

Research on Innovative Design of Products Suitable for the Elderly under the Concept of Sustainable Design

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Abstract—The problem of mismatch between supply and demand and waste of resources caused by the general inability of products suitable for the aged to meet users' needs. In today's world, all countries in the world are facing a serious ecological crisis, which requires active industrial transformation. Focusing on the continuous integration of adaptive product design and innovative design, this paper attempts to show the significance of extending research on adaptive product design and sustainable development of product design discipline after introducing innovative design into adaptive product design system from the perspective of sustainable design concept.

Keywords-products suitable for the elderly; Sustainable; creative design

1 INTRODUCTION

In the 21st century, the aging of China's population is accelerating. According to the statistics of the Seventh National Census, there are more than 267 million people over 60 years old in China, accounting for a high proportion of China's total population^[1]. With the improvement of living standards, the number of the elderly in China is increasing, and how to effectively guarantee the life of the elderly is getting more and more attention.

China has a large aging population, which is aging rapidly. How to effectively solve this problem is related to the development of the country, the happiness of hundreds of millions of people and the harmony and stability of the society.

According to relevant United Nations documents, people over 65 years old are called the elderly, and countries with more than 7% of the elderly are the aged countries^[2]. As figure 1 shown, the figures published in the Statistical Bulletin of National Economic and Social Development of the People's Republic of China in 2021 show that by 2021, the number of elderly people aged 65 and above has reached 200.56 million. The proportion of the elderly is increasing in our country. According to the latest statistics, the proportion of empty-nest elderly families in small and medium-sized cities in China is prominent, and this problem is more prominent in large and medium-sized cities. The group problem of the elderly is a problem that can't be ignored.

The aging of the population is bound to make the proportion of consumption of the elderly group continue to increase^[3]. It has been more than 40 years since the concept of sustainable development was first introduced at the United Nations in 1972. Nowadays, people and things, people and people, and things and objects are more closely connected, and the idea of virtual and real products blending with each other, wide-range integration and innovation among

disciplines, and sustainability has gradually been deeply rooted. Incorporating innovative research and methods into the design and research of products suitable for the elderly is of great significance to improving the design concept and practice level of design disciplines, improving the life happiness of the elderly, and realizing the sustainable development of the environment, economy and society.

Statistical Bulletin of National Economic and Social Development in 2021 [Ⓐ]		
index [Ⓐ]	Year-end number (10,000 people) [Ⓐ]	Specific gravity (%) [Ⓐ]
National population [Ⓐ]	141260 [Ⓐ]	100.0 [Ⓐ]
cities and towns [Ⓐ]	91425 [Ⓐ]	64.7 [Ⓐ]
countryside [Ⓐ]	49835 [Ⓐ]	35.3 [Ⓐ]
male [Ⓐ]	72311 [Ⓐ]	51.2 [Ⓐ]
woman [Ⓐ]	68949 [Ⓐ]	48.8 [Ⓐ]
0-15 years old [Ⓐ]	26302 [Ⓐ]	18.6 [Ⓐ]
16-59 years old [Ⓐ]	88222 [Ⓐ]	62.5 [Ⓐ]
60 years old and above [Ⓐ]	26736 [Ⓐ]	18.9 [Ⓐ]
Over 65 years old [Ⓐ]	20056 [Ⓐ]	14.2 [Ⓐ]

Figure 1 Statistical Bulletin of National Economic and Social Development
(Source: China Government Network)

2 RESEARCH ON THE DEVELOPMENT STATUS OF PRODUCTS SUITABLE FOR THE ELDERLY

2.1 Promote the high-quality development of the cause and industry of the aged.

In the government work report published on March 5, 2022, Li Keqiang proposed to strengthen social security and services, and speed up the establishment of an old-age service system that combines community institutions with coordination, medical care and rehabilitation. We will improve the supply of aged care services in urban and rural areas, subsidize and encourage non-governmental forces to carry out day care and postoperative rehabilitation care for the elderly, steadily push forward the pilot of long-term care insurance, and innovatively promote the development of the service mode of mutual support for the aged, so that the industry and industry of the elderly in China can be transformed into high-quality development.

2.1.1 Policy guarantee

The General Office of the State Council proposed to promote the consumption growth of the elderly in the Opinions on Promoting the Development of Aged Care Services (Guo Ban Fa [2019] No.5). Organize the National Competition for Innovative Design of Aged Goods, formulate the catalogue of aged goods, and establish the platform of "Industry-University-Research Cooperation" for "achievement transformation". Formulate policies that are beneficial to the health and life of the elderly, such as policies on renting and selling daily necessities for the elderly such as wheelchairs.

