# Working towards Universal Design

*Haruhiko Kojima*†, *Yoko Asano, and Shunichi Yonemura*

**Abstract**

This paper introduces the trend of universal design. It also gives an overview of related work in NTT Laboratories as an introduction to this set of selected papers. With Japan's population aging rapidly, the number of people with weaker-than-average physical and mental capabilities is sure to increase. In the future broadband and ubiquitous society, products, services, and environments must be based on universal design that provides ease of use for everyone.

## 1. Introduction

NTT Laboratories began full-scale research and development of human interface designs in the latter half of the 1980s. The concept of universal design has been a major focus of attention since the year 2000. This paper introduces the trend of universal design within Japan and gives an overview of related work in NTT Laboratories as an introduction to this set of selected papers.

## 2. Universal design

Though the term universal design was introduced in Japan around 1995, it has infiltrated society only relatively recently. The concept of barrier-free is already quite common in society. It refers to environments or products where barriers to persons with disabilities and to senior citizens have been eliminated and the lives of such people are supported. The starting point of the barrier-free concept is to consider how to increase the number of people who can use the environment or products used by the standard user. On the other hand, the concept of universal design is to design services, products, and environments that are easy to use for as many people as possible, irrespective of age, sex, and physical/mental capabilities. The concept of universal design was advocated by Ron Mace who was the head of The Center for Universal Design, North Carolina State University. The seven principles of universal design [1] are shown below.

(1) Equitable use: The design is useful and marketable to people with diverse abilities.
(2) Flexibility in use: The design accommodates a wide range of individual preferences and abilities.
(3) Simple and intuitive: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
(4) Perceptible information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
(5) Tolerance for error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.
(6) Low physical effort: The design can be used efficiently and comfortably and with a minimum of fatigue.
(7) Size and space for approach and use: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

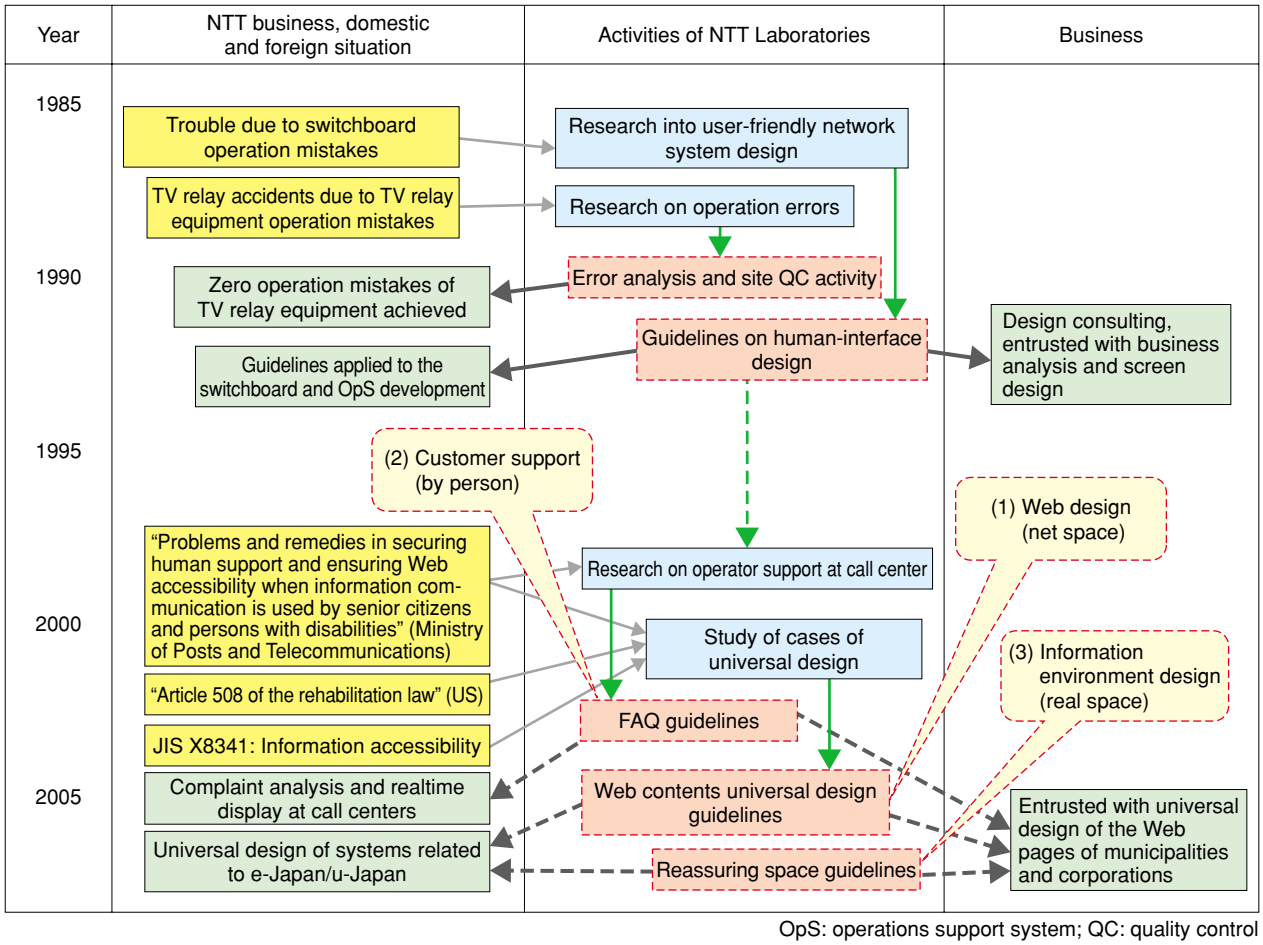
Nowhere in these principles do you see terms such as senior citizen or person with disabilities. The concept of universal design applies to any reader, including you. It is obvious that any design that is friendly for less-capable people is friendly for all people in general.

