

New Web-Usability Evaluation Method: Scenario-Based Walkthrough

● Satoko Segawa

● Masahiko Sugimura

● Kazushi Ishigaki

(Manuscript received October 15, 2004)

Conventional methods of evaluating Web usability require skilled and experienced evaluators and are therefore expensive. In response, we have developed an original Web-usability evaluation method called Scenario-Based Walkthrough. With this method, an evaluator systematically describes user scenarios to attain the objectives of a Website and evaluates the user actions required to complete each scenario based on a cognitive model. Because the Website objectives are defined in scenarios, the evaluator can effectively identify critical problems that could hinder attainment of the objectives. Furthermore, the method can even be used by nonexpert users and therefore allows Website quality to be maintained at low cost. Even for a complex Website designed for multiple business objectives, this method can be used to effectively evaluate and improve it to achieve business objectives by selecting the high-priority objectives using a business analysis tool called an issue tree. This paper describes the problems of conventional Web-usability evaluation methods and development of the Scenario-Based Walkthrough method. It also describes the usability evaluation procedure of the method and a case example in which the method was used to evaluate and improve the usability of a Website for providing technical support to computer users.

1. Introduction

According to a survey conducted in 2004 by Japan's Ministry of Economy, Trade and Industry, electronic commerce in Japan grew 67% (on a business-to-business basis) and 65% (on a business-to-consumer basis) over the previous year.¹⁾ These figures suggest that corporate Websites carry increasing weight as the focal points for communicating with customers.

It is known that 40 to 60% of the users of mail-order services (via the Internet) forgo the placing of orders because they cannot find the desired commodities or understand how to order²⁾ on relevant Websites. The inadequate usability of a business Website may adversely affect sales and result in lost business opportunities and increased costs due to many customer inquiries to the call center (**Figure 1**). Thus, the issue of

Website usability can be considered an important management task on which success in business depends, as well as a problem that may degrade customer services.

Enterprises have lately been required to promote the universal design of Website content with respect to compliance with Web accessibility standards, improvement of customer service, and corporate social responsibility. Moreover, improving Website usability for a wide range of users leads to the implementation of universal design.

A Website with a low degree of usability often has a variety of content categorized and positioned based solely on Website management. Such a Website is not created after selecting the content for business objectives or designed with the availability to users in mind. To create a usable Website that meets the actual use

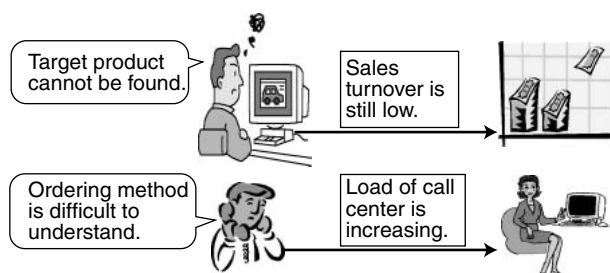


Figure 1
Impact on business when Website usability is insufficient.

conditions of users, the creator must define business objectives based on business management, arrange content in order of importance, and extract and eliminate possible problems in using content that may hamper the attainment of objectives on behalf of the users.

Extracting such problems requires a self-evaluation of Website content with respect to usability and an evaluation of usability with the participation of users. Since evaluation activities (involving the maintenance of Website quality) have conventionally required much time and labor, there is an urgent need for efficient methods of evaluation and improvement.

Fujitsu has developed and improved the Scenario-Based Walkthrough method as a solution for efficiently evaluating usability. The Scenario-Based Walkthrough method is now being used in consulting services for upgrading Websites for electronic commerce and investors,³⁾ and municipal Websites.⁴⁾

This paper first describes how conventional methods of evaluating usability cannot always effectively extract critical problems that hamper business objectives because there is no procedure for defining Website objectives.

This paper then describes how we developed the Scenario-Based Walkthrough method, which resolved the above problem posed by conventional methods, and the procedure used by this method to evaluate Website usability.

In the evaluation procedure using this method, Website objectives are defined based on

a business analysis method (issue tree). Then case episodes (scenarios) of how users actually use a site are described systematically to achieve the Website objectives, with the user actions needed to complete each scenario being checked without involving test subjects. Because Website objectives are defined in scenarios, the evaluator can effectively extract any critical problems that may hinder attainment of the objectives.

