Faculty of Cognitive Science and Human Development

THE DESIGN AND EVALUATION OF AN INDUSTRIAL TRAINING WEBSITE FOR THE FACULTY OF COGNITIVE SCIENCE AND HUMAN DEVELOPMENT (FCSHD)

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THE DESIGN AND EVALUATION OF AN INDUSTRIAL TRAINING WEBSITE FOR THE FACULTY OF COGNITIVE SCIENCES AND HUMAN DEVELOPMENT (FCSHD)

by

TAN MENG WEI

This project is submitted in partial fulfilment of the requirements for a
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ABSTRACT

THE DESIGN AND EVALUATION OF AN INDUSTRIAL TRAINING WEBSITE FOR THE FACULTY OF COGNITIVE SCIENCES AND HUMAN DEVELOPMENT (FCSHD)

Tan Meng Wei

The main aim of this study is to develop an industrial training website for the Faculty of Cognitive Sciences and Human Development (FCSHD) and evaluate the usability among its users. This industrial training website will allow users the facilitation of tracking down the relevant information when and where is needed. Besides, it also helps lecturers to coordinate and handle the procedures of industrial training. In addition, it helps students who are involved in industrial training to submit relevant documents such as daily log and report through this website. Trainee supervisors in their attached organizations can make use of the forms provided on the website to evaluate students' performance. The development process of this website is based on the lifecycle of Boehm's Spiral Model. Various software such as Macromedia Dreamweaver, Macromedia Flash MX, Ulead PhotoImpact 6.0 and Ulead GIF Animator 4.0 have been used to develop this website. Active Server Pages (ASP) language has also been used in the processing of forms. The data collection included the demography of respondents, ratings for content evaluation and ratings for website design which were carried out through questionnaires and rating scales. The evaluation found that overall the industrial training website has usability feature. Some recommendations and ideas for future work have been identified in the last chapter.

ABSTRAK

REKABENTUK DAN PENILAIAN HALAMAN WEB LATIHAN INDUSTRI UNTUK FAKULTI SAINS KOGNITIF DAN PEMBANGUNAN MANUSIA (FSKPM)

Tan Meng Wei

Tujuan kajian ini adalah untuk merekabentuk halaman web latihan industri untuk Fakulti Sains Kognitif dan Pembangunan Manusia (FSKPM) dan menilai halaman web ini dari segi kebolehgunaannya. Halaman web latihan industri ini akan memudahkan mereka memperolehi segala maklumat yang berkaitan dengan latihan industri melalui kemudahan Internet. Di samping itu, ia turut dapat memudahkan tugas pensyarah semasa dalam menguruskan hal-hal mengenai latihan industri. Penyelia organisasi boleh terus menilai prestasi kerja pelajar semasa menjalankan latihan di organisasi berkenaan melalui borang penilaian yang terdapat dalam halaman web ini. Pelajar-pelajar berkaitan juga boleh mengambil kesempatan ini untuk menghantar catatan tugas harian dan laporan tugas mereka kepada pensyarah masing-masing melalui halaman web latihan industri ini. Proses rekabentuk halaman web ini adalah berdasarkan model Boehm's Spiral. Dalam merekabentuk halaman web latihan industri ini, pelbagai perisian telah digunakan seperti Macromedia Dreamweaver, Macromedia Flash MX, Ulead PhotoImpact 6.0 dan Ulead GIF Animator 4.0. Selain daripada itu, bahasa pengaturcaraan Active Server Pages (ASP) turut digunakan untuk memproses data-data dalam borang yang diisikan oleh pihak organisasi, pensyarah dan pelajar semasa membuat penilaian, di mana borang tersebut juga disalurkan melalui halaman web ini. Data-data seperti maklumat demografi responden, penilaian terhadap kandungan halaman Web dan juga penilaian terhadap rekabentuk halaman Web ini telah dikumpulkan melalui borang soal-selidik dan skala Likert. Daripada analisis data yang diperolehi, secara keseluruhannya halaman Web ini mempunyai ciri-ciri kebolehgunaan. Di samping itu, beberapa cadangan dan idea untuk kajian yang akan datang turut disenaraikan.

CHAPTER 1
INTRODUCTION

1.1 Introduction

The World Wide Web (WWW) is the latest evolution of an effort to make information on computer throughout the world and make it available to as many users as possible. It is a collection of documents which store in the servers and viewed by clients. A large number of information repositories (websites) already exist, and new ones are rapidly being created. Almost all the pages on Web repositories provide elements that allow users to interact with them. Therefore, those who are designing pages for the WWW are actually designing user interface.