2.1.2 Product development

European and American design ideas such as "universal design", "inclusiveness" and "people-oriented" are widely used in community, residence and daily life, and have accumulated rich experience in design. such as Figure 2, a multifunctional equipment independently developed by Panasonic Company, which can transform the bed and chair to help the elderly with weak self-care ability and the disabled with hardship.



Figure 2 Robotic bed

(Image source: "China Robot Network")

At present, the domestic research on products and services for the elderly is still weak, mainly focusing on low-tech products, such as nursing products for the elderly. In recent years, a number of products for the elderly have appeared on the market. For example, "Eagle Sanitary Ware" company has developed bath products suitable for the elderly with the goal of "appropriate age and proper function". Some companies have introduced headphones, as Figure 3 shown, for the elderly.



Figure 3 Headphones for the elderly

(Image source: "Sohu.com")

2.1.3 Technical support for headphones

For the application of products for the elderly, the compatibility of its intelligent control system is not good, so it needs FPGA technology and real-time communication protocol. It is necessary to design intelligent control system, system sensor module, namely signal conditioning module, which includes a module for collecting listening information, a human-computer interaction module and an automatic transportation module for the application of products for the elderly. Figure 4 is the overall design structure diagram of the system.

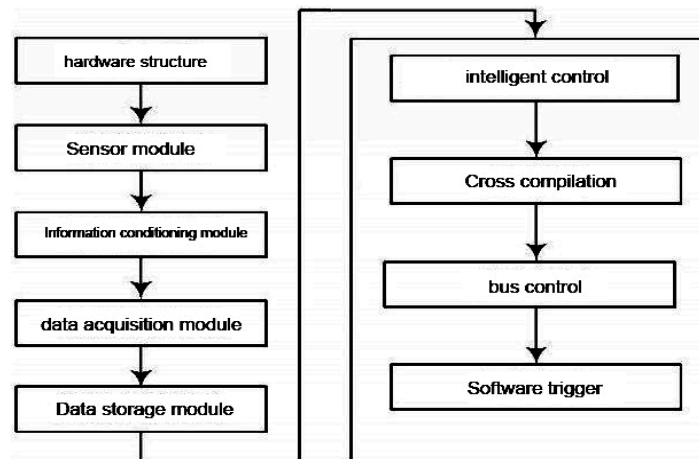


Figure 4 Overall design structure of system
(Image source: "Sohu.com")

The variation of frequency sample is used to collect the original data from the intelligent management of the program and extract the different parameters obtained from the program, combined with the different bus control methods to plan and store the information in the cluster. The human-computer interaction design and programming of intelligent information transmission can be tested together with the real-time bus transmission control protocol. The test results can be employed in the intelligence and the diversity of programs for the elderly-oriented products.

The intelligent control design of the elderly-oriented application aims to improve the intelligent and automatic control ability of the old application, and the remote control and wireless communication technology are also analyzed. Figure 5 shows the control convergence test of our intelligent control system for aging products.

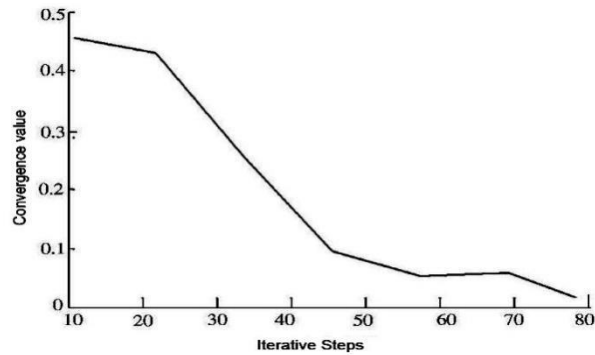


Figure 5 Test of control convergence
(Image source: "Sohu.com")

For example, the earphones for the elderly mentioned above can optimize the system to manage the elderly program by fully considering the application function of the elderly program. The system designs sensor module, signal conditioning module, listening data acquisition module, human-computer interaction module and main line transmission control module. The design of the intelligent operating system is based on the combined VIX bus technology, combined with FPGA logic control chip and the hardware design of the operating system. This is a design which is on the basis of collective information., at different locations, the information of sensors and control units collected through ARM protocol, is used in Integrated information planning and intelligent detection design with the application of intelligent control information processing technology. The integrated structure and adaptive planning of the applied intelligent control system are based on S3C2440A. Figure 6 is the resource scheduling input of the headset product control in our study, which makes the headset have excellent performance.

