

IJACT 24-12-17

## Web Usability Evaluation: The Methods

Minsoo Park

Department of Data Science, School of Applied Artificial Intelligence Engineering,  
Kangnam University  
[mspark7@gmail.com](mailto:mspark7@gmail.com)

### Abstract

Successful website construction and operation begins with understanding users, and to this end, user-participatory system evaluation from the user's perspective, not the developer's perspective, should be prioritized during the website construction and operation process. In order to improve the usability of the website, it is necessary to establish a foundation for continuous user testing and consistent system evaluation methods and procedures. Usability evaluation should be conducted throughout the entire system development process to achieve the most appropriate evaluation. If the obstacles revealed through usability evaluation are systematically analyzed and reflected in improving web services, there is an advantage in that the website can be designed according to the user's level and the website can be operated according to the user's perspective. Usability evaluation should be recognized as a process, not a result in itself. Therefore, usability evaluation should be conducted at the prototype or pilot test stage rather than as a procedure to verify errors after the completion of website development, so that it can be effectively utilized for actual website improvement and user satisfaction enhancement. In order to conduct empirical usability evaluation, it is necessary to comply with web standards so that it can be accessed by all web browsers. In addition, development that considers web accessibility should be conducted first so that all users can access it. If empirical evaluation including subjective satisfaction evaluation of users, mechanical evaluation using usability evaluation tools, and heuristic evaluation in which experts evaluate based on checklists are conducted in combination, the empirical evaluation procedure or time can be shortened. The expected effects of usability evaluation are as follows. If the obstacles revealed in the usability test results are systematically analyzed and reflected in the improvement of web services, there is an advantage in that the website can be designed to match the user's eye level and the website can be operated according to the user's perspective. Since users can easily use the website without obstacles or errors, it can induce continuous revisiting. By actively placing services that match the user's interests on the user's main movement path, interest and curiosity in the service can be drawn.

**Keywords:** Web Usability, Web Evaluation, Methods, Quantitative, Qualitative

## 1. Introduction

Usability evaluation should be distinguished from user satisfaction evaluation, which measures the overall satisfaction with a website, as it is an evaluation of how easy the user interface is to use. Analytical usability evaluation is preferably conducted by a group of HCI experts with an understanding of usability, using a website usability checklist. Empirical usability evaluation targets general users, but collects quantitative data

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Manuscript received: September 20, 2024 / revised: October 29, 2024 / accepted: November 25, 2024

Corresponding Author: [mspark7@gmail.com](mailto:mspark7@gmail.com)

Associate Professor, Department of Data Science, Kangnam University

and some qualitative data on the actual use process and results of the system. Satisfaction evaluation measures satisfaction with website use through questionnaires, etc., targeting actual website users.

Successful website construction and operation begins with understanding users, and to this end, user-participatory system evaluation from the user's perspective, not the developer's perspective, should be prioritized during the website construction and operation process. In order to improve the usability of the website, it is necessary to establish a foundation for continuous user testing and consistent system evaluation methods and procedures. Usability evaluation should be conducted throughout the entire system development process to achieve the most appropriate evaluation. Usability evaluation can be conducted in the laboratory as well as in the field, so realistic evaluation is possible depending on the desired degree. The following should be considered for usability evaluation: decision on the goal to be achieved through usability evaluation, exploration of what questions to ask in accordance with the goal, selection of an appropriate evaluation method, identification of practical issues, and evaluation/analysis/interpretation/representation of the resulting data.

By examining domestic and international usability guidelines and various usability evaluation methods, we aim to establish a standardized usability evaluation process and propose a step-by-step strategy for continuous usability improvement through this. This paper presents the categories, characteristics, and methods of usability evaluation and presents the main issues of web usability and general guidelines for improving the usability of websites.

## 2. Web Usability Evaluation: The Methods

The evaluation methods for the usability of websites are designed with the user-oriented design in mind, rather than from the perspective of the system developer. Jacob Nielsen [1-2] classified web usability evaluation methods into three categories: inquiry, inspection, and testing, depending on the method of evaluation, and there are various evaluation techniques depending on the evaluation method. In addition, there is a log file analysis technique that analyzes and evaluates the website's user log file [3-5].