This paper finally cites a case example of using the Scenario-Based Walkthrough method to define objectives and evaluate and improve Website usability for providing technical support to computer users.

2. Problems in conventional methods of evaluating usability

Guideline review and usability testing are employed to gauge the effectiveness of conventional methods of evaluating Website usability.

Guideline review extracts usability problems from the design specifications according to a checklist created based on past knowledge. Guideline review requires the evaluator to have specialized experience and skills for conducting an evaluation based on a simple checklist in view of the service characteristics specific to the target Website.⁵⁾ Conversely, inexperienced or unskilled evaluators that use guideline review cannot detect problems that are dependent on the services specific to individual Websites; they can only extract basic problems in Web page layout from the user's standpoint.

Usability testing extracts problems in operation through the observation of how test subjects perform a given operation task, such as purchasing merchandise under specified conditions on the target Website.⁶⁾ Usability testing involving five or six test subjects allows us to find most usability problems concerning operation for a given task. However, the setting of tasks is often inadequate and important problems may not be identified. For example, even if no operation problem is found

in the task of “purchasing merchandise,” there may be new problems (e.g., no function to enter delivery destination in addition to the purchaser) when the purpose of performing the task is changed to “purchasing a commodity as a gift.” Usability testing has no guiding principle for properly setting tasks. In other words, the proper setting of tasks largely depends on an evaluator's experience and skills, which may possibly prove inadequate for certain business objectives. Moreover, usability testing with test subjects is very costly for evaluating Websites that are frequently updated.

The conventional methods of evaluating usability described above depend on the evaluator's specialized experience and skills, and incur high cost when used to evaluate Website usability in terms of business characteristics specific to the target Websites. Therefore, conventional methods cannot be used effectively to maintain the usability of Websites for which content is frequently updated.

3. Development and improvement of Scenario-Based Walkthrough method

This section describes the development of the Scenario-Based Walkthrough method, which solved the problems in conventional methods of evaluating usability, and how we improved this method to enhance the procedure for defining Website objectives in order to evaluate the usability of multipurpose, complex Websites.

The authors developed Scenario-Based Walkthrough as an original Fujitsu method of evaluating usability that allows us to extract usability problems according to the business objectives of target Websites based on theories of usability engineering, such as Scenario-Based Design⁷⁾ and Cognitive Walkthrough.⁸⁾

The Scenario-Based Walkthrough method originally consisted of two phases. In one phase, the evaluator systematically extracts case episodes of actual site use by users (described as

scenarios) to define the objectives of the target Website. In the other phase, the evaluator answers questions about the steps of operation needed to perform each extracted scenario based on a cognitive model to evaluate problems that hamper attainment of the Website objectives.

To realize a Website suited for stated business objectives through evaluation using the Scenario-Based Walkthrough method, the evaluator must extract and evaluate those scenarios that are considered important to achieve the business objectives. Conversely, many important scenarios are extracted for a multipurpose Website, often resulting in conflicting corrective measures to be taken for different scenarios. To avoid such conflicts, scenarios should be narrowed down in order of the importance of objectives prior to evaluation. For the proper selection of scenarios based on substantial reasons, we developed a scenario selection technology using an issue tree, which is a basic method of business analysis. **Figure 2** shows the steps of the Scenario-Based Walkthrough procedure enhanced with scenario selection technology.

The following section describes each procedural step of the Scenario-Based Walkthrough method.

4. Usability evaluation procedure using Scenario-Based Walkthrough method

This section describes each step of the Scenario-Based Walkthrough method shown in Figure 2 from a technical standpoint.