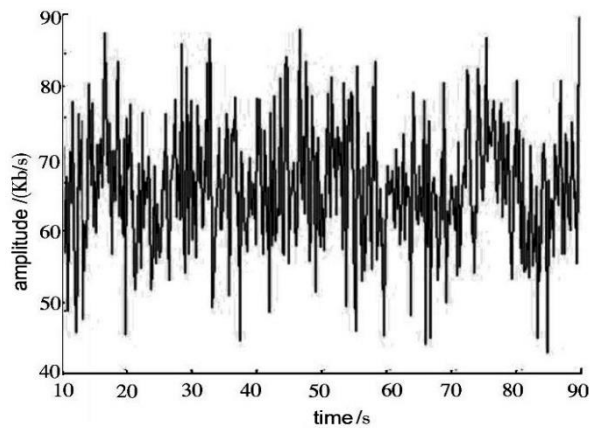


Figure 6 Resource scheduling input for control of products suitable for old people

(Image source: "Sohu.com")

Finally, to define the memory mapping of Blackfin, load the instructions for intelligent control of aging products in the Visual DSP++integrated development environment, jointly control with the host at the output SPI interface, and use 32-bit timers/counters to read/write the general program for intelligent control of the elderly - oriented products.

2.2 Current defects of products suitable for the elderly

Nowadays, most of the "old-fashioned" products on the market are improvements to existing products, such as simplifying or expanding the products currently used by young people, ostensibly aiming at the elderly, without taking into account the actual needs of the elderly to some extent^[4].

While many manufacturers are developing "intelligence" and "high-tech", they often neglect their "aging suitability" in actual use. Therefore, at present, some products can only meet the material needs of the elderly, without considering their particularity. Therefore, how to make the life of the elderly more convenient and comfortable plays an important role in promoting family harmony and social development.

3 ELDERLY PEOPLE, SUSTAINABLE DESIGN AND AGE-APPROPRIATE DESIGN

3.1 Older people and aging

Article 2 of China's Law on the Protection of the Rights and Interests of the Elderly stipulates that the age starting point of the elderly is 60 years old. That is, all citizens of the People's Republic of China who have reached the age of 60 belong to the elderly.

The number of the elderly in China is increasing, and the proportion of the elderly in the population is rising. Since 2010, China's aging has been increasing, and the proportion of the elderly is increasing. By the end of 2014, there were more than 20 million elderly people in China, and there were more than 40 million disabled elderly people who could barely take care of themselves.

According to the latest national census, the number of elderly people in China has exceeded 250 million, accounting for a huge proportion of 18% of the total population. The aging of population is a big problem before us, and how to serve and care for this huge group is also a big problem that we need to solve.

3.2 Sustainable design

Sustainable design pays attention to the unity and coordination between man and nature, and through design, we can create products that coordinate the present and future needs. Establishing a continuous consumption pattern, prolonging the life cycle of products and reducing the easy-to-discard of products are all the embodiments of the concept of sustainability in the design. Sustainable design mainly includes: establishing lasting consumption patterns, establishing sustainable communities, and developing sustainable performance resources. Sustainable design is a strategic design activity, which can balance economic, environmental, moral and social issues to guide and meet the needs of consumers.

4 DESIGN INNOVATION PRINCIPLE OF SUSTAINABLE PRODUCTS FOR THE AGED

In recent years, As Figure 7 shown, scholars at home and abroad have gradually gained important insights and a lot of attention to age-appropriate landscapes.

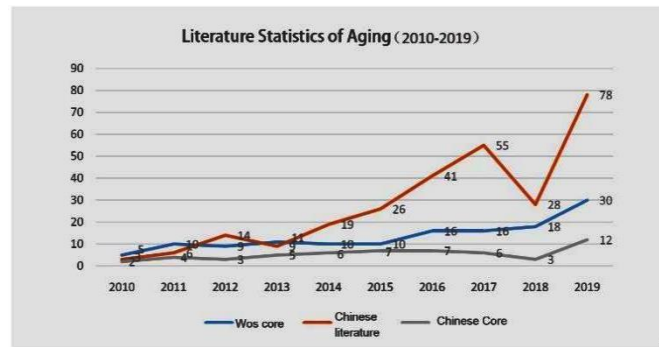


Figure 7 Statistical table of landscape ageability research literature

(Image source: "Sohu.com")

Affected by age, the elderly have poor acceptance ability, and it takes a long time to learn and accept new things. The elderly are weak in constitution, and it is difficult to engage in high-intensity work like young people. Due to the restrictions of travel conditions, the elderly have few travel opportunities, so it is often difficult to communicate with others. Under the influence of various circumstances, this kind of group is easy to feel lonely, so they need more psychological comfort. In many cases, the elderly are not to be cared for, but to be respected in order to realize their social value. Therefore, in the planning and design of old-age products, we should design and develop all kinds of aging products suitable for the elderly according to the different characteristics of the elderly of different ages and identities, instead of designing a single product once and for all.