While the Internet as a tool to create "critical mass" of intellectual resources (Licklider, 1968). It is a network of networks, linking computers to computers and sharing the TCP/IP protocols. Each runs software to provide or "serve" information and to access and view information. It is the transport vehicle for the information stored in files or documents on another computer. The World Wide Web incorporates all of the Internet services. From there, we can retrieve documents, view images, animation, and video, listen to sound files, speak and hear voice, and view programs that run on practically any software in the world.

The proliferation of pages with poor usability suggests that most designers of Web pages have little knowledge of user interface design and usability engineering. This serious problem needs to be addressed, as pages with poor usability can have some negative effects. The inability to find the information, disorganized pages, confusing information, the construction and disconnected links of pages and the lack of navigation support will cause users to be frustrated. Besides that, the barriers which are imposed by the poorly designed interface can cause the discouragement of the exploration. The time is wasted, because of disorganized pages, misleading link names, long pages and long download times. The problems just mentioned not only affect the use of a particular site, but are also responsible for the increasing of internet traffic.

Developing an industrial training website for the faculty of Cognitive Sciences and Human Development is a time consuming task. The designer must carefully design the applications' navigational architecture and user interface, if the designer wants them to be usable. In addition, the designer must clearly understand the user tasks in order to decide which navigation facilities the designer should include, according to the user needs. Besides that, the interface should help the user browse through the sea of information by giving those cues and feedback on their actions, and by presenting the information in a clear and meaningful way.

1.2 Problem Statement

Time is an important factor in industrial training. Currently, the manner in which FCSHD handles the industrial training programme is formalized and scheduled; it has a specified beginning and ending period. Therefore, this conventional way of managing the industrial training sometimes does not suit the student's scheduling needs. For example, when industrial training coordinator has fix a time to hold a meeting with those students who will be undergoing industrial training, there maybe some of them who would not be able to make it. Hence, they might miss some important points.

Students always need to contact with coordinator in order to contact with coordinator in order to get latest information such as the acceptance from the organization. There is also a problem of finding a suitable time and venue to have a discussion between students and lecturers especially when they face some problems in organization. Furthermore, for some students who undergo training far away from UNIMAS, they face problem of late submission of industrial training report. It takes longer time to send the report to UNIMAS by post.

1.3 Project Objectives and Purposes

1.3.1 General Objectives and Purposes

This project intends to design and evaluate an industrial training website for the faculty of Cognitive Sciences and Human Development (FCSHD). The purpose is to facilitate FCSHD students, industrial training coordinators and lecturers who are involve in industrial training procedures.

1.3.2 Specific Objectives

1) Design a usable industrial training website for FCSHD.
2) Develop and implement an industrial training website for FCSHD undergraduate students.
3) Evaluate the usability of the system.
4) Identify FCSHD students' perceptions towards the website.

1.4 Significance Of The Project

Industrial training website will allow industrial training coordinator to put all the important and relevant information on the website, such as report-writing guidelines, industrial training's regulations and information about certain organizations. Industrial training website can be used as a medium of communication which enables industrial training coordinators or lecturers to contact the students anytime, no matter where the students are. After the students have finished their reports, they can send the report through the website which includes this facility. They can send and receive the report within a few seconds by using this website. Moreover, it also can be as a medium for exchange relevant ideas among the students during the industrial training.

In short, the best feature about this industrial training website is it allows them the facilitation of tracking down the relevant information when and where they are needed. And it will change the way of industrial training coordinators and lecturers to handle the procedures of industrial training. Besides, it also change the way of students to submit relevant documents such as daily log and report.

1.5 Limitation Of The Project

This project scope is limited in creating an industrial training website for FCSHD on the web. This website is specially designed for undergraduate students in the faculty of Cognitive Science and Human Resource Development program, who need to undergo the industrial training. Some data sources, which will be used for this project, are not exactly same as those previous industrial training's data and some are not the latest information. Besides that, the misinterpretation of questionnaire by users which have different perception, experience and knowledge will affect the results of this project. Moreover, there is a possibility that users do not pay attention and are not sincere during answering the questionnaire. Environment is another factor that can influence the way users answer the question.