4.1 Defining business objectives using issue tree

The procedure for defining the important business objectives of a Website consists of two phases. One phase is creating an issue tree that breaks down business objectives to the level of detailed measures for clarifying the causal relationship between business objectives and the measures to be taken. The other phase is deter-

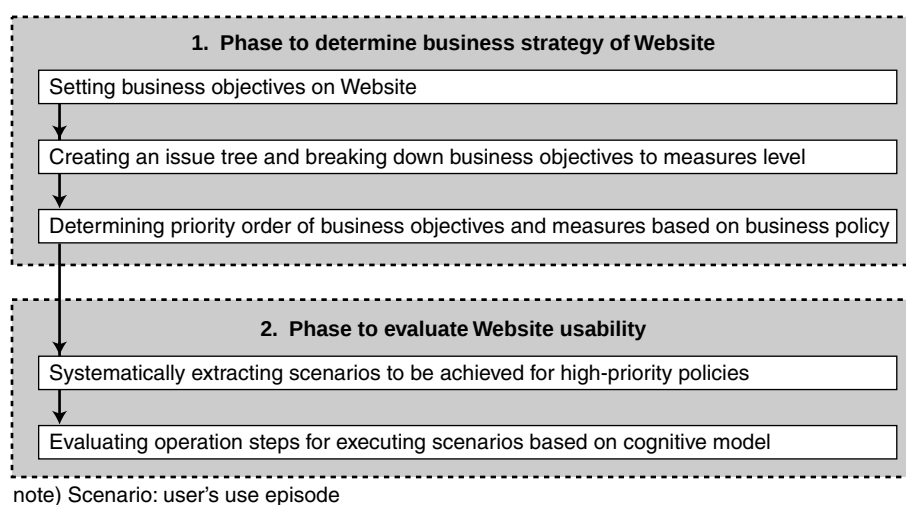


Figure 2
Steps of Scenario-Based Walkthrough procedure enhanced with scenario selection technology.

mining the priority order of business objectives and the measures to be taken according to business policy. The following explains the procedure for extracting high-priority scenarios (based on an issue tree) according to a business policy.

The issue tree method sequentially breaks down solutions for a key task to the level of detailed measures to be taken based on the MECE principle^{note 1)} and then arranges and expresses the solutions in a tree structure. This method allows the causal relationship between a stated business objective and measures to be clarified, and the priority of each measure to be examined according to business policy.

Moreover, by presenting the measures linked with scenarios, relationships between business objectives, measures, and scenarios can be clearly understood. As a result, scenarios can be selected according to the priority order of measures, and the grounds for selection presented.

As an example, **Figure 3** shows the flow of usability evaluation (using the issue tree meth-

od) of a Website designed for the mail-order sales of personal computers (PCs). First, the Website's business objective of "Improving profitability of the PC mail-order Website" is broken down to the level of measures. Next, a measure (such as "Promoting sales of highly profitable supplies") is selected as the priority measure according to the business policy of the customer operating this site. Then "Purchasing supplies" is described and evaluated as the scenario to be performed on the Website for accomplishing the priority measure. In this way, important problems that hamper attainment of a business objective can be effectively extracted.

4.2 Extracting scenarios systematically

The factors that largely and adversely affect Website usability include not only system specifications, but also the actual use conditions of users, including the type of user, purpose of use, and the social and physical environments. Since a scenario can imply various factors concerning use conditions through simple expressions, it can be used to check many problems. For example, for the task of "Purchasing a toy" on a toy-seller's Website, the scenario of "An old man wishing to

note 1) The Mutually Exclusive, Collectively Exhaustive (MECE) principle is a methodology propounded by McKinsey & Company, which means no omission and no duplication.

