# Cognitive walk-through in the evaluation of User Centered Interface Design

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*Abstract*— This paper describes different issues regarding how people have problems using websites. Major difficulties which users face includes how well system responds to the user, how people navigate and how people face difficulty finding some information on the website. To solve these issues research community have worked a lot and different people contribute in proposing their view using different inspection methods.

To evaluate the usability of system is an extensively studied topic in the research community of HCI. User center design is a popular principal of design. Designers keep in mind that how users are going to use the system before they design a system. Research literature found many evaluation methods which includes formal, automatic, empirical and informal methods. Informal includes inspection method which provides the comprise between cost and implementation time on one hand and make it possible to obtain the result on the other hand, cognitive walkthrough is one of them. Within the group of usability evaluation techniques Cognitive Walkthrough is the most popular and efficient method among professional and research in HCI. Cognitive walkthrough is a theory based usability evaluation method. It has proven to be useful for designing web systems. It has some shortcomings but if we focus on them they can be removed and it will be one of the best evaluation method in current era.

*Keywords-Usability, task analysis, cognitive walkthrough*

## I. INTRODUCTION

Nowadays, usability is considered one of the most important aspects for the success of any technological products, software projects or websites. In the context of software, if a product is difficult to use or provides mechanisms that are hard to understand, then the application is expected to fail [9]. In software project, software has to deal with an awkward situation: its designers are not the real, targeted users. That is why it is always mandatory to submit the project's interface to a rigorous scrutiny, which allows the finding of flaws and less-than-optimal features [10].

In web designing over the past few years, we have got used to certain standards. In order to make a lasting impression on your visitors, you need to build experiences that go beyond those of a plain, usable website [8]. For this reason, usability has become highly relevant, especially, during all phases of the software development process. Developers are aware that only a small percentage of users spend their time reading a manual. Therefore, the design of a graphical interface should be intuitive enough to meet users' expectations regarding usability [9].

Evaluation is an activity of vital importance in any development of interactive systems, enabling the testing of certain system-related aspects. Till date, various usability evaluation methods (UEMs) have been proposed by the research practitioners. The Cognitive Walkthrough (CW) is a well-known usability inspection method among them that focus on the evaluation of how easy to learn an information system is. It is essentially based on the fact that most users learn how to use an information system by exploring, walking through the different alternatives, options that the information system offers or present to them [14] [13] [12]. It also help to discover what can go wrong when the users have no previous knowledge of the system. Particularly novice users have little to no experience with the software's

and websites they use at school, work place or home, and frequently have to find their own way around it [10].

The current research aims to reduce usability issues among the users by providing insight in the extent to which users interact with different applications and websites by using cognitive walk-through technique. Section I covers the introduction. Section II is the literature review following by problem statement, research question, aims and objectives. Section III represents proposed methods. Section IV shows expected results. Section V describes significance.

## II. LITERATURE REVIEW

The present study focuses on the usability issues users have while interacting with websites. Its main focus is to clarify the relationship of the interface and the user understanding of it and how cognitive walkthrough is useful to achieve that particular goal. This study tries to minimize the usability flaws a website have and will present with a new re-design of the taken websites as to have a comparison between the initial and the final product.

### A. Human Computer Intercation

All the fields are striving to get the new knowledge. In Human Computer Interaction (HCI) the new knowledge is increasing day by day. In the whole family of HCI, there are many contributions which need be made. But a lot of researches have been done. HCI is multi disciplinary. This is a young field with vast knowledge. It took little time for types of knowledge in HCI to emerge, converge and stabilize. And there is a lot which still needs be done. The basic definition of Human Computer Interaction (HCI) is the study of how people interact with software or a system or how they use it.

In 2012, an author posted an unpublished whitepaper to his website, which states seven contribution types of HCI which are as follow [7]:

- Empirical Contribution: Empirical contribution is known as the backbone of science. This gives new knowledge based on findings through observation and data gathering. Data could be quantitative or qualitative came from laboratory or from the field. In HCI, empirical contributions came from different resources which includes experiments, user tests, interview, surveys, etc

- Artifact Contribution: HCI is the result of creation and realization of interactive artifacts, while empirical contributions are from science and Artifact contributions are invented from inventions. Artifacts force us to admit new possible future.

New knowledge is embedded in artifacts and relative material that define them.

- Methodological contributions: Methodological research contributions give new information of how to carry out our work. This improves our research or practice. They may influence how we do design and science. Methodological research contributions are carried out on the basis of utility, reproducibility, reliability and new methods validity.

- Theoretical contributions: Theoretical research contributions contain improved concepts, definitions, models, principles or frameworks. Methodological contributions tell us how we do things whereas, theoretical contributions tell us what we do, why we do and what result are we expecting from it. Theories can be quantitative or qualitative.

- Dataset contributions: Dataset contributions give new and useful body followed by analysis of its characteristics for the usefulness of research community. Benchmarks might go with datasets to make the comparisons standardize. Datasets enable evaluations of shared repositories by new algorithms, systems, or methods.

