

Application of a New Questionnaire to Measure the Usability: A Case Study in the E-Commerce Domain



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ABSTRACT

Nowadays, the quality attribute of usability is one of the most critical concerns of software development teams. The ease of use can represent the success of a software product in a competitive market like the current one. Given the relevance of the usability, several methods have been developed for the evaluation of this feature on the graphical user interfaces. The usability evaluation techniques have proven to be effective in improving the degree of user experience of the information systems. However, few are the methods that allow quantifying the usability in numerical values. In this study, the application of a questionnaire proposal to measure the usability degree is presented in a case study on the E-Commerce domain. Based on the results, it is possible to establish that the questionnaire can be used as valuable tool to evaluate the usability.

Key words: Human-Computer Interaction, quality assurance, usability, heuristic evaluation, quantifying questionnaire.

1. INTRODUCTION

The user experience is nowadays a concept widely addressed by developers and software specialists because of its impact on the satisfaction degree of the end users [1]. This concept can be defined by the ISO 9241-210 standard as the "person's perceptions and responses resulting from the use of a product, system or service" [2]. Most studies state that if the resulting experience of the interaction between a person and a specific software system is not satisfactory, it becomes unlikely for that person to reuse that system again in the future [3]. Many aspects are involved in the adoption of a technology as part of the media to achieve specific goals, and the usability is not the exception. The ease of use or the capability of a system to be used and understandable is an important quality attribute that contributes to obtain a satisfying and desired user experience. In the E-Commerce domain, this aspect becomes extremely critical and relevant, given the wide market that is available on the Internet [4]. Today, several websites that offer the same products and services can be identified. However, few of them concern about the end user and provide of an easy-to-use and usable graphical interface [5].

Given the need of identifying if a system meets an appropriate level of usability, certain evaluation methods were developed [6]. The problem that most of these techniques present is that although they allow identifying design aspects that require of

improvement, they do not allow obtaining a quantitative value about the level of usability of the system [7]. This fact can be eventually important in those cases in which a comparison is required. For instance, in the software development process, *parallel design* is becoming one of the most used techniques for the elaboration of graphical user interfaces [8]. This novel method involves the design of several proposals in parallel to subsequently select the best option between them. However, this decision is commonly performed based on subjective data and personal opinions of the designers and project managers. There is little evidence about the existence of an instrument that allows quantifying the usability in numerical scores [9]. If the usability degree were able to be measured by a tool, more objective decisions would be taken by the development team. Companies involved in the E-Commerce domain could notice how far they are from their main competitors and how much they must improve to be the best website of the online market [10]. Given this scenario and to provide the academia and industry with a tool to measure numerically the usability of software products, a questionnaire was designed and redesigned [11]. In this study, the use of the new proposal is evidenced to assess a website.

2. QUANTIFYING QUESTIONNAIRE

In a previous work [12], specialist Toni Granollers developed a questionnaire to measure the usability of software products based on the analysis of two widely recognized sources: the usability heuristics established by Jakob Nielsen [13] and the principles of interaction design proposed by Bruce Tognazzini [14]. An in-depth analysis of both approaches made it possible to design 60 questions oriented to assess the usability degree of information systems. The new proposal was constructed considering a five-point Likert scale, and involves questions that address to the following categories:

- **H1.** Visibility and system state.
- **H2.** Connection between the system and the real world, metaphor usage and human objects.
- **H3.** User control and freedom.
- **H4.** Consistency and standards.
- **H5.** Recognition rather than memory, learning and anticipation.
- **H6.** Flexibility and efficiency of use.
- **H7.** Help users recognize, diagnose and recover from errors.
- **H8.** Error prevention.
- **H9.** Aesthetic and minimalist design.

- **H10.** Help and documentation.
- **H11.** Save the state and protect the work.
- **H12.** Color and readability.
- **H13.** Autonomy.
- **H14.** Defaults.
- **H15.** Latency reduction.

3. DESIGN OF THE CASE STUDY

To validate the new questionnaire, an E-Commerce website was randomly selected: *www.mercadolibre.com.pe*. Likewise, five specialists from the field of Human-Computer Interaction were requested to interact with the website to use afterward, the new approach in the assessment of the usability. The case study was conducted with participants of similar expertise and background, to avoid the presence of this variable could alter the results. In this activity, the participants were professionals related to the Computing field. All of them have performed at least one usability evaluation in their professional career, and have a Master Degree in technological areas. The process that guided the usability assessment of the selected E-Commerce website can be appreciated in Figure 1.

