

## **Universal Design in practice at Oki Electric**

Naotsune Hosono, Ph.D. \*,      Hiroyuki Miki\*\*

*\*Oki Consulting Solutions,      \*\*Oki Electric Industry Co., Ltd.*  
*4-11-15, SHIBAURA, MINATO-KU, TOKYO 105-0023, JAPAN*

### **INTRODUCTION**

Oki Electric regards Universal Design (UD) as design that includes both general usability and accessibility from the perspective of disabled and elderly users. This approach coincides with Mr. Ron Mace's seven UD principles.

Currently, Japanese Industry Standard (JIS) is finalizing the new accessibility standard based on Guide 71 of ISO. As a committee member, Oki Electric has participated in this standardization rapidly integrated it into the existing, in-house Oki culture. This integration has expediting a more rapid, in-house adoption. Including usability studies, these activities have been ongoing for more than ten years. As a practical problem, the ATMs, ticket vending machines, and other such products, designed by this company for public use, are used daily by disabled and elderly people. However, different requirements exist for various products. Consequently, Oki Electric explores diverse business product requirements by transacting actual business using an in-house virtual conference system. Members of this company's development teams and UD specialists have offices in locations that are remote from each other, so this use of a virtual conference system has proved effective and satisfying to participating members.

Ideally, UD is a design for all. However, socially it may be difficult to derive a totally satisfactory solution. Conflict tends to emerge in UD where one group takes full advantage whereas another group experiences disadvantages. Fortunately, introduction of various issues and solutions using the in-house virtual conference system will continue and user experience will accumulate within the company over many years.

### **UD CONCEPT IN OKI**

Oki Electric Industries Co., Ltd. proposes “Oki, Network Solutions for a Global Society” as a corporate vision contributing to the growth of an “e-society”. Following this framework, Oki proposes “Easy and Accessible for all” within the scope of universal design. The original meaning of universal design encompasses all users, including elderly and disabled persons in the overall general population. Previously, manufacturers needed to design specialized units or plug-in equipment modules for disabled persons. However, universal design is an alternative way to design for all from the beginning stages. Mr. Ron

Mace introduced the approach in his famous UD seven principles. He defines universal design as “The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” (Mace, 1997).

His seven principles are;

**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 user's body size, posture, or mobility.

Principle one, two, six and seven are specific from the viewpoint of universal design whereas the rest of the principles coincide with ease of use. The basis of these principles suggests ways to avoid failure and potential humiliation for persons of limited abilities.

The seven principles may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments. This requires several monitored tests of the general population, including elderly and the disabled, while in the process of development to create feedback for the original design. This process especially coincides with the recently introduced “User Centred Design (UCD)” concept (Hosono, 2003). As mentioned above, many manufacturers may initially hesitate to apply universal design to their products due to the perceived wide extent of user studies. However, a steady flow of user experiences will ultimately provide excellent business opportunities and will become even more appealing as the advantages of early engineering integration of the design, technologies and support becomes apparent.

Oki considers UD within the framework of general accessibility including the

perspectives of disabled and elderly users (Figure 1).