1.6 Summary

In the beginning of this chapter, a brief description about World Wide Web (WWW), Internet and some issues on web pages design has been given in the introduction. This followed with problem statement, objectives of this project, significance and scope of this project.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Some explanations and opinions about previous studies which have relevance with this study is elaborated in this chapter. Here, the designer looks at the human-computer interaction, lifecycle models, Web pages design guidelines and some related literature.

2.2 Human-Computer Interaction (HCI)

Generally, the term "human-computer interaction" is used interchangeably with terms such as "man-machine interaction", "computer and human interaction" and "human-machine interaction." Most of us use the term "human-computer interaction", because it is the most common in the literature. In short, the definition of HCI might say that *"it is the study of the interaction between humans and computers"* (Booth, 1989). The goal of HCI is *"to ensure that the systems produce by designers for people to use are comprehensive, consistent and usable."* (Maddix, 1990)

HCI technique is come from a wide range of subjects such as computer science, software engineering, psychology, ergonomics and cognitive science. There is an important difference that must be made between the terms "human-computer interaction" and "human-computer interface." *"Interaction includes all aspects of the environment such as the working practices, office layout, provision of help and guidance, and so on; the interface is the parts of the system with which the user comes into contact physically perceptually or cognitively."* (Benyon & Murray, 1990)

Marvin Minsky has characterized one of the fundamental problems of HCI which is *"we know a good deal about computers, how they're put together, and how they behave, we know a reasonable amount about people, their cognitive abilities, and how they behave; but we lack knowledge of specific information about their behavior, beliefs and emotions in the particular situation of sitting in front of a computer."* (Maddix, 1990) He illustrates this situation graphically as shown below.

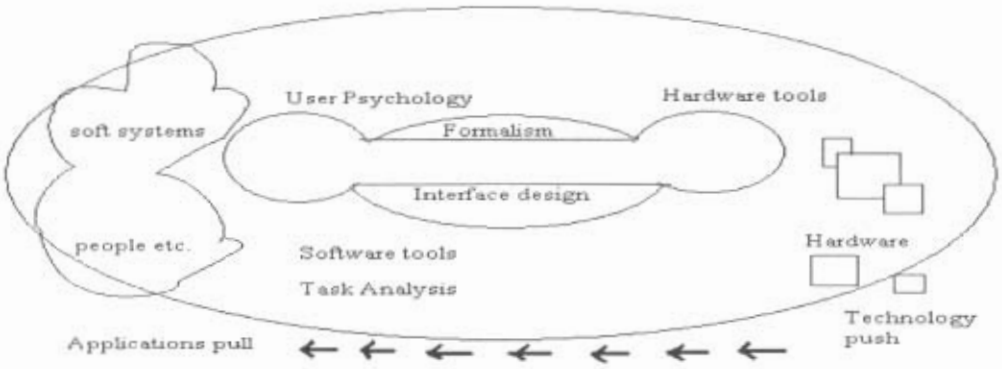

Figure 1 Fundamental of HCI problems
(Source: "*Human computer interaction: theory and practice*", Maddix, F., 1990. pp. 11)

2.2.1 Four Approaches to Human-Computer Interaction (HCI)

Knowing the approaches and the theories ensures that a designer's knowledge will not become obsolete but can continually be applied to any design. In reviews of the area of HCI, the methods have been categorized into four general approaches (Eberts, 1987). The four approaches are the anthropomorphic approach, the predictive modeling approach, the cognitive approach and the empirical approach.

For the anthropomorphic approach, the designer uses the process of human communication as a model for human-computer interaction. One of the advantages for this approach is that it can be used to create a unique design for system interfaces instead of following the guide of other disciplines.

The purpose of the predictive modeling approach is to try to predict performance of humans interacting with system. This approach can be used to determine if an interactive design is viable in terms of usability before it is prototyped. Moreover, it enables us to predict which design is better. It also can make fairly accurate error and time estimate for a task, for some cases, it can be used to predict how the user will perform a particular task.

Theories in cognitive science and cognitive psychology are applied to the HCI to make the processing of information by both the human and the computer easier and more efficient in the cognitive approach. Human perceive, store, and retrieve information from working memory and long-term memory, and then manipulate the information to make decisions and solve problems, and finally carry out responses. The overall goal of the cognitive approach can be summarized such as in Figure 2. Generally, for the cognitive approach, HCI is seen as presenting problems which have to be solved by the user. This approach has also been used to suggest which design may be suitable and easy to use rather than simply testing the design after it has been finalized.