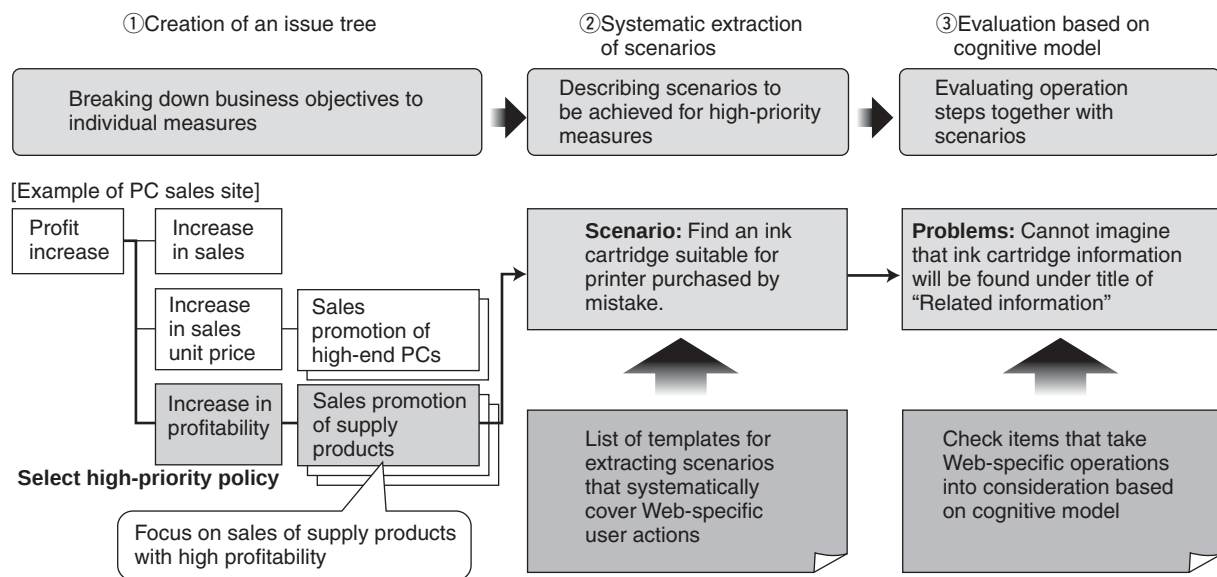


Figure 3
Flow of usability evaluation on PC sales site that uses issue tree.

purchase a toy featured in a TV commercial as a birthday gift for his grandchild" can be extracted. This scenario implies many items to evaluate as listed below, and enables the effective extraction of problems.

- 1) Can elderly people perform necessary operations on the Website?
- 2) Is sufficient information provided to determine whether children like the toy?
- 3) Can delivery of the toy by the date of the birthday be confirmed?
- 4) Can a birthday card be sent together with the toy?
- 5) Can the delivery destination be specified?
- 6) Can the toy be found using keywords taken from the advertising copy?

An infinite number of such scenarios can no doubt be created. For effective evaluation to achieve a given business objective, it is necessary to extract scenarios that are important to the business objective without any excess or deficiency.

The Scenario-Based Walkthrough method allows the evaluator to systematically extract scenarios for service utilization that are impor-

tant to achieve Website objectives by using a matrix as shown in **Figure 4**.

The scenario items in the cells along the vertical axis are patternized categories of actions to be taken during Website utilization, starting with "Knowing the content of the Website" and ending with "Implementing a service or function." These items were originally created by the authors as extended scenario items for evaluating Website usability with reference to the scenario classification method⁷⁾ devised by Carroll, who advocated Scenario-Based Design.

The cells along the horizontal axis contain the items extracted by analogy testing based on software engineering. These cells are patternized types of variations of action, including "Repetition" and "Combination."

Each cell of the matrix is provided with the templates of important scenarios obtained through past examination of highly usable Websites and experiments. The evaluator extracts scenarios suited for the service characteristics specific to the target Website (based on the templates), while interviewing the Website master and customer service representative. For example, the basic

Category	Basic system	Combination	Repetition	Abnormal system
Knowing content of Website		Understands what he or she can do on Website, and what advantages Website offers user.		
Search for a product				
Find interesting information by mistake				
Compare and select products				
Investigate and understand system				
Conclude a contract	On a page of target products, find a different grade product by mistake.			
Exchange information between other users			Investigate cancellation method and its fee system.	

Figure 4
Systematic extraction of scenarios.

action template for the action of “Knowing the content of the Website” is “A first-time visitor to the Website who understands what he or she can do on the Website, and what advantages the Website offers the user.” From this template, the evaluator can extract a scenario that reflects the business objective specific to the Website, such as “A first-time visitor to the Website who understands that he or she can purchase a commodity at a low price and at a specific time due to price fluctuations, receive a 5% member discount, and obtain price information on desired commodities by e-mail.”

4.3 Evaluating scenarios based on cognitive models

The Scenario-Based Walkthrough method allows the evaluator to break down an extracted scenario into steps of actions (e.g., reading, clicking, scrolling) and answer questions about the actions given as check items (**Figure 5**) based on cognitive models to extract problems. Since the evaluator extracts problems according to models of cognitive actions of the user (e.g., being motivated, finding something, performing operation, evaluating the result), evaluation can be done efficiently without using test subjects.

