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# **Usability and Culture as Two of the Value Criteria for Evaluating the Artifact - A New Perspective from the Artifact Development Analysis (ADA) -**

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**Abstract.** In this paper, the conceptual framework of the Artifact Development Analysis (ADA) and its relationship to the usability engineering are outlined. The ADA analyses the significance of all artifacts including hardware, software, humanware and system. Its viewpoint extends both in temporal and spatial dimensions. In short, it deals with the diversity of the artifact and casts the questions "why it is so" and "why it is not so". In this respect, the ADA is related to the usability engineering as one of the value attitudes. The usability engineering puts emphasis on effectiveness and efficiency. The usability is not always the value criterion of highest importance and some people sometimes put more emphasis on other criteria such as the aesthetic aspect, the cost, etc. Based on the findings of ADA, we should focus on the extent where the usability can provide the core satisfaction and we should also summarize the guideline on how the artifact should be designed.

**Keywords:** Artifact development analysis, culture, usability, value system, design, user engineering

## **1. Concept of Usability**

There are many definitions on the concept of usability among which the one proposed by Nielsen[1] and another defined in ISO9241-11[2] are well-known.

The former definition of usability proposed by Nielsen is a sub-concept of the usefulness and is a sub-sub-concept of the acceptability. Besides, Nielsen differentiated the usability from the utility. According to his definition, the usability has a non-negative connotation whereas the utility has a positive connotation. In other words, the usability is the state of the artifact where there are no negative aspects such as the error and the difficulty in learning.

On the other hand, ISO9241-11 proposed a definition of the concept with three sub-concepts including the effectiveness, the efficiency and the satisfaction. In this definition, both of the utility and the usability that Nielsen differentiated are included

in the definition of usability. Hence, sometimes the definition by Nielsen is called as the small usability and the one defined in ISO9241-11 is called as the big usability.

The ISO definition has been popular among European and Asian usability professionals, but recently it is becoming popular even in North America.

Although the definition of ISO9241-11 is currently accepted world-wide, Kurosu proposed a revised definition of usability that is expressed in Figure 1. Basic ideas are as follows;

1. The satisfaction is different from the effectiveness and the efficiency because the former is the subjective impression on the side of the user and the latter two are the objective characteristics on the side of the artifact.
2. The satisfaction is dependent on the effectiveness and the efficiency whereas the latter two are mutually exclusive and are independent with each other.
3. The satisfaction is dependent on more number of factors than the effectiveness and the efficiency including other quality traits such as cost, safety, reliability, compatibility and durability. And such subjective characteristics as sensibility, emotion, needs, and value system are also affecting the satisfaction.
4. Thus, the satisfaction could be regarded as the ultimate criterion for the artifact.

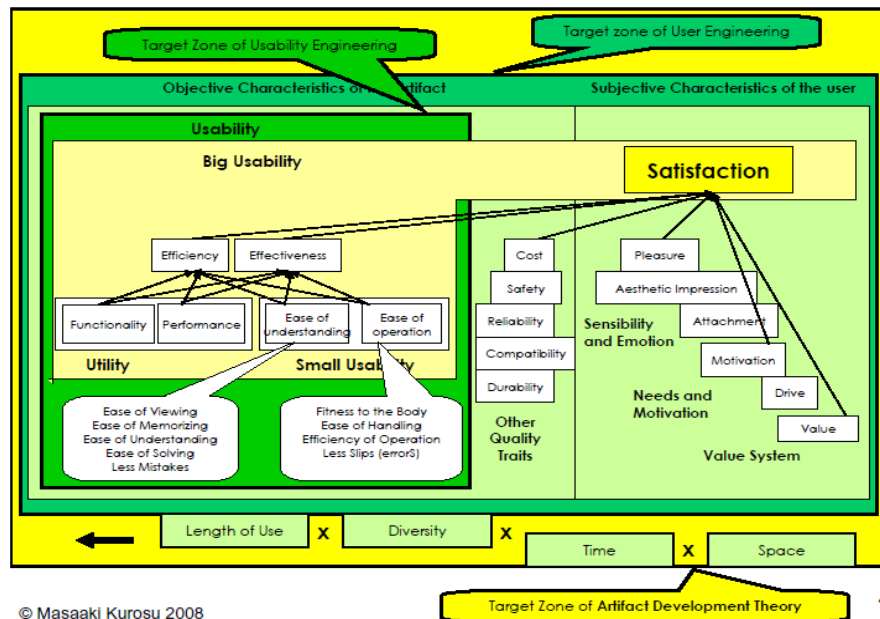


Fig. 1 The concept of the usability and the satisfaction proposed by Kurosu

5. Hence, the usability engineering should focus on the concept of usability that consists only of the effectiveness and the efficiency where the user

