked to perform a set of tasks in MOOsburg, and their actions were recorded and analyzed. Based on this user study, the final set of tasks for the help authoring studies was formed.

4.1 User and task analysis

Because MOOsburg is a community network, every member of the community qualifies as a user of the system. Community members who had been involved in the project to some extent were interviewed to discuss their expectations and experiences with MOOsburg. These open-ended interviews were also aimed at exploring user characteristics.

Three participants who served as a sample of the community were interviewed. The interviews were conducted at the participants' work place to enhance the contextual enquiry process. All three participants had used MOOsburg at least once. However, since MOOsburg was still evolving at that time, they were not familiar with some of the newer elements (e.g., the space-place concept was new to them). All of them had computing experience and did not find it hard to understand the system. Each participant represented different parts of the community; there was a schoolteacher, a town council member, and a senior citizen.

The participants were asked to describe the tasks they would perform with MOOsburg, the features they would like to see, and their general opinion about such a community network. Their answers showed that they wanted to perform realistic tasks that represented their community interests (see Appendix A). They wanted to use the existing tools as well as tools not yet available (e.g., meeting support). When envisioning these new tools the participants asserted that an online community evolves through active participation of the community members.

The participants were also asked to “play with” MOOsburg while their actions were observed. One participant had problems with creating a place and the other had problems with using the map tool. Because two of the participants were in-charge of group activities (student projects, league of women voters forum), they preferred to use the ballot and message board tools. Because all the participants use the internet extensively for their work and community activities, all of them also used the web bookmark tool.

The simple task analysis, conducted after the interviews, revealed that the message board is too simple to cause any problem. However, it also suggested that to demonstrate the usefulness of the message board, we needed to show the user some response to the message he or she posted. This would require one more person to follow the participant until he posts a message, and to respond to it (by typing a reply in the message board tool created by the participant). As a result, the second phase of the study focused on the use of the map, place, whiteboard, web bookmark, and ballot. The typical tasks with these objects are listed below.

Map: Map is the most extensively used tool in MOOsburg and users used it to either find their own or a friend’s place/space or to just “move around” and find out about activities in their area.

Place: The users would either create a new place for themselves or modify their existing place by editing the background, adding new tools or positioning it at a different location.

Whiteboard: The whiteboard could be used either as a separate tool or as the background editor for the place or space. The most common task with the whiteboard would be to use it as a background editor.

Web Bookmark: When users create a place for themselves, they would eventually want to provide a link to their personal or organizational websites on the worldwide web. This would act as a bridge between MOOsburg and the WWW.

Ballot: Since many organizations will conduct surveys or polls about issues, creating a poll and participating (i.e. voting) in it will be among the most common activities.

4.2 Usability Study

To explore users' approaches to the aforementioned tasks, a usability study was conducted with six users in a controlled environment. The study was conducted in the usability laboratory (in McBryde 102) and video recorded. None of the participants had used MOOsburg before; the participants belonged to four different organizations (two community organizations and two student associations) in Blacksburg. All participants had enough computing experience and considered themselves intermediate or expert users. None of them had used or participated in any online community activities before.

The participants were provided with a brief demo of MOOsburg. The experimenter explained to them the different interaction elements and basic interaction techniques (right click for menu, closing an edit window will automatically save the changes, etc.) in the MOOsburg user interface; all questions were answered. The participants were then asked to perform the following tasks (Table 3), and their interaction with MOOsburg was video recorded.

• Create a place for you in MOOsburg at the location where your house is in Blacksburg. Name that place "<*your name*>'s room" and decorate your room's background with your favorite color.   • Create a place for your friend in MOOsburg and name it as "<*friend's name*>'s room". Then create a message board and a web bookmark (to the BEV (http://www.bev.net)) in your room. Now move the web bookmark from your room to your friend's room.   • Create a space for you near your room. Decorate your space's background. Then draw a map for your space by editing the space. Now move your room and your friend's room inside that space.   • Create a ballot in your room asking the visitors' opinion about the Blacksburg Transit. Give them the following three options: Excellent, Good and Bad. Name the ballot appropriately and place a message in the signboard asking the visitors to vote in the ballot.

Table 3. Task list for usability study

The goal of the study was to characterize these users' approach to the tasks and critical issues involved in performing the tasks, and in particular to note the problems that might be eased by help materials. The following are some of the key issues that were noted:

- Because the initial display of the map showed the entire Blacksburg area with a dense cluster of dots (denoting places), the users zoomed-in to the map using the scroll bar in the map window. Though the map had different views, the simple, clear and default flat view was the preferred one.

- When the mouse was hovered over a street, the street name was displayed at the bottom of the map window. However, users did not usually notice the appearance of this text string.
- Using the 'Add a Place' feature caused some confusion. When users created a new location, most of them expected to be taken to the new location automatically. However, the system kept them in the initial location. Because most of the users wanted to go to the newly crated location, they were forced to remember its position on the map.
- The tasks with ballot and whiteboard were fairly straightforward. . The ballot seemed to be the most self-explanatory of all of the tools. The only problem with the whiteboard was the long delay and lack of confirmation about uploading an image file as a background picture. However, because it took a long time to upload an image file even with a fast internet connection, we decided to ask the user not to use this feature
- While creating a web bookmark proved to be a fairly simple task for most users, it had a critical problem. While entering the URL for the website, the users did not include "http://" (since most users do not type "http://" in the address bar of the web browser). If "http://" was not included, the bookmark would not work.

Almost all participants had problems with both understanding and using the concept of "space". Also, because a simple "place" satisfied most of their task requirements, we decided to omit the use of spaces in the help authoring study. Based on these findings, we decided to focus on the authoring of help for the map, place, web bookmark, and ballot. We also recognized that we would need to address both the creation and usage of those objects.

CHAPTER 5

Methodology

To test the hypothesis that users would be able to create effective task-based minimalist help (since they explore the system with real tasks) two user studies were designed. In the first study, the participants were asked to author help for a set of selected objects in MOOsburg. Their authoring performance and subjective reactions were recorded. In the second study, a second set of participants were asked to evaluate the help created in the previous study; subjective reactions were again collected.

5.1 Study 1: Document authoring

This study examined the potential for prompting the end-user to author either minimalist help or a traditional, comprehensive help. Both objective and subjective data were measured. The participants were divided into two groups that authored help in response to different prompts. The study focused on authoring help for the map, place, web bookmark and ballot, selected from the earlier usability studies. The participants were asked to explore MOOsburg (paying most attention to the four target objects) until they felt confident with using the system. Then they were asked to author help documents for the four objects. They were given specific instructions to produce either minimalist or traditional help. Their performance time was measured. After the participants had finished writing the help document, they answered a subjective questionnaire (with likert ratings) and discussed their experience with the author.

5.1.1 Participants

Twelve volunteers were assigned randomly to one of the two groups. All of the participants were involved in at least one organization in the Blacksburg community. Most of them were students at Virginia Tech and were contacted by the author through email and peer networking. All of the participants considered themselves expert or intermediate users in computer applications. Except for two users, all were familiar with online groups (mailing lists, forums, SIGs, etc.) and had used them at least once. They felt that online groups are very good sources of information (except for one user who had a bad experience with an online music forum), and agreed that they would tend to help others in those groups.

5.1.2 Materials and tools

A demographic questionnaire (see Appendix C) was used to gather background information about the participants. The questionnaire focused on the participants' computing background, community involvement, and exposure to online community activities.

A two-page MOOsburg guide (see Appendix D) was given to the participants to provide a brief introduction to MOOsburg. The document explained the different windows in the MOOsburg user interface and explained the difference between place and space. Although space was not involved in the study, providing an explanation about the space/ place concept was very useful in acclimating the user to MOOsburg. The guide also provided a list of key tools in the toolbox. The list just had the names of the tools; no descriptions were provided.

One of the key features of an online help is that it will be embedded in the application and the user will be able to switch between the help and the task without any problem. To provide an "immersed in the system" feel, the authoring prompt interface was developed in Java

(MOOsburg has also been developed in java).

Because the instructions about the specific approach were key to the success of the authoring task, it was decided to keep the instruction always visible and un-minimizable (see Figure 2).