To prepare the check items, we improved the evaluation items defined by the conventional Cognitive Walkthrough method⁶⁾ by specifying user actions on Websites as targets of evaluation.

We rearranged the check items by type of action (reading, clicking, or scrolling) so that even evaluators without knowledge of cognitive science can understand the content of each check item. Consider, for example, a sequence of actions such as “Clicking the Shopping Cart icon” needed to accomplish the scenario of “Purchasing a commodity.” The check items of “Is the user motivated to perform clicking?” and “Can the user easily find links and buttons?” allow the evaluator to extract such problems as “The user is unlikely to click the icon because it does not look like a link or button” and “The user may be unable to find the icon because it is positioned away from the commodity information.”

In summary, the Scenario-Based Walkthrough method makes it possible to evaluate Website usability in terms of business characteristics by using scenarios that accurately describe the service characteristics considered important to a Website’s business objectives. Evaluation can be very exhaustive since scenarios are extracted systematically based on patterns of user actions taken on Websites. When extracting problems, the evaluator uses cognitive models of user actions to conduct evaluation from the user’s standpoint. Thus, this method requires no test subjects for evaluation, and allows us to maintain the usability of even frequently updated Websites at low cost.

Operation	Cognitive model	Check items
Click	Being motivated	☐ Is user motivated to perform clicking? ⋮
	Finding something	☐ Can user easily find links and buttons? ☐ Can the title be easily associated with the word being searched for by the user? ⋮
	Performing operation	☐ Can the result obtained by clicking be predicted?
Read		Example of problem extract: User is unlikely to click the icon because it does not look like a link or button.
Scroll		
⋮		

Figure 5
Problem extraction based on cognitive models.

5. Case example of evaluation

This section cites a case example of using the method to evaluate the usability of a Fujitsu Website for providing technical support to computer users. This Website provides frequently asked questions (FAQs) and answers, and technical information to help customers solve problems. It also offers software fix patches for preventive maintenance to actively support the stable operation of customer systems.

1) Determining priority measures based on an issue tree

In conjunction with the Website master, we created an issue tree (**Figure 6**) and broke down the Website's objective of "Actively supporting the stable operation of customer systems" to the level of measures for "Helping customers solve problems" and "Reducing the occurrence of problems." In this case example, we set "Improving the availability of maintenance and operation information (technical information and FAQ)" and "Improving the availability of pages for printer troubleshooting subject to many inquiries" as the priority measures for helping customers solve problems.

2) Describing a scenario

We described a scenario that covers the measures determined in step 1) with reference to

templates. In this case example, we used the scenario template for "A first-time visitor to the Website who understands what he or she can do on the Website, and what advantages the Website offers the user" for the basic action of "Knowing the content of the Website." Thus, we described a scenario corresponding to the priority measures decided in step 1) for the Website as follows: "A first-time visitor to the Website who understands that he or she can obtain a wealth of knowledge and the latest patches useful for maintenance and operation, and check the contents of past inquiries and how current inquiries are answered" (Figure 6).

3) Evaluating items based on cognitive models

Concerning the steps of actions required to accomplish the scenario described in step 2), we answered the questions set by two check items based on cognitive models: "Can the user know that the result of scrolling will be advantageous?" and "Can the user easily associate titles with the words being searched?" As a result, we extracted the following problems (**Figure 7**):

- To find useful information on maintenance and operation, and the latest patches, the user must read many items on the menu on the left while scrolling it; therefore, the user

