

An Empirical Study on the Interaction Between People and Smart Pillows

Qihua Li¹, Lintao Tang¹ and Huizhen Xu²

¹Academy of Arts and Design, Tsinghua University, Haidian District, Beijing, P. R. China

²Fair Friend Institute of Intelligent Manufacturing, Hangzhou Vocational & Technical College, Zhejiang, P. R. China

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Abstract: Human-computer interaction is a human-centered methodology, it serves to better meet the needs of users and improve user experience. Pillow as a necessity of life, in the upgrading of consumption, is developing into intelligence. This essay applies the theory of consumption value, and adopts an interdisciplinary approach to explore users' demands for functional value, social value, emotional value, cognitive value and situational value of smart pillows. Two methods: ethnographic interview and co-design were used to summarise the smart pillow's user persona and customer journey, and to generate an innovative interaction design scheme. The research results can promote the development of interdisciplinary, and encourage people to follow the human-centered principle through innovative interaction design, thus providing people with a better lifestyle. Under the current multi-context social culture, interdisciplinary knowledge integration can meet the multi-dimensional consumption value of users and make innovative interaction design more scientific. At the same time, the innovative interaction design of user participation enables the product to bridge the gap between users and designers.

1 INTRODUCTION

According to research data, the market size of China's sleep economy will exceed 400 billion yuan in 2021, and it is expected to exceed one trillion yuan in 2030 (Wenli, 2022). The sleep economy has huge market potential. The driving populations of the sleep economy are the insomniac and the sub-healthy population. In the rapidly developing economic environment, poor sleep quality, difficulty in falling asleep, and easy to get sleepy have become the top three troubling sleep problems of the generation. The sleep economy and health concerns are driving the demand for pillows. Pillows, as a necessity of life, are closely related to sleep. Pillows are getting more and more attention. Pillows can affect cervical health and sleep quality, a comfortable pillow is very important for sleep. Human-computer interaction is a human-centered methodology, it serves to better meet the needs of users and improve user experience.

The theory of consumption value is a research hotspot and core subject in the field of marketing management, which has important significance and value in the aspect of user demands. Consumption value theory explains the reasons why users buy

products or services. It is a relatively complete consumption value framework, which determines the functional value, social value, emotional value, cognitive value and situational value that affect users' behaviors (Sheth et al., 1991). The theory of consumption value requires "human-centered", which applies an interdisciplinary approach to product innovation, and integrates sociology, psychology, anthropology, design, and other disciplines to co-create with multiple disciplines. Under the developing trend of intelligence, household products are being upgraded intelligently. Based on the theory of consumption value, what do users demand in terms of the functional value, social value, emotional value, cognitive value and situational value of smart pillows?

This study consists of exploratory investigations to determine interactive innovation opportunities for smart pillows, and three research questions are proposed to achieve the research objectives:

- What is the persona of the smart pillow users.
- What are the interactive innovation demands for smart pillows, based on the theory of consumption value.

- What innovative product interaction design can be carried out to make the smart pillow provide better interactive experiences for users.

2 METHODOLOGY

2.1 Methods in this Study

This research adopts interdisciplinary research methods, applies the knowledge of anthropology, sociology, design, and integrates research and practice through innovative product interaction design in the way of “research through design” (Manzini 2015). Two methods: ethnographic interview (Spradley, 2016) and co-design (Kohtala et al. 2020) were used. A total of 12 samples were analyzed and a scientific quota was set for the composition of the samples (Babbie, 2013).

Ethnographic interviews were conducted in a one-to-one manner, which eliminated group pressure and made the information provided by participants more authentic. During the interview, the host can observe and obtain the participants' behavior habits, usage scenarios, and needs for pillows. In addition, the host can understand the real life of the participants, establish empathy for them, and gain insight into the relationship between the behaviors and attitudes of the participants.

The contents found in the research are recorded and analyzed to gain insight into users' values and lifestyles. The value appeal and hidden needs associated with the smart pillow are captured in every detail of the participants' lives. In the research, participants from different backgrounds not only put forward their expectations for smart pillows, but also discussed the future possibilities of innovative interaction design through collaborative design. Participants contributed many ideas for innovative interaction designs for smart pillows. This study follows design ethics and is carried out with the consent of the participants. Design research and interaction design should be human-centered, take “goodness” as the principle, and use “goodness” methods to make people's lives happier.

