Combining Interactive Technology with Perceptual Training to Design an Interactive Installation for Elderly

Chen-Siang Huang, National Yunlin University of Science & Technology, Taiwan
Chao-Ming Wang, National Yunlin University of Science & Technology, Taiwan

The Asian Conference on Media & Mass Communication 2016
Official Conference Proceedings

Abstract
As people grow older, seniors face many problems of physical and mental degradation, and lead to difficulties in the elderly life. This research is to combine interactive technology with perceptual training to design an interactive installation for elderly. The proposed interactive installation is named "LOHAS-GO" that means all people will get better health when they use LOHAS-GO machine.
The interactive installation applies the perceptual experience from the game-based training to enhance elderly people's visual memory and tangible sensations, as well as promote physical limb coordination and sensitivity of body motion. "LOHAS-GO" integrates the digital images, audio, physical interaction, olfactory and gustatory perceptions to create a vigorous ambiance capable that achieves the goal of LOHAS. Experimental subject penetration caregivers assist to help elderly in executive training, and this interactive installation expects to increase the willingness of participating and the interactive pleasure for elderly.
The research conducted literature review and expert interview to build principles of interaction design, and then combined interactive technology with perceptual training to design and implement an interactive installation for elderly - "LOHAS-GO". Finally, this research used the interview survey and observation as evaluation. This research results are shown as follows. (1) Built principles of interaction design that based on literature reviews and expert interview. (2) Combined interactive technology with perceptual training to design and implement an interactive installation for Elderly. (3) Used the interview survey and observation to analyze effectiveness.

Keywords: Elderly, Active Aging, Perceptual Training, Interactive Installation Design.

1. Introduction

The population aged 65 or above had accounted for 12.83% of total population in Taiwan (Figure 1). The situation of hyper-aged society means more and more elderly faced the problem of physical and mental degradation including hearing and visual perception and other cognitive degradation, which lead them to learn new technologies with more difficulties. Most recent interactive devices on the market were not suit for Taiwanese elderly's custom and habits. The devices emphasized the functions and technics but ignored the affection between people (Marx, 2014).

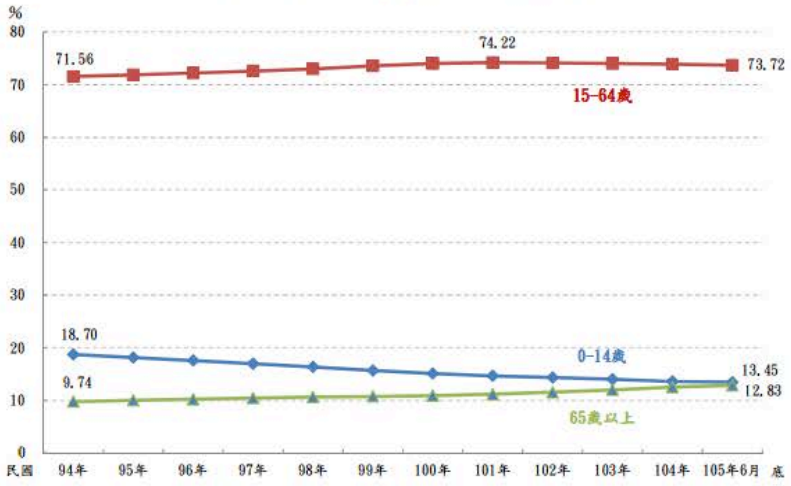

Figure 1: Age structure of household registration (Ministry of the Interior, 2015).

The improvement of technology made interactive devices develop quickly and elderly's acceptation of technology products became higher gradually. Through observation and interview to understand elderly's living environment and the habit of interface operation, and then summarize the demand of elderly's interactive interface.

This study using Arduino and sensing technics and combining traditional agricultural culture to design a work named "LOHAS-GO". Elderly are expected to stimulate perception and enhance hearing and visual perception and promote physical limb coordination and sensitivity of body motion through; moreover improve the willingness of elderly to participate in activities and pleasure.

