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A Study of Human Factors in Interactive Software

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ABSTRACT : This paper presents the result of an empirical study conducted in an organization to find out the impact of human factors that affect performance of the end users. Our results shed new insights into those factors that affect them, with significant implications to improve their performance.

KEYWORDS: End user, usability, satisfaction, novice users, library information system

I. INTRODUCTION

Today one of the most important concerns is how to use the system with effectiveness, efficiency and satisfaction. The ease or comfort during the usage of systems is mainly determined by characteristics of the software product itself, such as the user-interface. As usability is concerned with the usage of software systems generally, it forms an important pillar for determining and optimizing of product quality characteristics. Usability takes into consideration, the type of the users, the tasks to be carried out, as well as the physical and social aspects that can be related to the usage of the software products. There are several usability criteria available as guidelines that are defined in international standards such as the ISO 9241-11 [4]. For a successful application of these guidelines, software system designers need to understand the design goals and benefits of each guideline, the conditions under which the guideline should be applied, the precise nature of the proposed solution, and any procedure that must be followed to apply the guideline. ISO 9241-11 consists of guidelines on usability, providing definitions of usability that is used in subsequent related ergonomic standards. Moreover, this ISO explains how to identify the information necessary to be taken into account when specifying or evaluating usability in terms of measures of user performance and satisfaction. "Usability evaluation" can be defined as the act of measuring (or identifying potential issues affecting) usability attributes of a system or device with respect to particular users, performing particular tasks, in particular contexts. The reason that users, tasks, and contexts are part of the definition is that the values of usability attributes can vary depending on the background knowledge and experience of users, the tasks for which the system is used, and the context in which it is used [5].

Various evaluation criteria can be used to test the usability of the system:

- *Effectiveness:* It is accuracy and completeness with which specified users can achieve specified goals in particular environment [6]. Producing the result that is wanted or intended produces a successful result. The total average of effectiveness has a relatively low score; thus, it seems that some additional features should be added to activate the system. Also when the total evaluation is low, this means that the user needs more time than expected to carry out the given tasks.
- *Efficiency:* Efficiency is defined as the resources expended in relation to the accuracy and completeness of goals achieved [6]; or the quality of doing something characterized with no waste of time or money. On this basis, evaluation is decided to improve the structure of the interfaces and to add a number of features before releasing the system to the users.

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- *Satisfaction*: It is a tool to measure computer user's subjective satisfaction with the computer interface. It contains an overall measure of satisfaction and measures user satisfaction in four specific interface aspects: screen factors, terminology and system feedback, learning factors, and system capabilities [7].

It is tangible that computers do more than just providing information and offering services to people to use [8]. Carroll [9] notes that the design of computing systems is part of an ongoing cycle in which new technologies raise new opportunities for human activities; as people's tasks change in response to these opportunities [5].

II. RESEARCH METHODOLOGY: EMPIRICAL STUDY

The purpose of our empirical study is to find out the important usability aspects, which need to be improved to reach high degree of usability. Since usability and empirical study are mutually dependent, we feel an effective empirical study is needed which could validate our findings. The main purpose of empirical study in our thesis is to study usability in a practical environment by observing the experiences of user while using the system. Hence, the empirical study is needed to find the usability flaws which affect the current system. To do an effective, empirical study five preset tasks have been identified and will be performed by the participants to increase the validity of the collected data. The collected data is checked and analyzed. To be specific the objectives of the study were to gain an insight into the issues of usability of the user interface and how usable our design was for different classes of users. Our study followed general guidelines for usability testing. These included designing tasks, the questionnaire, recruiting test participants, conducting testing, and analyzing test results.

The study took place in Think Computers. Think Computers is an interdisciplinary, professional consulting firm, which has its primary purpose the application of Managerial, Information system and Engineering skills to the solution of a wide number of problems in various commercial environments. The firm has in the past provided Software solutions government training in size from small private organizations to Major Corporation. Think Computers has a large number of developers with experience in development tools. Participants were informed that the tasks that they would be asked to do was not a test of their intelligence. All participants began by filling out a general information questionnaire concerning their personal characteristics like age and education (Illustrated in Appendix I). Researcher used library interface of Think Computers for this study. Participants were asked to perform the given tasks. Task duration and task success scores were collected. The task time started after the participant read the task aloud and ended in one of two ways:

1. The participants finished the task. A predetermined "correct" answer for each task was used to calculate task success measures.
2. The participants gave up.