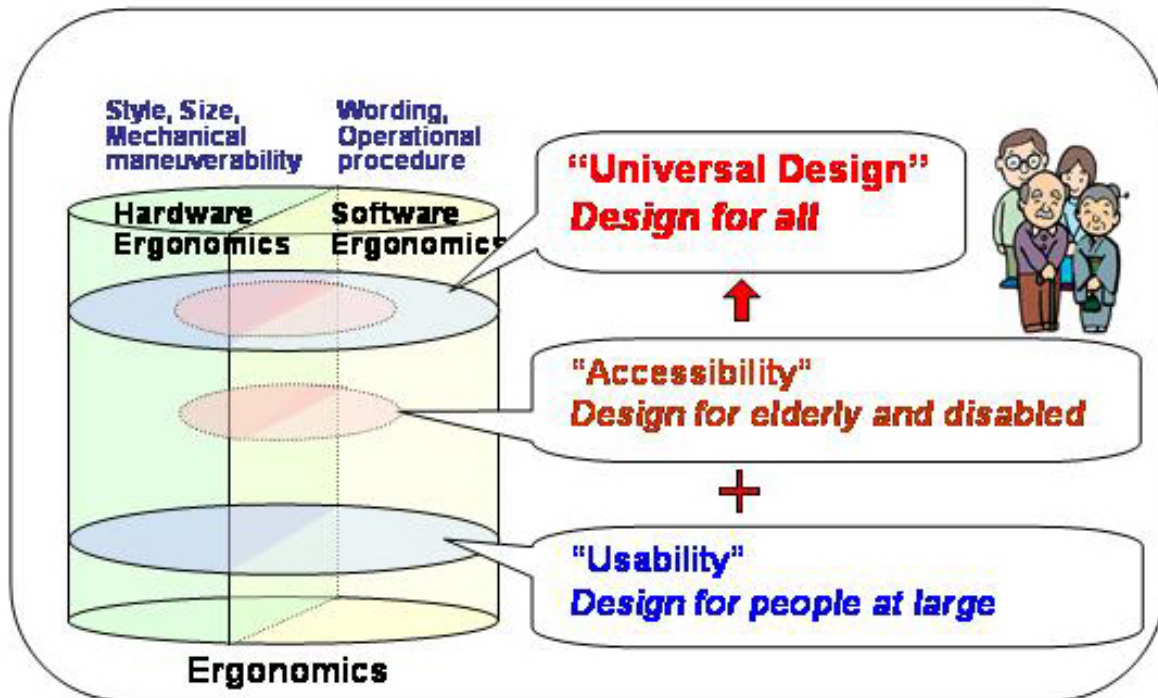


Figure 1. The position of Universal design in Oki

Historically, the basics derive from applied ergonomics “the study of the conditions in which people work most effectively with machines” (Longman Group, 1987). The hardware ergonomics evolved first as style, size and mechanical manipulation. With the influence of the Personal Computer (PC), software ergonomics followed, evolving wording and operational procedures. In context of use, ergonomics compare products whereas UD, accessibility and usability focus on the users.

#### FORTHCOMING ACCESSIBILITY STANDARD IN JAPAN

Japanese Industries Standards (JIS) enacts “Guidelines for older persons and persons with disabilities, - information and communications equipment, software and services -, Part1: Common Guidelines: JIS X 8314-1” in May 2004 (INSTAC, 2004). This standard specifies guidelines for improving the accessibility of Information Communication Equipment (ICE), software, and services used by elderly people and the permanently or temporarily disabled. This standard established under the ISO/IEC Guide 71: 2001, “Guidelines for standards developers to address the needs of older persons and persons with disabilities” (ISO, 2001). Beneath part 1, there follows Part 2 : information processing equipment and Part 3 : Web Content (Figure 2).

