Analysis and Comparison of Usability Models and Techniques Measuring User Performance Interacting with Websites

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ABSTRACT

Human Computer Interaction is rapidly growing in different aspects and areas. One of the areas that grab many scholars and researchers interest is usability. Usability is a main factor and critical pillar of products success and acceptance. In this paper, we deeply analyze the current usability models that measure the user performance during the interaction with products. Then, we fairly compare between each model to discover and present the strength and weakness of each model for supporting developer and business organization with guidelines during the development process of the products before launching the actual and final one. Decomposing comparison between each model is performed based on specific criteria. Comparison is tabulated, graphically depicted, and analytically decomposed.

Keywords

Autonomous robots, Maze Solving, Micromouse

I. Introduction

Human computer interaction has been the center of study of many scholars and researchers interest for decades. It is broad concept that appears to be widely used in many areas and sectors. Human computer interaction normally focuses on making human being have the flexibility and easiness of interaction with physical and non-physical objects. In other words, simplicity of interaction improves the quality of products and the design of tangible or intangible objects. One of the significant areas of human computer interaction is usability of tangible and intangible objects. Usability mainly focuses on the simplicity and easiness of the interaction between systems and its respective users. Recently, people, particularly, users become aware of their requirements and unwilling to tolerate faulty products. Moreover, they tend to have less attention to the features, which the product offers; they rigorously concentrate on the ease and conveniences of the feature operation. Usability has been profoundly discussed by many experts from different angles and perspectives. They all agree that despite the functionality of the systems, ease of interaction and use is considered to be essential in product quality and acceptance.

Despite of the significance of the usability of products, there have been many models proposed to evaluate and test the usability of variety of products. These usability models evaluate the extent of usability of specific products based on different criteria. In other words, receiving feedbacks of any system or product regarding to its simplicity of use and interaction can be determined using variety of mechanisms and methodology. Certain mechanisms are based on real time feedbacks. These mechanisms require participants to engage in specific products. The participants' feedback can be capture in different forms. As such, participants' feedback can be a spontaneous verbalization and then transcribed using different ways and analysis methodology of eliciting meaningful information. Verbalizations of participants capture using audio or camera recording by involving an intermediary observer to provide an introductory regarding to the task. Other mechanisms conduct and collect data using distributed surveys either manually or digitally.

II. Related Work

With the explosive growth of production of tangible and intangible objects, usability becomes a centre-focus of users, developers, scholars, and researchers. To examine the key aspects of the evaluation of specific products, particular models need to be applied to measure user performance and the extent of product usability. Although there have been several models to measure the performance of the user interacting with certain products to test and evaluate its usability. One of

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the robust models that widely known and used is GOMS model. GOMS model is based on human information processing theory. In addition, Keystroke-level model (KLM) simplifies the GOMS model by removing the processes and substituting by six processes. Biswas et al [1] surveyed the human modeling in human computer interaction.

2.1 GOMS model and KLM model

As it is widely known for usability test and evaluation of user performance, GOMS model is effectively considered to be a powerful model to test and evaluate the usability (UI) [2]. Specifically, it is a mechanism of duration predications when an expert user is specifically engaging with an assignment or task. It predicates the time will take for particular users to complete the task. Normally, GOMS model consists of four basic elements for predication: goals, operators, methods, selection rules. Figure 1 illustrates the elements of the model.

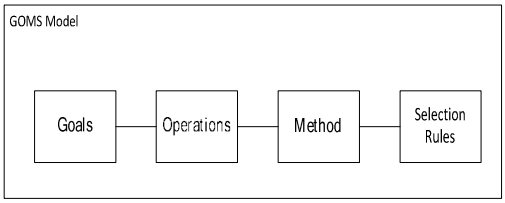

Fig. 1 GOMS Model Elements

- Goals : what users attempt or try to accomplish from performing specific task.
- Operators : the elementary perceptual, motor or cognitive actions that are used to accomplish the goals.
- Methods : the guidelines describing the process of reaching and accomplishing the goal.
- Selection Rules : which method is appropriate for a specific goal.

On the other hands, KLM (Keystroke-Level Model) is an upgraded version of GOMS. It is suggested by Card and Moran as a technique of user performance prediction [2]. The performance execution time is estimated by listing the sequence operators and then adding up the times of the user operators. KLM consists of five operators: K for pressing a key, P for pointing to a location on screen with the mouse, H for moving hands to home position on the keyboard, M for mentally preparing to perform an action, and R for system response where the user waits for the system. Each operator is accompanied by an estimated execution time. The following example is an illustration of KLM.

Table 1 Operator elements of KLM

Operators	Description	Time (sec)
K	Click on "Replace" command	0.20
H	Home on keyboard	0.40
P	Point to correct field	1.10
M	Specify word to be replaced	2.15
R	System respond	unknown

As we investigated the weakness and strength of GOMS model and KLM models, we identified that both GOMS and KLM models focus on the user performance while performing the task and ignoring the other factors correlate with the usability parameters.

2.2 Protocol Analysis Techniques

Commonly, protocol analysis is used in the psychologist field to elicit information from subjects' verbalization that firmly related to certain system. However, in general, protocol analysis is practically and technically useful in the evaluation of products or systems usability. It is set protocols consisting of verbalization as a set of video and audio footage. These verbalizations are given by the participant contributions. This verbalization is then analyzed and encoded to identify meaningful information. Protocol analysis has been used in evaluation of commercial websites and social websites as where participants asked to provide their evaluation in a form of verbalization emissions [3]. It is considered to be a powerful technique in the usability evaluations [4]. The main problem with this technique is the long processes that require the observer to perform in order to reach the objectives of the reach and discover reliable information tie with a system or products. In order words, it is time consuming.

2.3 Comparison of Usability Evaluation Models and Techniques

Table 2 describes and explains the strength and weakness of each model and technique evaluating the usability of any systems that involves users. Additionally, these models measure the user performance during the interaction with a selected system or products with variation of the performance criteria.

Table 2 Comparison of usability model measuring user performances

Model / Attribute	Protocol Analysis	GOMS Model	KLM Model
Efficiency	It is efficient in identifying problems tie to a certain system	It is efficient but it constrains users to certain chains	It is efficient since it has clear processes with time measurements
Time	It is time consuming since it involves several steps	It is less time consuming but only focus on user performance	It is highly effective and less time consuming comparing with other techniques
Reliability	The data extracted are highly reliable and accounted for	It is less reliable comparing to protocol analysis	It is more reliable than GOMS but less than protocol analysis

It is clear that table 2 shows the significant difference between each model and techniques studied in this paper. Based on our analysis and study, we deem that protocol analysis is highly reliable in terms of data acquisitions, extraction, reliability, accuracy, and less time consuming comparing with other models and techniques that involves participants in the evaluation process of specific systems.

III. Conclusion

In this paper, we find that measuring user performance from various aspects is practically important. To deal with evaluation of the usability using existing models and techniques need robust findings to distinguish among other alternatives. We identified that protocol analysis is significantly reliable technique as a mechanism of conducting usability evaluations that requires participant to contribute.

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