

# EVALUATING UNIVERSAL DESIGN QUANTITATIVELY USING UNIVERSAL DESIGN DEGREE

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## ABSTRACT:

The proposed method was designed in order to evaluate products or systems using a table of UD degree quantitatively. As the method is to evaluate tasks based on characteristics of diverse users, concrete criteria of 12 diverse user groups and 9 UD items, the results of the evaluation are stable. For one example, the JR Osaka and Kyoto railway station were compared to be evaluated using the UD degree.

Keywords: universal design, universal design degree, Matrix of UD degree

## I. UD degree

The Universal design (UD) degree were calculated as following procedure [yamaoka,2005 ](Table 1.).

- 1) Some tasks of a system (or scene) which are very important and affect users are selected.
- 2) If a task is designed well for a user group, 1 is expressed in the cell of the matrix. If not so well, 0.5 is done. And if not at all, 0 is done.

These decisions are done based on 12 diverse user groups, its characteristics and 9 UD items.

- 3) The degree of UD is calculated as  $(\text{the number} \times 1 + \text{the number} \times 0.5) / \text{number of all cells}$ .
- 4) The degree of task suitable for diverse user group is calculated as  $(\text{the number} \times 1 + \text{the number} \times 0.5 \text{ in a line}) / \text{number of all cells}$ .
- 5) The degree of diverse user group suitable for tasks are calculated as  $(\text{the number} \times 1 + \text{the number} \times 0.5 \text{ in a column}) / \text{number of all cells}$ .

The proposed method is designed in order to evaluate products using table of degree of UD quantitatively and structurally.

The following 12 diverse user groups and its characteristics are employed when calculating UD degree.

user group with -----

- 1) no impairment ,
- 2) impairment in seeing, 3) weak eyesight, 4) color weakness or color blindness
- 5) impairment in hearing, 6) impairment in voice
- 7) cognitive impairment , 8) user group who cannot understand the nation's language
- 9) group of the aged

user group -----

- 10) wheelchair or cane, 11) with impairment in extremities, 12) children

Table I. Matrix of UD degree

Scene or some tasks of a system: -----				
	user(1)	user(2)	user(n)	degree of task
task(1)	Good(1)	Bad(0)	---	T(1) (%)
task(2)	so-so(0.5)	Good(1)	---	T(2) (%)
task(n)	---	---	---	T(n) (%)
degree of diverse user	U(a) (%)	U(b) (%)	U(n) (%)	degree of UD X (%)

## 1.1. EVALUATION CRITERIA OF 12 USER GROUPS

Evaluation criteria of 12 user groups [Yamaoka, 2005] are made clear (Table 2.). Level-I means good:

users from 70 % to 100% of target users are satisfied. Level-2 means not so good: users from 30 % to 70% of target users are satisfied. Level-3 means bad: users from 0 % to 30% of target users are satisfied.

Table 2. An example of criteria of user group with impairment in seeing

	Level-1:good(1)	Level-2:so-so(0.5)	Level-3:bad(0)
2)user group with impairment in seeing	enough providing auditory or tactile information for a product	not enough providing auditory or tactile information for a product	no providing auditory or tactile information for a product

## 1.2. 9 UD ITEMS

9 UD items (Yamaoka,2003) are as follows.

- (1)Adjustability, (2)Redundancy, (3)Immediate understanding of functions and features, (4)Feedback, (5)Error tolerance, (6)Acquisition of information, (7)Understanding and judging information, (8)Operation, (9)Continuity of information and operation

## 1.3. THE UD DEGREE OF JR OSAKA AND JR KYOTO STATION

The UD degree of JR Osaka and Kyoto station are 67% and 48% respectively.

## REFERENCES:

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