- There are survey and questionnaire methods for inquiry.
- There are heuristic evaluation and feature checklist methods for inspection.
- There are think aloud, performance measure, and eye tracking methods for testing.

Usability evaluation is classified into expert evaluation and user evaluation according to the characteristics of the evaluator, and is also largely classified into analytical evaluation and empirical evaluation according to the characteristics of the evaluation method. As shown in Table 1, analytical evaluation has the advantage of being inexpensive and being able to grasp things in a short period of time, but has the disadvantage of being subject to expert bias and not being able to hear the opinions of users. Empirical evaluation has the advantage of being able to directly observe the behavior of users and hear their opinions, but has the disadvantage of taking a lot of time and money. The evaluation method can be selected according to the cost of the evaluation, the necessity of user opinions, and the purpose of the evaluation, but several methods can be used in parallel to conduct a step-by-step and comprehensive evaluation.

Analytical evaluation is a method in which experts evaluate a system that has already been created or will be created without the participation of actual users, and it predicts and evaluates what problems actual users might have if they used the system. Analytical evaluation methods are broadly divided into testing methods using practical rules and modeling methods using theoretical models, with Heuristic Evaluation and Cognitive Walkthrough being the most representative evaluation methods. Heuristics are general design principles that have been used for a long time and are already widely known.

**Table 1. Comparison of pros and cons of usability evaluation methods**

	Analytical evaluation	Empirical evaluation
Pros	· Relatively low cost	· You can observe direct problems

	<ul style="list-style-type: none"> <li>· No special equipment required</li> <li>· Can be implemented early in the development phase</li> <li>· Can identify problems and suggest solutions in a short period of time</li> </ul>	<ul style="list-style-type: none"> <li>through user behavior</li> <li>· You can hear user opinions directly</li> </ul>
Cons	<ul style="list-style-type: none"> <li>· Expert bias may be involved</li> <li>· The problems discovered may not be a big problem for users</li> <li>Unable to hear users' opinions</li> </ul>	<ul style="list-style-type: none"> <li>· Usability lab testing is expensive</li> <li>· Time consuming</li> </ul>
Evaluator	<ul style="list-style-type: none"> <li>· Expert</li> </ul>	<ul style="list-style-type: none"> <li>· End-user</li> </ul>

Empirical evaluation is the most reliable and frequently used evaluation method in which actual users lead the evaluation of the system. Since the ultimate goal of all websites is to provide the best experience to users who use the services provided on the web, empirical evaluation methods are the most direct and reliable methods to achieve this goal of the website. Representative empirical evaluation methods include Focus Group Interview (FGI) method and Usability Lab Testing method.

Analytical evaluation methods are largely divided into testing methods and modeling methods, and the evaluation techniques included here are as shown in Table 2 below. List testing method, one of the test methods, is a method in which experts evaluate the system according to a set checklist. Heuristic evaluation, which is the most commonly used, is a method in which experts evaluate the degree to which the website interface conforms through a checklist and reflect the discovered problems in website improvement. It is the most commonly used method because it can be carried out relatively easily by 3 to 5 experts.

**Table 2. Types of analytical evaluation methods**

	Type I	Type II
Test method	List test	Heuristics, regular usability testing method, guideline evaluation method, specification testing method, consistency testing method, standard testing method
	Rehearsal test	Cognitive rehearsal, group rehearsal
Model method	Model method	GOMS, cognitive task analysis
	Simulation	Petri Net modeling, scent of Information modeling

The rehearsal test method assumes that the evaluator is an actual user and follows the process of users using the system as if rehearsing it to identify problems. It is effective in evaluating the learnability of Jacob Nielsen's usability principle [6-7]. Cognitive Walkthrough is a method of identifying usability problems of the user interface (UI) based on the user's Task Analysis. It can efficiently evaluate whether a website is easy to learn and intuitive for beginners. It can be executed simply and quickly if there is an expert to evaluate, but it is less

likely to find problems than the heuristic evaluation method.

Empirical evaluation is divided into laboratory evaluation, field evaluation, and non-regular evaluation as shown in Table 3. Various evaluation techniques can be used, which is not a mutually exclusive relationship but a mutually complementary relationship.