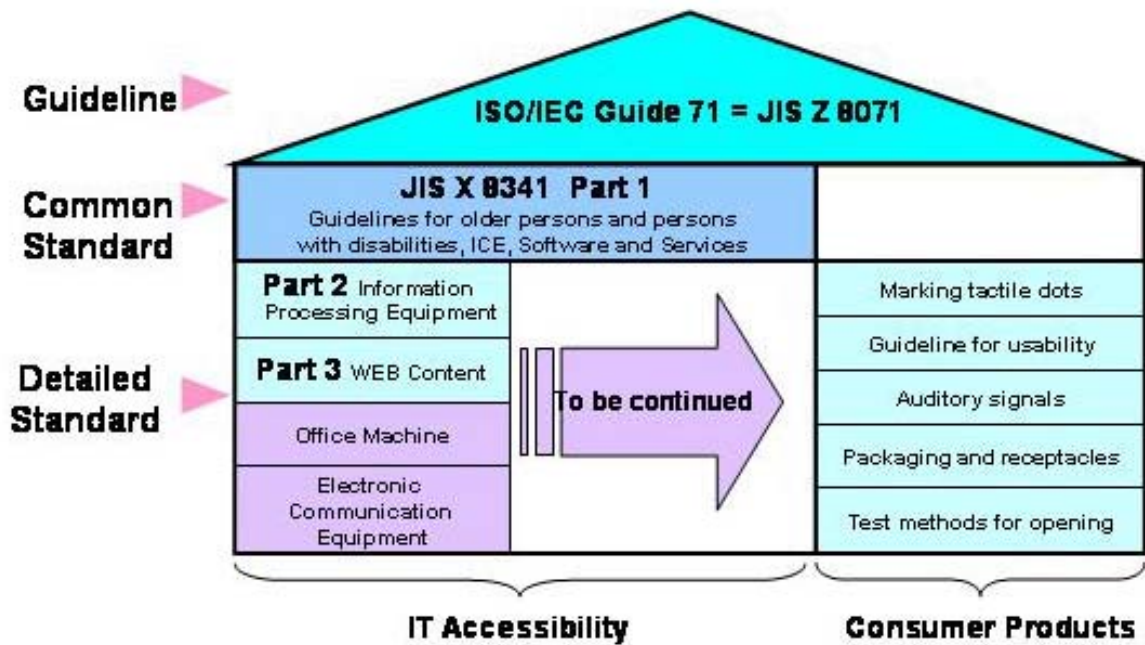


Figure 2. IT Accessibility JIS X 8341

**QUALITY OF LIFE**

Figure 3 shows the simplified Quality of Life (QOL) standard relationships consisting of three portions: Products, development Process and People or employees.

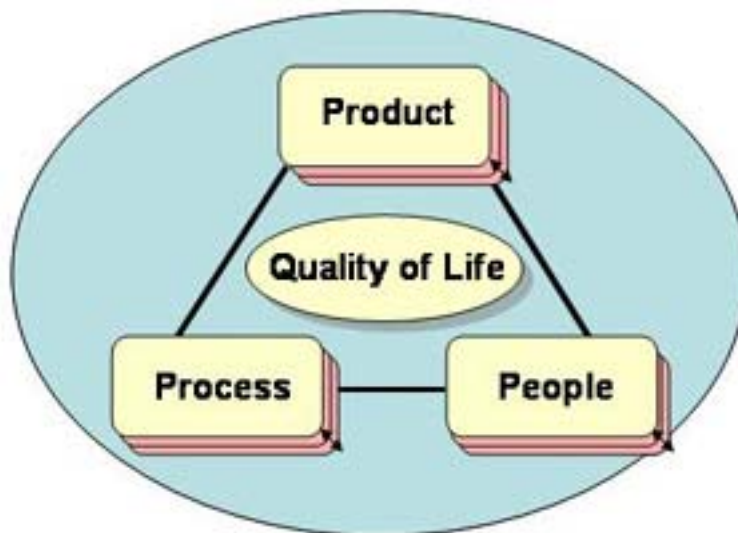


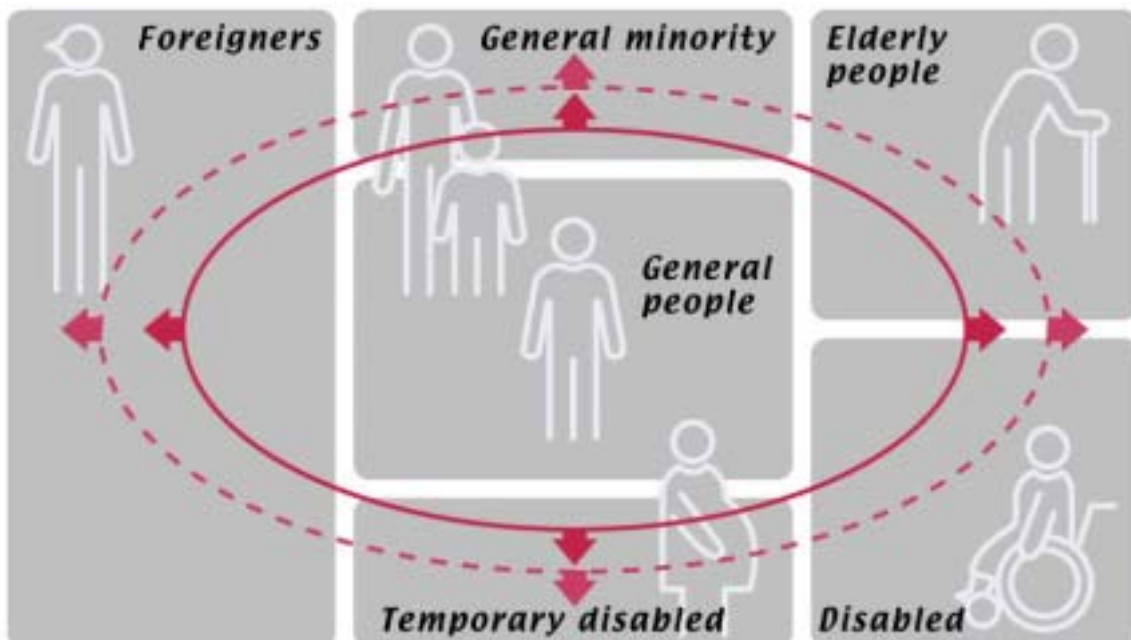
Figure 3. Quality of Life

The fundamental purpose is the improvement of accessibility and usability underlying QOL. Actually, the portions are prescribed in detail in each dependant portion. Referring to the international standard on the product, it layers “Guide Line”, “Common Standard”, and “Detailed Standard”. There exists especially implicit formation among three in the field of hardware usability. Whereas, due to the rather short historical background of the previous existence of usability, there exists intermingled formation of accessibility.