2. Research Methods and Purposes

This study built the design principle through literature review and prototype the work "LOHAS-GO", and evaluated the work with interview and observation in the end. The expected results were as following:

(1) Using literature review and expert interview to provide design principle of perception training installation and prototype it.
(2) Combining interactive technology and perceptual training to develop interactive device "LOHAS-GO."
(3) Using interview and observation method to evaluate the effect of prototype, and build the standard of interactive installation.

3. Literature Review

3.1 Active aging

Elderly faced problems of physical and mental, and lead to difficulties a difficult elderly life as aging (Lee, 2006). The extended problems of hyper-aged society including the heavy burden for child, and due to physical degradation, elderly might lost self-esteem for living. Therefore, “Active Aging” was proposed by WHO (2002), expected elderly can keep health and improve quality of their life.

Because of vision, memory degradation and cognition error, elderly couldn’t use electronic products for long time and memorized complex operation steps, and their reaction was slower. These situations made elderly feel fearful and exclusionary when they were learning the difficult things (Tang and Shiao, 2009).

3.2 Perceptual Training

Perception divided into visual, auditory, olfactory, tactile, taste and sixth senses. Through the body organs to receive stimuli, and transmitted to the brain into message. However the elderly perceived degradation reduced the sensitivity of stimulation, resulting in slow response and limb mobility problems (Lee, 2006).

According to the interactive process while elderly operating the installation for perceptual experience design and it can separate into emotional value and functional value, and then through sensory perception, emotional perception, thinking perception and service quality to design (Yuan, 2003).

Perceived Interactivity included human-to-human, human-to-document and human-to-system (McMillan, 2002). And perceptual interactive process divided into control, communication, respond speed, humane, positive emotions, emotional links and feedback for detection.

3.3 Interactive Technology

Human–Computer Interaction (HCI) is the communication between system and user. HCI includes Information Design, Interaction Design and Sensorial Design. Sensorial Design refers to the device and the human organ through the mutual transmission or reception of messages, allowing users to experience the interactive process of vision, hearing, touch, smell, taste and other stimulation (Shedroff, 1999).

Jakob Nielsen (1995) indicated System Availability and mentioned usefulness is part of usability. Moreover, he pointed out Learnability, Memorability, Efficiency, Errors, Satisfaction are the standard for system evaluation.

3.4 Related Case Studies

According to the analysis of age structure of household from registration Ministry of the Interior, the ratio of elderly (over 65 years old) increased each year. Taiwan trade office showed that every country developed suitable products for elderly market. These products not only used for company but also for muscle stretching and brain

training, in order to prevent aging. The research did the case studies of elderly and perceptual training as following:

(1) Shooting Game (Zheng, Lin and Xu, 2015):

"Shooting Game" made user doing shooting action to have physical activity and achieve rehabilitation. At the same time, the sensors triggered the light, cheers to give visual and auditory feedback (Figure 2).

Figure 2: Shooting Game (Zheng *et al.*, 2015).

(2) Interactive Windmill (Zheng etc., 2015):

Windmill had microphone sensor on it for airflow detection and the windmill is driven by the rear motor. According to user's blowing volume, adjust the speed of the windmill and give light feedback (Figure 3).

Figure 3: Interactive Windmill (Zheng *et al.*, 2015).

(3) Welcome Spring (Lin, 2013):

Through the action of putting shoes into shoebox, activating interactive wall and displaying family photos to evoke memories (Figure 4).

Figure 4: Welcome Spring (Lin, 2013).

(4) Treatment & Hope (Lin, 2013):

By interacting with objects, activating interactive wall which displaying old photos and music. (Figure 5) Providing interactive devices for scenario-based treatment.

Figure 5: Treatment & Hope (Lin, 2013).

(5) Take the wind (Lin, 2013):

By bending bamboo and telescopic mechanism, the chair adjusts the value of ride height, length and reference according to body and limb degradation state (Figure 6).

Figure 6: Take the wind (Lin, 2013).