III. PARTICIPANTS

These participants were balanced by age, literacy level and general computer experience. Participants were divided into two groups; 1- having age less than or equal to 40, 2- having age above 40. Literacy level was measured using a 3-pt scale: users with different literacy levels namely 1=literate, 2=semi literate and 3=illiterate. Computer experience was measured using a 5-pt scale: 1= novice, 2=beginner, 3=intermediate, 4=advanced and 5=expert.

IV. PROTOTYPE DESCRIPTION

The following section describes some of the screenshots of Library Software. This Software is used by Think Computers for their library management. We have chosen this software for our participants to perform the given task. Scenarios were used to describe how the users will perform the task.

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Figure 1: Menu to navigate from Homepage to Query page

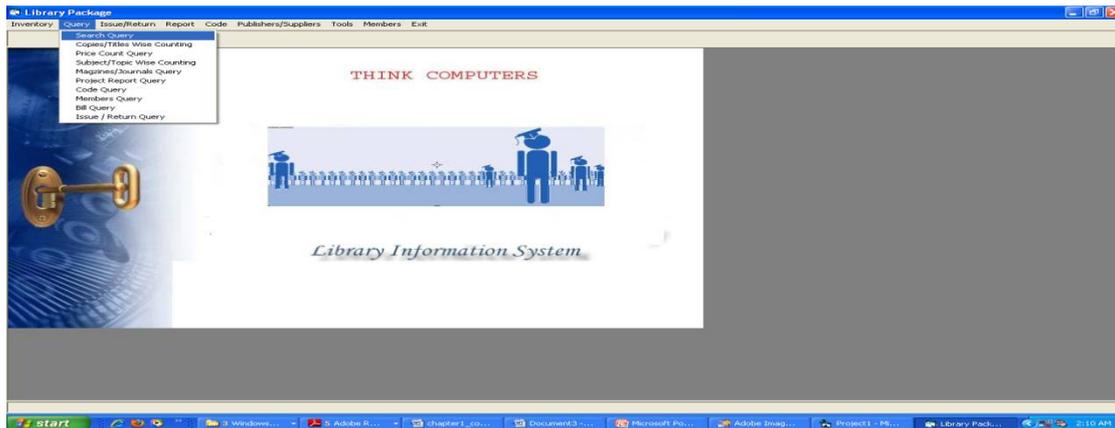
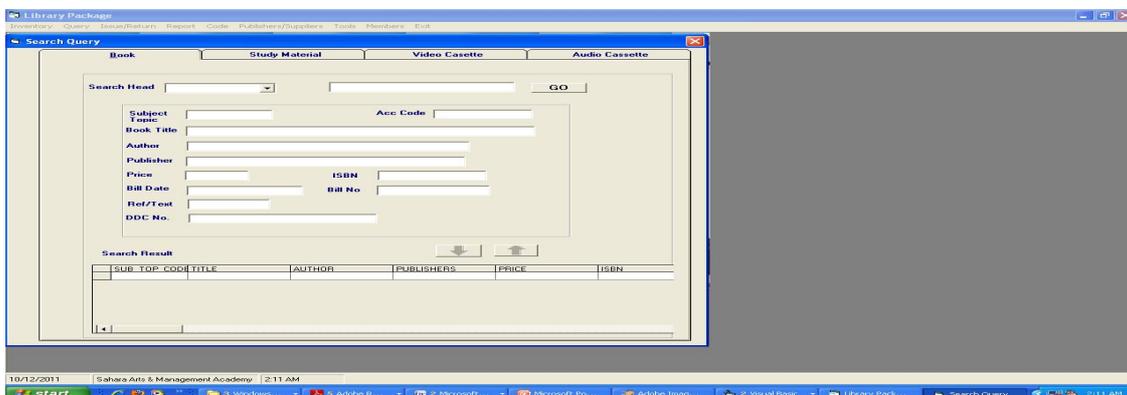


Figure 2: Query page of Library software



V. SCENARIO

Participants have to find out “Yashwant Kanetkar’s” book “Let Us ‘C’”, from the library. (1) Find the above mentioned book. (2) Find multiple edition of the book. (3) Find the recent version. (4) What is the unique id of the book. (5) Take print out of the details so you can refer to it later.