Following these three aspects of standards will derive efficiency and effectiveness for manufacturers.

## USERS PROFILE

From the concept of QOL, Figure 4 shows the user profile underneath universal design. In the global population, the majority will be general people without disabilities.



*Figure 4. Users Profile*

However, for instance, there will exist a minority of relatively tall or short people or people with temporary disabilities deemed injured, pregnant, or people accompanied by children, or carrying large parcels. Similarly, there will exist elderly and disabled persons as well as foreigners. UD therefore requires designing to cover all to most. Furthermore,

the universal user profile covers gender, proficiency, culture, literacy, body dimensions, handedness, temporary disability, historical background, age, visual abilities, auditory abilities, strength and biometrics abilities and cognitive abilities, etc.

## UD SCHEME IN OKI

For many years committee members at Oki has participated and contributed to the International Organization for Standardization (ISO) and Japanese Industrial Standard (JIS). These activities take in Japan Ergonomics Society (JES), Japan Standards Association (JSA), and Communications and Information Network Association of Japan (CIAJ). The Oki Ergonomics Committee started meeting every month in the early 90's to deal with these standards and modify in-house standardization acclimatizing the Oki culture. This committee met, in general, to cover the three portions of QOL. Oki Ergonomics Committee members consist of R&D, the design section, the public equipment development section of ATM or ticketing machine, office equipment development section of printers or FAX machines, consulting section and the WEB or HTML based software section.

In parallel with these activities, there exists a "Special mission project" and "Business-oriented project" (Figure 5).

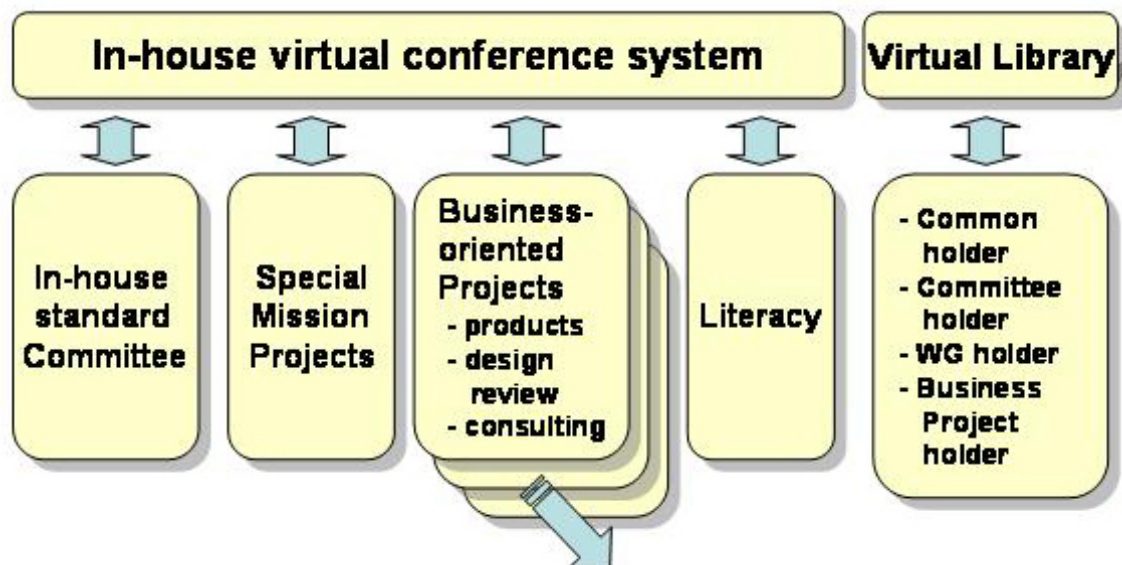


Figure 5. Universal Design committee and projects in Oki

The special mission project is a project that is purpose oriented and time limited. In the past there were two projects investigating how to cope with FCC255 and Act 508 of USA in Oki products. In this situation, the in-house international legal section participated since

the act was deeply interrelated with US law.