- Survey contributions: Survey research contributions and meta-analyses are tested by how well they are arranged and what is known for the present time and to find its future research opportunities. The result of survey contribution is good after the topic being discussed have reached to a certain level of maturity. Good surveys show completeness, depth, maturity and good organization.

- Opinion contribution: Everybody has a different point of view so, opinion research contribution is considered as to change the point of readers by persuasion. Opinion research is evaluated on the bases of the arguments people present in order to support their result. These focus on areas of wide interest [7].

### B. Usability

Usability is the prime feature to assess the effectiveness of websites therefore evaluating usability is an essential task

[1]. Usability is usually measured in terms of three attributes; efficiency, competence and fulfillment of the user's needs [2]. The usability is tested to the extent an application or website performs their tasks according to the preliminary functionalities of them [3]. As there are individual differences in the users like demands, preferences, abilities and expertise so thus designers work by keeping all these attributes in front of them [4]. By tradition, usability test were carried out for the intent of evaluation of general usability of user interface of Wireless Access Protocol (WAP) [5]. "Speak the user's language" has been a major usability principle for more than 20 years [6].

### C. Inspection Methods

These techniques comprises of a set of methods that are all based on having evaluators inspect a user interface with respect to its conformance to a set of guidelines. Guidelines can range from highly specific prescriptions to broad principles [11].

- Cognitive Walkthrough: Cognitive walkthrough [11] is a theoretically structured usability evaluation process that focuses on a user's cognitive activities, especially while performing a task. Cognitive walk through involves one or more evaluators discovering an interface, prototype, or paper mock-up by going through a pre-determined set of tasks and measuring the understandability and easiness of learning for each task. It lays the emphasis on user and helps in identifying the user goals.

- Heuristic Evaluation: Heuristic evaluation is the most informal inspection method [13], mainly because it counts upon a small set of usability criteria. In this technique, one or more evaluators autonomously evaluate an interface using a list of heuristics. HCI experts separately review an interface and categories and justify problems based on a short set of heuristics. The outcome of this evaluation is typically a list of possible usability problems.

- Feature Inspection: The purpose of this evaluation method [13] is to inspect a feature set of a product and to analyze the availability, understandability, and other functionality aspects for each feature. Evaluators use a list of product features along with situations for such inspections.

- Pluralistic Walkthrough: Pluralistic Walkthrough [16] is a variation of the cognitive walk through inspection method wherein representative users, evaluators, and developers inspect the interface as a group.

- Perspective based Inspection: Perspective-based inspection [15] is a variation of heuristic evaluation. Interfaces are inspected from three diverse perspectives i.e. novice use, expert use and error handling; considering one perspective at a time.

- Formal Usability Inspection: It is a six step procedure that combines heuristic evaluation and cognitive walkthrough. The steps include planning, kick-off meeting, review, logging meeting, rework and follow-up [Bell (1992)].

- Consistency Inspection: Evaluators use this method to conclude a consistent interface appearance and functionality that they can then use to weigh the uniformity of interfaces across multiple products in a family. It gives a summary of the inconsistencies [Wixonet al. (1994)].

- Standards Inspection: In this inspection method [Wixon et al. (1994)], an evaluator equates components of an interface to a list of industry standards to assess the interface's compliance with these standards. This inspection method is usually aimed at ensuring a product's market conformance.

### III. PROBLEM STATEMENT

In this modern technology era, the use of websites and software application has become an integral part for daily work solutions. The success of any of these depends upon how easy they are to be used. In this manner, usability comes into play which is considered one of the most important aspects of any technological system. In the context of websites, if a web interface is difficult to use or provides mechanisms that are hard to handle, then the web page is expected to fail. In the hunt for deciding the usability of several types of interface, a number of usability inspection methods are available, among them cognitive walk through method is also a considerable approach for studying the ease of any user interface.

### IV. RESEARCH QUESTION

To what extent the cognitive walkthrough method is an effective technique for evaluation of user interface design?

## V. AIMS & OBJECTIVES

The study aims to develop an understanding of usability of any interface by cognitive walkthrough method that how a novice user feels about a particular user interface design and how may he proceed with it. It also checks that the use of prior knowledge and experience of a user along with the extent to which the users will be trying to produce whatever effect the action has. It will recognize that either it produces the effect as the user wants or not so that after the action is taken, the users understand the results they get, so they can go on to the next action with confidence.

## VI. PROPOSED METHODS

Different methods can be implemented for gathering data as per requirement. For instance data gathering techniques includes interviews, surveys, questionnaires and people are selected in the basis of sample collection techniques which is considered as representatives of an entire population. Random selection can be done to gather participants for the work. Ability to drive will be the requirement for each driver and language translation of the questionnaires can be done as per situation.

- Survey questionnaire: The survey questionnaire can contain various questions aimed at evaluating the issues which cause the users to spend more time on the websites and to identify, if there was any, a link between the capabilities of the user to handle a difficult website. All questions will be closed ended.

- Interviewing: interviews with the users can be conducted as required.

- Random selection: questionnaire will be distributed randomly among the users as some of them can be novice and professional users as well.