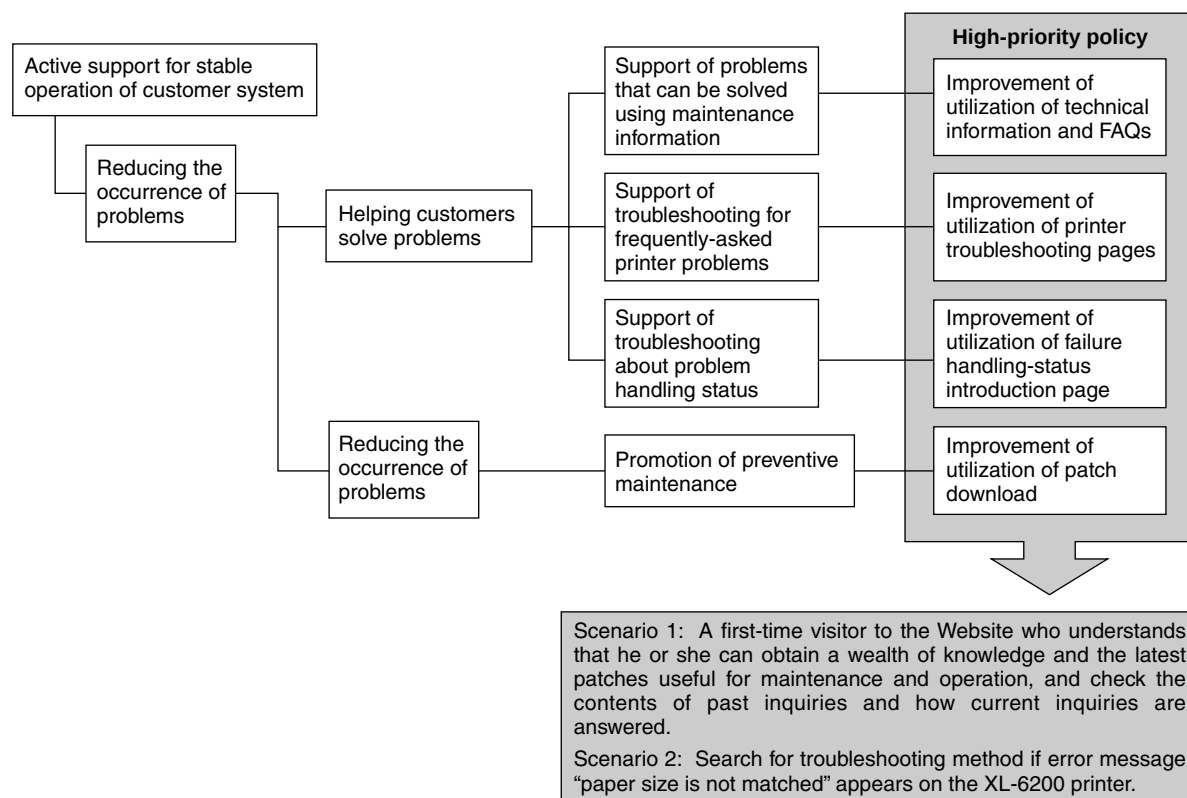


Figure 6
Issue tree of Website for system support contractor.

may not be able to find the desired information (① in Figure 7).

- The user may associate the title “History of inquiries and responses”^{note 2)} with a function of past-inquiry management in mind, but cannot know that the current situation of responses to inquiries can be confirmed (② in Figure 7).

Figure 8 shows the improvements made based on the result of evaluating Website usability. The titles (“News & Topics,” “Download,” and “Troubleshooting”) placed prominently in the middle of the Web page suggest that the user can

obtain information and the latest patches useful for maintenance and operation. Moreover, the title “Current situation and history of inquiries and responses” suggests that the user can refer to not only past inquiries and responses, but also the current situation.

As illustrated above, by evaluating usability with a selected scenario considered important to the business objectives, we can effectively extract critical problems that may hamper the attainment of Website objectives and improve the target Website so that it meets the business objectives.

6. Conclusion

This paper described Scenario-Based Walkthrough as an original Fujitsu method of evaluating Website usability. This method involves an enhanced process to clarify Website objectives and allows us to extract usability

note 2) “History of inquiries and responses” shows: 1) how customer’s problems (e.g., server failure) have been handled (i.e., solved over the phone, being investigated, repair request accepted, parts being ordered) and 2) a list of past responses to customers’ problems with date and descriptive memos.