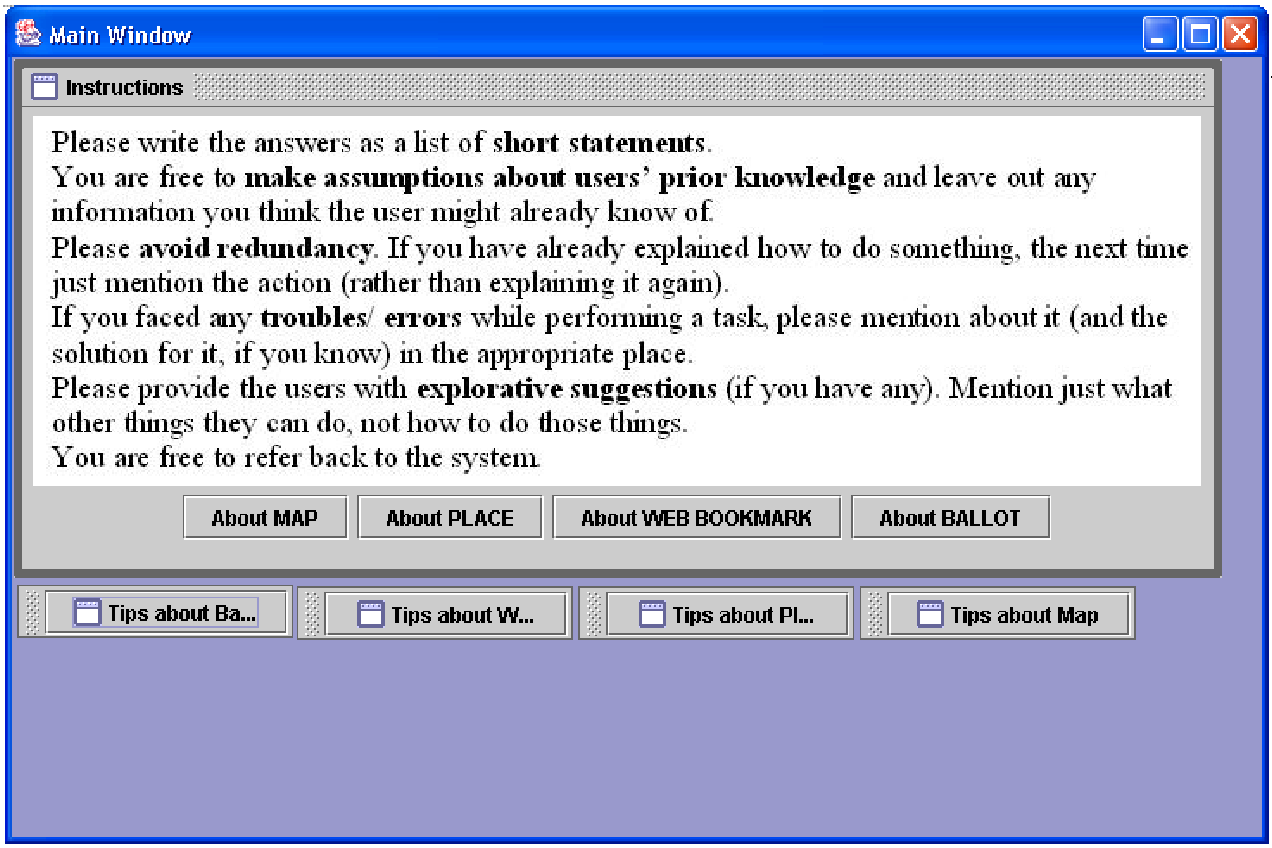

Fig 2. User interface for authoring minimalist help

The prompting interface had five internal windows: one instruction window and four separate windows for the four target objects/tasks. In addition to the instructions, the instruction window had buttons to activate the four task/object windows. The object/task windows were designed such that the user could return to a particular window and edit the help content at any point in time during the study.

Two versions of post-test questionnaire (see Appendix E and Appendix F) were used to gather subjective responses. For the minimalist group, the questionnaire was based on the tasks the participants performed with the target objects. The questionnaire gathered responses about the difficulty level of tasks, completeness and usefulness of the help (that was authored by the participants), and effectiveness of the minimalist approach. The questions for the traditional group were formed based on the objects; questions were asked about the usefulness of the objects, finding the features of the objects, usefulness of the help, preferences about using the features listed in the help, and suggestions to improve the help document.

A DELL Inspiron 8100 laptop computer was used for all the tests. The computer was connected to the MOOsburg server using an Ethernet connection (100 Mbps). The user interface for authoring was developed using the Java Swing lightweight components. JDK 1.4 was used as the development environment. The help documents created for each task/object was stored separately as text files.

5.1.3 Test procedure

The studies were conducted either at the participants' home/office or at the author's home in order to provide the participants with a more realistic environment. All the participants completed an informed consent form (see Appendix B). After that they were asked to complete a demographic questionnaire. Next the goal of the study was explained to them; they were told that the authoring part of the study would be timed and also that they ask the experimenter for any help needed. Then they were given the MOOsburg study guide (see Appendix D) to gain an understanding of the system. We did not provide a demo because we thought that it might force the participant to follow a similar thread of interaction to the demo. After reading the study guide, the participants were asked to explore MOOsburg and use it as they wished. They were allowed to explore the system until they felt comfortable with using it. Once they felt confident enough, they were asked to use the authoring interface and create help documents. To maintain an unbiased approach, both the groups were given identical tasks and directions for completing the document for all the four objects were kept the same within each group.

For the minimalist group, the participants were asked to first state the most typical task they would perform with a given object, and then to provide instructions for performing this task. In this, they were asked to follow minimalist principles (see Figure 3a). For the traditional help authoring task, the participants were asked to describe each of the objects and list and explain all the steps involved in creating and using those objects (see Figure 3b).

For the minimalist approach, the instructions focused on the following principles:

- Focus on a real task
- Slash the verbiage
- Avoid redundant information
- Anticipate errors and provide error recovery information
- Help the user start with the task immediately
- Provide explorative suggestions

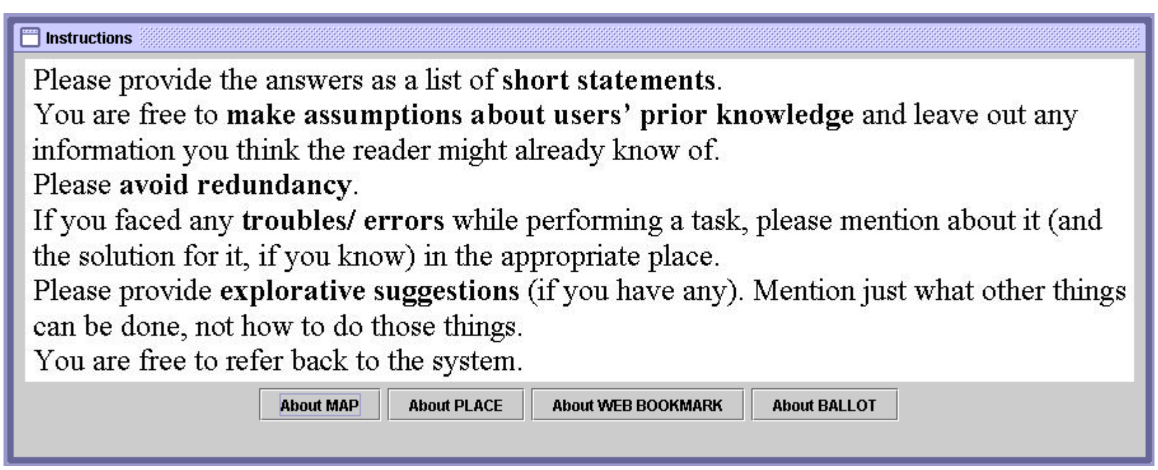

Fig 3a. Instructions for minimalist help

For the traditional approach the instructions tried to enforce the following guidelines:

- Provide a description about the object
- Provide a complete list of all the features of the object
- State all possible actions that could be performed with the object.