† NTT Cyber Solutions Laboratories
Yokosuka-shi, 239-0847 Japan
E-mail: ud-center@lab.ntt.co.jp

Domestic and foreign activities relevant to universal design became evident just before the year 2000. In response to the expansion of types of Internet users accompanying the spread of the Internet, a set of design guidelines called Web Content Accessibility Guidelines 1.0 [2] was developed by WAI (Web Accessibility Initiative) in 1999. They were intended to allow anyone to access the information offered on the Web. WAI is an organization that studies Web accessibility as part of an international consortium called W3C (World Wide Web Consortium). Accessibility is a term that describes to what extent information and services are available to various people. It is almost synonymous with the term universal design. The Ministry of Posts and Telecommunications of Japan (at that time) publicly announced in May 2000 "Problems and remedies in securing human support and ensuring Web accessibility when information communication is used by senior citizens and persons with disabilities" [3]. This was aimed at promoting the use of IT by such people in an environment of intense IT development and rapid population aging. Ever since "Article 508 of the rehabilitation law" [4] came into force in the United States in June 2001, IT equipment and software purchased by any public organization in the United States must be usable by persons with disabilities. In response, the Japan Industrial Standards Committee released in June 2004 the document "JIS X8341-3:2004 Guidelines for older persons and persons with disabilities—Information and communications equipment, software and services—Part 3: Web content" [5].

## 3. Interface design: research and development at NTT

NTT established the NTT Human Interface Laboratories in 1987 to promote research and development related to the media communication processing of voice and images etc. and terminals. NTT expended considerable effort on the research of human interface designs, both in name and reality (**Fig. 1**).




OpS: operations support system; QC: quality control

Fig. 1. History of R&D of the interface design at NTT.

