

Research on Aging Design of Household Products Based on FBM Model

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ABSTRACT

In order to meet the safety, comfort and efficiency goals and human-centered usability requirements of the elderly at home in the process of using products, an age-appropriate design research method for household products based on the FBM model is proposed. This study firstly elaborates the specific theoretical contents of the FBM behavior model, and identifies three elements: behavior motivation, behavior ability and trigger factors. Secondly, taking the elderly at home as the research object, the design process of home products for the elderly is explored in three dimensions: target users, behavioral characteristics and design objects, a progressive behavioral hierarchy prototype of behavioral cognition is established, the interaction and experience of the elderly at home is constructed, and the definition of home products is clarified. Analyzing the mapping relationship between the behavior of external elements such as structure and form of aging-friendly design and product function. Finally, the aging design principles of home products are systematically mined, organized, and integrated so that the elderly at home can use the products more accurately, naturally, easily, and smoothly. Introducing the FBM model into the study of age-appropriate design of household products, focusing on the analysis of the behavioral characteristics of the elderly, can effectively avoid subjective factors in age-appropriate product design, ensure that the design requirements of age-appropriate products originate from behavior, and improve the scientific nature of the design. It provides new methods and ideas for the design and research of age-appropriate products and similar products.

Keywords: *FBM models; behavioral studies; household products, age-appropriate design*

1. INTRODUCTION

The aging phenomenon in China is very serious. By the end of 2021, 260 million people over 60 years old will account for 18.1% of the total population. As the rate of aging increases, society is under tremendous pressure to provide for the elderly. The advent of an aging society has contributed to the flourishing of the "silver hair market". The society needs to speed up the pace of adapting to aging, improve the experience of using elderly products based on the needs of elderly users, and reduce the physical and mental burden of the elderly. After individuals enter old age, cognitive function will decline, such as perception, memory and so on. The physiological characteristics and cognitive ability of the elderly will undergo different degrees of degenerative changes, which affect the quality of life. In addition, some home products are not designed with the needs of elderly users fully in mind, which brings them the trouble and frustration of poor user experience. Therefore, this

paper explores the design process of home products for the elderly through the FBM model based on the cognitive characteristics of the elderly group, from three dimensions of target users, behavioral characteristics and design objects, and from three dimensions of elderly behavior. so as to achieve the purpose of safe, comfortable and efficient use of products by the elderly at home.

2. THE FBM BEHAVIORAL MODEL

American behavioral psychology researcher Professor Brian Jeffrey Fogg proposed a new theoretical model of human behavior after realizing the shortcomings and limitations of traditional product design methods that are user-centered and adapt to user behavior. User behavior research is the study of the behavioral characteristics, behavioral habits and other factors of the target user group and their rational application, which has a high guiding value for product design. Thus, the FBM model suggests that individual

behaviors are determined by a combination of three factors: motivation, ability, and triggers. The entire theoretical model contains no quantitative data units. It describes the relationship between these three factors and user behavior from the perspective of conceptual essence. The theoretical model deconstructs the conditions for the occurrence of user behavior and provides an in-depth analysis of the deeper level of whether user behavior occurs. The rationale that guides the direction of product design. the FBM behavior model is shown in Figure 1.

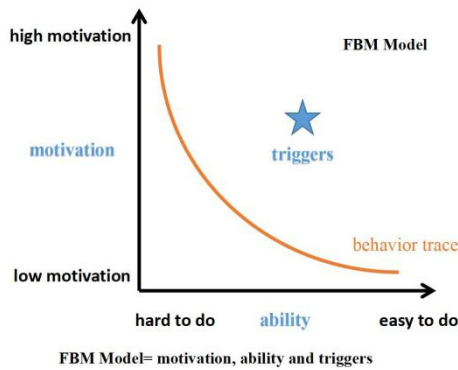


Figure 1 FBM behavior model

In the FBM model, two fixed horizontal and vertical axes form a plane quadrant that represents the user's target behavior. The vertical axis represents the user's behavioral motivation, that is, the user's own willingness to generate the target behavior. The position of the vertical axis represents the strength of the user's behavioral motivation. The higher the vertical axis, the stronger the behavioral motivation and the closer to the target behavior. the weaker. The horizontal axis represents the user's own ability to complete the behavior. The right the horizontal axis is, the stronger the behavioral ability is, and vice versa. At the same time, it also indicates the difficulty level of the behavior. From left to right, it represents the easier it is to complete the target behavior. The curve represents the trajectory generated by the behavior. Even if the user's behavioral ability is weak, he can execute the target behavior when he has a strong enough behavioral motivation, and vice versa, that is, high motivation and low ability or low motivation and high ability can produce the target behavior. The stars represent the trigger factors, which stimulate the target behavior to occur at the appropriate time. The trigger factors are not fixed in position and can exist anywhere in the plane. However, when the triggering factor is on the inside of the curve, the behavioral motivation and behavioral ability are insufficient, and it is difficult to stimulate the target behavior even if there is an appropriate triggering factor.