4.1 Availability principle

For old users, practicality and usability are the most important. With the continuous development of science and technology, it brings more convenience and technical barriers to people. However, for most elderly people, they have a certain fear and avoid new technologies and new things. Therefore, the usability design principle should be followed in the behavior design process of the elderly users, and the technical threshold of the elderly users should be lowered. The principle of usability is to take the user as the center and evaluate the attractiveness, learning, effectiveness, controllability and error prevention of products. Attractiveness means that users are interested in products and willing to use them; Efficiency refers to the quick completion of tasks by users using products; Ease of learning is the first way that products support continuous learning. Controllability means that users try to complete their creativity through control when using products. Error prevention is the way products help users avoid errors.

4.2 The principle of experience

Make ageing design education a common theme for design teaching in colleges and universities^[5]. The experience principle is embodied in all levels of design, including the design results and the design and implementation scheme of related services. For example, the design of intelligent voice products should consider the contextual elements familiar to the target users, such as user interface simulation, speech processing dialect, etc. By studying and exploring the usage habits of the elderly, we can realize empathy in the use of products, so that the elderly can continue to use products better.

5 MANY BENEFITS BROUGHT BY THE DESIGN INNOVATION OF SUSTAINABLE PRODUCTS FOR THE AGED

As Figure 8 shown, In the process of studying age-appropriate products, scholars have obvious changes in the research focus of products. The focus of research varies from period to period.

Change in research focus

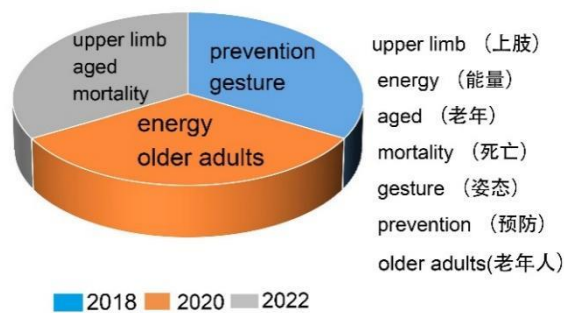


Figure 8 Change in research focus

(Image source: " Personal hand-painted")

With the development of times and technology, new requirements are put forward for the design of various products. A good product experience is not only a product experience, but also a comprehensive, spatial, feeling and psychological state of consumers. In order to design a product production scheme, it is necessary to analyze and discuss all aspects that affect the whole design system, such as the observation and understanding of stakeholders and the feasibility of technical scheme.

5.1 Product design

While traditional product design focuses on objects and "user-centered" design focuses on users, innovative product design under the concept of sustainable design must pay attention to more

things: stakeholders, environment, objects, process and the whole design process are all objects, which must be studied and designed during product design.

5.1.1 Design core concept

The development of digital technology in China has made positive progress and results^[6]. The essence of product design is to highlight the value of the product with eye-catching and unobtrusive expressive force. The design itself is a manifestation of the vitality and creativity of designers and even human beings. The designer's personality design idea is the leading factor of product innovation design. Creativity is actually a means for people to describe their future vision. Designers' job is to use their artistic aesthetics to discover and construct beauty in the world, which is the process of reshaping beauty and creating creativity. Designers need to reunite a variety of design elements and design purposes in their minds and integrate their own design ideas to create a product with unique tension. The final product may be simple and clear, but the design process is complex and changeable.

5.1.2 Design core requirements

Qualified product design can reflect and meet users' various needs, and the process of research and design is to discover people's needs and meet and solve them. Excellent design should be able to convey the excellent quality and performance of its products through their appearance and style. Stimulate buyers' desire for consumption. Design contains art, but it should not only contain art.

We affirm the design level and professional ability of our designers. However, we should not only design products according to designers' preferences, or express artistic beauty as artists wish. A qualified product should give consideration to both artistry and practicality as much as possible on the basis of insight into the current fashion trends. Designers should fully understand customers' needs and properly combine them in product design.