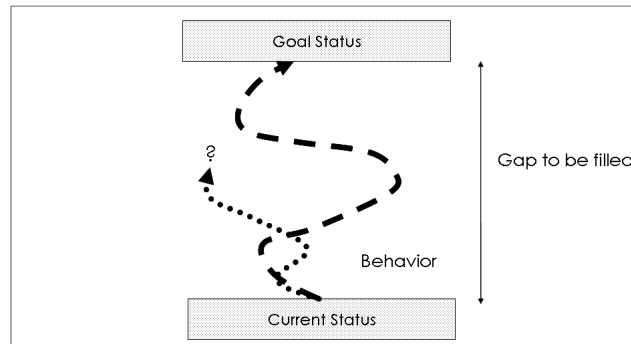
engineering is focusing on the concept of satisfaction including the usability as a sub-concept.

6. The artifact should finally be evaluated in terms of the satisfaction. In other words, the usability evaluation is evaluating the artifact just from the effectiveness and the efficiency perspective.

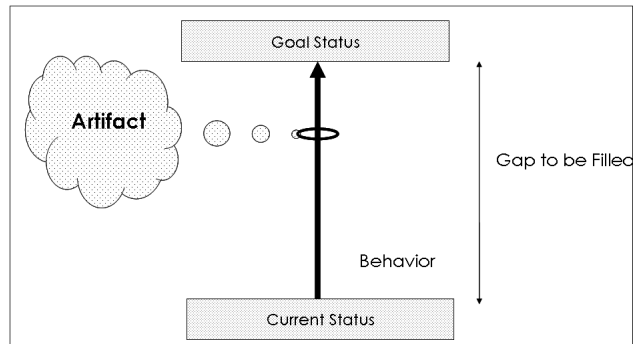
## 2. Artifact Development Analysis (ADA)

From the viewpoint of the user engineering, artifacts are invented, designed, and redesigned so that the goal achievement of human being can be facilitated effectively and efficiently and thus bring the satisfaction. Fundamental schemes of this idea are represented in Figure 2 and 3. In situations where the user can hardly achieve the goal, an artifact is designed so as to facilitate the goal achievement in the right direction (effectiveness) and in the shortest time (efficiency).

The artifact is something that the human being created, produced, manufactured, altered, diverted or altered for supporting the goal achievement effectively and efficiently and with satisfaction. It is contrary to the natural objects that are intact by the human being. Artifacts include the hardware (instruments, tools, machines, devices, equipments, media, etc.), the software (computer program, interactive procedure, courtesy steps laws and regulations, manners, etiquettes, traffic signs, characters, symbols, artistic expressions etc.), the humanware (gestures, postures, hand signs, user support activity, maintenance activity, instructional activity, guidance, reception, secretary, flight attendant, etc.), and the system as the integration of them (political system, insurance system, traffic system, medical system, educational system, corporate system, family, etc.).



**Fig. 2** The goal achievement



**Fig. 3** The goal achievement and the artifact

The Artifact Development Analysis (ADA) is the scientific approach that analyzes artifacts that were invented and used by people of specific period of time and of specific region for the achievement of the specific goal [3-8]. It is related to the user engineering but is not engineering but a science that seeks for clarifying the logic underlying the reality whereas the user engineering is an engineering that looks for designing that can be satisfactory to the user.

Fundamentally, the ADA takes following stances.

1. ADA seeks for answers to following questions  
 What kind of variations are there?  
 Did each of variations have an inevitability to be designed as such?  
 Weren't there possibilities that any different types of artifact could be designed or selected?
2. ADA evaluates each one of variations to what extent it is reasonably adapted to the goal achievement and checks if there are some residual problems.
3. Finally, ADA specifies the artifact that is necessary and sufficient for fulfilling the conditions for achieving the goal.