- Cognitive walkthrough: It will describes user's interaction with the websites in terms four steps:

  1) The user sets a goal to be accomplished with the system (for example, "check spelling of this document").
  2) The user searches the interface for currently available actions (menu items, buttons, command-line inputs, etc.).
  3) The user selects the action that seems likely to make progress toward the goal.
  4) The user performs the selected action and evaluates the system's feedback for evidence that progress is being made toward the current goal.

- Statistical Package for the Social Sciences (SPSS): SPSS is a Windows based program that can be use to enter data for analysis and to create tables and graphs of the results. SPSS is competent of handling large amounts of data and can perform all of the analyses covered in the text and much more.

- Card Sorting: It will consist of the cards on which domain entities will be printed. Respondents will sort the cards into groups/categories and explain the criteria they use for sorting, and the names they assign to groups. It will be useful to determine to investigate respondent's recall knowledge of the domain entity. Second it will distinguish between high and low level problems. Third, it will give us insights into the targeted population's views of the topic. Fourth, card sort results can provide an input for another technique and further analysis. Finally, the card sorting process will help us to do our task in relatively quickly, at nominal cost, and is flexible and easy to handle.

## VII. EXPECTED RESULTS

It will help us to indentify the obstacles between the user and interface which affects the usability and also decide whether the Cognitive Walkthrough technique is suitable to check the design and usability evaluation of websites. It will distinguish among various flaws which create difficulty in the usage of the particular website. Data gathered through it can be used in future for introducing new prototype for the websites.

## SIGNIFICANCE

This study will help the designers to establish a convenient and user-friendly interface model design which will facilitate the users to easily understand and use the system in a much better way, which will become time saving for them. This will make the selection of design easier for them by matching their needs and cognition level.

## REFERENCES

[1]  R. Tahir and F. Arif, " A Measurement Model Based on Usability Metrics for Mobile Learning User Interface for Children", in The International Journal of E-Learning and Educational Technologies in the Digital Media (IJEETDM) 1(1): 16-31 &#13;The Society of Digital Information and Wireless Communication (SDIWC), Jan - 2015 (ISSN: 2410-0439)

[2]  R. Flewitt et al., "New directions for early literacy in a digital age: The iPad", in Journal of Early Childhood Literacy, 20 May 2014, DOI: 10.1177/1468798414533560

[3]  B. Zaid et al. , "A Comparative Study of Usability Methods for Mobile Applications", in International Journal of Scientific &

Engineering Research Volume 3, Issue 8, August-2012 1 ISSN 2229-5518

[4] Rahmati et al.,"Exploring iPhone Usage: The Influence of Socioeconomic Differences on Smartphone Adoption, Usage and Usability", in MobileHCI'12, September 21–24, 2012, San Francisco, CA, USA.

[5] N. Ahmed et al., "Smart Phone Application Evaluation with Usability Testing Approach", in Journal of Software Engineering and Applications, 2014, 7, 1045-1054

[6] J. Nielsen and R. Budiu, "Mobile Usability", ISBN-13: 978-0-321-88448-0, 2013.

[7] Wobbrock, J.O. (2012). Seven research contributions in HCI. Unpublished. Available at http://faculty.washington.edu/wobbrock/pubs/Wobbrock-2012.pdf

[8] "Principles of Website Usability | 5 Key Principles Of Good Website Usability", *The Daily Egg*, 2016. [Online]. Available: http://tinyurl.com/z4syvvm . [Accessed: 02- Dec- 2016].

[9] F. Paz and J. Pow-Sang, "A Systematic Mapping Review of Usability Evaluation Methods for Software Development Process", *International Journal of Software Engineering and Its Applications*, vol. 10, no. 1, pp. 165-178, 2016.

[10] A. Mano and J. Creissac Campos, "Cognitive walkthroughs in the evaluation of user interfaces for childre", Braga, Portugal.

[11] S. Gupta, "A Comparative study of Usability Evaluation Methods", *International Journal of Computer Trends and Technology*, vol. 22, no. 3, pp. 103-106, 2015.

[12] T. Granollers and J. Lorés, "Incorporation of users in the Evaluation of Usability by Cognitive Walkthrough," *HCI related papers of Interacción 2004*, pp. 243–255.

[13] Nielsen, J. & Mack, R.L. (1994). Usability Inspection Methods. John Wiley & Sons, New York, NY.

[14] Wharton, C. (1992). Cognitive Walkthroughs: Instructions, Forms and Examples. Institute of Cognitive Science. Technical Report CU-ICS-92-17. University of Colorado, Boulder.

[15] "An empirical study of perspective-based usability inspection", by Zhijun Zhang, Victor Basili, and Ben Shneiderman. Proceedings of the Human Factors and Ergonomics Soceity 42nd Annual Meeting. pp. 1346-1350. Chicago, 1998

[16] Bias, R. G. (1994). The Pluralistic Usability Walkthrough: Coordinated Empathies. IBM Corporation. In Nielsen, J. & Mack, R.L. (1994). Usability Inspection Methods. John Wiley & Sons, New York, NY. chapter 3 (63-76).