(6) Virtual avatar interactive platform (Liu etc., 2013):

Combining "Avatar Kinect TM" technics and Unity 3D developed a Distance virtual avatars interactive platform for elderly care (Figure 7). Let student volunteer lead elderly to exercise in care center.

Figure 7: Virtual avatar interactive platform (Liu *et al.*, 2013).

(7) Tangible Entertainment Projection System (Siqi Liu, 2011):

Using micro projector to connect real world and virtual world for entertainment (Figure 8). So that elderly can interact with their families, neighbors and so on. This work improved elderly's social network, also to provide a space for pleasant interaction.

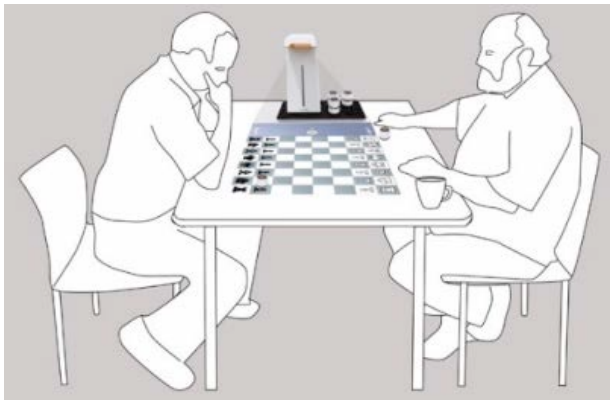

Figure 8: Tangible Entertainment Projection System (Siqi Liu, 2011).

Analyzing the related cases, most of the products on the market were using various multi-media and sensors. And through family and friends interaction to motivate elderly using new technology and promote the affection social between people, and it enhanced the willingness of participate activates. The analyze and comparison was as table 1:

Table 1. Cases Comparison(Collated by this study)

Work	Interactive Interface	Feedback
Shooting Game	Ultrasonic sensing	LED light, Cheers, Music
Interactive Windmill	Microphone	LED light, Wind, Music
Treatment & Hope	Interactive Wall	Old photos, Nostalgic music
Welcome Spring	Interactive furniture	Old photos, Nostalgic music
Take the wind	Interactive furniture	Old photos, Nostalgic music
Virtual avatar interactive platform	Kinect, Camera	Virtual avatar, 3D scenes,
TEPOS	Micro project, Pattern recognition	Camera view, People's sound

According to cases studies, while designing the interactive interface for elderly need to consider their life style and transfer into interactive media. The operation must be intuitive and avoid complex process. The feedback was able to wake up elderly's memory.

This study was based on interactive game expecting to increase the feedback of touch, taste and smell, and reduce complex rules and action design. The goal is letting elderly stretch body to simulate their perception to enhance the ability of reaching message. For game design, interface should be easy to read, don't use complicated graphics. The game will start from easy to difficult stage which is suitable for elderly. In the future, it needs to consider the design is adapt for elderly's demand or not. With the guidance of caregivers, it is easier to bring elderly into game scenario, creating a pleasant, safe, decompression atmosphere.

4. System Design and Experiment

4.1 Introduction of "LOHAS-GO"

"LOHAS-GO" expected elderly can cultivate LOHAS attitude, balanced diet, healthy body and soul, and a meaningful life. Therefore, this work's design focused on elderly's diet, connecting care center, central kitchen and local organic agriculture to plan a system that prepare and distribute healthy meal for elderly.

Shown as system structure (Figure 9), first, the ingredient list will provide by local organic agriculture and sent to interactive installation, and via the game, elderly choose the ingredient they like, the system will generate the food data and sent to the central kitchen. Central kitchen will cook the nutritious meal according to the everyday dietary guidelines announced by the ministry of health and welfare (2016).