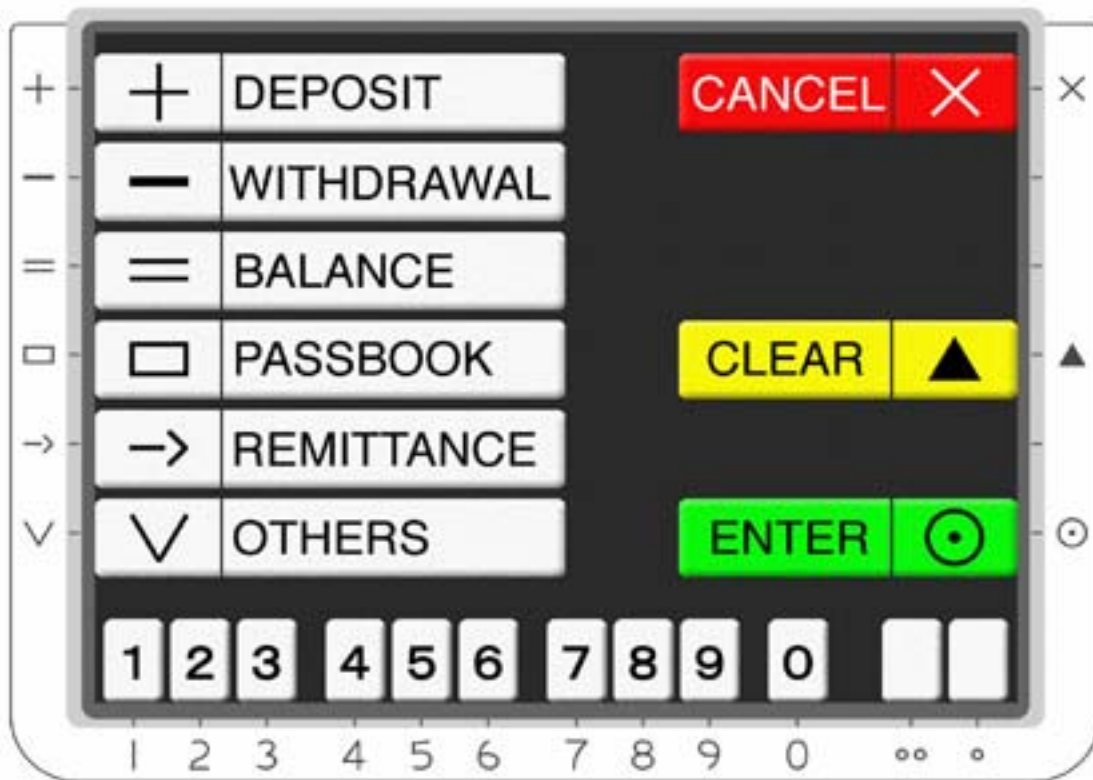
Another activity is the business-oriented project. The purpose of this project is to interpret the detailed output of the Oki Ergonomics Committee to deploy and apply reflecting user requirements to each product effectively, efficiently, and satisfactorily. In fact, the issues and requirements from users vary from machine to machine and the output of the Oki Ergonomics Committee will eventually not be enough. Moreover, it requires much more involvement with Profits and Loss (P/L) issues as well. The members of business-oriented projects consist of product line managers in the business units, system engineers (SE), universal design specialists, consultants, and designers. The six development processes consist of the survey and planning process, the specification forming process, the experimental production process, the pre-mass production process, the mass production process and the revision process. The business-oriented project is most influential and effectual in determining initial stages such as; the planning process, the specification forming process, and the revision process among with the development process. The business-oriented project is managed using the in-house virtual conference system to compensate for fewer face-to-face meetings as member offices are remote from each other and it becomes difficult to hold frequent meetings. This in-house virtual conference system is particularly useful when it is necessary to exchange detailed information with specialists or to backtrack previously discussed histories. In practice, it is flexible combined with business-oriented project and face-to-face meetings. A by-product of the project is to find a partial output of one project that may apply to other projects. For instance, the result of a motion line in the airport was applicable to train stations.