2.2 Sampling

Considering the different demands of users for smart pillows based on factors such as age, gender, identity, income, type, and price of the pillow, this study adopts non-probability sampling, as Babbie (2013) refers as quota sampling, and carries out reasonable distribution of each characteristic. The participants

include students, white-collar workers, middle and senior managers, etc. According to Nielsen's experience, in some qualitative studies, more than 80% of the problems can be found with 8 samples, while in quantitative studies, statistically significant results can be obtained with 30 samples. This study uses a qualitative approach to explore the new demands of users. The samples are shown in Figure 1.



Figure 1: Samples of pillow users in the research.

2.3 Ethnographic Interview

The interview process consists of eight steps: (1) research objective determination, (2) research method design, (3) user quota making, (4) sample recruitment and screening, (5) interview outline design, (6) execution of interviews, (7) hypothesis verification, (8) result analysis.

The interview outline mainly consists of five parts. The first part is the warm-up and self-introduction of the interviewees. The purpose is to introduce the objective of this study, establish a harmonious and friendly atmosphere, and understand the sleeping habits and concepts of the interviewees. The second part is pillow usage habits and purchase motivation, aiming to understand users' usage habits of pillows and the sleep-related products that they own, in order to understand users' purchase scenarios of pillow products. The third part is the purchase process and consideration factors, the purpose is to understand the information acquired channels of users, to clarify the purchase decision-making process and users' factors of concern. The fourth part is the evaluation of pillow usage, the purpose is to understand users' expectations, satisfactions, and pain points of the pillow, and understand users' pillow using habits. The fifth part is the testing of the pillow's function and material requirements, to understand users' preference for the pillow's function, material, and shape, also to explore users' unmet expectations.

3 DATA ANALYSIS

3.1 User Persona

The father of interaction design (Cooper, 2004) proposed the concept of user persona, which is a virtual representation of real users and a target user model based on a series of real information. A user persona is a fictional, specific, and focused description of a target user. Domestic scholars have also studied and developed user persona. Currently, the commonly used concept of user persona refers to the characteristics of a group that integrates buyers and users, and describes the target user. The descriptive elements include age, gender, family structure, educational background, and other demographic characteristics, as well as emotions, attitudes, behaviors, preferences, motives, goals, pain points, habits, and other factors. That is, the user persona is used to express clearly what kind of "person" the user is.



Figure 2: User persona.

Based on the information obtained from the investigation, the user persona of the smart pillow is summarized (see Figure 2). The users of smart pillows are mainly young and middle-aged, and their core demands for the pillows are focused on health,

spine protection, and comfort. They come from better economic backgrounds and possess higher consumption capacities. In terms of life status, they are under great pressure to balance their family life and career. In terms of health, they often have problems such as lack of energy, insomnia, easy to wake up, poor sleep, shoulder and neck pain, headache and so on. They are more inclined to invest in health and expect technology to improve their health. Because there are growing amounts of sub-health problems such as shoulder and neck muscle strain and cervical curvature change, they have a higher demand for pillow sleep monitoring and massage functions. In terms of consumption concept, they pay attention to material safety, scientific and comfortable design, and they pursue new functions and new technologies to improve the quality of life. In purchasing decisions, they care most about the products and brands, and pay more attention to the pillow fitting for cervical spine support, hoping to improve sleep and health through intelligent functions. They prefer brands that focus on sleep and have technical expertise.

3.2 Customer Journey

Customer journey (Kalbach, 2018) is an effective tool to analyze the interaction between users and products. The basic elements of customer journey include user behaviors, goals, emotions, pain points, contact points, key moments, satisfactions, and improvement opportunities. In the abductive analysis of customer journey, it can focus on core contact points such as key moments to explore the potential demands of users and find new opportunities. Customer journey can systematically analyze user demands and behaviors. The user persona and customer journey have become two commonly used tools. Under the collaborative design with users, the user persona and customer journey can be efficiently summarised, providing rich information input for the abductive reasoning of product interaction innovation, and truly realizing user-demand based product innovation.