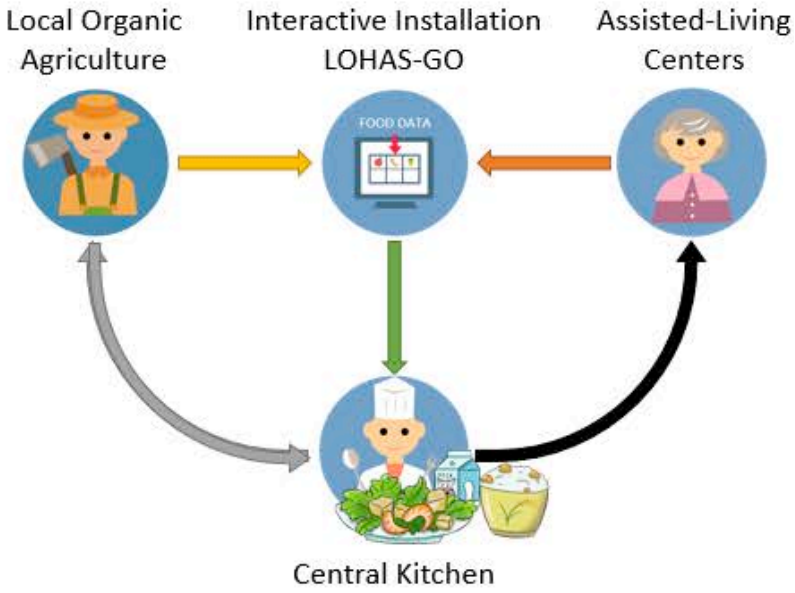

Figure 9. System Structure of "LOHAS-GO" (Drawn by this study).

This installation is a game-based work into framing culture so that elderly experience the activities of perception. The monitor will display the visual effect and use Arduino with perceptual sensor to make elderly feel the touch, smell and taste stimulation. With the task of training to coordinate the movement of brain to complete the task.

During interactive process can increase the interaction between elderly and people, and through repeated operation enhance the chance for elderly exercise which can

delay the speed of physical degradation and also develop the interest of new technology and improve the willingness to join activities and interaction pleasant.

4.2 Interactive Schematic Diagram

Figure 10 is the schematic diagram, for "LOHAS-GO". The installation's perceptual experience included vision, hearing and taste, and it can divided into two parts. One is interface operation, elderly can do the easy action, like sowing, watering, harvesting, fertilizing, feeding and so on to finish the tasks; the second part is perceptual feedback, during the game, stimulate elderly by images and sounds.

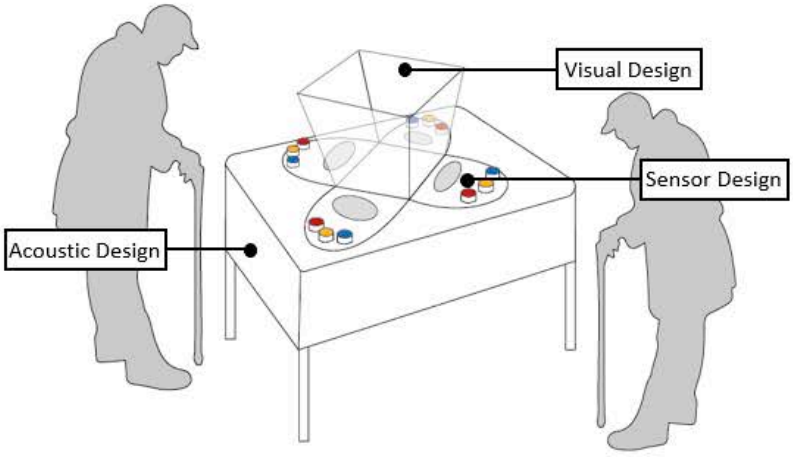

Figure 10. Schematic Diagram (Drawn by this study).

4.3 Develop Environment and Tool

This study used Arduino UNO to integrate sensor circuit, and developed user interface and game software by Processing and Unity 3D, and evaluate elderly's demand to design the installation. "LOHAS-GO" displayed game scene by 3D projection and also having sounds effect and music, this work combined animation and human-computer interaction installation to display the stimulation.