One example is the case of communication network errors or TV relay trouble that occurred in the latter half of the 1980s due to operation mistakes at switchboards or television relay devices managed by NTT. In response, NTT Human Interface Laboratories began research into user-friendly network system designs. The quality concept of "zero operation mistakes" was attained at the television relay center through error analysis and on-site quality control activities. Moreover, human interface design guidelines were constructed and used to develop human interface systems for telephone switchboards and operation systems. In addition, a consulting business was started up that included business analysis as well as screen design. Along with the guidelines on accessibility to the above-mentioned information and the Web, research that supports the contacting of center operators and case studies regarding universal design have been conducted since 2000 in the NTT Cyber Solutions Laboratories, which was established in 1999 as an offshoot of the NTT Human Interface Laboratories.

Through these research activities, the following three guidelines were developed (**Fig. 2**).

(1) Universal design for net space: NTT Web Contents Universal Design Guidelines
(2) Universal design for customer support: FAQ Design Guidelines
(3) Universal design for real space: Secure Space Guidelines

(1) Universal design guidelines for Web contents

The first edition of NTT Web Contents Universal Design Guidelines was developed in 2003 by supplementing WAI's Web Content Accessibility Guidelines 1.0 with some additional sections that consider usability and the particular problems of the Japanese language and provide specific explanations and relevant cases. The second edition was released in September 2004 and made available to companies in the NTT Group. It addressed the implementation of JIS X8341-3 while including sections for the better use of universal design by considering the knowledge and experience gained through consultations with users and from the demands of users and through interviews with senior citizens and persons with disabilities. These guidelines are described in more detail in the next paper in this issue. [6]

(2) FAQ design guidelines

The first edition of the FAQ design guidelines was also developed based on an analysis of the treatment of customers as established by the contacting center and an evaluation of existing user support sites (FAQ: frequently asked questions (and answers)). Moreover, new display and navigation methods are being created based on the results of experiments on how to best handle the trouble so as to more efficiently satisfy users reading the FAQ as well as ones contacting the center. The FAQ design guidelines are being applied to the communication design of advanced technical support [7].

(3) Secure space guidelines

Cases where highly confidential information is handled in public spaces, such as public wireless LAN (local area network) access points and remote offices, are increasing. Research on designs for secure information-handling spaces has started from the security concern, because if appropriate security is provided, users will be able to handle private information without concern. The "Pictoral Secure Space Guidelines" were developed based on psychological experiments, e.g., on what distance people are com-


(1) NTT Web Contents Universal Design Guidelines
(2) FAQ Design Guidelines
(3) Secure Space Guidelines

Fig. 2. Three guidelines for universal design.

fortable with other people behind them and on the shape and height of partitions between people in offices. A proof-of-concept experiment was conducted in a real public space at the Marunouchi Building in Tokyo in addition to a laboratory experiment. This topic is discussed in more detail in the fourth paper in this set of selected papers [8].

## 4. Universal IT Design Center

The Universal IT Design Center was established to support the entire NTT Group to promote and support universal design technologies for information technology (IT). Its role is shown in **Fig. 3**. The center intends to encourage, educate, and convey information to all the organizations and employees belonging to the NTT Group so that they may well recognize and appreciate universal design. It provides the "NTT Web Contents Universal Design Guidelines" to NTT Group companies. These guidelines are now being used for Web solutions and the construction of the official homepage for each NTT company.

## 5. Concluding remarks

Trends in Japan and activities of NTT Laboratories related to universal design were introduced. By using case studies, the NTT Group will build up an environment where know-how is accumulated and shared within the group regarding methods of specific design and Web accessibility evaluation [9]. For this environment, universal design cases will be collected and Web universal design checking and support tools, such as a voice reading browser, will be developed. In addition, the research and development of terminal design and space design will continue.