On the completion of these tasks, the participants were asked to fill up questionnaire (feedback). The questions for subjective evaluation have been established after referring to different types of questionnaires. We have chosen computer system usability questionnaire (CSUQ) [10]. This questionnaire, developed at IBM, is composed of 19 questions. We had made some changes in the questionnaire (Illustrated in Appendix I). Finally, the participant were thanked and asked if they had any questions.

VI. RESULTS

A small number of participants were able to complete their task. Most of them completed fewer tasks successfully and took longer time on each task. Age, Computer experience and literacy level of the participants correlated with overall performance. Since the focus of our study was to identify usability problems in current user interface. Few

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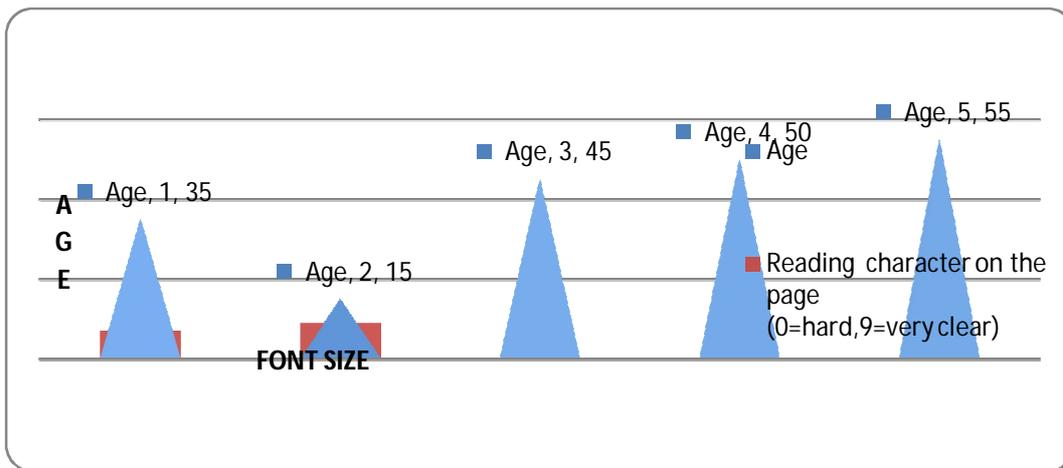
participants who were unable to complete the tasks, when we discussed the reasons of their failure they said that they couldn't understand the functionality of the system. These users were puzzled by the meaning of selecting inputs actually they were not following the proper order.

VII. OBSERVATIONS

We had a number of usability observations about the system.

1. The user of old age does not prefer to recall information from one part of a dialogue to another. Participants of old age could not easily read characters, they preferred bigger font size. Few users reported that during task
2. when the users have to select menu for searching the book there was no tool tip available.

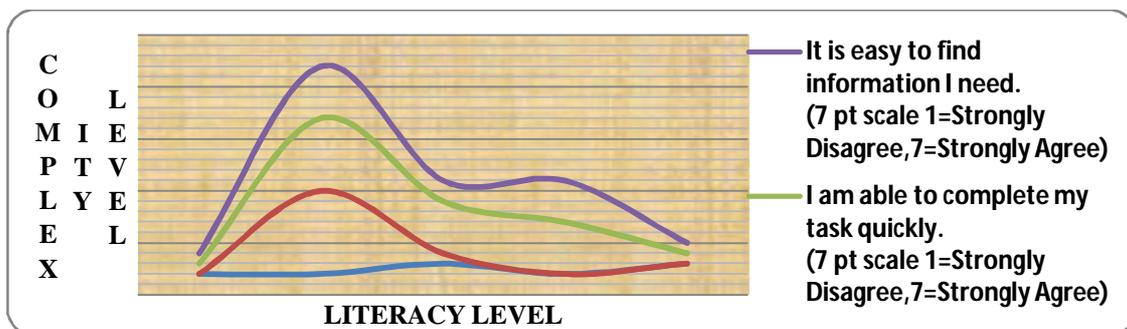
Figure 3: Old age participants prefer bigger font size



From the above figure we can conclude that as the age increases participants prefer bigger font size.

3. The most significant problems that people with low literacy level encountered in comprehending the interface was that they read word by word trying to make sense of the information they read. It is clear that in order to provide a genuinely usable system for this group it is necessary to use more pictures, audio etc.