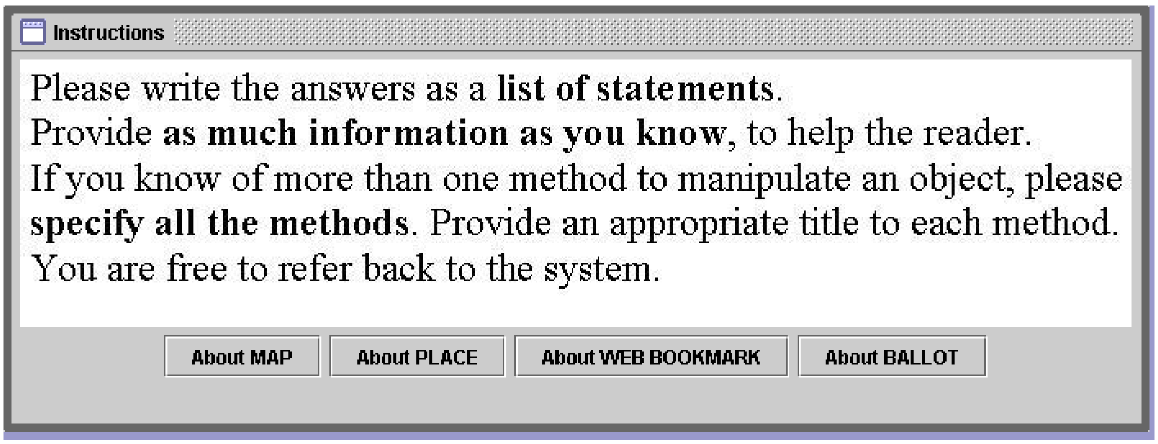

Fig 3b. Instructions for traditional help

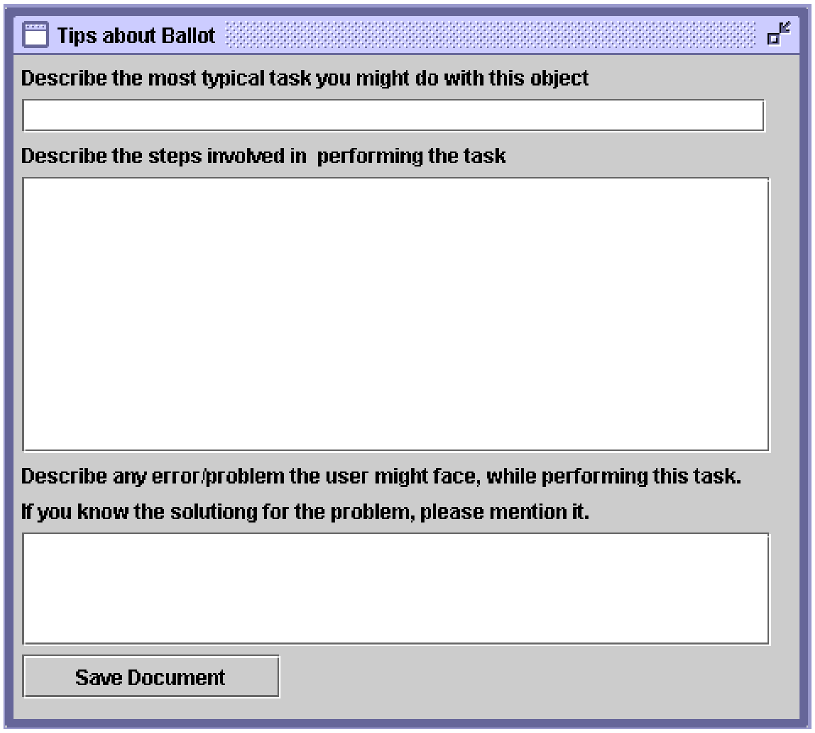

Fig 4a. Authoring interface for minimalist help

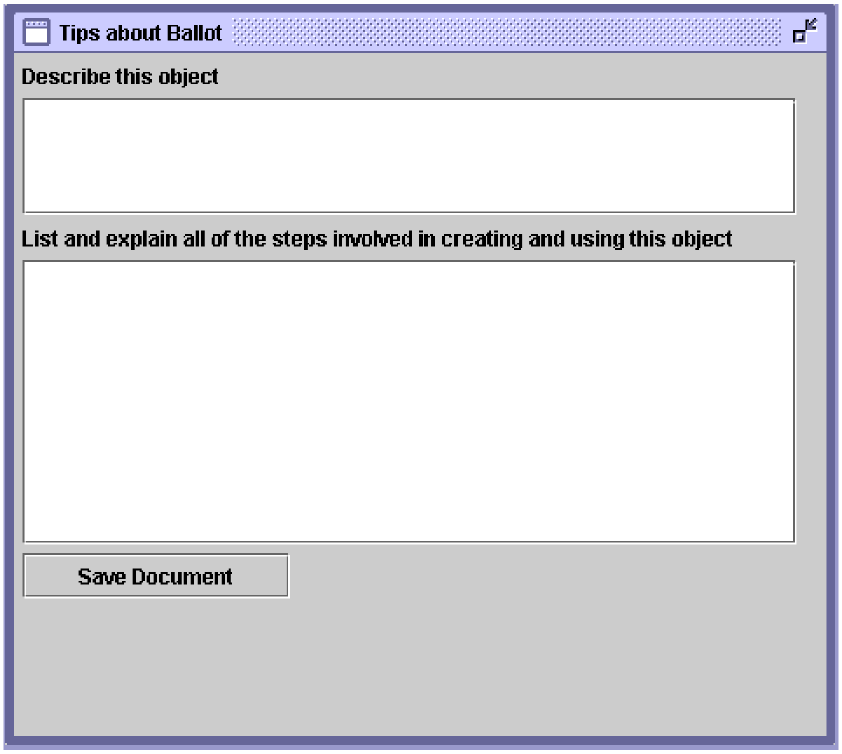

Fig 4b. Authoring interface for traditional help

Help written for each task or object was stored as a separate text file. After the participants had created the document, they answered a questionnaire and discussed their experience and opinions with the author.

5.2 Study 2: Evaluating the Help

In this study the participants were asked to evaluate the help created during the previous study. Each participant evaluated both minimalist and traditional help documents (i.e. two of each sort). The category of the individual help file was chosen randomly for each participant, with the restriction that all help files were evaluated an equal number of times. The goal of this study was to obtain subjective opinions about using the help created by end-users.

5.2.1 Participants

Six volunteers participated in this study. As in the previous study, all were involved in different community activities (Christian fellowship, international student organizations, community service groups, etc.). All of them had at least an intermediate level of computing knowledge. Except for one participant, all were familiar with mechanisms for online groups. Four of them have been actively participating in online forums. None of the participants had used MOOsburg before.

5.2.2 Materials

Similar to the previous study, a demographic questionnaire (see Appendix C) and a study guide (see Appendix D) were used in the first half of the study. The questionnaire focused on the participants' computing background, community involvement, and exposure to online community activities. A two-page MOOsburg guide (same as the one provided in the previous study) was given to the participants to provide a brief introduction to MOOsburg. A subjective questionnaire (see Appendix H) was used to gather the participants' opinions about the two approaches. The questionnaire evaluated the participants' opinions about the usefulness of the document, amount of information, percentage of document read, and preferences about modifying the document.

5.2.3 Test procedure

The participants were asked to complete an informed consent form (see Appendix G) and the goal of the study was explained to them. They were also asked to complete a demographic questionnaire (see Appendix C) to collect background information about them. Then they were asked to read the study guide (see Appendix D) to understand the MOOsburg user interface. After that they were asked to explore MOOsburg and use it in any way they wanted. They were asked to focus on the four target objects. After they had finished exploring the system, the users were asked to list a most typical task they would do with each object. For the minimalist help, the document that matched most closely to the task specified by the participant was selected. However, the documents evaluated for traditional help were determined randomly. All the participants evaluated four help documents; two minimalist documents and two traditional documents. The selection of the type of help for each object was assigned randomly, with the restriction that all objects received an equal number of minimalist versus traditional assignments. For each object, the participants completed a separate questionnaire. After they had evaluated all the four documents, they also discussed their preferences and opinions of the two different helps with the experimenter.

CHAPTER 6

Results

To answer the research questions, both objective and subjective measures were analyzed. The objective measures analyzed were performance time, errors, number of references to the system, number of words, number of words per minute, and number of steps. In the first study (document authoring), participant's subjective opinions about the authoring task and the authored document were collected. Also the documents were evaluated (by the author) to see whether the intended type of document was produced or not. In the second study (document evaluation), the participant's preferences and opinions of the two approaches were measured.

6.1 Objective measures

The quantitative data recorded during the first study (performance time, word count, number of times referred to the system) were statistically analyzed with ANOVA (1-way or 2 way) to determine whether the authoring behavior of the minimalist group was faster or more "effective" than the traditional help group. Alpha was set to 0.05. Further details of the data analysis may be found in appendix J.

6.1.1 Performance time

The total performance time was measured by summing the times required to create each of the four documents. Our hypothesis was that the minimalist authoring would take less time than the traditional help authoring. Although the traditional help group took somewhat longer than the minimalist group (1434s Vs 1354s, see Figure 5), a two-way repeated measures

ANOVA (instruction type Vs object type) revealed no main effect of instruction type ($F(1, 40) = 0.82$, n.s).

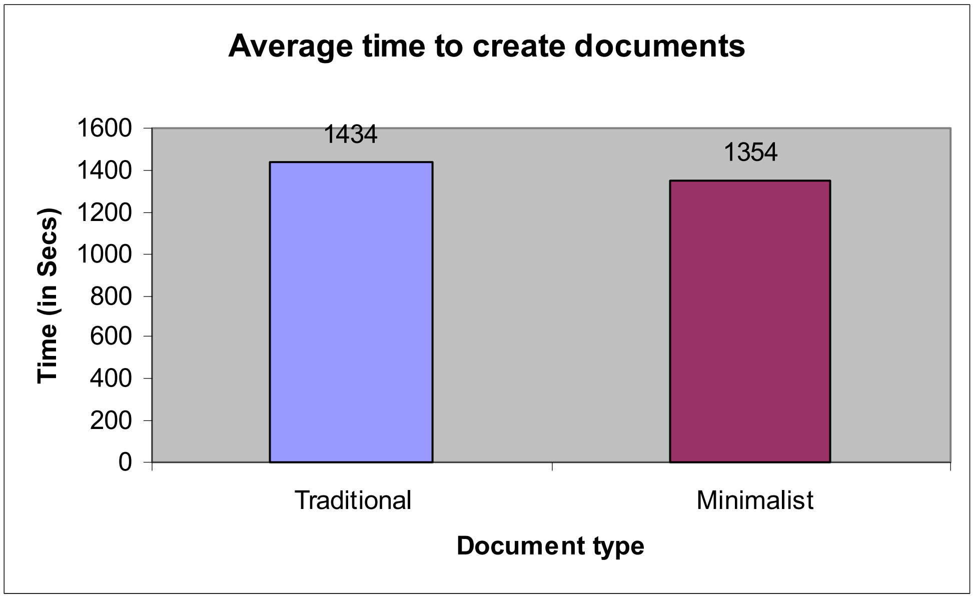

Figure 5. Performance time

However, there was a significant difference in the time taken to write help for the different objects (see Figure 6; $F(3, 40) = 22.98$, $p<0.0001$). Further more, there was a significant interaction between the object type and instruction type ($F(3, 40) = 5.68$, $p<0.01$. A one-way ANOVA conducted separately on each of the four objects showed that the different approaches had significant effect only on the help documents written for the map object ($F(1, 10) = 12.2$, $p<0.05$)

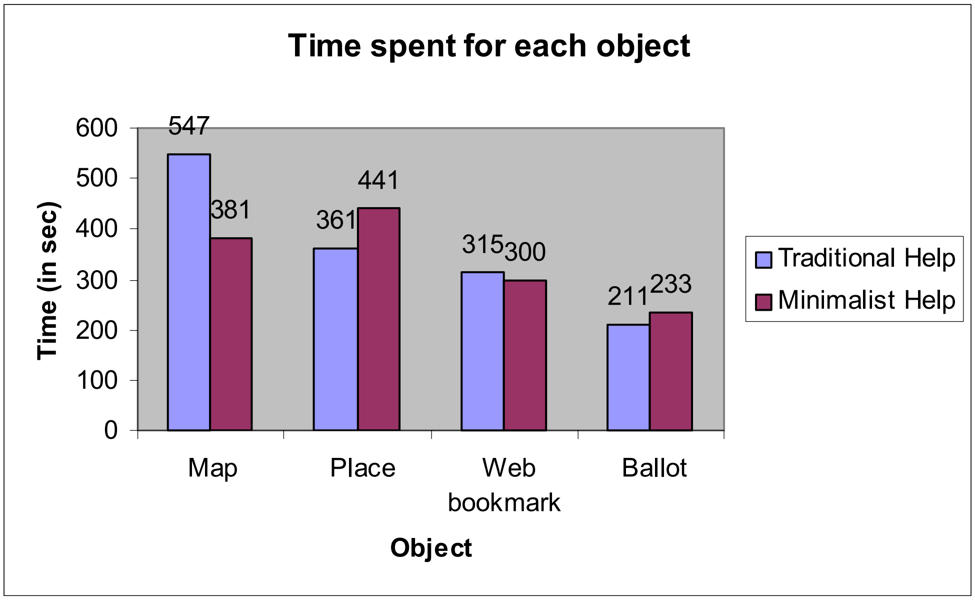

Figure 6. Time spent for each object

6.1.2 Performance errors

Traditional approach	• Misinterpreted the buttons for nudging the place in a particular direction as a way of specifying the location of the place in the map (i.e. clicking on "n" would mean that the place is located in the northern part of the map).
Minimalist approach	• Did not realize that the ballot tool can be renamed, and kept mentioning the ballot tool icon as the "New Ballot" icon (which is the default name for the tool) throughout the document. This confused the document users in the second study. • Thought that clicking on the "Home" button in the map would center the current location on the map. • Thought that entering a space is not possible. • Thought that clicking the bookmark icon would ask for the URL. But clicking the bookmark icon will try to either open the URL (if specified) or do nothing.