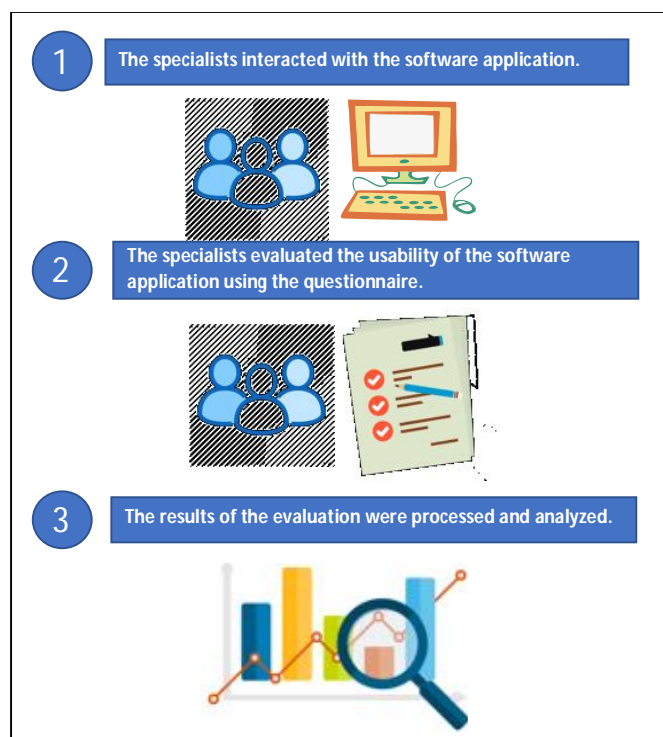


Figure 1: Usability Evaluation Process

4. RESULTS

Each category/heuristic that is covered by the questionnaire is approximately composed of four/five items that can be rated from 1 to 5, where 1 is referred to "strongly disagree" answer type, and 5 is referred to "strongly agree" answer type. All the items are written in an affirmative way asking the specialists about the fulfillment of a specific usability guideline related to the heuristic in reference [11]. Finally, once the evaluators

have answered all the questions, the usability final score of the system is obtained with basis on the following mathematical formula [7]:

$$\frac{\sum_{i=1}^m \frac{\sum_{j=1}^n s_{ij}}{n}}{m} \quad (1)$$

Where,

- s_{ij} is the assigned score by each evaluator "i" to each item "j" of the questionnaire.
- n is the number of items of the questionnaire.
- m is the number of evaluators.

Table 1: Average scores of the evaluators by heuristic

Heuristic	Average Scores				
	E1	E2	E3	E4	E5
H1	3.80	4.40	4.00	3.60	4.40
H2	4.00	3.75	4.25	4.00	4.00
H3	4.67	4.67	4.67	4.33	5.00
H4	4.33	4.17	4.83	4.33	4.17
H5	4.20	4.40	3.60	4.20	4.20
H6	4.33	4.17	4.33	4.33	4.17
H7	3.75	3.75	3.25	3.75	3.50
H8	5.00	4.67	4.67	4.00	4.67
H9	4.50	4.00	4.00	4.50	4.25
H10	3.80	3.40	3.40	3.60	4.00
H11	4.33	4.33	4.67	4.33	4.33
H12	4.00	4.25	4.25	3.75	3.75
H13	3.67	3.33	3.67	3.33	3.00
H14	2.67	2.67	2.33	3.00	2.00
H15	4.50	3.50	4.50	3.00	4.00

Table I shows the average scores assigned by the evaluators to each heuristic after the interaction with system. According to these results, the level of usability of the website is appropriate (a total average score of 3.99 from a maximum score of 5.00 and a minimum score of 1.00). The questionnaire, unlike other techniques allows the identification of the aspects in which the website needs improvements. The main usability problems of the website are related to the lack of customization options and to the absence of a help section of frequently asked questions. Likewise, the errors displayed by the software system are not coded, making it difficult to identify subsequently the scenario that could hinder the purchase process. Finally, the categories that could be considered as relevant for the end users, are not highlighted. The font color in contrast with the colors that are used for the background becomes difficult the visibility of the titles of the different sections.

5. CONCLUSION AND FUTURE WORKS

The usability is nowadays a relevant software quality aspect that must be considered for the success of any system in the online market. The accessibility to a high number of websites

that are available on Internet has caused that specific issues as the *ease of use*, make the difference on the user's perception. Given the current relevance of the usability, multiple methods have been developed to evaluate if a system meets with the required usability degree. However, most of these techniques are oriented to identify aspects of improvement, rather than determining the usability degree of a website in numerical values. For this reason, a questionnaire was developed. This new proposal is based on two recognized sets of principles that cover all the dimensions of usability for the assessment of this quality aspect. In this research, the new approach was applied, and the results are reported.

This study has allowed to determine that this new approach can be used to measure the level of usability of a website from the E-Commerce domain in numerical values. In addition, the results of this measurement proposal can be used to determine how much the graphical user interface design must improve to obtain satisfactory levels of usability. The proposal allows to identify also specific design aspects in which the development team should focus. In this scenario that was conducted with professionals in HCI, relevant considerations were identified for the selected website. Although the usability degree of the evaluated system is appropriate, if the design problems were fixed, the level of competitiveness of the web system would increase even more in relation with the main referents.

The case study evidences that the new proposal can be applied effectively to obtain the level of usability of a website and to identify aspects of improvement. However, it is still necessary to conduct reliability and validity studies in different scenarios to demonstrate the generalization of the questionnaire.

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