Figure 4: Users with low literacy level prefer simple language



The results also indicated that low literacy users do not prefer dense pages. As information technologies expand far beyond the traditional personal computers into public information systems, designers of these systems must

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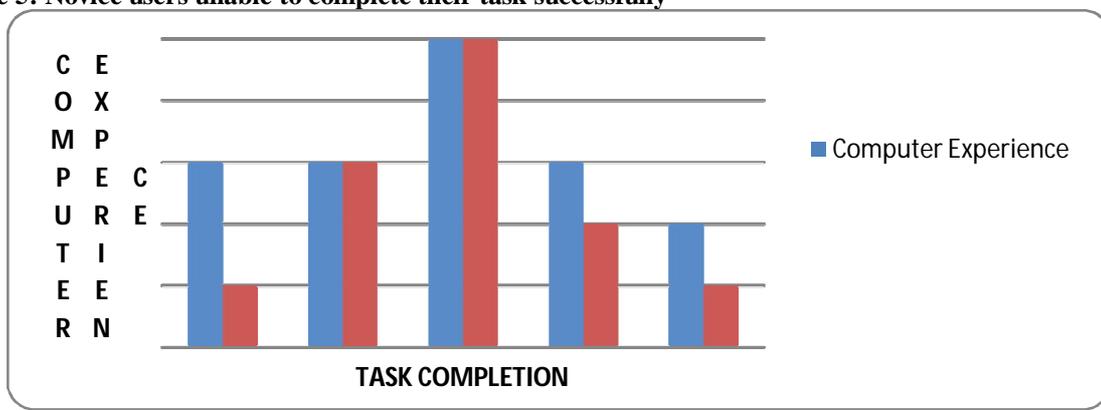
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consider their target audience’s level of literacy [2]. As Government and Social Services information move to online distribution, digital inclusion will require designers to consider the problems faced by low literacy users [3].

- Most of the participants who have computer experience could complete all the tasks. Novice and low literacy users couldn’t understand technical terms properly.

Figure 5: Novice users unable to complete their task successfully



Many users reported that the task1 was not completely successful, because it is not giving the proper guidance. Also when the user entered the Author name in search box to find the corresponding books, some users did not get the results because of space between keywords. Here the users got confused how to go on with the task. Here an alternative such as dropdown list is not provided by the system. When the user misspells the name of the Author, the system should be smart enough to show appropriate suggestion of authors that enables the users to complete the task. The system should be uniform and unitary which means the standard followed in one part of the system must be followed throughout the process. For example the operations of functions, tasks must be consistent. In the Library Interface standard font size is not maintained throughout the process because of which the users felt little difficult to read the contents. Users cannot complete the tasks successfully because the important menus were not visible to users. In the interface users who don’t have computer experience did not understand meaning of Query Menu. So terminology was not clear to the users.

Table 1: Factors which affect usability of the system

Factors	Impact of these factors on the usability of the system
Age	In the study conducted by us we found that only 2.3% of tasks could be completed by people of old age. Duration of task completion was very high. Most of them mentioned that they found system complicated and error messages were not clear.
Literacy Level	Results of the study indicate that usability of the system is highly affected by literacy level. Participants with low literacy couldn’t understand most of the terminology used in the system due to this they made so many errors.
Computer Experience	The survey is indicative of the fact that system is moderately affected by the experience of the target user. As we had already mentioned that novice users prefer easy to use system whereas professional users prefer efficiency.

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At all points during the designing of interface the target users should keep in mind and efforts should be made to ensure that the interface did not get confusing for the users. Icons, language and terminology should be understandable by the target users. Shortcuts or accelerators, unseen by novice users, are provided to speed up interaction and task completion by frequent users. Few participants mentioned that error messages were expressed in complicated language. Error messages should define problems precisely and give quick, simple, constructive, specific instructions for recovery. There is a great difference in task completion for different participants. This is due to the different experience, age and literacy level of the participants.

VIII. CONCLUSION

The designers of the system should always consider human factors during design time because end user feel that if it is not easy to use, not easy to learn, not according to their needs, then even an excellent software could fail. Since users differ with regards to abilities, requirements and preferences so the system should aim to cover the broadest range of the users. User Interface tools should provide special helps to the designers like guidance and suggestions etc.

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