Table 4. Errors/ Misinterpretations

The performance variable was included in the study to measure the quality of the document. After the study, the experimenter checked each document for any error or misinterpreted information. Statements that had either incorrect or confusing information were considered as errors. There was only one error in the twenty-four documents created in the traditional document, but there were four errors in the minimalist documents. These errors are summarized briefly in Table 4.

6.1.3 Number of references to the system

During the study the experimenter observed the participants' behavior and recorded the number of times the participants referred back to the MOOsburg system. The hypothesis was that the minimalist group would refer back to the system fewer times than the traditional group, because they would rely more on their task-based experience. As can be seen in Figure 7, there was a significant difference, $F(1, 10) = 11$, $p < 0.01$, between the traditional group ($M = 20.17$, $S.D = 7.026$) and the minimalist group ($M = 9.33$, $S.D = 3.83$).

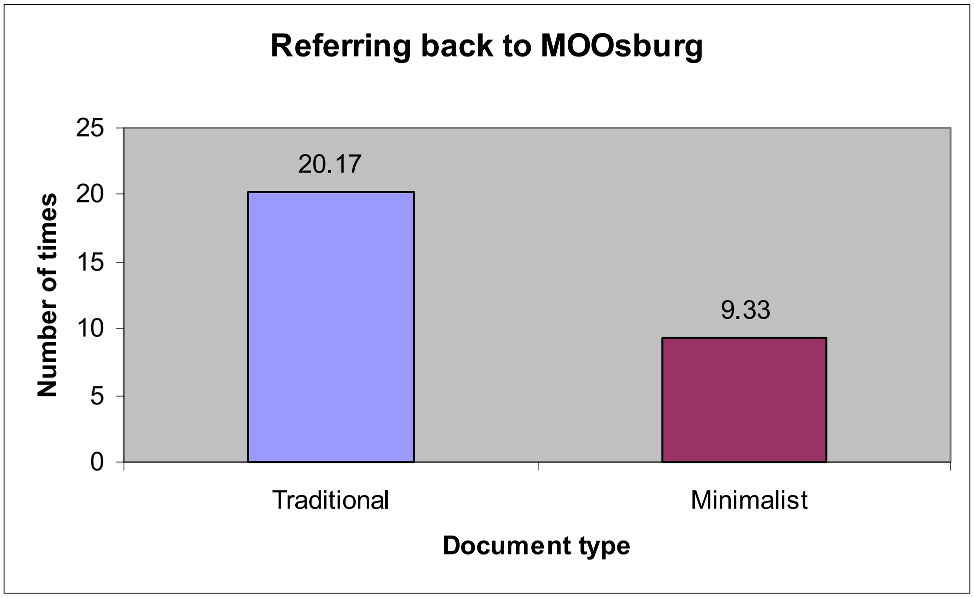

Figure 7. Number of references to MOOsburg

6.1.4 Number of words

The key factor that differentiated the two approaches was the number of words in the document. Because the documents were used in the evaluation study without any editing, all the words (e.g., including articles, prepositions, etc.) were counted. The hypothesis was that the minimalist document would have fewer words than the traditional document. The traditional approach (M = 527.5, S.D = 93.51) produced documents with almost twice as many words as in the minimalist approach (M = 273.3, S.D = 17.48). As can be seen in Figure 8, a two-way repeated measures ANOVA (instruction type Vs object type) revealed that there was significant difference between the two approaches ($F(1, 40) = 140.43$, $p<0.001$). The statistical analysis also showed that there was no interaction between the instruction type and object ($F(3, 40) = 1.92$, n.s).

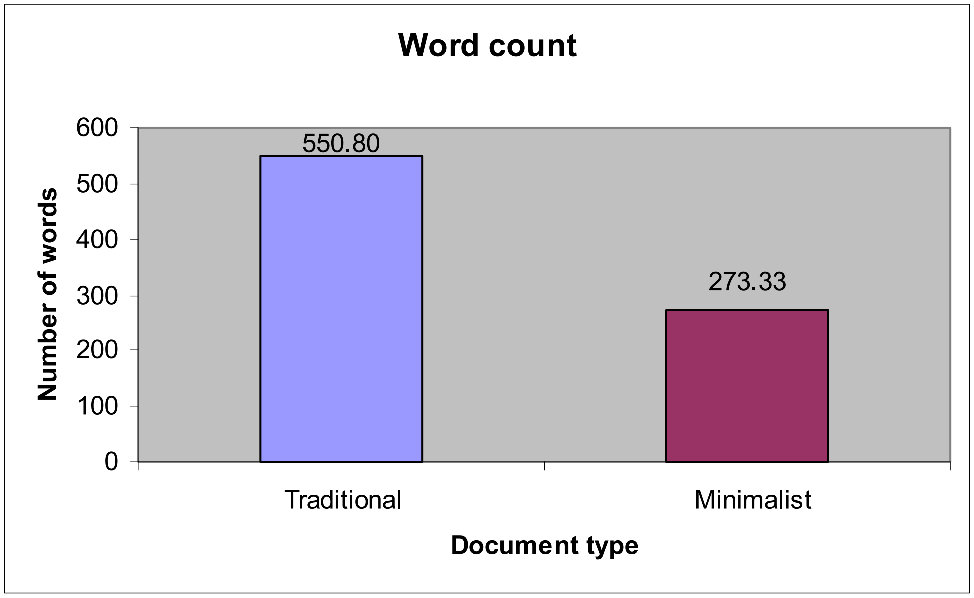

Figure 8. Number of words

6.1.5 Productivity

Productivity was defined as the number of words produced per minute. The productivity for each session was calculated and a one-way ANOVA showed that the difference between the two approaches was significant ($F(1, 10) = 61.42$, $p < 0.001$). In this case the results showed that the traditional approach (M = 22.34, S.D = 2.18) had a higher value than the minimalist approach (M = 12.34, S.D = 2.23).

6.1.6 Number of steps

The number of steps per task/object was calculated to see whether the value was within the memory-chunking limit recommended by Kearsley (1988). In both approaches the participants had been asked to write the instructions as a list of statements. Each statement (or list element) was considered as a separate step. The average number of steps per task in minimalist document was 4.8 (S.D = 1.15), while the traditional document had 6.75 (S.D = 1.67) steps per object. The two-way repeated measures ANOVA (instruction type Vs object) showed that there was significant difference between the two approaches ($F(1, 10) = 18.87$, $p<0.001$). There was no significant interaction between the instruction approaches and objects ($F(3, 40) = 0.95$, n.s).

6.2 Subjective reactions

The subjective questionnaires (see Appendices E, F) focused on the participants' opinion of the content and usefulness of the document created. Their opinion about using MOOsburg and the tools was also collected. Their opinion about the usefulness of the tools was collected to see whether the authoring task had any impact on the user's perceptions of the system. Table 5 lists the subjective responses from the document authors. A likert rating scale was used for most of the questions, where 1 denotes least agreement with the statement and 7 denotes complete acceptance of the statement. For the questions that needed more discrete response, multiple choices were given (see individual items in the table).

Question	Traditional approach		Minimalist approach	
	Mean	S.D	Mean	S.D
MOOsburg system was easy to use.	5.5	0.96	5.5	0.96
Using map would be easy.	6	0.82	6	1
Using place would be easy.	6.2	0.69	5.8	0.69
Using web bookmark would be easy.	6	1	5.5	1.5
Using ballot would be easy.	6.3,	0.47	5.8	0.89
The help I authored will be very useful to novice users.	5.5	0.76	6	0.57
The help I authored will be very useful to expert users.	3.7	1.25	4.3	1.25
Amount of information in the help is (1 – too little, 3 – just enough, 5 – too much)	3.5	0.5	2.83	0.37

Table 5a. Document authoring – Questions answered by both groups

Question	Traditional approach		Minimalist approach	
	Mean	S.D	Mean	S.D
I was able to find and understand the features of the objects easily.	6.3,	0.38	N/A	N/A
My knowledge about the system to complete the tasks is more than enough.	N/A	N/A	5.8	0.89
When I use these objects in the future, I'll use all the features I explored today.	5.5	1.1	N/A	N/A
Completeness of the document: (1 – deliberately incomplete, 7 – complete)	N/A	N/A	3.25	1.3

Table 5b. Document authoring – Group specific responses

The one-way ANOVA showed that there was significant difference between the groups only for the opinion about the amount of information in the documents ($F(1, 10) = 5.71$, $p<0.05$). Detailed results can be found in appendix J. Both the groups felt that their document would be more useful to novice users than to experts. For instance, one participant said "[i]t was totally for beginners, so may be it could be refined for expert users.". Another stated "I might have missed some shortcuts that would be very useful for experts". Traditional writers said that they would use most of the features they explored. They also felt that their document had slightly more information than needed. The minimalist writers felt that their document was fairly incomplete, and had slightly less information than needed. One minimalist participant felt that making assumptions about other users was a dangerous idea. He said that he could make assumptions about his friends and members of his community service group, but since the help document might be used by anyone in the community he was reluctant to make any assumptions. Another participant was not clear about the exploratory suggestions. He thought that just saying what to do and not mentioning how to do it would be useless. During the study the minimalist authors were observed to spend a considerable amount of time in thinking. When asked about this, they said they were thinking about ways to produce precise, and short steps, possible error situations and exploratory suggestions. They said that finding (or trying to find) exploratory suggestions was the toughest part of the authoring task.