The methodology of empirical approach as applied to human-computer interactions has been outlined by Shneiderman (1980), Moher and Scheider (1982), and Embley (1978). Empirical approach offers an alternative to intuition in determining the best design. Under this approach, the interface designer would be required to design, implement, and analyze the results from empirical studies.

These four approaches provide a structure for how to approach the problem of designing a user interface. A new principle is needed in each context for each task and design. Therefore, a user interface designer must understand the approaches and theories along with the task.

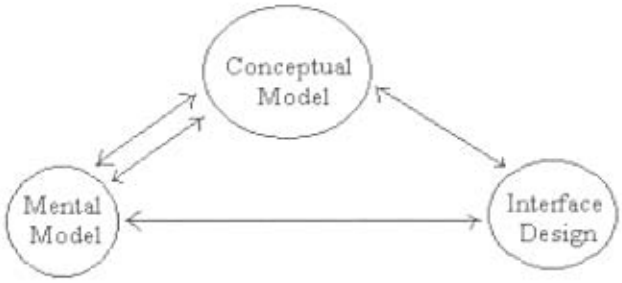

Figure 2 Conceptualization of the design of human-computer interfaces
(Source: "*User interface design*", Eberts, R.E., 1990. pp. 50)

2.2.2 Mental Model

The mental model is the model that the user has in their mind just as how the computer system or program works; this mental model guides how the user structures the interaction task. (Norman, 1986). Norman (1983) explains this in the following way: "*In interacting with the environment, with others, and with the artifacts of technology, people form internal, mental models of themselves and of the things with which they are interacting. These models provide predictive and explanatory power for understanding the interaction.*" The mental model is important to HCI in two ways. Firstly, the methods have been researched to improve the development of an accurate mental model of the system. Secondly, by determining the form of the mental model can be important in interface design.

One of the research which shows mental models was provided by Wason in 1966 whose research is about *four cards* problem. Johnson-Laird (1981) has taken this problem and stated that not only does our reasoning not conform to formal logic, but furthermore, that our decision is dependent upon the domain of the problem.

In brief, *the problems may be logically identical, but the responses to the problems may vary according to the domain* (Johnson-Laird, 1981; Manktelow & Jones, 1987). Johnson-Laird's work has pointed out that mental models must not allow us to deal with propositional statements and problems, our models of the world must also allow us to understand spatial relations.

The mental model is built up through interactions with the display representation which provides the user, along with off-line documentation. The formation of the mental model is the key to understanding methods that can be used to design effective interfaces for system users. Norman (1983) has made some observations on the kinds of mental models that users utilize when interacting with machines. When people encounter new machines, devices or computers they begin to construct mental models to represent their behavior and operation. Those internal models provide a means by which people can understand and predict the world around them, but we construct these models as we go along and as a consequence our models tend to be incomplete, unstable, do not have firm boundaries, are unscientific and parsimonious (Norman, 1983). We can see the instability of mental models when we saw that people forget details, and confuse one system with another because of the lack of firm boundaries between models.

2.2.3 Conceptual Model

Conceptual model allows us to understand to understand complex devices (Young, 1981). For example, a person may have a conceptual model of a system. This person will understand the basic principles of the internal coding system. Nevertheless, although this individual understands the principles of what is happening, it may not be possible for the person to relate what is known to the random access memory (RAM) and processor which change different aspects of the system's performance. The individual does not have the model which maps the principles of what is understood to the physical variables of the system. This is the *task-action mapping model* which relates the conceptual model to what can and should be done.

Norman (1983), on the other hand, uses the term conceptual model to mean something which is not necessarily held by the user at all. In Norman's terms, a conceptual model is an accurate, consistent, and complete model of a system. This model is the kind that the designer of the system wishes to present. Norman emphasizes that the design should allows the conceptual model of the system to be explicitly intelligible and consistent. A successful testing of an interface is a comparison of the user's mental model to the conceptual model. Norman (1986) argues that some tasks lend themselves better to explicitly displaying the conceptual model of the user. Generally, the more specialized the application, the better the conceptual model.