3. DESIGN ANALYSIS OF HOUSEHOLD PRODUCTS BASED ON BEHAVIORAL CHARACTERISTICS OF THE ELDERLY

3.1 Behavior characteristics of the elderly at home

Behaviors are what happens to individual users around events and the physical space they are in. The behavior of the elderly at home is closely related to the elderly individual, residential space, and household products. In this paper, the research on the behavioral characteristics model of the elderly at home mainly discusses the living process of the elderly at home from three elements: target users, behavioral characteristics and design objects. The target users are mainly composed of basic user information and lifestyle information, including the basic physical characteristics, living environment, economic status, living habits and consumption concepts of smart home products of the elderly at home. Design objects refer to interactive objects such as products and interfaces involved in intelligent life, including interaction design carriers, interaction design factors and interaction design concepts. The interaction design carrier is used to carry the design content of concrete software and hardware products and abstract interaction methods and strategies. Interaction design factors are design requirements transformed from research on target users and their behavioral characteristics, and are used to guide interaction design concepts in design objects. Behavior is the medium that connects target users and design objects. The study of target user behavior comes from the analysis of behavioral characteristics, that is, behavioral characteristics come from target users. The behavioral characteristics in this theoretical framework refer to the behavioral characteristics of the elderly at home. Through the three elements of the FBM model, the target user behavior is further divided into three aspects: behavioral ability, behavioral motivation, and triggering factors, so as to extract the corresponding behavioral characteristics, and then influence and transform for design factors. The framework of living behavior characteristics of the elderly at home combined with the FBM model is shown in Figure 2.

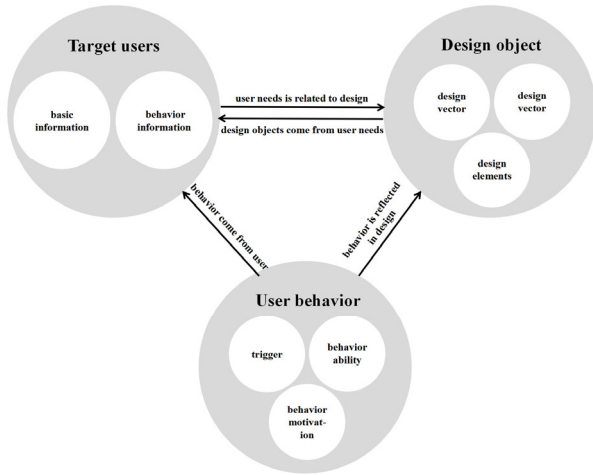


Figure 2 behavior characteristics of the elderly at home combined with the FBM model

3.2 Behavioral Hierarchy Prototyping

In the previous design for the aging of household products, most of the target users analyzed from the perspective of children or other stakeholders to clarify the concept of interaction design, design factors, and design carriers, and seldom took the behavioral characteristics of the elderly into consideration. The purpose of constructing a prototype of the behavior hierarchy of the elderly at home is to analyze the behavioral relationship between the elderly at home and household products, and to establish a suitable aging design of household products with the elderly at home as the target user and the behavioral characteristics as the focus of analysis. Product usage is the interaction process between users and products. It is a dynamic behavior process based on time, space, regularity, repetition, and identity with user behavior patterns as the main means of expression. It defines the relationship between users and products. The human-machine relationship between them matches the mapping structure between product functions and user needs, and reflects the value appeal of product availability and ease of use.

The building elements of product behavior hierarchy prototype mainly include user population, use environment, use time, use purpose, behavior process (behavior action/behavior sequence) and behavior result. Faced with a product with a given function in a certain time and space, based on the purpose of value appeal, users adopt corresponding behavioral methods, first cognition, and then interaction, and finally form the overall experience of the product. Therefore, extracting the product behavior hierarchy prototype from the user level can be summarized into the cognitive layer, the interaction layer and the experience layer.

3.3 Elderly behavior semantics and product mapping relationship

The mapping relationship between the behavior of the elderly and products is mainly an internal and unique feeling established by users in the process of behavior cognition and behavior interaction, rather than an external and formalized representation. In the process of using household products, each behavior of the elderly can map the characteristics of the product, and this characteristic will also be fed back to the elderly. A good behavioral experience is the result of the interaction between behavioral semantics and household product characteristics. The characteristics of sex, holographic, participatory and accommodating.