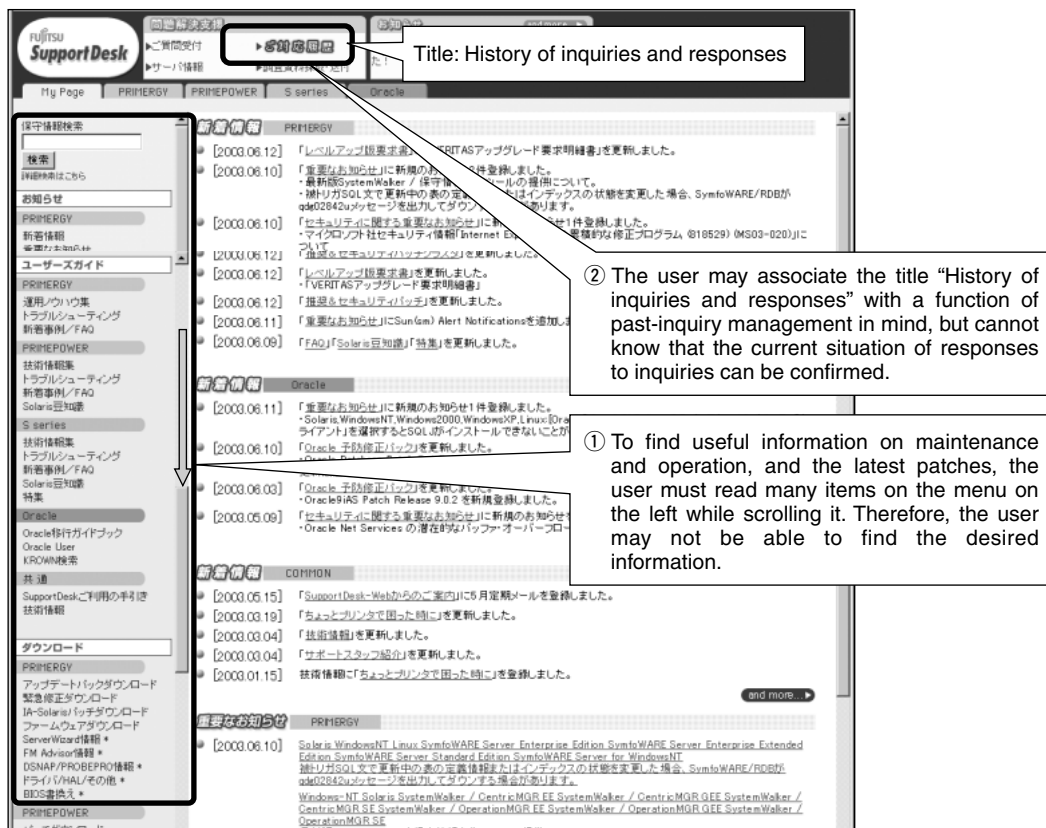


Figure 7
Example evaluation based on cognitive model.