Generally the ADA approach takes following steps.

- Step 1. Discover the diversity among artifacts based on approaches including history, archaeology, cultural anthropology, ethnography and folklore so that the historical background and the spatial differences can be clarified.
- Step 2. Find out the commonality and the difference among artifacts.
- Step 3. Investigate the reason why it is as such and why it is not as other alternatives.
- Step 4. Pursue the inevitability of the specificity of design.
- Step 5. Obtain the evaluation for other design to see if the current design is optimal and is acceptable and will give the satisfaction.
- Step 6. Consider about the underlying value system that satisfies the user.
- Step 7. Integrate the evaluation from the viewpoint of goal-achievement.
- Step 8. Consider if some design that is better than the current artifact can possibly be designed or not.
- Step 9. Set up the design guideline in terms of the goal achievement.

## 2.1 Variation among Artifacts

Variations among artifacts have two dimensions, i.e. the time and the space. The time dimension includes the historical time of the human being and the individual time relating to the individual lifecycle. Thus the ADA approach is related to the history, the archaeology and the psychology. The spatial dimension includes the real space and the virtual space where the former includes the geographic space, the political space, the ethnological space and the cultural space and the latter includes the conceptual space and the organizational space. In this sense, the ADA approach is related to the cultural anthropology, the ethnology, the ethnography, the folklore and the sociology.

There are very many factors to generate the diversity of which the ADA focuses its attention. Table 1 shows the list of possible factors that may affect the diversity among artifacts.

**Table 1.** Factors Affecting the Diversity among Artifacts

<b>Factors specific to</b>		
<b>the manufacturer</b>	<b>the user</b>	<b>the social group</b>
Availability of the material	Importance of the goal	Persistence to the tradition
Availability of the manufacturing tool	Physical characteristics	Group conformity
Characteristics of the object	Psychological characteristics	Historical background
Manufacturing cost	Social context of use	Ethnic consciousness
Brand image	Physical and geographical environment	Influence of the religion
Emphasis on the maintenance	Purchasing ability (economical situation)	Degree of multi-ethnicity
Emphasis on the reliability	Expected life span	
Emphasis on the safety	Literacy for using it	
Aesthetic sense of the designer	Attribution to the social group	
	Sensitivity to the fashion and aesthetic aspects	
	Emphasis on the usability	

## 2.2 Variety of Goals

Usually the goal can be expressed by verbs as follows.

**Table 2.** Goals Represented as Verbs (examples)

Obtain, Purchase	Communicate	Sleep
Eat, Drink	Identify location	Know the time
Preserve	Enjoy	Empower the sense
Cook	Wear	Fight
Record, Write	Clean	Punish
Inhabit	Move, Walk	Maintain society

## 3 Value Attitude and Culture

### 3.1 Value Attitude for Artifact Evaluation

Table 3 is a tentative list of value attitudes inspired by the idea of Spranger [9]. In this table, the usability is just one element of the whole value attitudes. It is the culture that differentiates the weight vector for these value attitudes. In other words, there is a culture that emphasizes the usability but there could be another culture that emphasizes the aesthetic impression. Diversity among artifacts that are designed for supporting the same goal achievement can be derived from the difference of value attitudes.

**Table 3** List of Value Attitudes That Are Related to the Evaluation of the Artifacts

Functional Value Attitude	Put emphasis on a new function and/or the multi-functionality
Usability Value Attitude	Put emphasis on the effectiveness and the efficiency
Aesthetic Value Attitude	Put emphasis on the appearance and the good-looking design
Sensibility Value Attitude	Put emphasis on the attachment or the emotional relationship
Economic Value Attitude	Put emphasis on the cost (initial cost and maintenance cost)
Quality Value Attitude	Put emphasis on the qualities such as the reliability, the safety, and the compatibility
Ethical Value Attitude	Put emphasis on the environmental aspect and the sustainability

### 3.2 Acceptability of Diversity

Interesting point is the fact that some diversity among artifacts can be acceptable while others cannot be. An example of the acceptable diversity is the case where each alternative has its own advantage and can be used in different situations. An example is the car and the bicycle where the former is suitable for going to a far place or carrying heavy items and the latter is suitable for going to a near place or going through a narrow road.

