

## Web Accessibility Evaluation Technology

*Masahiro Watanabe<sup>†</sup>, Daisuke Asai, Harumi Saito, and Keiji Morita*

### Abstract

This article introduces the concept of web accessibility and its associated problems. To identify these problems and correct them easily, we are studying evaluation techniques that judge whether a web design takes accessibility into consideration.

### 1. Introduction

Japan is becoming an aged society and more and more elderly people are now using the Internet. Moreover, a huge number of people are using personal computers and the Internet, including disabled people. Therefore, it has become increasingly important that everyone can use web content to acquire information, regardless of age or disability. This characteristic is called web accessibility.

To reveal the characteristics of web content, let us compare web content and newspapers. With a newspaper, people who feel that the text and photographs are too small may use a magnifying glass to enlarge them. However, totally blind people cannot read the text in a newspaper and need someone else to read it for them. With web content, on the other hand, it is impossible to obtain information without using some sort of information and communications technology (ICT) such as a web browser on an electronic device. Moreover, people accessing web content can use their own preferred device and browser, and the range that must be supported is quite large.

Blind people can use screen-reading software that utilizes a synthesized voice to read out web content, as shown in **Fig. 1**, and obtain information for themselves without relying on other people. This advantage is a huge feature of web content. In addition, information in the web content can be converted into

various presentation formats besides voice. Content can also be displayed on mobile phones and can be converted into braille for presentation on braille devices. Text can be resized or displayed in a high-contrast mode (reverse video) for people who find screens too bright. People who have trouble using a mouse can use input methods that have been tailored for them.

In this way, one web page can be accessed from various different types of devices. An important concept is that web content can be converted into the optimal form for each person using it and that it can be changed. With a newspaper, one would probably have to enlarge the text and make a special issue intended for elderly people, in the same way that some books are available in a large-print edition. However, with a web design intended for elderly people, it is not necessary to enlarge the text beforehand; it is enough to have a web design that allows text to be resized without causing problems.

It should be noted, however, that this conversion needs to be done skillfully; otherwise, problems related to web accessibility can occur. Some specific examples are listed in **Table 1**. Various different scenarios can be considered for the use of web content, such as information being converted into voice, text being displayed, and text being enlarged and displayed. In each of these cases, problems occur, as indicated by these examples. In addition, since a completely blind person cannot use a mouse to control an ICT device because he or she cannot see the cursor on the screen, it is also necessary to have a web

<sup>†</sup> NTT Cyber Solutions Laboratories  
Yokosuka-shi, 239-0847 Japan

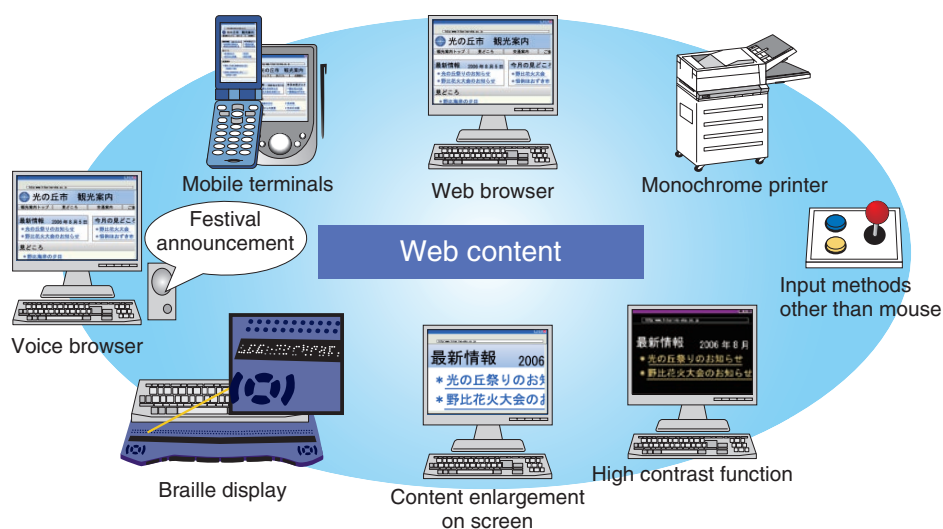


Fig. 1. Web accessibility and various types of ICT equipment.

Table 1. Specific examples of web accessibility problems.