6.3 Document Characteristics

The help documents created by the traditional authoring group had a description of each object and listed all the features of the object. On many occasions the help documents created by the same participant had redundant information (since the tools shared a common architecture). Some participants discussed possible problems that could occur while using a particular object. For instance, one participant said that “[o]ne problematic thing with creation is that it is necessary to watch the map when you create the object because the object color is blue, the same as most others and easy to lose in the map”. Another stated, “[s]ometimes the toolbox window might be minimized. In that case look at the bottom left corner of the window”. All the help documents for a particular object had almost similar structure and information.

The documents created by the minimalist authoring group had a task title, steps involved in the task, and any error information or suggestions related to the task. Some of the participants tried to provide exploratory suggestions (“You have the option of checking the messages related to that place, adding your own bookmarks and voting in the ballot”) and also omitted obvious details (“Follow instructions on the screen to easily create a ballot.”). Many documents had error information or suggestions. The following are some of the suggestions mentioned in the documents:

- During the "creation" mode, the choices have check boxes, though they might look like radio buttons. That's completely fine. At the end, only option button comes.
- Don't forget to give "http://" before the URL.
- If by chance, you use or move your original place by using n-s-w-e buttons, spend considerable time to precisely re-locate the place.

Typical examples from each group are shown in appendix I.

6.4 Document user response

The subjective opinions of document users about usefulness of the document, amount of information in the document, percentage of document read, amount of time spent with the document, preference to add or remove information to or from the document, and satisfaction were collected. Table 6 lists the subjective responses of the participants. As in the previous study, a likert rating scale was used for most of the questions. The total number of responses for each approach was twelve (six participants evaluated two documents from each group). Statistical analysis showed that there was no significant difference between any of the subjective measures (see Appendix J). The participants felt that both the documents were equally useful. There was a tendency to feel that the traditional help document had more information than needed and the minimalist document had an inadequate amount of information. However, in both cases there was not much deviation from the adequate amount of information. The participants were slightly more satisfied with the traditional approach (M = 6.5, S.D = 0.5) than the minimalist approach (M = 6.38, S.D = 1.65), but this difference was not significant.

Question	Traditional help		Minimalist help	
	Mean	**S.D**	**Mean**	**S.D**
The document will be very useful	6	1	6.25	1.64
The amount of information in the document was: (1 – too little, 7 – too much)	4.5	1.22	3.75	1.09
I read the help document: (1 – sparingly, 7 – completely)	6.13	0.93	6.75	0.43
The time I spent with the document was: (1 – too short and not very useful, 2 – too short but very effective, 3 – adequate, 4 – too long but very effective, 5 – too long and not very useful)	2.63	0.7	2.5	0.71
If I were asked to improve the document I would: (1 – remove some information, 2 – leave it as it is 3 – add some information)	1.63	0.69	2	0.5
I am satisfied with the help content (1 – completely disagree, 7 – completely agree)	6.5	0.5	6.38	1.65

Table 6. Document user responses

In the open-ended discussion that was held after the participants had filled the questionnaires, some of the participants said that they would prefer traditional help to a minimalist help. One participant felt that the minimalist help looked like a trouble-shooting mechanism (with no description, only the information and error messages) and he wanted an exhaustive list of all problems related to the specific task. Another user wanted to have all the information in one place (i.e. traditional help). He said that in such a case he would know where to go if he wanted more detail. At the same time he liked the suggestions/error information provided in the minimalist document.

CHAPTER 7

Discussion

We conducted two studies, one examining the help authoring process, and the second evaluating user written help. Several sorts of data were collected to address our three research questions. Our findings are summarized for each question.

7.1 Research question 1

Can end-users be guided to author help that is "minimalist" versus more "traditional" in character?

Quantitative measures showed that it is possible to prompt end-users to create a minimalist help for a community network. The documents created using the minimalist approach had the following characteristics:

- a minimal number of words
- error recovery information pertaining to the task
- exploratory suggestions
- less number of steps than traditional approach. The average number of steps was within the "chunking" limit of human memory.

However, we also observed that the time needed to create a minimalist document is not much less than the time needed for a traditional document. Also minimalist documents contained more errors than traditional documents. In addition minimalist authors were not as productive as the traditional authors. These findings make it hard to assert that an effective minimalist help can be created. Our observations suggest that minimalist authors spent relatively more time "thinking" than traditional help authors. The post-study interview showed that users were thinking about exploratory suggestions and ways to reduce the number of words they used. This is consistent with published work on minimalism that warns that it is not the "easy" way out (Carroll, 1990). It may be that if minimalist authors had been encouraged to spend even more time using MOOsburg and writing help, the documents could have improved in quality.

These speculations raise another issue. Because the authoring was done in a controlled environment and the users were "participating in a study", they might have tried to follow the instructions sincerely. But will they behave the same way when they work on their own? The amount of time spent thinking by the minimalist authors and the number of times the traditional authors referred back to MOOsburg seemed quite high. It is not clear whether these time requirements would be within the acceptable limits for a normal user. When people use MOOsburg in a casual setting, they may not pay much attention to the directions to create minimalist or traditional help.

The minimalist documents had more errors (4) than the traditional documents (1). The nature of the errors (caused mainly by a lack of exposure to the tools) shows that the user's expertise is a key element in creating a minimalist document. The study also showed that the minimalist documents were not consistent with regards to content. Some authors provided exploratory suggestions and error information, but some did not. The traditional documents had fewer errors and all the documents were mostly similar to each other. Since the minimalist documents seemed inconsistent and informal, the document users might be skeptical about their credibility.

7.2 Research question 2

If users can be guided to produce minimalist help documents, will they be more positive about the authoring experience than users writing more traditional help documents?

Statistical analysis of the participants' subjective responses showed no significant difference in reactions to the two approaches. However, the open-ended discussions showed that the participants preferred to create traditional, comprehensive help instead of minimalist help. The reasons could be that some of the minimalist principles (such as leaving out obvious information, avoiding redundancy, making assumptions about users) were not easy for all the participants to agree upon. Indeed one participant fervently argued against the idea of leaving out the obvious information (and letting the user come across it when performing the task). Again, this reinforces some of the research literature that suggests that even professional technical writers find the application of minimalism difficult and counter-intuitive at times.

7.3 Research question 3

Will end-users who read help documents written by other end-users prefer minimalist help documents or more traditional one?

There was no significant difference in the participants' preferences between the two approaches. But informally the participants claimed that they would prefer traditional help over a minimalist one. Some participants felt that providing exploratory suggestions pertaining to a particular task (as done in the minimalist documents) made the document look incomplete and hence reduced their confidence in both the help document and the object they were using. However, all the document users welcomed the general presence of error information and exploratory suggestions.

The document created using the traditional approach had the following characteristics:

- Complete information about the object.
- Short sentences.
- More steps than the minimalist document.
- No error recovery information (as expected), but some exploratory suggestions.
- Redundant information.

The participants did not read the traditional document completely. However, they seemed to be confident in their use of the traditional help document because it had all information about the object. In an application like MOOsburg where objects are self-explanatory and where there is a direct mapping between the task and execution methods, the users may be able to discover how to perform the tasks on their own. The typical assistance users may want to look in the help documents could be a list of additional features to enhance their task. So they may prefer a more comprehensive, feature-by-feature listing than a training manual type of help.

7.4 Suggestions for future work

As there has been no previous study reported about end-users as help document writers, this research has provided the starting point for a new area of research in end-user authoring. One of the drawbacks in this study has been that the tasks/objects used were not complex and did not have many sub-tasks. Therefore, using more complex tasks could provide further insight. Because it was a controlled experiment (though the task selection was left to the participant), the participants in this study may have tried to be unusually cooperative. Conducting a study in a more open environment will be critical for collecting more realistic data.

In this study, the participants had no prior experience with the system. The reason behind this decision was to test the performance of participants with equal experience. However, the errors in the document showed that expert users would have fared better than our participants, who simply *thought* they had gained enough knowledge. It would be an interesting study to observe the willingness of actual users for long term authoring. While novice or intermediate users may not have the confidence to author a help document, experienced users may not have the interest or patience (since they may considered themselves power users).

The research also showed that the participants were not convinced about some of the minimalist principles (e.g., exploratory suggestions). As Beam (1994) suggested, users may be provided some initial training about authoring and then asked to write help documents. The possibilities of such an approach in a community network can be tested.

In a community network where users can create and add their own objects to the network, the creator of an object may be asked to write an initial help document. Later other members of the network may be given permissions to edit that help document. Because users would be editing the document written by their peer, the social implications of such an approach can be studied. This approach could also provide insight into collaborative end-user authoring.

In this study, participants' writing skills were not analyzed. Because providing brief information is a key minimalist principle, the impact of writing skills on authoring minimalist documents can be studied. The effect of writing skills on the willingness to author documents can also be studied.

Another direction from which to study end-user authoring could be to compare a commercially provided minimalist help for an online community application with end-user created minimalist help. One would expect a commercial help system to better exemplify minimalist principles (e.g., through a careful design process), but the end-user help may feel more personal and welcoming as a part of the community.

7.5 Conclusion

The research demonstrated that it is possible to prompt end-users to author a minimalist help document for a community network to which they belong. However, there was no conclusive evidence that the minimalist help document created by end-users is an improvement over more traditional, feature-by-feature help document. The results seem to support Jansen's argument that subjects are often confused by the deliberate incompleteness (exploratory suggestions) of minimalist instructions. Although there was no statistical evidence, the participants preferred traditionalist approach over minimalist approach. This opinion might be due, at least partly, to the nature of the MOOsburg environment, where users already know how to behave in a community and simply want to know what features can be employed while using different objects.