The specific mapping relationship between the two includes three aspects: the first point is the characteristics of the product itself; the second point is the characteristics of the product performance when the behavior occurs; the third point is the feedback state of the product after the behavior. Among them, behavioral characteristics are related to the utility of the product and the psychological feelings generated when using the product, which includes the function and usability of the product. When the product is available, easy to use and easy to use, the interaction between the product and the user will be accurate, natural, easy and smooth, which can meet the requirements of human-computer interaction such as safety, comfort and efficiency. The mapping relationship between the behavior of elderly and the product is shown in Figure 3.

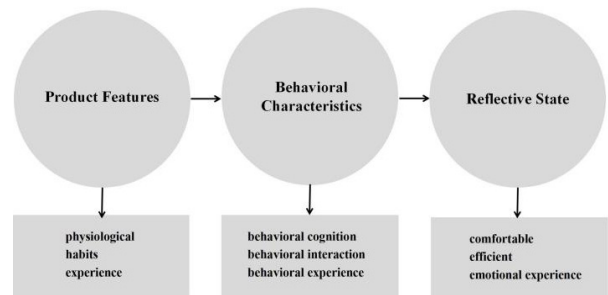


Figure 3 elderly behavior and the product mapping diagram

4. AGING DESIGN PRINCIPLES FOR HOUSEHOLD PRODUCTS

Safety First Design Principles: Dangers and impairments in daily behavioral activities increase dramatically in the elderly due to aging of their physical functions. The decline of the physical strength of the elderly makes it extremely inconvenient to bend down to pick up and place items. At the same time, their own vision declines, which makes this behavior even more dangerous. The elderly may suddenly fall forward or be unable to stand up when bending over. The design of aging-appropriate home products mainly considers how

to improve the safety of the home environment from two aspects: preventing danger and dealing with dangerous situations. On the one hand, considering the safety problems of the elderly at home when using household products, at the beginning of the design of household products, it is necessary to avoid the elderly at different physical stages now and in the future based on the physical function state, home environment space, and home behavior characteristics of the elderly. A variety of unexpected and dangerous situations that can be encountered when using the product. On the other hand, it is necessary to strengthen the safety protection of the elderly when using household products.

Product Functional Design Principles: the aging-friendly design of household products should pay more attention to product functionality. With the continuous development of technology, the needs of the elderly for furniture products are also constantly changing. In addition to providing the daily needs of the elderly, household products should also take into account new needs such as medical treatment, health management, intelligent functions, and leisure and entertainment. With the gradual increase and improvement of the functions of smart bedroom furniture, the living needs of the elderly are gradually becoming more diversified. For example, the smart home seat can actively adjust the posture of the seat according to the automatic monitoring of the user's different sitting postures and the obtained related data, thereby improving the health level of the elderly.

Follow the principles of elderly behavior: Behavioral habits and lifestyles that have been cultivated for a long time will not be easily changed, which makes it difficult for the elderly to learn new things. The aging-appropriate design of household products should be designed in accordance with the behavioral habits of the elderly and the household products they use. The role of aging-appropriate household products is to guide the elderly to use new products. A smart home design that conforms to their daily operating habits can prevent the elderly from being trapped in interactive methods, increase the operating efficiency of household products, shorten the distance between new products and the elderly, and eliminate their inner resistance.

Products with fault-tolerant design principle: For situations such as wrong operation caused by operation error or unconscious operation, timely reminder and information feedback should be provided. When the elderly use smart home, they often cause misoperation due to factors such as experience, attention and comprehension, so there are higher requirements for the fault tolerance of intelligent terminals. Fault tolerance can be divided into three stages: prevention, timely stop and post-event remediation. Prevention is to consider the error behaviors that older people are prone to at the early stage of design and to reduce the error rate at the source. Timely stopping is the timely feedback of the error

behavior, which can determine whether there are serious consequences and the system will stop itself. Post-event remedy is that the senior home product can provide the function to cancel the wrong operation when the wrong behavior occurs, so as to recover and avoid the wrong expansion.

5. CONCLUSION

This study elaborates the specific theoretical content of the FBM behavior model, and explores the design process of home products for the elderly with the elderly at home as the research object. Starting from the behavioral characteristics of the elderly, the design requirements of age-appropriate products are obtained based on behavior, the mapping relationship between the semantics of elderly behavior and products is clarified, and the principles of age-appropriate design of home products are systematically mined, sorted out and integrated, so that the elderly at home can use the products more accurately, naturally, relaxed and smoothly. This study completes the research of age-appropriate design of household products based on FBM model at the theoretical level, but the method is only a preliminary exploration, and the summarized method is not very popular in the design field due to the lack of research in this area in the literature. According to the types of aging-friendly household products, this study can consider the improvement, refinement, optimization and extension by using gray system theory, fuzzy comprehensive evaluation and FBS model to form a systematic research paradigm of aging-friendly design of household products and apply it to the design and development of other products to achieve the goals of safety, health, efficiency and comfort of age-appropriate product design.

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