Situation	Problem	Solution
Conversion of information to voice	Because there is no text representation of an image, there is nothing that can be read out, so the image's meaning cannot be understood.	Provide a text description of an image (text alternative).
Conversion of information to voice	When the synthetic voice reads out "red text indicates the current stock prices", no one can understand which of the spoken numbers were red.	Refer to text in a non-visual manner, i.e., without referring to its color.
Conversion of information to voice	Because the information in a table is read out in the order given in the source code, the spoken order is unsuitable and difficult to understand: "time, location, 11 o'clock, Yokosuka".	Arrange information in an order that is understandable when read out such as "time, 11 o'clock, location, Yokosuka".
Display of text	It is difficult to read white text against a light-yellow background.	Use color combinations for text and background that provide enough contrast.
Resizing of text	Enlarging the text size may result in a heading overlapping the body text, making the text difficult to read.	Ensure that text does not overlap when enlarged.
Keyboard operation	If a user uses the tab key to select a part, the focus is trapped within that part.	Enable the focus in a web page to be moved by keyboard operation.

design that can be operated by keyboard alone. A design that supports keyboard operation can also accommodate various other types of input device.

Web accessibility problems related to color occur not only when information is being conveyed by voice, but also when it is printed out on a monochrome printer or when the user has color vision deficiencies. Web designs should consider such problems.

## 2. Standardization of web accessibility

Guidelines that summarize how best to produce web designs have recently been created and standard-

ized in order to address web accessibility problems. The guidelines that are currently used globally are the Web Content Accessibility Guidelines (WCAG) 2.0 recommended by the World Wide Web Consortium (W3C) [1]. WCAG 2.0 has been incorporated into standards and legislation in many countries and has become a worldwide standard.

WCAG 2.0 has also been adopted in Japan, and JIS X 8341-3 (JIS: Japanese Industrial Standards) was revised accordingly in August 2010 [2]. This standard has two main features: (1) the criteria are explicit, so it is possible to test whether a criterion has been satisfied and (2) there is no dependence on specific coding techniques such as HTML (hypertext markup

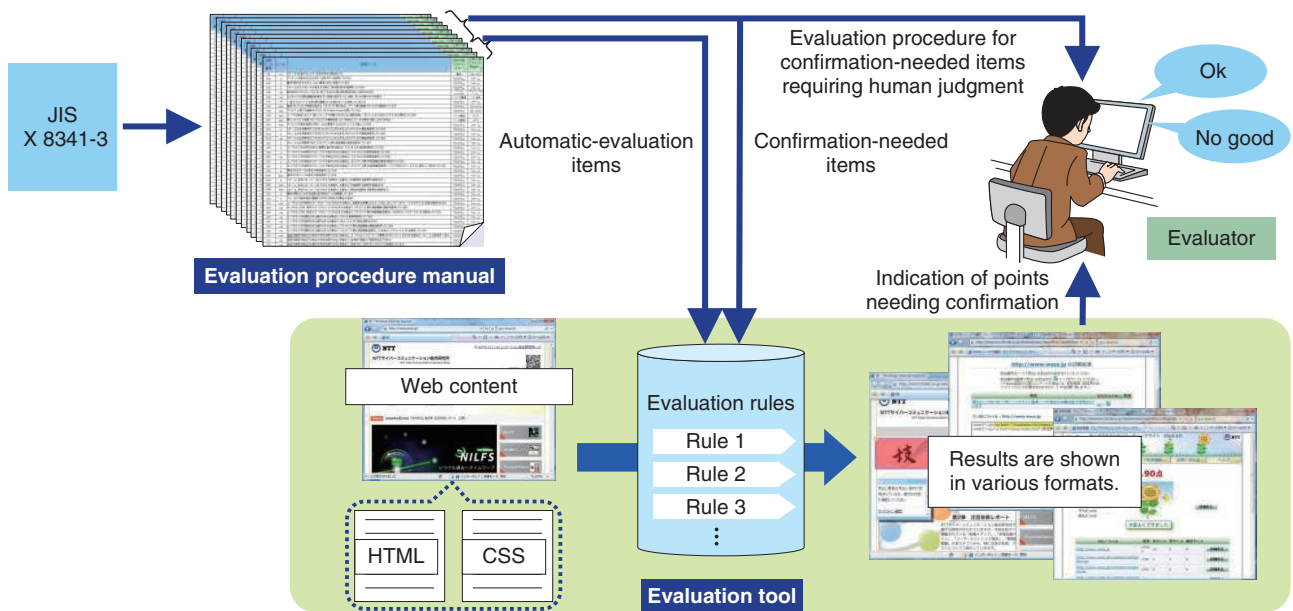


Fig. 2. Relationship between evaluation procedure manual and evaluation tool.

language).

