The Persuasive Design for Aged People's Health Behavior Change in the Domiciliary Health-Care Background

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Abstract. Ageing population in China is increasing, which is to be a sorely test to China's pension services industry. Preventive treatment is an important concept of traditional Chinese medicine and keeping a healthy lifestyle is a good way to improve the health of senior citizen. Many elderly people become to pay more attention to improve their health self-management now, but many people don't know how to trigger themselves in keeping daily health. These are the research background of this article. As to improving elders' health behaviors, persuasive technology is applied. Persuasive Tech is broadly defined as the technology that is designed to change attitudes or behaviors of the users through persuasion and social influence, but not through coercion. DWI model is a tool to inspire the user's behavior change. According to this model, we research on the method of persuasion in health-keeping. Then we design different prototypes based on this method about how to persuade elders change their health behaviors in daily routines.

Keywords: Persuasive technology · Aged people · Health behavior

1 Persuasive Design and Persuasive Model

Persuasive Design (PD) is the extension of human centered design [1]. It supports the change of human behavior and attitude in the way of design [2]. Fogg developed a behavioral change model. According to this model three factors of behavior change were brought up, motivation, ability, and trigger [3, 4]. Design intended to influence or improve certain user behaviors [5]. In the field of product design, the subject of health is in particular attractive [6]. Many researchers do research in this area. Four persuasive design models are evaluated, persuasion advices and design guidelines of research are offered [7]. There are two modes in the latest model: "inspiration" and "prescription" [8]. The two modes are divided into six different lens, on behalf of the design to influence the behavior of specific perspectives. It serves to explore the various design patterns [5]. The Design with Intent (DWI) Method helps designers and other stake-holders generate Persuasive Design concepts to investigate further, by putting forward examples and insights from different disciplines [8]. The patterns are grouped into six 'lenses' (Fig. 1).
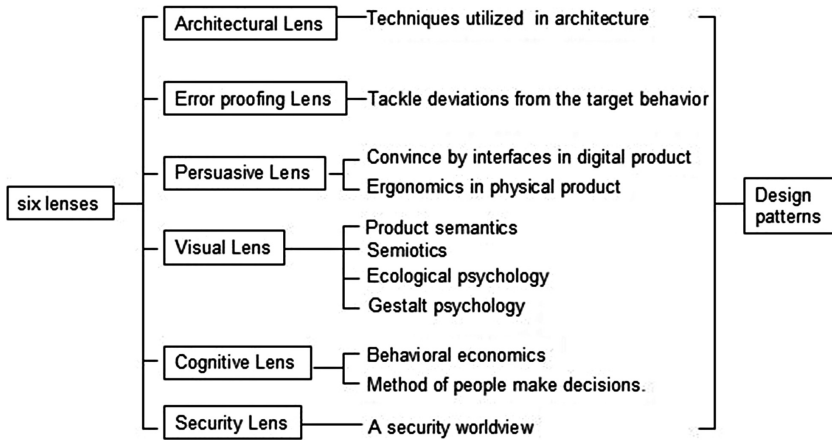
Fig. 1. The six lenses of DWI model [8]

The persuasive design method in this research is as follows (Fig. 2):
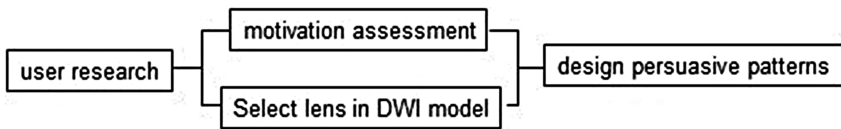

Fig. 2. The persuasive design method

Persuasive Patterns are triggers to promote changes of user behaviors in using products, such as ease of use design, error-proofing design, emotional design, visual semantic design, cognitive decisions design, security design. The PD principle is to encourage users to use the product on the basis of the non mandatory measures, and gradually improve their healthy behavior.

2 Pattern Analysis of Persuasive Design for Health

According to the Maslow's hierarchy of needs, the health needs of elders are analyzed (Table 1). Based on the DWI model, persuasive patterns are designed by the brainstorming. The first design is about the Error Proofing Lens, such as loud whistle, flash of light, limited structures of products. The second design refers to emotional reminders with Visual Lens, such as remainder by human voice or expression symbols, etc. The third design is about Cognitive Lens. It can be identified through the subconscious, and will not bring the offensive force to users.