## References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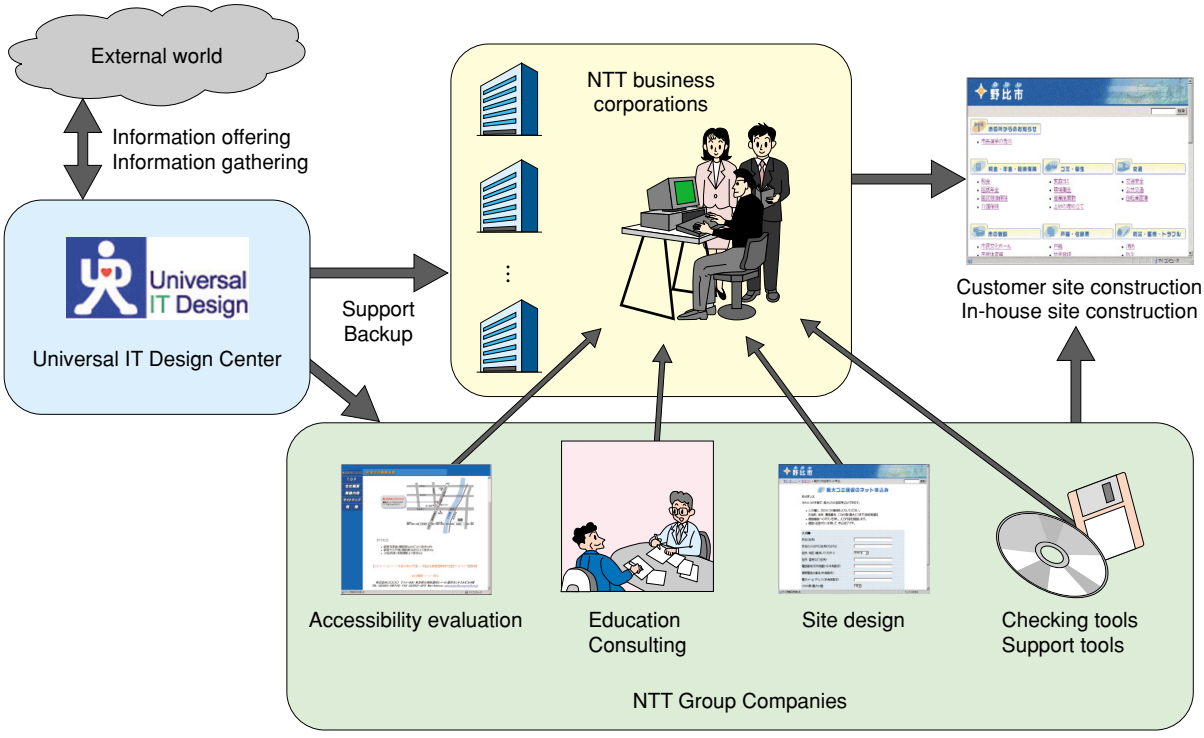


Fig. 3. Role of the Universal IT Design Center.

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**Haruhiko Kojima**
General Manager, Research Planning Department, NTT Cyber Solutions Laboratories.
He received the B.S. degree in mathematics from Waseda University, Tokyo in 1982. In 1982, he joined the Yokosuka Electrical Communications Laboratories, Nippon Telegraph and Telephone Public Corporation (now NTT), Yokosuka. Since then, he has been engaged in R&D of character and document structure recognition, ISDN terminals and systems, video handling, and universal design. He is a member of the Institute of Electronics, Information and Communication Engineers (IEICE) of Japan and the Information Processing Society of Japan (IPSJ).

**Yoko Asano**
Senior Research Engineer, Human Interaction Project, NTT Cyber Solutions Laboratories.
She received the B.E. degree in administration engineering from Keio University, Yokohama, Kanagawa in 1988 and joined NTT Human Interface Laboratories the same year. She moved to NTT Cyber Solutions Laboratories in 1999. Since then, she has been conducting research on human interfaces. She is a member of the Human Interface Society, the Japan Ergonomics Society, and IPSJ.

**Shunichi Yonemura**
Senior Research Engineer, NTT Cyber Solutions Laboratories.
He received the B.E. and M.E. degrees in electrical engineering from Niigata University, Niigata in 1983 and 1985, respectively. He joined NTT Electrical Communication Laboratories in 1985 and moved to NTT Cyber Solutions Laboratories in 2004. He is a member of the Human Interface Society and IEICE.