4.4 Interactive Interface Design

Figure 11 is the game start scene, user need to press the button "Start" to enter mode selection scene. In order to close elderly's life; the work scenario is traditional framing life. And it has two stages in game, one is "Fruit and vegetable cultivation" and the other is "Livestock breeding" (Figure 12).

Figure 11. Game start Scene (Drawn by this study).

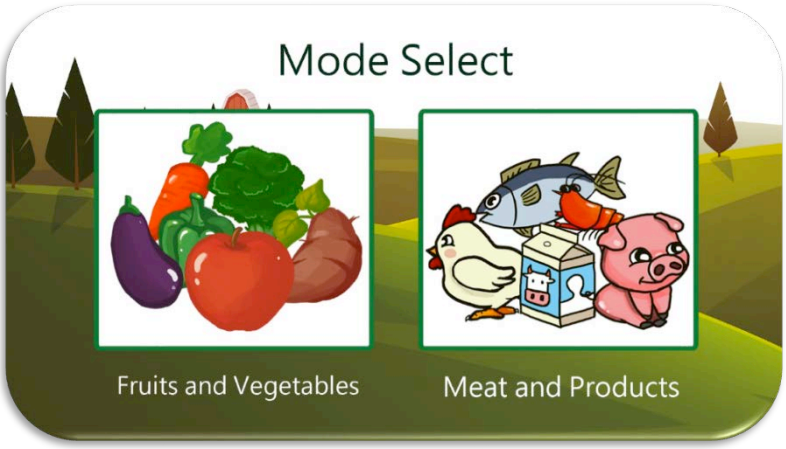

Figure 12. Mode Selection Scene (Drawn by this study).

If user selects “Fruit and vegetable cultivation” mode (Figure 13), he can choose the favorite seed provided by organic agriculture to begin planting (Figure 14) and user have to do 4 steps: sowing, watering, fertilizing, and harvesting to finish the task (Figure 15).

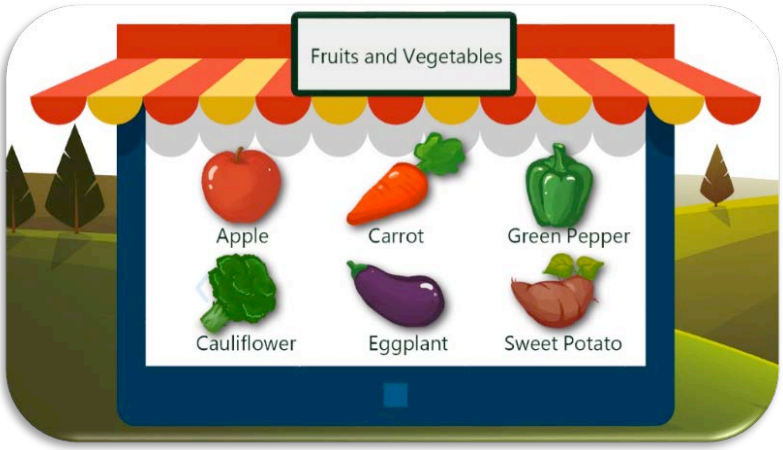

Figure 13. Fruit and Vegetable Cultivation Selection Scene (Drawn by this study).

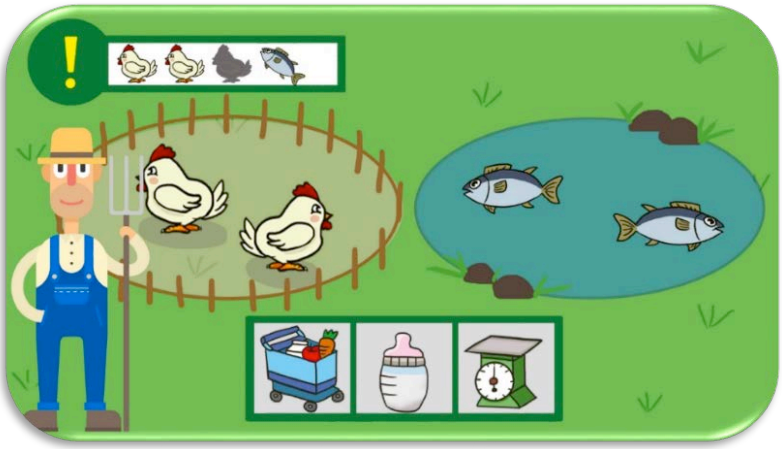

Figure 14. Fruit and Vegetable Cultivation Game Scene (Drawn by this study).