Table 1. Health behavior classification and health needs analysis of the elderly

User research	Motivation assessment by the Maslow's hierarchy	Health needs in daily life	Select lens and design persuasive patterns (DWI)
Physical health	1. Physiological need 2. Safety need	Healthy diets, drinking water, take medicine, exercise, physical testing, emergency help……	- Time remind - Physical restriction reminder - Easy to use - Physical condition visualization
Mental health	3. Belongingness and love need 4. Esteem need 5. Need for self-actualization	No mood, weakness, no social behavior, loneliness……	- Keep in touch with the outside environment, - To maintain the integrity of personality, - Social relationships - Metaphor design

Fig. 3. Designed by Xiangrong Ye

Fig. 4. Designed by Chenlong Wen

Fig. 5. Designed by Jiayao Chen

2.1   Persuasive Design Based on Error Proofing Lens

The medicine kit (Fig. 3) is designed with structure limits, and elderly people can set the alarm to remind them take daily medication on time. The medicine kit structure constraints the number of drugs by pressing the button, one pill a time, because of taking into account the old man's inflexible fingers. This structure is easy to use and will avoid the pills rolling out, which can reduce the chances of elderly people forgetting to take medicine.

2.2   Persuasive Design Based on Visual Lens

The elderly needs to drink water every day to maintain a healthy body, but because of the memory loss of them, they often can't remember the time and quantity of drinking. Expression cup (Fig. 4) is a design to remind the elderly pay attention to the regular life of healthy drinking. After setting the daily amount and frequency of drinking, the cup will remind the elderly by lights flashing on in time, and show different expressions to let users pay attention to their drinking status. For example, if the user forgot the time, the cup will show the sad face. While users drink water on time, it will show the smiling face. It is found that the elderly are generally like this alert mode according to user tests.

2.3   Persuasive Design Based on Persuasive Lens

Due to their decrease physical function, elderly gradually reduce their social activities. They contact with outside less and less because of the lacking of goals and motivations. Some people are too stubborn to go out, so that psychological symptoms of depression are increased. Because of lack of guidance and trigger, they often hesitate to participate in the activities in the neighborhood. The walking stick (Fig. 5) is designed with a social remind function. When the elderly of neighborhood participate in collective activities outdoors, the crutches will send a flashing signal to remind the elderly to go out together. With the driving force of social relationships, the chance of outdoor activities of elderly is increased. At the same time the social motivation is also enhanced, and the psychological health is improved.

3   Case Study of the Persuasive Design Method

3.1   Background of Health Behavior of the Elderly

After 60 years old, a series of physiological and psychological factors will be changed to elderly. Physical ability and memory will gradually decline. If coupled with the disease, some elderly people will feel sorrow, worry, and fear all the time. In order to maintain a healthy state, they need to improve their physiological and psychological factors. On the one hand, the elderly need to build more social relationships to relieve the psychological depression and do more exercise; on the other hand, because of lack of fitness environment and outdoor weather restrictions, they need do more exercise alone at home. Indoor fitness bicycle is designed to improve elderly health. There are many effects for elderly riding fitness bicycle, such as expand the heart function, reduce the risk of hypertension, make bones strong, lose weight, etc. Although with so many good effects, the exercise alone is very boring and many people can not adhere to exercise at home. That's why Pervasive design is introduced here.

3.2   User Research About the Persuasive Factors

We Released research questionnaire to find whether the elderly loneliness is one of the main factors affecting health. In this study, 22 elderly people were investigated, including 2 people over 75 years old, 11 people over 65 years old, 9 people over 55 years old. The residential areas are 40.91 % in the city center, 22.73 % in the urban and rural area, and 36.36 % in areas far away from the rural area. The elderly live with their spouses accounted for 63.64 %, live alone accounted for 22.73 %. 90. 91 % elderly need more communication with their children about spiritual life. 31.82 % of the old man felt lonely when no one accompanied with them, 54.55 % of the elderly think the lack of spiritual sustenance to make them feel lonely. 63.64 % of the old people hope that they need someone to accompany with them in exercise.

For multiple choice question about what kind of company makes old people feel better, 36.36 % choose the demand of accompanied chat, 27.27 % choose the accompany entertainment, 45.45 % choose the silently accompany, and 77.27 % choose to contact with their children and family, 18.18 % choose to get health counseling knowledge. So our hypothesis is that social factor and physical data visualization will be a positive effect on the elderly health behavior to use the elderly fitness bicycle.

3.3   Persuasive Design for Improving Elders' Health Behavior

After doing the user research, elderly needs are combined in the prototype. According to DWI model, we hold a workshop and discuss the design patterns under different lenses by brainstorming. Then persuasive Lens and Visual Lens are selected to create the persuasive design.

Visual lens: product visual design plays a semantic guiding role, so that the elderly can be easy to identify interface, feel safe and easy to learn how to use it.