There are a few types of unacceptable diversities. (1) One case is that some alternative is evidently better than others. An example is the case of the SD (or HCSD) memory card vs. such other memory cards as compact flash, smart media, memory stick, xD-picture, MMC, etc. (2) Another case is that some alternatives are evidently inferior to others. An example for this case is storing the music in the cassette tape, mini disc, or sound sheet in contrast to downloading the music from Internet, storing the music in the memory card. (3) Finally, there is a case where each alternative has its own advantage but the contexts of use are similar. An example is the numerical key pad for the calculator (IT) and for the telephone (CT). They should be integrated in the era of ICT though they were existing in different regions in the past.

### 3.4 Model of the User and the Designer

Fig. 4 shows the model of the consumer and the user and how the value attitudes are affecting their behavior. The model of the consumer in this figure is related to previous models proposed in the field of marketing and advertisement [10-18].

The flow of behavior starts from the left side and the consumer finally selects some artifact that can be accepted according to the value attitude and the criteria stored in memory. Until then, the consumer repeats the search and the evaluation. When s/he finds an artifact that can be accepted, s/he starts to use it, and the flow of behavior goes to the right side. During the use of the artifact that s/he purchased, s/he constantly evaluates it based on the value attitude, the criteria stored in memory and such social criteria as culture and tradition. If the artifact showed a problem that cannot be fixed, s/he will decide to abandon it and goes back to the left side and becomes the consumer again. This figure shows how the value attitude can be related to the purchase and the use of the artifact.

Fig. 5 shows how the designer considers value attitudes while s/he is designing some artifact. The designer starts the activity according to ISO13407[19] and while planning the design solution, s/he will consider the diverse alternatives based on the consideration on the historical diversity and the cultural diversity (and some new ideas) and will make a kind of calculation in terms of the value criteria as shown in Table 3. The designer considers various criteria including the functionality, the usability, etc each of which has a certain degree of weight of his/her personal importance. Each design alternative (item  $k$  where  $k = 1, 2 \dots o$ ) may have its own value and the sum of multiplication as the total value ( $V$ ) will be calculated. The designer, then, will choose the design alternative with the maximum value of  $V$ .



These figures thus include the usability and the culture as two of key components and should be regarded as the framework for the discussion on the relationship between the usability and the culture.