The first feature of JIS X 8341-3 is testability. Among the examples in Table 1 is the problem of low contrast between the text color and background color, which makes the text difficult to read. More specifically, what level of contrast would be sufficient? A formula for calculating contrast is included in JIS X 8341-3, with the criterion being that the result must be at least 4.5:1. Such a criterion is clear, so we can perform an objective test for accessibility.

The second feature is that specific web techniques are not mentioned in the standard. If web techniques were to be mentioned in detail in the standard, the standard would be unable to keep pace with technical advances. The main part of the standard is in terms that can be used even if web techniques progress further, and users can refer to related technical documentation for specific techniques.

W3C has been set up to ensure that web designers can respond to advances in web techniques by creating and updating the related technical documentation. JIS X 8341-3 also refers to the technical documentation related to WCAG 2.0. The technical reference materials to be used along with the JIS standard, such as Japanese translations of WCAG 2.0-related technical documentation, are maintained by the Web Accessibility Infrastructure Committee (WAIC) of the Information Access Council [3].

### 3. Web accessibility evaluation technology

To create a web design that considers web accessibility, it is necessary to determine whether there is a problem with accessibility and, if so, to adjust the design. Technology for investigating whether or not there is a problem with a web design from the viewpoint of accessibility is called web accessibility evaluation technology. We are deepening our understanding of JIS X 8341-3 by participating in WAIC activities and have been working on the research and development of evaluation technology based on JIS X 8341-3. We have worked on the development of evaluation tools in the past [4], [5], but have changed the evaluation details in line with JIS revisions. We have developed an evaluation procedure manual that summarizes the evaluation procedure using the most recent evaluation tool, which promotes automatic evaluations and confirmations, to enable people who are not particularly familiar with accessibility to perform evaluations simply.

The relationship between the evaluation procedure manual and the evaluation tool is shown in Fig. 2. The manual's evaluation items include automatic-evaluation items, which can be evaluated automatically by the evaluation tool according to rules, and confirmation-required items that require human judgment and correction of the tool's rule-based evaluation. For example, if a text description is attached to an image

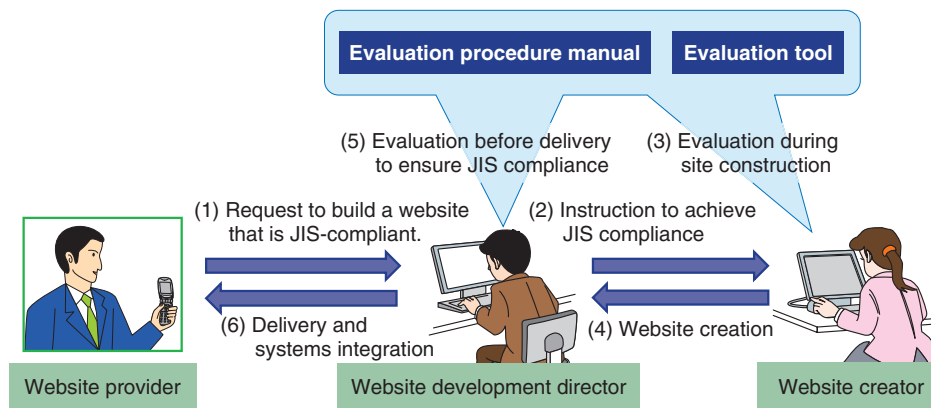


Fig. 3. Example of using web accessibility evaluation technologies.

(text alternative), what the image represents cannot be determined mechanically, although the evaluation tool points out which element need to be evaluated. In such a case, a person (evaluator) must compare and judge the image and the text alternative with reference to the manual. If the text alternative “photograph of the sea” is attached to a photograph of mountains, the text alternative does not reflect the contents of the image, so it is judged not to satisfy the JIS criterion.

The evaluation procedure and judgment criteria are written in detail in the evaluation procedure manual. In addition, a table format is used to enable viewing of evaluation rules at a glance. The evaluation rules can be sorted or filtered, and ease of use during evaluation has been considered.

The evaluation tool is installed on a server and can be used as a web application. Thus, a feature of this system is that it is unnecessary to install the software locally and it is immediately available for use. If the URL (uniform resource locator) of the web page to be evaluated is input into the evaluation tool, the web page’s HTML files and CSS (cascading style sheets) files are evaluated according to the evaluation rules.