Persuasive Lens: in the part of intelligent software product, dashboard data is feedback timely and related social relationships are combined into persuasion mode, encouraging the elderly to do exercise together and feel more enjoyable. The PD model will help to improve the health behavior and experience of elderly.
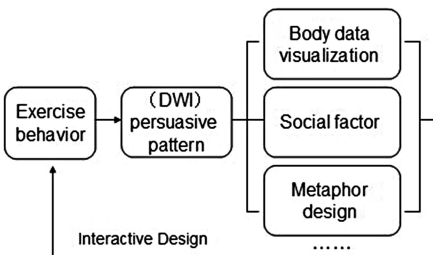

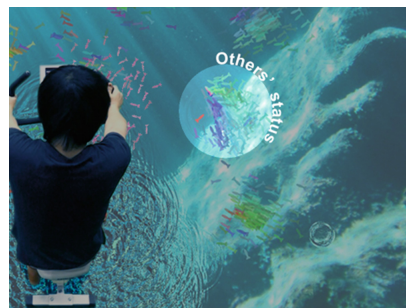**Fig. 6.** Persuasive Pattern

Fig. 7. Prototype, designed by B. Yu, K. Lin, X. Lin, Y. Guo

Based on the preliminary study, the advantages of various persuasive patterns (Figs. 6 and 7) are created, and the persuasive design of the intelligent fitness bicycle is as follows:

(1) Body data visualization. It is the body data visualization that makes the health of the feedback timelier and more vivid to the elderly. The information is projected onto the ground. The size of the ripple in the interface reflects the exercise time and calorie consumption, with the number of ripples reflecting the heart pulse index. The more obvious of the ripples on the interface, the better effect of exercise.

(2) Social factor. To ease the loneliness when the elderly exercise with fitness bicycle, social mode is a trigger to improve the enthusiasm of exercise behavior, such as user collaboration in the health games or chatting with friends or relatives when users riding the bicycle, etc. Social communication between friends or relatives is a mode to encourage the elderly does exercise regularly.

(3) Metaphor design. In the interactive interface of the fitness bicycle, a group of fish is swimming around a user which is the metaphor of the social relationship of their exercise friends. The more friends join the movement, and the more the number and species of fish. He needn't to keep on talking in the movement only feels someone is company with him. User's need of the quiet and entertainment company is met by the metaphor social interactive information. It will be funny to users' health behaviors.

The prototype has been tested by 31 elder people including 14 males and 17 females, and 87 % of them show they like this product and want to do more exercise with social company mode.

4 Discussion

According to the above case study, we sum up the persuasion design methods for the elderly health behaviors change in home care scenario: (1) Analysis of the needs of users health according to the Maslow's hierarchy of needs (2) Based on the DWI model to collect the design samples and technical information, then evaluate the effectiveness of the design patterns. (3) Select proper lens and list out the corresponding interactive methods according to the effectiveness by the brainstorming. (4) In the step of design, user needs and the persuasive model are combined together, which will help to create many ideas. After selecting the proper persuasive design ideas, the prototype will be created to meet the users' needs.

In conclusion, this article studied how to use the persuasive model in design process so that to improve the health motivation and health behaviors of the elderly. The decline of the physiological ability of the elderly and the sense of loneliness will greatly affect their physical and mental health. Moreover, old people are difficult to accept the new technology. The persuasion design in the product and human-computer interaction will be more humanized and interesting to users, which will be easy to accept for elderly.

References

1. Redström, J.: Persuasive design: fringes and foundations. In: IJsselsteijn, W.A., de Kort, Y.A. W., Midden, C., Eggen, B., van den Hoven, E. (eds.) PERSUASIVE 2006. LNCS, vol. 3962, pp. 112–122. Springer, Heidelberg (2006)
2. Torning, K., Oinas-Kukkonen, H.: Persuasive system design: state of the art and future directions. In: Proceedings of PERSUASIVE, p. 30 (2009)
3. Fogg, B.J.: Creating persuasive technologies: an eight-step design process. In: Proceedings of the 4th International Conference on Persuasive Technology (Persuasive 2009), pp. 1–6, Claremont, CA (2009)
4. Fogg, B.J.: A Behavior Model for Persuasive Design. Persuasive Technology Lab, Stanford University. www.bjfogg.com
5. Lockton, D.: Design with intent toolkit Wiki. http://www.danlockton.com/dwi/Main_Page. Accessed 14 May 2013
6. Chatterjee, S., Price, A.: Healthy living with persuasive technologies: framework, issues, and challenges. J. Am. Med. Inform. Assoc. **16**(2), 171–178 (2009)
7. Tørning, K.: A review of four persuasive design models. Int. J. Conceptual Struct. Smart Appl. **1**(2), 17–27 (2013)
8. Lockton, D., Harrison, D., Stanton, N.A.: The design with intent method: a design tool for influencing user behaviour. Appl. Ergon. **41**(3), 382–392 (2010)