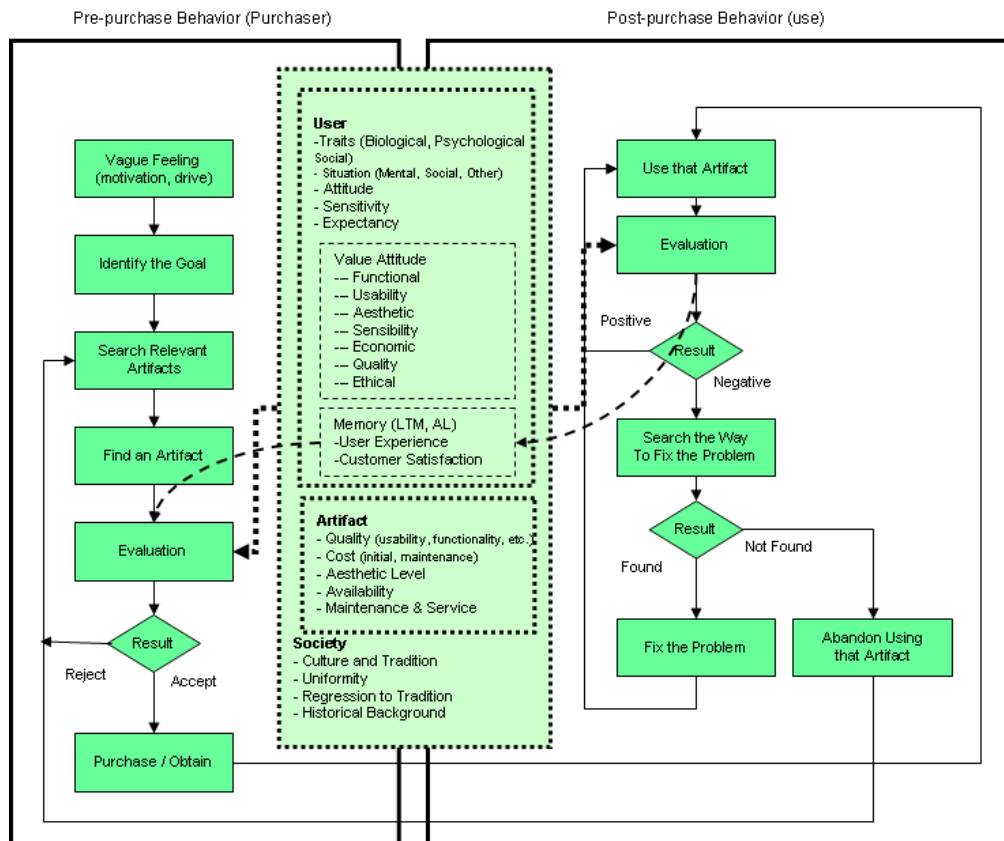


Fig. 3 The Behavior of the Purchaser and the User (adapted from Kurosu and Ando [8])

#### 4. Conclusion

In this paper, the conceptual framework of the Artifact Development Theory (ADA) and its relationship to the usability engineering were outlined. The ADA provides the analytical viewpoint for the artifact. Its viewpoint extends both in temporal and spatial dimensions. In short, it deals with the diversity of the artifact and casts the questions "why it is so" and "why it is not so".

In this respect, the ADA is related to the concept of usability as one of the value attitudes. Although the usability engineering puts emphasis on the usability, i.e. the effectiveness and the efficiency of the artifact, it is important that the usability is not

always the value attitude of the highest importance and the user and the designer sometimes put more emphasis on the aesthetic aspect, the cost, etc.

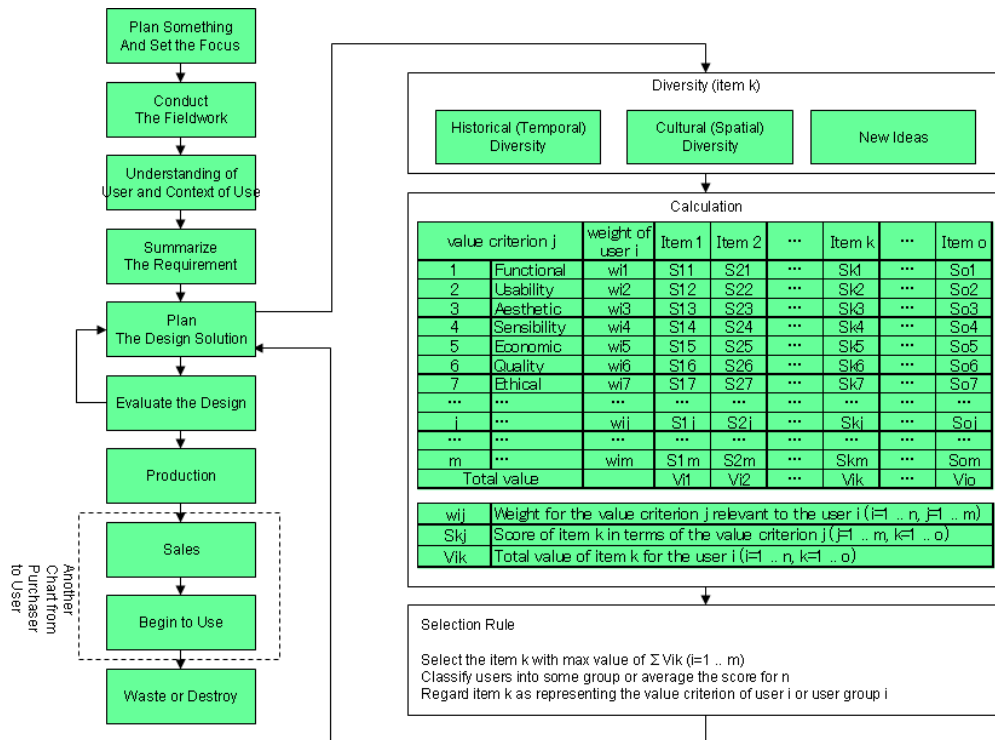


Fig. 4 The Behavior of the Designer

Based on the findings of ADA, it is possible to see to what extent the usability of some artifact could give the core satisfaction to the user and also to provide the guideline on how the artifact should be designed.

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