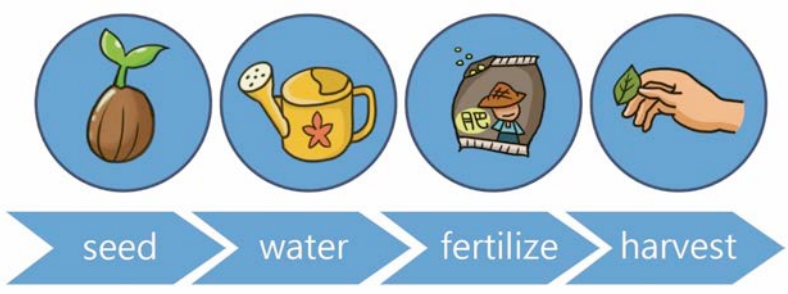

Figure 15. Planting Process (Drawn by this study).

If user selects "Livestock breeding" mode (Figure 16), he can choose the favorite livestock to farm (Figure 17), the framing process includes shopping, feeding and weighting (Figure 18), after doing 3 steps to finish the task.

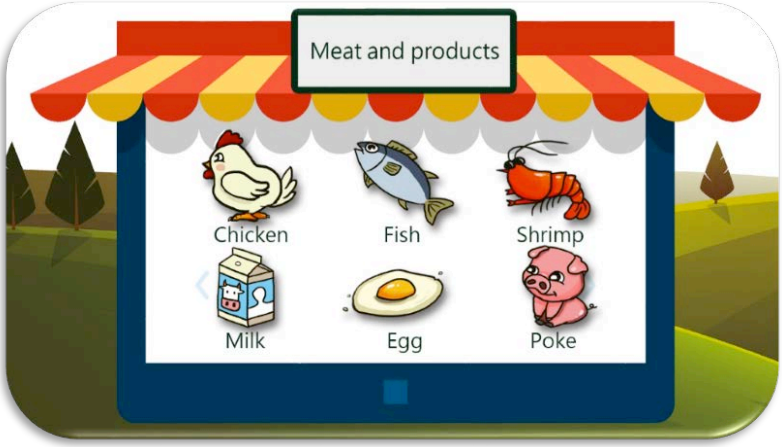

Figure 16. Livestock Selection Scene (Drawn by this study).

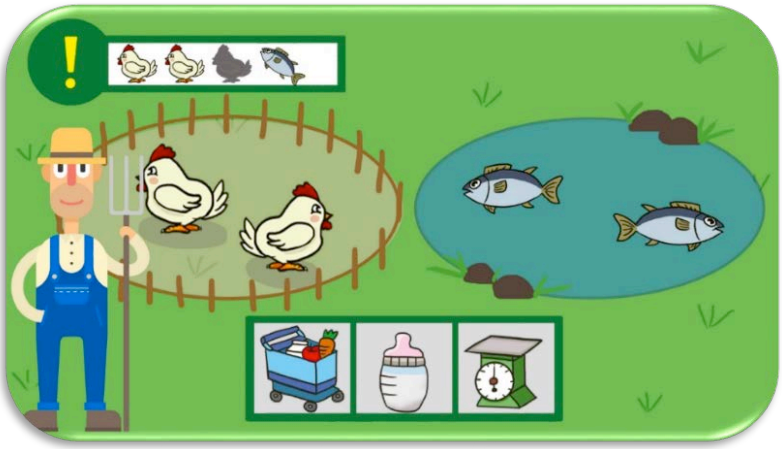

Figure 17. Livestock Game Scene (Drawn by this study).