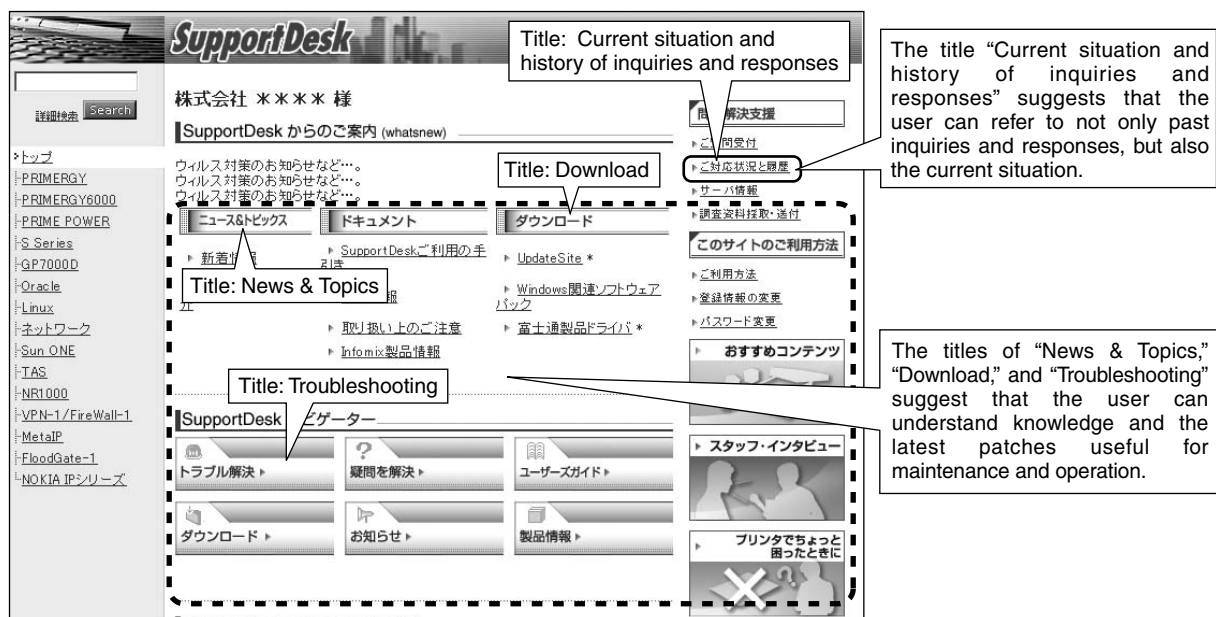


Figure 8
Proposal for improving Web pages created based on Website-usability evaluation results.

problems from Websites according to stated business objectives so that even multipurpose, complex Websites can be properly evaluated. With this method, Website objectives are initially defined from the standpoint of business management, and then problems that may hamper the attainment of Website objectives are extracted. Thus, Websites can be effectively improved according to business objectives. Even if a target Website has multipurpose, complex content, it can be properly evaluated and improved after determining the priority order of its objectives in consultation with the Website master.

For future application of the Scenario-Based Walkthrough method to various categories and types of business, we need to develop a method of efficiently understanding the business of each customer.



Satoko Segawa received the B.S. degree in Applied Information Science from Tokushima University, Tokushima, Japan in 1987. She joined Fujitsu Laboratories Ltd., Kawasaki, Japan in 1987, where she has been engaged in research and development of usability engineering, specifically methods of evaluating Websites.



Masahiko Sugimura received the M.E. degree in Applied Systems Science from Kyoto University, Kyoto, Japan in 1995. Later that year he joined Fujitsu Laboratories Ltd., Kawasaki, Japan and has been engaged in research and development of usability engineering and requirement engineering, specifically analyzing user experience and Website objectives.

References

- 1) Ministry of Economy, Trade and Industry: The Marketing Research on Electronic Commerce. (in Japanese).
http://www.meti.go.jp/policy/it_policy/statistics/outlook/040917denshishotorihiki_report.pdf
- 2) Jacob Nielsen: Success Rate: The Simplest Usability Metric. February 18, 2001.
<http://www.useit.com/alterbox/20010218.html>
- 3) Fujitsu Press Release: Consulting services for upgrading Websites for investors. (in Japanese).
<http://pr.fujitsu.com/jp/news/2004/08/16.html>
- 4) Fujitsu Press Release: Web Universal Design solution. (in Japanese).
<http://pr.fujitsu.com/jp/news/2004/09/9-1.html>
- 5) Research-Based Web Design & Usability Guidelines, National Cancer Institute.
<http://usability.gov/guidelines/>
- 6) C. Lewis: Using the 'thinking-aloud' method in cognitive interface design. Research Report RC-9265, IBM T.J Watson Research Center, Yorktown Heights, 1982.
- 7) J. Carroll: Making Use: Scenario-Based Design of Human-Computer Interactions. MIT Press, 2000.
- 8) C. Lewis et al.: Testing a walkthrough methodology for theory-based design of walk-up-and-use interfaces. Proc. CHI'90, ACM, 1990, p.235-242.



Kazushi Ishigaki received the B.S. and M.S. degrees in Information Science from the University of Tokyo, Tokyo, Japan in 1980 and 1982, respectively. He joined Fujitsu Laboratories Ltd., Kawasaki, Japan in 1982, where he has been engaged in research and development of online handwriting character recognition, human computer interaction, and usability engineering. He is a member of the Information Processing Society of Japan (IPSJ), the Human Interface Society of Japan (HIS), and the Institute of Electronics, Information and Communication Engineers of Japan (IEICE).