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APPENDIX A: Pre-study user interview excerpt

Three users of MOOsburg were interviewed and their feedback about the MOOsburg system and suggestions to enhance their work in MOOsburg were received.

USERS:

A. A senior citizen who is a community volunteer, key person in the Senior center, American Association of University Women and the League of women voters
B. A high school teacher that teaches earth science and biology for 9th grade students
C. A head of a department in Virginia Tech who is also a town council member. He is an active member in the telecommunication advisory committee that plans to support/focus on MOOsburg

User A:

She is a senior citizen who is a community volunteer. Primarily she spearheads most of the activities in the 85 members league office and BEV-Seniors organization. The League of women voters is an informative body that does activities like census, etc. She organizes the bulletin (not online) for the league and it is sent to the members and select non-members. She also manages the online news for the league. BEV-Seniors have the primary goal of enhancing computer communications among senior citizens by improving their ability to use computers and BEV software. This user is in-charge of the Computer coaching program.

The user is quiet well versed with computers and has on-hands experience with Microsoft Word and HTML editing (the bulletin has style guides). She is also administering the BEV-seniors web page and the mailing list. Though the user has been living in Blacksburg for a long time, she found it difficult to locate the place where she is living, using the MOOsburg map. Initially she had problems in understanding the space & place concept. But once we explained about it, she wanted to create a space for her house with the rooms as separate places in the space.

User B:

She is a biology and earth science teacher for 9th grade students. One of her main activities was, helping the students in creating a virtual museum (about earth science and biology). The students were separated into groups having an editor, researcher, writer and artist. They gathered the information through magazines and conference reports. They were creating the web pages using Macromedia and used a 3D software (Canoma) for creating the graphics.

As a teacher she has good computer knowledge. She has been using PC and Mac systems in her office and residence. Also she is one of the moderators of the school's web page. Though she has been using MOOsburg, the space & place concept was quite new to her. Also she had problems in coping with the frequent changes in MOOsburg. For example, to move around the map, she used to click on a point and that point will become the center of the map. But when we met her, we were able to click+hold and move the mouse to move the map. She could not understand it initially. She felt that adding **fly-over helps** to the tools would be very helpful (i.e. since MOOsburg uses the right-click feature for manipulating the tools, having a fly-over saying "right click to view the menu" will be useful).

User C:

He is the head of a department in Virginia Tech also a member of the town council. The town council is the legislative authority that supervises the town management. He is an active member in the telecommunication advisory committee that plans to support/focus on MOOsburg. He has a good computing background. But, as he has been using Mac machines, he could not access MOOsburg often.

He had three suggestions to implement in MOOsburg.

1. e-democracy
2. e-museum
3. neighborhood communication program

E-democracy

As a town council member he wanted to listen to what people say about issues and he also wanted to use technology to increase people's access to decision making. But the main problem they have is that people do not have access to most of the processes. He wanted the decision making process of the town to be more transparent and he thought that MOOsburg could be used as an online meeting place for this purpose.

E-museum

The user felt that the 200-year history of Blacksburg has not been represented to the people. He felt that an e-museum would be a very good way of providing the history of Blacksburg to people. He wanted the e-museum to walk the visitors through Blacksburg in various times, virtually. For example, the visitor can see how a particular place looked in 1825 and he should also be able to see how it looked after 50 years. Our user had a collection of pictures and he felt that more information could be collected from people.

Neighborhood communication program

The user wanted to build a neighborhood communication program using MOOsburg. He wanted to create the feeling of a community using the web-based interactive programs such as MOOsburg. Some of the ideas he had were, increasing safety by using the e-community features, a rental permitting program and a neighborhood organization identification development program. He also felt that wireless communication could be very helpful in the neighborhood communication program.

APPENDIX B: Informed consent form for document authors

Virginia Polytechnic Institute and State University
Informed Consent for Participant of Investigative Project

Title of Project: **End-User Authoring in MOOsburg**
Investigators: **Vinoth Jagannathan**

I. THE PURPOSE OF THIS RESEARCH

You are invited to participate in a study about Authoring in a Multi user domain. The purpose of this research is to analyze the possibilities of making the users author (write) a help manual (using a particular approach) for a community network they use.

II. PROCEDURES

You will participate in an experiment consisting of two sessions. In the first session you will fill a demographic questionnaire. In the second phase you will be exploring MOOsburg (a community internet resource for Blacksburg) and performing few simple tasks in MOOsburg and produce a set of documents. These documents will be used as HELP in the later part of the study.

Your role during the experiment is that of help writer. We are **not evaluating you** in any way; you are helping us to identify the authoring patterns and flow of tasks in MOOsburg. All information that you help us attain will remain anonymous. You may be asked questions after each phase, in order to clarify our understanding of your answers.

The session will last about 60 minutes. For research purposes, the study will be timed. There are no risks to you. The tasks are not very tiring, but you are welcome to take breaks as needed. You may also terminate your participation at any time, for any reason.

III. RISKS

There are no known risks to the subjects of this study.

IV. BENEFITS OF THIS PROJECT

Your participation in this project will provide information that will be used to design an automated help session/ user manual for MOOsburg. No guarantee of benefits has been made to encourage you to participate. You may receive a synopsis summarizing this research when completed. Please leave a self-addressed envelope with the experimenter and a copy of the results will be sent to you.

You are requested to refrain from discussing the questionnaire with other people who might be in the candidate pool from which other participants might be drawn.

V. EXTENT OF ANONYMITY AND CONFIDENTIALITY

The results of this study will be kept strictly confidential. Your written consent is required for the researchers to release any data identified with you as an individual to anyone other than personnel working on the project. The information you provide will have your name removed and only a subject number will identify you during analyses and any written reports of the research.

VI. COMPENSATION

Your participation is voluntary and unpaid.

VII. FREEDOM TO WITHDRAW

You are free to withdraw from this study at any time for any reason.

VIII. APPROVAL OF RESEARCH

This research has been approved, as required by the Institutional Review Board for projects involving human subjects at Virginia Polytechnic Institute and State University and by the Department of Computer Science.

IX. SUBJECT'S RESPONSIBILITIES AND PERMISSION

I voluntarily agree to participate in this study, and I know of no reason I cannot participate. I have read and understand the informed consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project. If I participate, I may withdraw at any time without penalty. I agree to abide by the rules of this project

____ _____________

Signature Date

____ ________________________

Name (please print) Contact: Phone/Address/Email
(Optional)

Should I have any questions about this research or its conduct, I may contact:

Vinoth Jagannathan 540-231-3986 / vjaganna@vt.edu

Investigator Telephone/e-mail

Dr.Mary Beth Rosson 540-231-6470 / rosson@vt.edu

Investigator, Faculty Advisor Telephone/e-mail

David M. Moore____________540-231-4991/ moored@vt.edu_

Chair, IRB Telephone/e-mail

Office of Research Compliance

Research & Graduate Studies

Subjects must be given a complete copy (or duplicate original) of the signed Informed Consent

APPENDIX C: Demographic Questionnaire

Name:
Age:

1. How long have you been living in Blacksburg?

2. Are you familiar with the Blacksburg Electronic Village (BEV) website?

3. Are you associated with any organizations in Blacksburg? If so, please mention the name of the organization.

4. Can you tell me about your computing background?
   - ❑ Novice (just know how to browse the web, check email)
   - ❑ Intermediate (Familiar with applications like MS Word, Excel, etc.)
   - ❑ Expert (Done some programming, designed web pages, etc.)

5. List the operating systems you are familiar with

6. Please specify 3 applications that are most frequently used by you

7. How familiar are you with the following type of applications?
   Drawing/ graphic design applications (e.g., MS Paint, PhotoShop, CorelDraw)
   - ❑ Never used such applications
   - ❑ Familiar with such applications
   - ❑ Extensively used such applications

Web design applications (e.g., Dreamweaver, MS FrontPage)
   - ❑ Never used such applications
   - ❑ Familiar with such applications
   - ❑ Extensively used such applications

8. Have you been associated with any mailing list or discussion forum or special interest group?

Please answer the following questions, only if you answered 'Yes' to the previous question

9. How often have you posted questions or suggestions in those on-line groups?
   - ❑ Never
   - ❑ Very few times
   - ❑ Often

10. If you have posted any questions in your group, how useful were the responses?

- Very useful
- Moderately useful
- Not at all useful

11. What do you feel about answering the questions (or discussing the issues) posted in your group?
    - Very useful
    - Moderately useful
    - Not at all useful
12. In general, what is your opinion about the discussion forums/ special interest groups/ mailing lists?