## **UD PRACTICE IN OKI**

Following QOL, manufacturers are required to cope with both the product and the development process as well. Below are two UD examples, an Automated Teller Machines (ATM) for blind people and the process for printer development with UCD are introduced.

### **ATM for blind people**

A barrier free ATM with tactile symbols for visually disabled people was developed (Figure 6).



*Figure 6. ATM display with tactile symbols for visually disabled*

Two sets of tactile symbols were created and were compared by visually disabled users. The first set was created with well-known simple symbols. The second one was initially created based on images of ATM functions. The experimental results suggested that the set with well-known symbols conform to the subjects' image and their preferences (Hirano, Miki, 2002). The tactile symbols were analyzed and classified by confirmation of the original image based on easy to learn, easy to memorize, and users' preference.

#### **Printer development process with UCD**

Surveying all the specifications of each country's regulations is required for the production of global standard office machines such as printers or FAX machines. The production line has naturally adopted the UCD concept from the beginning. For instance, the switches and button sizes need be operational regardless of user nationality, culture, gender or age. The button titles on the operational panel shall be marked with each national language. Moreover, it is necessary to consider the body dimensions and strength



of the users in supplementing paper supplies. It is also necessary to gather feed back on any discontentment or any updated requirements from current machine users.

Oki established an in-house development process regulation in 1996. Translated into English this regulation is widely distributed. The Oki marketing section collects global customers' requirements and performs analyze to determine new product seeds (Figure 7).



Figure 7. In-house development process

The planning section will balance a compromise between the technology seeds and users needs. The planning section will finalize and fix the optimized specification. When the prototype comes out, all global users will evaluate it. At this stage, simple and easy manipulation is evaluated from the viewpoint of UD. Recently, the evaluation focuses on software operations usability on a large WEB display, and printer driver utility software. Even after shipment of the product, customers' requirements continue to be collected and analyzed by the Customer Satisfaction (CS) section sharing the global information database.

**UD CONFLICTS AND ISSUES**

Conflict tends to emerge in universal design where one group takes full advantage whereas another group experiences disadvantages. For instance, using a mobile phone in a train can be quite efficient for a mobile phone user. However, people surrounding the user

may suffer from unwanted noise or by irrelevant conversations. Further, its electronic-magnetic wave may effect a patient with a cardiac pacemaker.

In order to bring solutions to these issues, the following approach is proposed (Luebking, 2001);

1. First, identify the nature of the user group and its character.
2. Then extract the points of conflict or contradictions among them.
3. Finally, find the compromise solution for these issues.

To extract issues, the concept of use, which is comprised of the aspect of the users, products, tasks and environment, is applied to derive effective, efficient, and satisfactory solutions.

From the social aspect, it can be quite difficult to equally satisfy disabled people and people without disabilities or satisfy the needs of both underdeveloped countries and developed ones. Therefore, every government of today or all manufacturers are required to consider this balance and develop a sense of maturity when they bring forward new ideas using universal design.

## **CONCLUSION**

This proceeding paper discusses the universal design concept and its scheme in use at Oki. It discusses two example practices Oki uses employing an in-house virtual conferencing system. This paper also considers conflicts and issues in universal design when manufacturer designers face design compromises balancing requirements from diverse groups.

## **REFERENCES**

Hirano, K. Miki, H. 2002. "An experimental study on tactile symbols for barrier free ATM", *Journal of Human Interface Society*, Vol.3, No.3, PP171-179.

Hosono, N. 2003. "A Study on User-Centred Design Process -Application of Sensory Analysis combining Token method with Correspondence Analysis-". Doctoral Thesis of Keio University. Tokyo.

INSTAC. 2004. "Guidelines for older persons and persons with disabilities— information and communications equipment, software and services— Part1: Common Guidelines". JSA. Tokyo.

ISO. 2001. ISO/IEC Guide 71: 2001, "Guidelines for standards developers to address the needs of older persons and persons with disabilities". ISO Central Secretariat, Geneva.

Longman Group. 1987. *Longman Dictionary of Contemporary English*. Longman Essex.

Luebking, S. 2001. "Universal design ?". uaccess-l@trace.wisc.edu. Trace Centre. Madison.

Mace, R. 1997. "What is the Universal design? The Principles".  
[http://www.design.ncsu.edu/cud/univ\\_design/princ\\_overview.htm](http://www.design.ncsu.edu/cud/univ_design/princ_overview.htm). NC State University.  
Raleigh.