**Table 3. Types of empirical evaluation methods**

	Type
Laboratory evaluation	Process evaluation
	Performance evaluation
Field evaluation	Focus group interview
	Contextual inquiry
	Field observation
Non-regular evaluation	Learning test
	Competitive usability test
	Acceptance test

Laboratory evaluation is conducted in a laboratory setting where factors that may interfere with or distract users are appropriately controlled. It is an experimental method that examines user interaction, error occurrence, and problem-solving processes by giving several tasks and observing them to find the cause of the problem and clues to the solution. Laboratory evaluation is mainly conducted for the purpose of verifying a specific hypothesis through precise analysis, so it is necessary to confirm whether the factors that have a critical impact on the success of the system have been accurately identified through laboratory evaluation. When conducting laboratory evaluation, it is important to select appropriate subjects and tasks, check whether the subjects are familiar with the test method, and make the laboratory space comfortable for the subjects. It is effective in finding problems, but it is expensive to set up laboratory equipment, etc.

Process evaluation during laboratory evaluation is an evaluation method that identifies the difficulties users experienced while using the system, and is a developmental evaluation method aimed at improving and supplementing the system. Performance evaluation during laboratory evaluation is a comprehensive evaluation method that ultimately evaluates the system's performance and evaluates how quickly and with few errors users achieved their tasks.

Field evaluation is a method that can identify more realistic problems than laboratory evaluation by conducting evaluations in situations where users actually use the system, rather than in artificially created laboratory situations. It can evaluate how various contexts affect users, but it has the disadvantage of being difficult to summarize or interpret the evaluation results in numbers because many factors outside the evaluation occur. The evaluator who participates in the field evaluation must have a complete understanding of the target system to be evaluated, and the system to be evaluated must also have a certain degree of completion to expect reliable results. The active cooperation of the field manager is very important for field evaluation, and the field evaluator must provide the subjects participating in the evaluation with sufficient motivation and as much information as possible.

There are three on-site evaluation methods, FGI, contextual inquiry, and field observation, depending on how user information is obtained. FGI (Focus Group Interview) is a qualitative evaluation method mainly used to identify requirements before website development. Users with commonalities are gathered into groups (7~8 people) to share opinions and collect data on the website and issues, and through this, opinions on the detailed status of the website can also be heard. Contextual Inquiry is a method in which users performing tasks individually interview and observe users in the field where the evaluation website is being used. This method allows for insight into issues and requirements. Field Observation is a method used when developing a non-generalized target, and issues are identified through observation without asking separate questions to users.

Non-formal evaluation methods include learning evaluation, destructive evaluation, acceptance evaluation, and competitive evaluation. Learning evaluation methods are used to evaluate what problems there are in interactions during the development process. Destructive evaluation evaluates system problems in situations that cause errors. Acceptance evaluation evaluates the user response by providing the system without prior knowledge. Competitive evaluation is a method that provides the system to multiple users at the same time and lets them compete to see who can find more problems.

### 3. Discussion and Conclusion

If the obstacles revealed through usability evaluation are systematically analyzed and reflected in improving web services, there is an advantage in that the website can be designed according to the user's level and the website can be operated according to the user's perspective. Usability evaluation should be recognized as a process, not a result in itself. Therefore, usability evaluation should be conducted at the prototype or pilot test stage rather than as a procedure to verify errors after the completion of website development, so that it can be effectively utilized for actual website improvement and user satisfaction enhancement. In order to conduct empirical usability evaluation, it is necessary to comply with web standards so that it can be accessed by all web browsers. In addition, development that considers web accessibility should be conducted first so that all users can access it. If empirical evaluation including subjective satisfaction evaluation of users, mechanical evaluation using usability evaluation tools, and heuristic evaluation in which experts evaluate based on checklists are conducted in combination, the empirical evaluation procedure or time can be shortened. The expected effects of usability evaluation are as follows. If the obstacles revealed in the usability test results are systematically analyzed and reflected in the improvement of web services, there is an advantage in that the website can be designed to match the user's eye level and the website can be operated according to the user's perspective. Since users can easily use the website without obstacles or errors, it can induce continuous revisiting. By actively placing services that match the user's interests on the user's main movement path, interest and curiosity in the service can be drawn.

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