The Implementation of 3D Printing in Customized Interactive Design for Elderly Welfare Technology

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Abstract. There are various technology products or IT services which can support elderly at home. However, most of them are designed without considering the individual preferences, needs and situations of elderly people. This study attempt to explore the concepts of elderly product design based on the theory of Emotional Design and aims at exploring solutions on how to meet the needs of the elderly through more humanistic aspects: "attractive" and "customized" technology products. Consequently, this study proposes the 3D printed "personalized" interactive flowerpot design for the elderly, called WATERS.

Keywords: Elderly welfare, 3D printing, interactive design, product design.

1 Introduction

Taiwan is becoming an aging society. Aging is not only an issue that advanced countries are facing today, but also a subject that future technology will address. In fact, each elderly person hopes to be cared, respected, and to enjoy convenience in life, and thus live happily and with dignity. These are basic needs of the elderly. Therefore, the welfare study of the elderly shall include humanistic concern. The current trend of the study involves cross-discipline study in both technological and humanistic fields. Humanistic concern is being addressed on the basis of technology.

Technology products are generally understood as the results of mass production per certain standard. Most of elderly welfare technology designs are designed without considering the individual preferences, needs and situations of elderly users (Malanowski et.al, 2008). However, design for the elderly have to achieve the needs of "personalization" because each elderly person has his/her distinct needs.

In addition to the requirement of "personalized", the elderly welfare technology design also emphasizes on the usability and explores how to enhance the technology acceptance and adoption, especially in the interactive design. Some attributes of interactive device evoke certain emotions and perceptions, which influence the user's behavior. Therefore, devices have to be not only useful but attractive, especially its appearance. Research on emotion and cognition has shown that attractive and beautiful things really do work better, as Donald Norman demonstrates in his book: Emotional Design (Norman, 2003). It is more probable for elderly to accept and adopt well designed interactive devices because these cover simultaneously their personalized functional, emotional and social needs.

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2 Research Objective

In order to meet the needs of "personalization" product designs, this study focuses on the new trend of design and manufacturing process. The 3D printing technology which enables *custom manufacturing* has created new ways to design. 3D printing enables small quantities of customized products to be produced at relatively low costs.

For recent years, the threshold for Rapid Prototyping technology has been lowered. 3D Printing is being widely used in various fields. Not only in advanced technology fields, such as aerospace, military, medicine, etc.3D Printing is also being popularized among general public. Low price 3D Printer sold to the consumers in the market include Makerbot, Cube 3D, and Solidoodle. Through a simple operation, "customized" product or things for daily use may be manufactured by 3D printing easily.

In the process of manufacturing interactive design product, 3D Printing plays an important role mainly because it can facilitate a customized and speedy production with high accuracy, thus meeting the requirement of designing parts for a highly interactive technology product. Moreover, through 3D Printing, many customized generative or parametric design shapes may be manufactured in a short time.

Therefore, this study aims at exploring solutions on how to meet the needs of the elderly through "customized" technology products, and proposing to produce "personalized" interactive products for the elderly through 3D Printing.

3 Design Concept

To enhance elderly users' willingness to adopt and use assistive technology at home, it should be perceived as compatible with their life-style, acceptable by their relatives and caregivers. Most elderly people prefer to stay in their own home and live an independent life as much and as long as possible. The research field of 'ageing at home' technology focuses on the needs of elders in their daily activities in their own homes (Dishman, 2004).Through interviews, this study has revealed that most of elderly people spend their time at home in ***gardening*** after they retire. It is thus expected to meet senior citizens' needs for being cared through creation of interactive products for their gardening activities.

The interactive device, **WATERS**, which is proposed in this study, has its name from a saying "*Water your family relationships as you water your flower-pots*." It is a customized interactive planter for the elderly, manufactured with 3D Printing technology, and also called "Customized Symbol Communication Planter."

The main design concept of WATERS is to use it as a platform, through the interaction between the elderly and planter, to nourish the relationship between the elderly and their children.

4 Design Prototype

WATERS Shapes Design

The shapes of these planters are inspired by Chinese symbols and Chinese zodiac. They were generated with generative design by using a parametric tool called Grasshopper. The elderly can pick a Chinese symbol of his/her preference (Figure 1).

The parametric tool then generates multiple planter shapes for the elderly to pick. The 3D Printer then "prints" the main container of the "customized" planter (Figure 2). The base of the planter employs the design of modulated manufacturing with Arduino as an interactive mechanism set at the base.

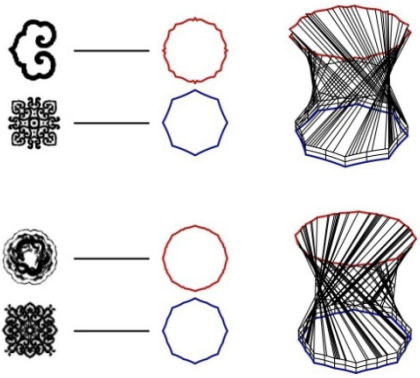

Fig. 1. Chinese symbols generative design

Fig. 2. 3D printed WATERS planters

WATERS Interactive System Architecture

The system architecture of WATERS is an open platform and it includes two parts: hardware (Body) and software (Brain). The hardware (Body) of this device is a customized 3D printed planter while the software (Brain) is installed in the planter base which operated by Arduino. It can be used in diverse interaction scenarios when installing different software or APP. For instance, it can present different interactive modes while changing the software (Brain).

WATERS Interactive Scenario

Every morning, the planter plays Chinese five-note music after it detects the humidity. Different music will be played for different humidity. The elderly will be guided to do various Chinese exercises with respect to the climate. While the music is played, the planter will also swing following the rhythm as if it exercises with the elderly. Once the human movement sensor of the planter detects the movement of the elderly, it will activate Automatic Sprinkler System to enable each planter to automatically watering. Later, the planter sends information to the cell phone or *desktop planter* of the children through wireless network connection, so that the children may know that their parents have already waken up for morning exercise and know what the weather is like at their parents' place. They can thus call their parents for greetings (Figure 3).

Fig. 3. Scenario of WATERS interactive planters

5 Conclusion

Consequently, this research proposes the "personalized" 3D printed interactive product called WATERS, the interactive planter for elderly and their children. In addition to meet the needs of the elderly through this "customized" interactive products, the main role of this interactive device is to nourish the relationship between the elderly and their children. This relationship connecting feature is based on emotional design concept, in order to make the elderly feel happy and warm while using the product. Furthermore, the usability of this daily use planter as an interactive device will more intuitive and humanistic. Technology of 3D printing is applied to the form manufacturing process of this product to meet the personal needs of the elderly. The customized components and parts are fabricated using 3D printer in a short time and low cost. This study finds that the implement of 3D printing in the elderly healthcare or welfare technology design is effectively.

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