The Universal Design Model of Set Top Box

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Abstract. "E" life, a new trend to influence people's dairy-life since internet explored. No product or concept can be successful if it ignores the needs of its users and Digital Set Top Box (STB) is no exception. However, there has been a noticeable lack of real information about how STB are used. So, the objective of this study is established a series of surveys in an effort to help user in using STB. The study presents a process, based on user requirements, for users. Seven factors affecting E-books design are identified and discussed; these guidelines can be categorized into principles of universal design. Once the affected issues of universal design has been established, designers can get the relative understanding of developing ergonomic designed in STB development.

Keywords: STB, usability, universal design, human factors.

1 Introduction

The digitization of TV industry is a definite development policy of Taiwan in "Year 2002 to 2007 Country development key plan" published by Executive Yuan in 2002. The plan explains and defines clearly about TV digitization implementation strategy and process schedule. In the face of the transition and business opportunities brought by TV digitization, all kinds of media industries players devoted themselves into this big campaign. And the key factor of TV digitization is the application and promotion of DTV Set-Top-Box.

The Technology innovation goal for 21 century is digital live. Whatever are terrestrial communication, direct satellite, digital broadcasting TV, and wireless communication all enhance to digitalization. The digitalization trend is extended to every where around the world. The function of digital appliance is information sharing, easy using, and customization. Digital appliance includes information product appliance and appliance product information, personal communication, and entertainment.

There are three kind of application in digital appliance. The first application is that home display function device includes different display technology. For example, CRT TV,PDP TV, LCD TV, rear projector, and projector TV. The second application is home gateway for media and information processing device. For example, Set-Top box, Game console, DVD player, PVR (personal video recorder). The third application are mobile home entertainment device include DSC (Digital still camera), SHD (Smart Handheld Device), Mobile Game Console.

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Digital Set Top box is a main stream in home entertainment device market during five years. The shipment of this device is exceeded 10 million units and revenue is also exceeded 1 billion USD.

2 Objective

With the high development of information technology, consumers can be at a loss and uncertain in the face of "high-tech" products that overlooked "humanity." Therefore, an important issue that industrial designers work hard to deal with is how to use human factors engineering, or "user-centered" through industrial design to close the wide gulf between the user and the product. On the other hand, because technological advances have provoked a change in social structure, this has a caused a problem that needs to be resolved by the governments of many countries. The concept of "universal design" has derived from the multiplicity and differences among user groups, which has been catered to by product design. "Universal design," in accordance to the principle of human factors engineering, promotes the design concept that "a product should be capable of being used by a majority of people." For example, the design of chairs and tables for students must consider safe, effective, and comfortable usability by students with vastly different physical needs.

Norman [3] indicated a design principle that sets the user at the center, a philosophy that is based on the user's needs and interests that emphasize usability and understandability. In other words, only a principle that focuses on the user can grasp the whole issue involving "human / machine / environment" and "human / product / context." Therefore, a "user-centered" design principle needs to take into account elements such as the user's cognitive, psychological, and physical conditions. However, if there are individual considerations for users in a group, development of design necessarily becomes more difficult. As a result, this study attempts to develop a suitable human factors engineering and design assessment model. Its purpose is to extend the design principle of "user-centered" to the application of "universal design," according to human factors theory and differences in design practice. Then use the human factors analytical model, explore the human factors issues that relate to human-machine interface, as well as the functional issues related to engineering interface. Human factors analysis of operation interface and engineering exploration of engineering interface are used; these results are used as a basis for practice design, to ensure a human factors design that is user-centered.

3 Human Factor's Model

From the perspective of design practice, a product is not only merchandise of the manufacturer, but also a work of the designer and appliance of the user. In the process of communication transmission, a product passes from the contractor, designer, producer, to the user. Relative to different cognitive models of different entities, different meaning is infused in the product. In this way, the product is another symbol that transmits signals and expresses meaning. Thus, this study finally brings in the mental model of product semantics and cognition [3], combined with human factors engineering analysis to establish an assessment model that is centered around the "user," as shown in Figure 1 [1]. This is in attempt to lead designs to achieve the ideal

of "universal design," and use this assessment model to elevate humanity-friendly design goals. Another goal of "universal design" is to response Donald Norman's concept that "a good design benefits the public." Also, the human factors assessment and analytical model proposed by this study can be used as a point of reference for the design of future products.