2.2.4 Metaphor

Metaphors in HCI allows us ensure that users acquire an appropriate mental model of a system. This approach will help users by explaining the workings of the system. Metaphors are used in everyday speech (Lakoff & Johnson, 1980). For example, if we are informed that the amount of money in our bank account has increased, we might say that our savings have *gone up*. The notion of *increase* is metaphorically associated with concepts such as *height* and *going up* (Lakoff & Johnson, 1981). In essence, metaphors provide short-cuts to understanding complex concepts; they can be used to shape users behavior in circumstances that are unfamiliar and that they might otherwise find confusing. The user must be able to apply old, familiar knowledge to a new situation in order to incorporate a metaphor. The designer of an interface must be careful to maintain the metaphor on the interface so that it is consistent. One of the most used metaphors and one of the most successful has been the desktop metaphor. The Apple Human Interface Guidelines (Apple Computer Inc, 1987) instruct designers *"to use concrete metaphors wherever possible for computer processes that correspond to the everyday would that users are comfortable with"*, citing the desktop metaphor employed by the Apple Macintosh as a successful example.

Carroll et al. (1988) have formulated a theory of metaphor use. There are three stages which were stated in his theory. In the first stage, the recognition or retrieval of something known which can be targeted to the new computerized domain, which called it as *instantiation*. Next, we need to generate the inferences about how an instantiated source can be applied to the target domain, which we called this stage as *elaboration*. At this second stage, we also used to identify the mismatches between the source domain and the target domain. Finally, in the *consolidation* stage, we try to consolidate the elaborated metaphor into a mental model of the target domain itself. At this stage, the new mental model is not same as the original metaphor; it is a new entity which account for the matches and mismatches between the source and the target domains.

Carroll et al. (1988) suggests that four steps are involved when designing interfaces using metaphors which is based upon the above stages.

a) The identification of candidate metaphors.
b) The detailing of the metaphor or software matches with respect to representative user scenarios.
c) The identification of likely mismatches and their implications.
d) The identification of design strategies to help users manage mismatches.

Tognazzini (1991) offers a further suggestion on how to construct design models which fit in with users' existing knowledge and experience: adopt a metaphor that users are familiar with, and communicate the metaphor through the system image. This can be done by using a set of objects in the system image to cue an existing model, and making user interface objects behave in a similar way. The use of metaphors in frequently suggested as a way of making systems more accessible to users.

Marcus (1995) states that a graphical user interface (GUI) "*must account for the following...A comprehensible mental image (metaphor).*" Vaughan (1996) recommends a GUI designer "stick with real-world metaphors that will be understood by the widest selection of potential end-users." Erikson (1995) defines metaphors as "*...natural models; they allow us to take our knowledge of familiar objects and events and use it to give structure to abstract, less well understood concepts.*" Baecker, Grudin, Buxton, and Greenberg (1995) add another element to the metaphor by describing metaphors not in traditional terms as a "container" but for the World Wide Web as a "window onto limitless resources of the global network."

2.2.5 User Model

Originally, the term user model may have been intended to mean the user's mental model of a task and system, the term has come to have a number of different meanings. Hammond et al. (1983) distinguish three main uses of this term. First, the term *user model* can be used to mean a representation of the user embedded within a system. Secondly, a *user model* is something closer to what Norman calls a *conceptual model*; it acts as a goal for the designer of a system during the design process. Hammond et al. (1983) refer to this as the *design interface image.* Thirdly, the term *user model* can be taken to mean a model of the user's knowledge of the system and task. In this sense, *user modeling* is taken to refer to the representation of the user's model of a system and task.

Young (1985) makes a similar, but slightly different usage of the term *user model* can be used. Firstly, it is the designer's model of the user, which helps guide design and aids predictions about the overall performance of the human-computer system. Next, it is the user's conceptual model of the system. Finally, the term *user model* can be used to mean an embedded user model and it is used to adapt the system to suit the user. Clowes (1987) suggests that there are the following types of user models: the designer's model of the user; and the user's model of the task; the user's model of the system; and the system's embedded model of the user.

The importance of the relationship between external, real-world tasks which users seeks to perform, and the computer system's functions which they have to master in order to complete a real-world task, had been emphasized in early research on user's models by Young (1981) and Moran (1983). Green (1990) introduced the term *viscosity* to illustrate this relationship; the viscosity of a system increases with the number of internal (system) tasks the user has to know in order to perform the desired external (real-world) task.

Johnson-Laird (1983), Manktelow & Jones (1987) state that there are two ways of in which such a user's model can be constructed:

a) By cueing an existing model and extending it.
b) By construction *de novo*.