The tool’s evaluation rules were created from the JIS-based evaluation rules in the evaluation procedure manual. The evaluation results are displayed as one of three categories (compliant, noncompliant, or confirmation-required) for each HTML element. Compliant and noncompliant elements are ones where the corresponding JIS criteria are or are not satisfied, respectively. Confirmation-required elements are ones that must be checked by a human evaluator and either confirmed or corrected.

The evaluation tool displays the results in various different formats. A score display giving a summary

of the evaluation results, the number of extracted elements corresponding to evaluation rules, and the extraction elements within the HTML source code are highlighted and displayed in red frames within the window displaying the web page. The evaluator can evaluate an image’s text alternative by comparing the image displayed on the screen with the text alternative displayed in the source code. A comment page is also provided for each evaluation rule. By referring to the comment pages, a user can gain a deeper understanding of the accessibility.

Our web accessibility evaluation technology is designed for the assumed usage scenario illustrated in **Fig. 3**. A web provider such as an autonomous entity asks a development director in an NTT Group company to construct a JIS-compliant website. The development director tells the web creator to use NTT’s web accessibility evaluation manual and tool in order to achieve JIS compliance because it enables even web creators who are unfamiliar with accessibility to create accessibility-friendly pages and learn about accessibility at the same time. This web accessibility evaluation technology is used both during web content creation and during the checking phase after content creation but before delivery to the web provider. We consider that this should be helpful in the production of web content that considers accessibility.

#### 4. Conclusion

The two main reasons that web accessibility is not spreading are a lack of knowledge of methods for considering web accessibility and the cost of web accessibility evaluation. Evaluation by humans takes

time and requires specialist knowledge. In user-centered design, we follow a cycle of observing and interviewing evaluators and then making improvements on the basis of those results and reviewing ways of making the evaluation process more efficient.

At the same time, we must expand our awareness of web accessibility to make it commonplace to consider it instead of refusing to consider it because of the evaluation cost. We participate in the activities of the Japan Web Accessibility Consortium (a non-profit organization) and are working towards promoting JIS-based web accessibility [6]. We will also continue our research and development of web accessibility evaluation technology in order to create a society in which everyone can enjoy the advantages of networks.

## References

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**Masahiro Watanabe**

Senior Research Engineer, ICT Design Center, NTT Cyber Solutions Laboratories.

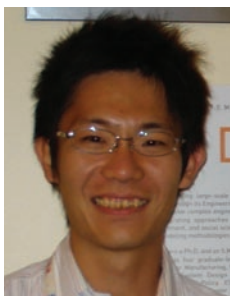
He received the B.E. and M.E. degrees in mechanical engineering and the Dr.E. degree in electronics, information, and communication engineering from Waseda University, Tokyo, in 1991, 1993, and 2003, respectively. He joined NTT Basic Research Laboratories in 1993 and studied the human auditory system. Since moving to NTT Cyber Solutions Laboratories in 1999, he has been studying human-computer interaction, especially universal design and user-centered design. He is a member of the Human Interface Society and the Acoustical Society of Japan.



**Harumi Saito**

Research Scientist, ICT Design Center, NTT Cyber Solutions Laboratories.

She received the B.A. and M.A. degrees in psychology from the University of Tokyo in 2004 and 2006, respectively. She joined NTT Cyber Solutions Laboratories in 2006, where she worked on graphical user interface design. Her interests include color design and color vision characteristics. She is a member of the Information Processing Society of Japan and the Color Science Association of Japan.



**Daisuke Asai**

Research Engineer, ICT Design Center, NTT Cyber Solutions Laboratories.

He received the M.S. degree in mechanical engineering from the University of Tokyo in 2005. He joined NTT Cyber Solutions Laboratories in 2005 as a research engineer and worked on human computer interaction, focusing especially on designing methodologies to enhance web accessibility for disabled and elderly people. From 2010 through May 2011, he was a visiting researcher at MIT AgeLab working on the design of technologies to enhance the quality of life for elderly people living alone.



**Keiji Morita**

ICT Design Center, NTT Cyber Solutions Laboratories.

He received the bachelor's degree in social welfare from Bukkyo University, Kyoto, in 1994. During 1998–2002, he was working in a welfare institution. He joined NTT Cyber Solutions Laboratories in 2005. He is currently engaged in a web accessibility evaluation study.