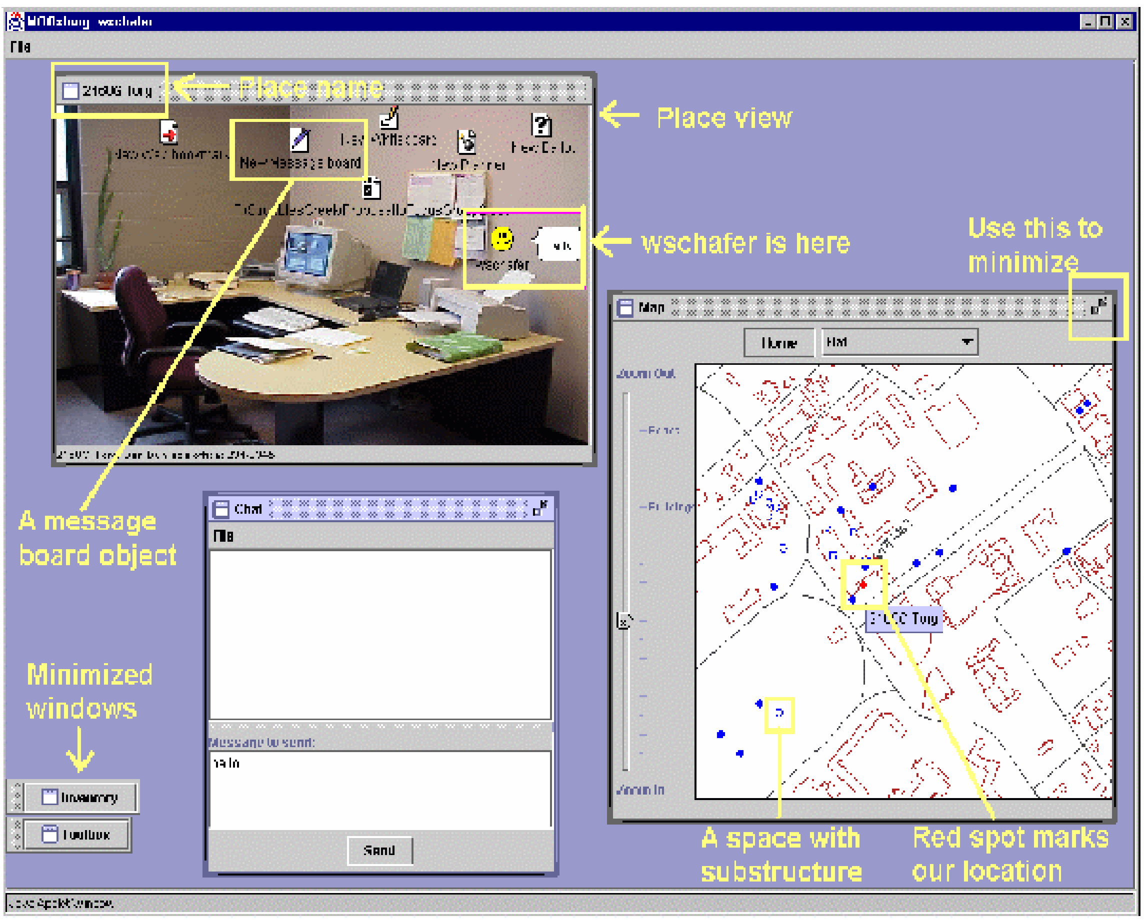
APPENDIX D: MOOsburg study guide

MOOsburg Project

The MOOsburg project is focused on developing a community internet resource for Blacksburg. The purpose of the project is to create a community based on-line resource modeled on the town of Blacksburg. The goal is to foster real-time communication and interaction among the local community. A web page is no longer a static information provider, but a meeting place for people with common interests, a repository for interactive objects, a mutable world changeable by the users, both content recipients and creators.

Working with MOOsburg windows

When you load MOOsburg you will see three windows pop-up. The map is for navigation and tells you which place you are current at (the one in red). The chat window corresponds to a chat session in that place and the other window is your view of the place.



User "wschafer" is visiting 2160 in Torgersen.

You can resize the chat window and the map window by dragging any side or corner. You can also minimize the chat and the map by using the icon in the top right-hand corner. Minimized windows appear in the lower left-hand corner of the MOOsburg window. Clicking on them opens them.

The **Toolbox** is used for creating new collaborative objects and the **Inventory** is a collection of objects you are carrying around with you.

Working with the map

You can navigate to other locations by clicking on the other spots on the map. Green spots indicate where other people are located, blue spots indicate visitable locations without people, and the red spot is where you are located. Circles that are not filled in are spaces that have substructure (see Navigating Spaces). Mousing over a spot will show the name of the place.

Navigating Spaces

MOOsburg uses a hierarchical design of places and spaces. Spaces are containers that contain other places and spaces and places are visitable locations. This is similar to files and folders, where folders contain other files and folders and files are the actual documents.

On the map, spaces are distinguished from places by open circles. There are two ways to enter a space. Using the map you can right-click on an open circle and choose "Enter space" from the menu. If you are located at the space you want to enter (the open circle is red), right-clicking in the place view brings up a menu with an "Enter Space" choice.

Once you enter a space, the place view and the map will change. The new map reflects a map of the space and will contain spots just like those on the MOOsburg map. Similar to the MOOsburg map, you can visit each spot and enter in the open circles. As you enter spaces, the map also adjusts with buttons for exiting. These buttons run along the top of the map. For example, clicking on the icon for "Blacksburg" will take you out of the space and back to the Blacksburg map.

Leaving MOOsburg

When you leave MOOsburg the system will remember the last place you were visiting and position you there the next time you log in. You can exit the system by choosing File, Close or by clicking the X in the top right-hand corner. Also, you need to close the little window that reads: "MOOsburg applet will load below ..."

Index of key objects

Message Board

Whiteboard

Shared file

Web bookmark

Planner

Ballot

Right click on an object to see the menu.

APPENDIX E: Post-task questionnaire for minimalist authors

Please evaluate the following statements based on your experience.

1. In overall, the MOOsburg system is very useful

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

2. Performing a task, using the map was easy

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

3. Performing a task, using the place object was easy.

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

4. Performing a task, using web bookmark tool was easy.

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

5. Performing a task, using the ballot tool was easy.

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

6. The document I have authored will be very useful to expert users.

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

7. The document I have authored will be very useful to novice users.

   Completely Disagree 1 2 3 4 5 6 7 Completely agree

8. The amount of information in the document is

   Too little 1 2 3 4 5 6 7 Too much

9. Completeness of the document

   Deliberately Incomplete 1 2 3 4 5 6 7 Complete

10. My knowledge about the system to complete the tasks is

    Insufficient 1 2 3 4 5 6 7 More than enough

11. Please mention any suggestions to improve the documents you created.

APPENDIX F: Post-task questionnaire for traditional authors

Please evaluate the following statements based on your experience.

1. The system was very easy to use.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

2. The Map object was very useful.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

3. The Place object was very useful.

   Completely Disagree 1 2 3 4 5 6 7 Completely Disagree

4. The Whiteboard object was very useful.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

5. The Web Bookmark object was very useful.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

6. The Ballot object was very useful.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

7. I was able to find and understand the features of the Map object very easily.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

8. I was able to find and understand the features of the Place object very easily.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

9. I was able to find and understand the features of the Whiteboard object very easily.

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

10. I was able to find and understand the features of the Web Bookmark object very easily.

    Completely Disagree 1 2 3 4 5 6 7 Completely Agree

11. I was able to find and understand the features of the Ballot object very easily.

Completely Disagree 1 2 3 4 5 6 7 Completely Agree

12. What do you think about the amount of information provided in the document you prepared?
    - Too much
    - More than enough
    - Just enough
    - There is some information, but it is not enough
    - Too little

13. When I use MOOsburg in future, I'll use these objects with confidence.

Completely Disagree 1 2 3 4 5 6 7 Completely Agree

14. When I use these objects in the future, I'll use all the features I explored today.

Completely Disagree 1 2 3 4 5 6 7 Completely Agree

15. The help I created will be useful for novice users.

Completely Disagree 1 2 3 4 5 6 7 Completely Agree

16. The help I created will be useful for expert users.

Completely Disagree 1 2 3 4 5 6 7 Completely Agree

17. Do you have any suggestions to improve the document you created?

APPENDIX G: Informed consent form for document users

Virginia Polytechnic Institute and State University
Informed Consent for Participant of Investigative Project

Title of Project: **End-User Authoring in MOOsburg**
Investigators: **Vinoth Jagannathan**

I. THE PURPOSE OF THIS RESEARCH

You are invited to participate in a study about Authoring in a Multi user domain. The purpose of this research is to analyze the possibilities of making the users author (write) a help manual (using a particular approach) for a community network they use.

II. PROCEDURES

You will participate in an experiment consisting of two sessions. In the first session you will fill a demographic questionnaire and explore MOOsburg (a community internet resource for Blacksburg). After that you will be asked to evaluate a help document (created by other users) and discuss about it (in a questionnaire).

Your role during the experiment is that of online community member. We are **not evaluating you** in any way; you are helping us to identify the authoring patterns and flow of tasks in MOOsburg. All information that you help us attain will remain anonymous. You may be asked questions after each phase, in order to clarify our understanding of your answers.

The session will last about 60 minutes. For research purposes, the study will be timed. There are no risks to you. The tasks are not very tiring, but you are welcome to take breaks as needed. You may also terminate your participation at any time, for any reason.

III. RISKS

There are no known risks to the subjects of this study.

IV. BENEFITS OF THIS PROJECT

Your participation in this project will provide information that will be used to design an automated help session/ user manual for MOOsburg. No guarantee of benefits has been made to encourage you to participate. You may receive a synopsis summarizing this research when completed. Please leave a self-addressed envelope with the experimenter and a copy of the results will be sent to you.

You are requested to refrain from discussing the questionnaire with other people who might be in the candidate pool from which other participants might be drawn.

V. EXTENT OF ANONYMITY AND CONFIDENTIALITY

The results of this study will be kept strictly confidential. Your written consent is required for the researchers to release any data identified with you as an individual to anyone other than personnel working on the project. The information you provide will have your name removed and only a subject number will identify you during analyses and any written reports of the research.

VI. COMPENSATION

Your participation is voluntary and unpaid.

VII. FREEDOM TO WITHDRAW

You are free to withdraw from this study <u>at any time</u> for any reason.

VIII. APPROVAL OF RESEARCH

This research has been approved, as required by the Institutional Review Board for projects involving human subjects at Virginia Polytechnic Institute and State University and by the Department of Computer Science.

IX. SUBJECT'S RESPONSIBILITIES AND PERMISSION

I voluntarily agree to participate in this study, and I know of no reason I cannot participate. I have read and understand the informed consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project. If I participate, I may withdraw at any time without penalty. I agree to abide by the rules of this project

____ __________________
Signature Date

____ ______________________
Name (please print) Contact: Phone/Address/Email (Optional)

Should I have any questions about this research or its conduct, I may contact:

<u>Vinoth Jagannathan 540-231-3986 / vjaganna@vt.edu</u>

Investigator Telephone/e-mail

<u>Dr.Mary Beth Rosson 540-231-6470 / rosson@vt.edu</u>

Investigator, Faculty Advisor Telephone/e-mail

David M. Moore____________540-231-4991/ moored@vt.edu_

Chair, IRB Telephone/e-mail

Office of Research Compliance

Research & Graduate Studies

Subjects must be given a complete copy (or duplicate original) of the signed Informed Consent

APPENDIX H: User reaction survey

Please circle the option that suits your opinion about the statements.