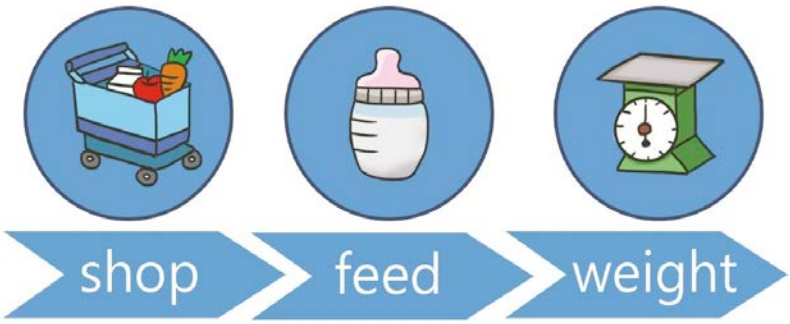

Figure 18. Framing Process (Drawn by this study).

5. Conclusion

The improvement of digital technology will change the modern living style. In the future, elderly will face more and more technology products, and how to learn better these new interface for many applications. Currently, many products for elderly have good functions and provide convenience, but some of products ignored the real need of elderly and decreased the direct interaction between people. Elderly likes to have more contact with family and friends rather than the other benefits from products. Many researchers have to stay with elderly in order to realize the real demand of elderly in their life.

In this study, we found that the reason why elderly willing to use technology was because they can affection connection. However, the physical degradation resulting in decreased muscle strength, memory, ability to understand, and these made them encounter difficulties while operating interface and then felt fearful and exclusionary for products. To sum up, the design of interactive installation for elderly must be easy to use and clear interface.

References

Interior, M. o. t. (2015). Population Structure Analysis at the End of June 2015.

Lee, C. F. (2006). Approaches to Product Design for the Elderly. Journal of Design, 11(3), 65-79.

Lin, C. K. (2013). Memories： Creative elderly product designs and memories evokes spatial design for dementia. Journal of Gerontechnology and Service Management, 1(2), 123-132.

Marx. (2014). What kind of wisdom products, so that the silver-haired clan a fall in love? Retrieved from http://www.proguidescreen.com/?p=599

McMillan, S. J.(2002). Exploring models of interactivity from multiple research traditions: Users, document, and systems. In L. A. Lievrouw, & S. Livingstone (Eds.), Handbook of New Media: Social Shaping and Consequences of ICTs.

P. J. Liu, C. Pei, & Sun, T. L. (2013). Kinect-based Long-distance Avatar Interaction to Support Distanced Elderly Care. Journal of Gerontechnology and Service Management, 1(2), 57-71.

Shedroff, N.(1999).Information interaction design: A unified field theory of design. Information design, 267-292.

Siqi Liu (2011). TEPOS : Tangible Entertainment Projection System for Elderly [Tuvie design of the future].Retrieved from http:// www.tuvie.com/tepos-tangible-entertainment-projection-system-for-elderly-people/

Tang, H. H., & Shiao, G. Y. (2009). The Design and Evaluation of Digital Interface for the Elderly in Multidisciplinary Collaboration. Journal of Ergonomic Study, 10(2), 33-42.

Welfare, M. o. H. a. (2016). Health wise to eat the health education materials. Retrieved from http://obesity.hpa.gov.tw/TC/downloadList.aspx?cid=80

WHO. (2002). Active Aging: A Policy Framework. Geneva: WHO. Retrieved Aug 2016, from http://apps.who.int/iris/bitstream/10665/67215/1/WHO_NMH_NPH_02.8.pdf。

Yuan, Y.-H. (2003). A Study of the Relationship Among Experiential Marketing, Experiential Value and Customer Satisfaction. (Master), National Taipei University of Technology, Taipei.

Zheng, J. K., Lin, C. Q., & Xu, N. L. (2015). The reaserach of interactive installation design for non-drug therapy in dementia patients. Journal of Gerontechnology and Service Management, 3(3), 347-348.

Contact email: jimmy820606@yahoo.com.tw