The customer journey of smart pillow can be divided into four stages: demand generation, information research, product evaluation, purchase and use. In the demand generation stage, there are three reasons that drive users to buy new pillows. The first reason is that the original pillow can become dirty and worn out over time, with poor comfort, support, and so on. The second reason is that users have problems with sleep quality and health, so they buy healthier and more comfortable pillows to improve it. The third reason is that the pillow in the

function, material, design and other aspects of the launch of new products, attracting users to buy it. During the search information stage, users mainly learn about pillow information through e-commerce platforms, official websites, content platforms, and physical stores. Expert evaluation, KOL recommendation, sales volume and user reviews also have a great impact on users. In the purchase evaluation stage, user will evaluate and compare the following functions of the pillow, including moderate softness and hardness, breathable design, anti-mite, anti-microbial, height regulation, sleep monitoring and massage function, etc., which are the embodiment of comfort and professionalism of the pillow. Users trust well-known brands, because it speaks for the products' value and ensures their quality. In terms of pillow appearance and material, users prefer rectangular-shaped, memory cotton-made and gray-colored designs. At present, the pillowcase is mainly made of pure cotton, and users pay more attention to the color of the pillowcase. White, gray, and yellow are preferred by users. With the development of the cultural and creative industry, there are more and more pillows printed with cultural and creative patterns, which improve users' sense of pleasure and are also favored by them. In the stage of purchase and use, more and more users purchase products on the e-commerce platform, because it has abundant products and affordable prices. In the use of pillows, if the pillow brings users experiences beyond their expectations, they are more likely to recommend it to their friends. In the interview, it is discovered that the pillow is generally used for 2-3 years. Most users dry the pillow regularly, but rarely wash the pillow inner with water.

4 FINDING

Consumption value theory explains why users buy one product rather than another. When users choose products, they will compare the consumption value of different products and choose the product that can provide them with the highest consumption value. In the theory of consumption value, functional value refers to the basic function or physical properties of a product. Emotional value refers to the emotional experience that a product can bring to consumers, which comes from the feeling or affection caused by the product. Social value means that a product can connect consumers through social groups, improve social status and shape social image. Cognitive value refers to the product that can bring freshness to consumers, satisfy their curiosity, and pursuit of new

knowledge or novelty psychology. Situational value refers to the choices consumers make when facing certain situations. A product can temporarily provide greater functionality or social value, changing the behavior of consumers.

The application of consumption value theory is based on internet big data and investigation, this essay summarizes users' demands for the functional value, social value, emotional value, cognitive value and situational value of smart pillows (see Figure 3).

Users' functional value demands for smart pillows mainly include moderate softness and hardness, breathable design, anti-mite and anti-microbial, and height regulation.

Users' emotional value demands for smart pillows mainly include rectangle shape, memory cotton filling, and gray in color.

Users' social value demands for smart pillows mainly include brand, which not only guarantees quality but also symbolizes identity.

Users' cognitive value demands for smart pillows mainly include high sales volume, which can bring trust.

Users' situational value demands for smart pillows mainly include sleep monitoring or cervical spine repair.

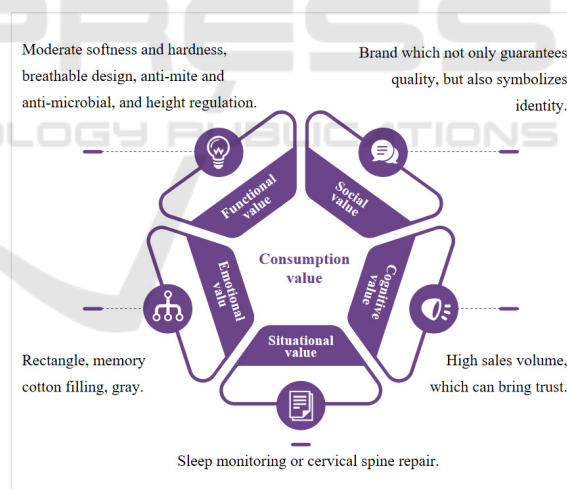


Figure 3: The consumption value of smart pillows.

Based on users' demand for the consumption value of smart pillows, this study carried out the innovative interaction design of smart pillows (see Figure 4). The core features of the innovative interactive design of the intelligent pillow are sleep monitoring and height regulation. Sleep monitoring can record health data such as sleep duration, deep sleep, latent sleep, heart rate, and respiratory rate, providing users with sensory health monitoring and scientifically improved sleep. Height regulation is

innovatively realized by the way of pulling rope, which is convenient for users to easily adjust the height according to their individual conditions and obtain a comfortable sleep experience. In addition, the innovative interactive design also meets users' other consumption value needs, such as moderate softness and hardness, rectangle shape, high-quality memory cotton material, and so on.

The product innovation interaction design based on the consumption value theory can provide users with multi-dimensional value experiences. By meeting users' demands for functional value, social value, emotional value, cognitive value and situational value, it avoids the limitations of product innovation design carried out from a single perspective. Under the current multi-context social culture, interdisciplinary knowledge integration can meet the multi-dimensional consumption value of users and make innovative interaction design more scientific. At the same time, the innovative interaction design of user participation enables the product to bridge the gap between users and designers.