2.2.6 Usability

Sometimes the term *usability* is used to indicate a particular approach to the issues of HCI. It is concerned with both *"obtaining user requirements in the early stages of design, and with evaluating systems that have been built."* (Booth, 1989)

"This is the type specimen of the 'peanut butter theory of usability', in which usability is seen as a spread that can be smeared over any design, however dreadful, with good results if the spread is thick enough. If the underlying functionality is confusing, then spread a graphical user interface on it...If the user interface still has some problems, smear some manuals over it. If the manuals are still deficient, smear on some training which you force users to take." (Lewis & Rieman, 1994).

Shackel (1984) defines usability as *"The capability in human functional terms, to be used easily (to a specified level of subjective assessment) and effectively (to a specified level of performance), by the specified range of users, given specified training and user support to fulfill the specified range of tasks within the specified range of environmental scenarios."* While ISO (1989) consider usability of a product to be the degree to which specific users can achieve specific goals in a particular environment with effectiveness, efficiency and satisfaction.

Usability is also concern in developing website. Most of the users will not spend a lot of time trying to learn the interface of the website. If the website is confusing or if the users cannot find the relevant information or has to ask assistance from other sources, the users might stop using the website.

Gould (1985) provides a useful list of the components of usability which is shown in Figure 3. This list suggested some areas that a study of usability should be covered in the aspect of system development and implementation.

SYSTEM PERFORMANCE
Reliability
Responsiveness

SYSTEM FUNCTIONS

USER INTERFACE
Organization
Input / Output hardware
For end users
For other groups

READING MATERIALS
End user groups
Support groups
LANGUAGE TRANSLATION
Reading materials
User Interface

OUTREACH PROGRAMME
End-user training
On-line help system

Hot-lines

ABILITY FOR CUSTOMERS TO MODIFY AND EXTEND

INSTALLATION
Packaging and unpacking
Installing

FIELD MAINTENANCE AND SERVICEABILITY

ADVERTISING
Motivating customers to buy
Motivating user to use

SUPPORT-GROUP USERS
Marketing people
Trainers

Operators
Maintenance workers

Figure 3 Gould's list of usability components
(Source: "*An introduction to human-computer interaction*", Booth, P.A., 1989. pp. 105)

While Eason (1984) has suggested a number of variables which might be affect the usability of the system and this can be shown as Figure 4.

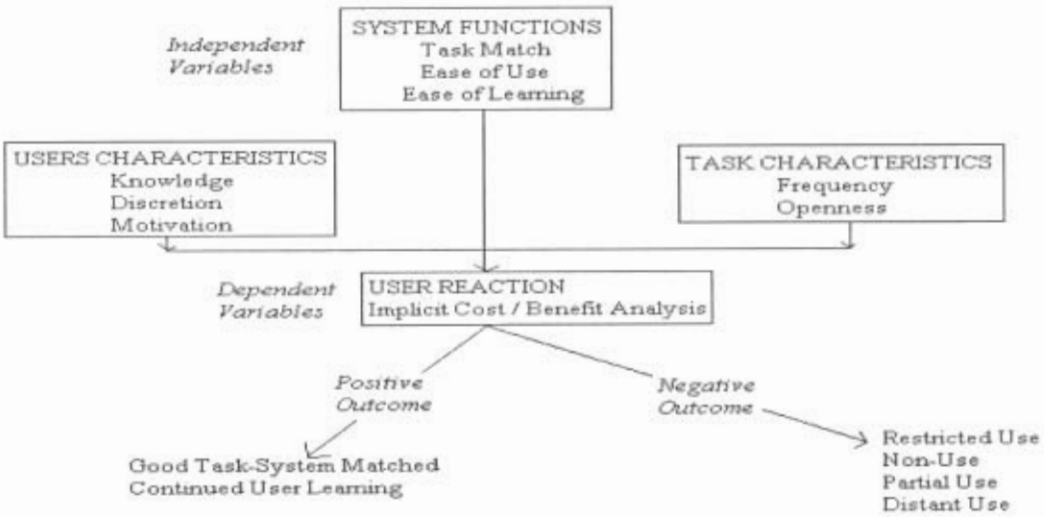

Figure 4 Eason's (1984) causal framework of usability
(Source: "*An introduction to human-computer interaction*", Booth, P.A., 1989. pp. 106)

The essence of what Eason (1984) suggests is that the usability of a system will depend, not only upon the nature of the user, but also upon the characteristics of the task and system. That is to say, that the variables of task, system and user all combine to determine the usability of a system.