1. The help document will be

   Useless 1 2 3 4 5 6 7 Very helpful

2. The amount of information in the document is

   Too little 1 2 3 4 5 6 7 Too much

3. I read the help document

   Sparingly 1 2 3 4 5 6 7 Completely

4. The time I spent with the document is
   a. Too long and not very useful
   b. Too long but very effective
   c. Adequate
   d. Too short but effective
   e. Too short and not very useful

5. With this help document, I can complete the task

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

6. If I were asked to improve the help manual I would
   a. Add more information
   b. Leave it as it is
   c. Remove some information

7. I am satisfied with the instructions

   Completely Disagree 1 2 3 4 5 6 7 Completely Agree

8. The probability for someone to use help for this task is

   (0%) 1 2 3 4 5 6 7 (100%)

APPENDIX I: Sample Help Documents

<u>Minimalist Approach</u>

Task: Create survey using this

- Choose the Ballot from Toolbox
- This creates new ballot icon on the popup window
- Edit/configure by providing the questions, choices..

Suggestions: During the "creation" mode, the choices have check boxes, though you might to look like radio buttons. That’s completely fine. At the end, only option button comes.!

Task: Create your favorite bookmark near your place

- Go to Toolbox window and choose "Web bookmark"
- This creates a new bookmark in your "selected place"
- Now, rename is as you want.
- Add your favorite website's URL by going into edit mode!

Suggestions: Don’t forget to give "http://" before the URL

Task: Find the map/directions/distance from my home to often visited places

- Create a place/space for my home.
- Create a place/space for the locations I shall be visiting.
- Determine the relative positions between the origin and destination
- Also, check for the various routes connecting them.

Suggestions: While adding space/place, the pop up window would not be stable. Wait for that!

Task: Create place in the map for any location most desired

- Right click on the map, where you want to create a place
- Give a name for it in the new pop up window, create any paint images for enhancing it. Also any picture can be uploaded along with it.

Suggestions: If by chance, you use or move your original place by using n-s-w-e buttons, spend considerable time to precisely re-locate the place.

Traditional Approach

What is a Ballot Tool?
This object is like taking a survey, given some choices for the result. Some people visiting the place can answer the survey as one of their tasks.

Creating and Using a Ballot Tool

- click ballot from the tool box and click create
- left or right click the ballot icon on the place and select from the following options
- you can rename the object by simply clicking rename
- you can delete the object by clicking the remove from the menu item
- you have to configure the ballot , before you vote or see the results, this is a simple wizard which guides you thro the creation of the question and the choices
- you can edit the security features by edit security, this limits the usage of this by the respective user privileges
- you can take it with you in the inventory by clicking take from the menu list
- Inspect is like the "About " box
- you can vote by clicking vote and it gives the question and the choices as radio buttons, once you select you choice, say vote
- you can see the results of this survey, by clicking the display current results, which gives the percentage of the votes and which choices are selected how many times

What is a Bookmark Tool?
This object is to give a hyperlink from within a place so that you can visit that webpage.

Creating and using a Ballot Tool

- click the web bookmark in the tool box and click create
- left click the web bookmark and select edit URL to type in the active hyperlink, use http://www.yyy.zzz format
- you can rename the object by clicking the rename from the menu
- you can remove it by simply confirming to the information window after you click remove
- you can give the security features like who can see it, who can edit, modify etc. with the edit security menu item
- you can take it with you by "take" which puts it in the inventory
- inspect is like the "About" window
- finally, you can click the "Open the web bookmark" to go to the linked web page

What is a Map?
Map is a navigator tool, which guides us about the other places and spaces present in the given region. It has other objects like places, spaces etc. which may be nested.

Using a Map
- clicking on the map and dragging does the PAN operation
- can use the left side zoom slide to either zoom in or out
- can go back to the "show all" mode by clicking HOME
- you can select the view you wish to pursue
- right clicking and selecting "GO to" takes you the place/space you have selected
- when you are inside a space, you can go to any other places or spaces inside it by doing the same previous operation
- When nested inside a space, the map gives the nesting sequence, by clicking on which takes you to the respective map.
- you can minimize it by clicking the top right corner icon or by dragging the sides or corner
- there is a direction indication to guide you to the right direction

What is a Place Object?
This object indicates the location you are visiting currently. This object may have many other objects like web bookmark, ballot etc. which are present in the tool box inside it.

Creating and using a Place Object
- You can right click in any location on the map and say you need to add a place.
- After you visit someone's place, if the person is there you can even communicate with him thro the chat window, share a file with him, etc.
- It shows the person logged in (who is visiting the place)
- You can edit a place using Paint, giving the right back ground, diff. images, etc...
- You can remove it by confirming to the pop up window after you click remove.
- you can take it with you where ever you are going by placing it in the inventory
- You can mention the security features, as who can use, edit, modify etc.
- you can add a information window by clicking "Add a new sign"
- Inspect is like the information or "About" window.

APPENDIX J: Statistical Analysis

1. Time by Instr Type, Object (2-way ANOVA)

n	48

Time by Instr Type	n	Mean	SD	SE
Comp	24	358.6	149.7	30.56
Min	24	338.6	98.1	20.03

Time by Object	n	Mean	SD	SE
Map	12	463.7	117.2	33.83
Place	12	400.9	84.9	24.51
WBMK	12	307.5	71.1	20.53
BT	12	222.3	69.1	19.93

Source of variation	SSq	DF	MSq	F	p
Instr Type	4780.0	1	4780.0	0.82	0.3714
Object	403318.2	3	134439.4	22.98	<0.0001
Instr Type × Task	99688.7	3	33229.6	5.68	0.0024
Within cells	233976.5	40	5849.4		
Total	741763.5	47			

2. No. of times referred back to the system by Instr Type: comp, min

n	12

No. of times by Instr Type	n	Mean	SD	SE
comp	6	20.167	7.026	2.8684
min	6	9.333	3.830	1.5635

Source of variation	SSq	DF	MSq	F	p
Instr Type	352.083	1	352.083	11.00	0.0078
Within cells	320.167	10	32.017		
Total	672.250	11			

3. No. of words by Instr Type, Object (2-way ANOVA)

n	48

Words by Instr Type	n	Mean	SD	SE
Comp	24	143.667	28.199	5.7561
Min	24	65.500	17.533	3.5788

Words by Object	n	Mean	SD	SE
Map	12	115.583	49.779	14.3698
Place	12	101.333	40.273	11.6257
WBMK	12	101.833	34.380	9.9246
BT	12	99.583	59.246	17.1028

Source of variation	SSq	DF	MSq	F	p
Instr Type	73320.333	1	73320.333	143.40	<0.0001
Object	1969.500	3	656.500	1.28	0.2930
Instr Type × Object	2937.833	3	979.278	1.92	0.1426
Within cells	20452.000	40	511.300		
Total	98679.667	47			

4. Productivity by Instr Type: comp, min

n	12

Productivity by Instr Type	n	Mean	SD	SE
comp	6	22.337	2.187	0.8929
min	6	12.347	2.229	0.9098

Source of variation	SSq	DF	MSq	F	p
Instr Type	299.442	1	299.442	61.42	<0.0001
Within cells	48.750	10	4.875		
Total	348.193	11			

5. Steps by Instr Type: comp, min (2-way ANOVA)

n	48

Steps by Instr Type	n	Mean	SD	SE
Comp	24	6.75	1.674	0.3969
Min	24	4.817	1.171	0.3506

Steps by Object	n	Mean	SD	SE
Place	12	5.917	2.021	0.5833

Map	12	6.250	2.340	0.6756
WBMK	12	6.250	1.960	0.5658
BT	12	6.000	2.594	0.7487

Source of variation	SSq	DF	MSq	F	p
Instr Type	67.688	1	67.688	18.87	<0.0001
Object	1.063	3	0.354	0.10	0.9603
Instr Type × Object	10.229	3	3.410	0.95	0.4255
Within cells	143.500	40	3.588		
Total	222.479	47			

1-Way ANOVA for document author questionnaire

n	12

Question	SSq	DF	MSq	F	p
System	0.000	1	0.000	0.00	1.0000
Map	0.000	1	0.000	0.00	1.0000
Place	0.333	1	0.333	0.5900	0.4608
WBMK	0.75	1	0.75	0.38	0.549
BT	0.75	1	0.75	1.22	0.2959
For Novice	0.75	1	0.75	1.36	0.27
For Experts	1.333	1	1.333	0.71	0.4178
Amt of Info	1.333	1	1.333	5.71	0.0379

1-Way ANOVA for document user questionnaire

n	12

Question	SSq	DF	MSq	F	p
Doc Useful	0.375	1	0.375	0.22	0.6469
Amt of Info	3.375	1	3.375	3.19	0.0877
Percentage read	2.042	1	2.042	3.77	0.0651
Time spent	0.167	1	0.167	0.38	0.5443
add/remove info	0.667	1	0.667	1.69	0.2068
Satisfaction	0.167	1	0.167	0.12	0.7369

VITA

Vinoth Jagannathan was born and raised in Tamil Nadu, India. In 2000, he received his Bachelor of Engineering degree from Madurai Kamaraj University. In 2002, he completed his Master of Science in Computer Science and Applications at Virginia Polytechnic Institute and State University. He pursued research in the area of Human-Computer Interaction. While obtaining his Master's degree, he also spent two semesters as a Graduate Teaching Assistant. Vinoth is a member of the Association for Computing Machinery and Institute of Electrical and Electronics Engineering.