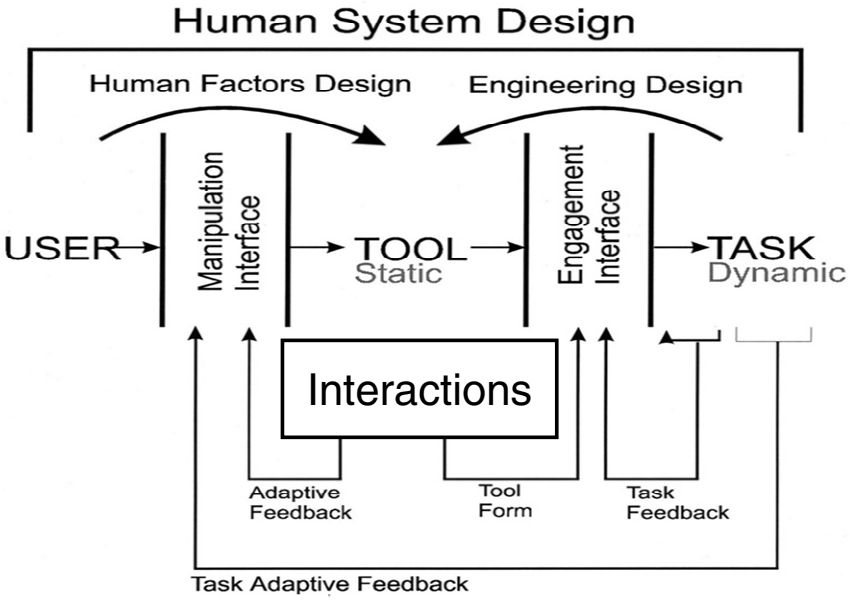

Fig. 1. A symbolic representation of user-tool system design

Norman [3] proposed a theory on the psychological model concept of users, dividing psychological models into three types: design model, user model, and system image. Design model is the designer's psychological concept of the product, user model is the user's idea of how to operate the product; the ideal situation is a coincidence between the design and user models. Thus, system image is exceptionally important, because the designer must ensure that all aspects of the product conform to an appropriate psychological model. Figure 2 shows the relationship of models.

This study uses this model as a basis to explore how human factors engineering can be applied in design practice. According to the psychological model of Don Norman, the relationship between human factors engineering and design practice establish their correspondence. A brief explanation is as follows:

1. With respect to the system (product), the product has an overall system image, including human factors engineering and functional design to convey the designer's creativity.
2. With respect to the designer, the designer uses the product image (form) to convey his creativity.
3. With respect to the user, through product image (form), assess creativity from the perspective of the user.

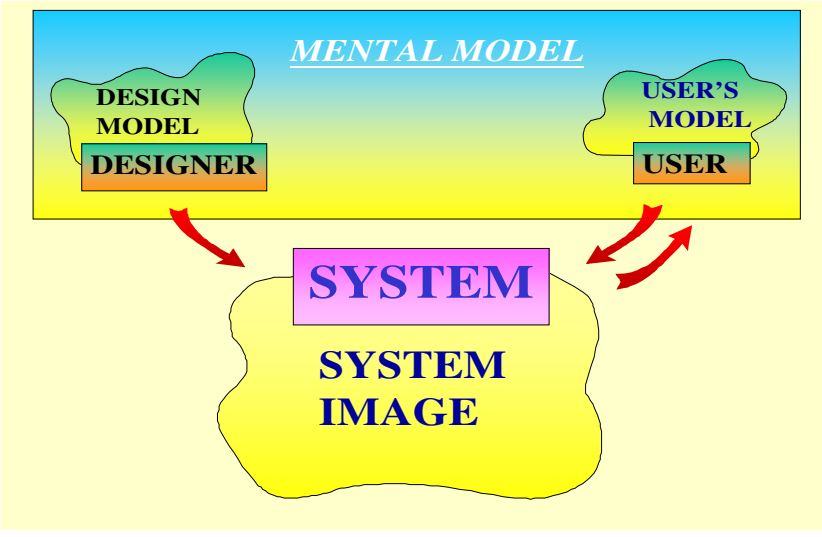

Fig. 2. Noman's mental models

4 The Principles of Universal Design

At the beginning of the 21st century, the world is very different from 100 years ago. People are living longer and surviving better. Potential consumers of designs who

Table 1. The seven principles of Universal Design

Principle	Subject matter
(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	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.

may be limited in function by age or disability are increasing at a dramatic rate. Designers are trained to design for a mythical "average" group of people which in fact does not actually exist. Every individual is unique. The idea of Universal Design, proposed by Mace [2], began in demographic, legislative, economic, and social changes among older adults and people with disabilities [2] (The Center of Universal Design, 1998). Universal Design can be defined as the design of products and environments to be usable to the greatest extent possible by people of all ages and abilities. Ergonomic considerations are a part of "Universal Design". Therefore, it is very important to integrate ergonomic considerations into the principles of Universal Design as a major design strategy. The seven principles of this paradigm are shown in Table 1.

5 Discussion

Universal Design is an approach to creating everyday environments and products that are usable by all people to the greatest possible extent. By using Universal Design, companies can maximize their potential market. However, successful application of these principles requires an understanding of human diversity (ergonomic considerations). Design and manufacturing engineers seem well aware that the most efficient way of improving ergonomics in the manufacturing process is by becoming involved in the early phases of product development. This study presents an example of how to take ergonomic considerations into engineering design when applying Universal Design. This study is the first research project aimed at understanding issues related to evaluate of STB based on the concept of Universal Design.

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