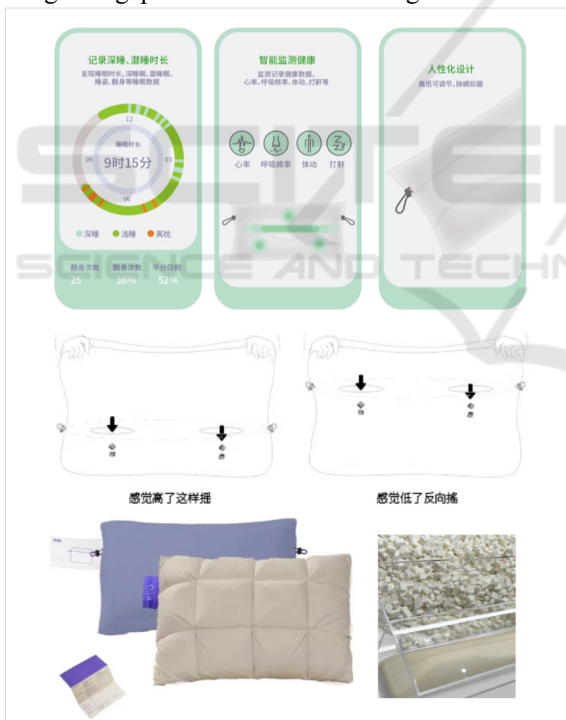


Figure 4: Innovative interactive design for smart pillows.

5 DISCUSSION

5.1 This Study Solves Three Problems

Household intelligence is a big development trend, smart pillows are becoming more and more popular. Through two research methods of ethnographic interview and collaborative design, this paper analyses and summarizes the consumption value demands of users for smart pillows. In the future, we will continue to conduct research to obtain more research results. This study addresses three questions:

- What is the persona of the smart pillow users.
- What are the interactive innovation demands for smart pillows, based on the theory of consumption value.
- What innovative product interaction design can be carried out to make the smart pillow provide better interactive experience for users ?

5.2 Contribution to Knowledge

This paper has two main contributions to knowledge. First of all, it has enriched the knowledge of the application of consumption value to interactive innovation design, which is conducive to help designers systematically understand user demands. It provides knowledge reference for future research and practical application. Secondly, a new combination of research methods is adopted to provide a new method for the study of interactive innovation design. The integrated application of ethnographic interview and collaborative design, as well as the summary of the user persona and customer journey, is conducive to insight and analysis of the potential demands of users.

5.3 Value of the Method and Future Research

The interaction design based on user demand is the guarantee for the success of innovation. The interaction design of new products of traditional enterprises is usually carried out by experience. With the development of experience economy, users have more and more demands for products. The interaction design of new products should not be conducted solely based on the experience of designers subjectively. Instead, more consideration should be given to the ideas of users and they should be allowed to participate in the process of interaction design of new products. In the past practice of innovative interaction design, the method of user participation is rarely used. Adhering to the human-centered

principle, it is of great significance to invite users to participate in product interaction design.

Innovative interaction design has changed people's way of life, re-designed the relationship between people, and also re-designed the relationship between people and things. In order to better meet the demands of users, the application of consumption value theory in design requires interdisciplinary methods and user participation design. Products designed based on consumption value theory provide users with multi-dimensional value experiences.

In the future, relevant research can be carried out continuously to track the interaction between people and smart pillows, discover user needs, and provide information basis for innovative interaction design. In addition, the method of this study can be applied to the study interaction between people and other products, such as smart refrigerators, vacuum cleaners, smart phones, smart doorbells and so on.

6 CONCLUSIONS

The demand for smart pillows is driven by the sleep economy, consumption upgrades, intelligence developments, sub-health conditions and so on. The theory of consumption value has important significance and value in the aspect of insight into user demands. Consumption value theory explains the reasons why users buy products or services. This essay adopts an interdisciplinary approach to explore users' demands for the functional value, social value, emotional value, cognitive value and situational value of smart pillows.

Two methodologies of the ethnographic interview and co-design are adopted in this study. Based on users' demand for the consumption value of smart pillows, this study summarizes the user persona and customer journey of the smart pillow, and generates an innovative interaction design scheme. The product innovation interaction design based on the consumption value theory can provide users with multi-dimensional value experiences. This study not only enriches the knowledge of interaction design, but also promotes the development of interdisciplinarity. The research results can encourage people to carry out interactive design following the human-centered principle.

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