5.1.3 Excellent design cases

Familia is a series of intelligent products developed by Studio Fantasio. Its purpose is to make the old people reduce their dependence on the elderly and increase their confidence, so that they can regain their dignity. These products are designed for ordinary products, and the user interface is simple, so they don't need to learn. such as Figure 9, The object of the two functions is an upright desk lamp, and it is also a lighting amplifier, suitable for all ages. You can pick it up and turn it over, because a luminous magnifying glass can help you see more clearly. Design products by considering the needs of elderly users.



Figure 9 Illuminated magnifying glass

(Image source: "Sohu.com")

5.2 Commercial competition

5.2.1 The key to winning the competition

In today's market environment, the competitive advantages of products in hardware and design are quickly copied and surpassed by other competitors. In the long exploration, the blue ocean quickly turned into the red ocean. What can't be copied and surpassed is the positive experience of consumers' long-term use, as well as their loyalty and even dependence on products.

5.2.2 Innovation of product design

For example, the aging and barrier-free transformation proposed by the Ministry of Industry and Information Technology at the end of 2020 aims to solve the difficulties encountered by special groups such as the elderly and the disabled when using intelligent technologies such as the Internet. By January, 2022, the first batch of 43 new care modes and elder modes of APP achievements have been accepted (the elder version mode has larger font size, simple operation, larger buttons, and can directly listen to the voice by clicking the text).

6 CONCLUSION

At present, people and things, people and people, and things and objects are more closely connected, virtual experience and real products are blended with each other, and the concept of sustainability is deeply rooted in the hearts of the people.

It is very important to show that innovative design will be introduced into the product design system for the elderly from the perspective of sustainable design concept for research and exploration, so as to improve the design concept and practice level of design disciplines and realize the sustainable development of environment, economy and society. In terms of the consumption of health for the elderly compared to the consumption of health for non-elderly people, we get the data shown in the Figure 10, and the data is generally stable.

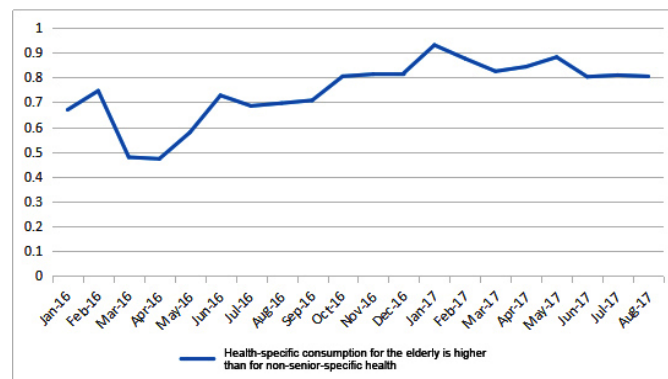


Figure 10 Health-specific consumption for the elderly is higher than for non-senior-specific health

(Image source: "Sohu.com")

No matter how the times develop and the technology is innovated, the aging of the population has always been a difficult problem. The problem of product design for the elderly is becoming more and more prominent, and the product market for the elderly is uneven, and there is a certain positioning deviation in the design. Designers should pay more attention to the "new and old" groups, and pay attention to their needs in medical treatment, study and life.

Although these groups are older, they are also these groups whose thoughts are emancipated and their bodies are healthy, and they are still pursuing the realization of their self-worth and social value^[7]. With regard to the product design of such groups, we need to think and design from a long-term and developmental perspective, and strive to make the products reveal the warmth and care of human nature, so that the elderly groups can be cared for in life and emotion.

REFERENCES

- [1]. J.suitable aging design. *Design*, 2022,35(15):7.
- [2]. J.Zheng Lu, Li Mingzhu, Huang Liqing, Chao Wenbo, Yan Hui. Aging-appropriate design strategy for mobile applications
- [3]. J.Cheng Gong, Liu Wei. Research on the aging-friendly design of smart kitchen system. *Design*, 2022, 35(07):97-99.
- [4]. J.Li Jiayu, Si Zhengming. The aging-APPropriate design strategy of smart product app. *Design*, 2021,34(17):129-131.
- [5]. J.Xu Guanghui. Research on the Teaching of Aging Design Based on Environmental Design Specialty. *Art Work*, 2021(03):111-114.
- [6]. Yang Zan. Strive for a healthy aging enabled by digital technologies [N]. *People's Post and Telecommunications*,2022-09-22(005). DOI:10.28659/n.cnki.nrmyd.2022.002721.
- [7]. J.Ni Shiming. Research on the present situation and aging-resistant design of outdoor fitness equipment in rural areas of Shaoxing. *Industrial Design*, 2021(05):108-109.