Design of Household Clothing Disinfection Machine From the Perspective of Health Protection

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Abstract. The purpose of this article is to analyze people's daily clothing disinfection needs after the outbreak of public health incidents from the perspective of health protection, deeply explore clothing disinfection and sterilization needs, transform the needs into product design elements, and design products that better meet user needs. The product. Methods: The Kansei Engineering method and the literature method were used to sort out the thoughts and extract the Kansei cognitive words, and select an array of words with outstanding priorities through a questionnaire survey; several products were selected as samples to extract the Kansei word images and transform them into specific data. Finally, it is analyzed through SPSS and applied to the design. Conclusion This product will be based on the perspective of family health protection and through perceptual engineering methods to build a household clothing disinfection machine that meets new needs in the context of the new era.

Keywords: Clothing disinfection; Kansei engineering; Household use; Product design.

1 Introduction

With the development of technology and economic progress, various household appliances have shifted from a single function to a multi-functional form. Based on the background of the current era after the outbreak of public health incidents, people have already strengthened their health management concepts. Household clothing disinfection machines have become indispensable products in contemporary families. The trendy and functional household clothing disinfection products are imminent. Because its use scenario is a family, this gives the product an important functional need to improve the user's emotional experience. The products applied in the family scene should consider various user groups with a large background span when designing. It should also improve the integration of products and the environment. This article guides the design of household clothing disinfection products that meet the needs of users through perceptual engineering methods, and contributes to the research field of household clothing disinfection machine products.

2 Research methods—Kansei Engineering

Kansei engineering aims to understand people's subjective feelings and emotional reactions to products, services, environments, and interactions. It focuses on the interaction between people and products or environments, explores people's feelings, emotions, and emotional

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reactions to things, and studies these reactions to improve the design of products and environments. When users come into contact with a product, they will inevitably have their expectations for the product. The goal of Kansei Engineering is to understand these emotions and their impact on products, services, and the environment to guide the design of more satisfactory products. During the implementation process, common classifications include Kansei vocabulary classification, Kansei engineering systems, and Kansei engineering modeling. This article will combine the perceptual vocabulary classification method with the perceptual engineering system to organize and analyze users' needs for household clothing disinfection equipment, convert them into quantifiable data structures, and combine the above two methods to provide a methodological basis and design practice for product design.

3 Analysis of the current status of household clothing disinfection machine products

3.1 Usage scenario restrictions

Through market research and literature reading, it is found that the current research on disinfection and sterilization products is mostly used in public, large, and medical places[1]. In the above scenarios, the products are large, consume a lot of power, are noisy, and are cumbersome to operate. As for products used in home scenarios, there are fewer products for disinfecting clothes. The only products that exist are not user-centered and are counter-trend products.

3.2 Lack of product safety

Some products do pay attention to the need for household clothing disinfection, but they do not pay attention to other aspects of the product. They simply add a disinfection function, lacking detailed considerations. Because this product is used in special scenarios, with children and elderly people in the family, the most important thing in the design of this product is safety. What method of disinfection is used? Will misoperation cause serious safety issues? These are all issues that need to be prioritized when designing this product.

3.3 Upgrading of product technology

After a survey of existing products on the market, it was found that most of the existing clothing disinfection products on the market use the following three disinfection methods to work, ultrasonic mite removal, ozone sterilization, and negative ion sterilization. However, with the upgrading and progress of technology, ultraviolet sterilization technology[2] has long been mature and used in various required fields. Ultraviolet sterilization technology is also called short-wave sterilizing ultraviolet light. Its principle is to destroy the molecular structure of DNA and RNA of microbial cells to achieve sterilization and disinfection. The effect, combined with the experience of response measures after the occurrence of past public health incidents, ultraviolet sterilization technology can fully meet the needs of household clothing disinfection. Therefore, the technology of household clothing disinfection machines is also expected to be further upgraded and improved. Ultraviolet sterilization technology is applied in the field of clothing disinfection[3]. The development of the product makes it possible to further improve the safety of the product while taking into account functional integrity.

3.4 The value of perceptual engineering research and analysis of household clothing disinfection machines

Kansei Engineering has important analytical value in the research of household clothing disinfection machines, which can improve the design quality, user experience, and market competitiveness of products[4]. How a household clothing disinfection machine designed for home scenes can organically combine man, machine, and environment with just the right function and shape is an issue that a designer should grasp. By using Kansei Engineering, we can design product appearances and functional features that resonate with users' emotions, accurately meet users' safety and comfort expectations for products, carry out targeted designs, and innovatively discover new designs. Elements, such as some personalized and customizable appearances, intelligent interactions, light and shadow effects, etc., thereby increasing the product's appeal in the market. During the design process, designers need to constantly scrutinize the relationship between people, things, and situations. If the practical function of a product is the prerequisite for whether it is qualified, then the aesthetic function is the winning point to meet the spiritual needs of users. The research and application of Kansei Engineering in the product design of household clothing disinfection machines provides designers with a more comprehensive perspective, helping to create products that are more attractive, user-friendly, and in line with the trends of the times.

4 Design of household clothing disinfection products based on Kansei Engineering

4.1 Design principles for household clothing disinfection products

Clothing disinfection products used in home scenarios are different from products in other scenarios. They have special usage scenarios, complex user groups, and highly targeted disinfection objects. This leads to the outstanding characteristics of the product. It must not only meet the basic product disinfection function, but we should also take into account the special needs of some vulnerable user groups, such as children, the elderly, and disabled users[5]. Therefore, compared with disinfection equipment in other scenarios, it has specific requirements in terms of size, sustainability, ease of cleaning, and ease of operation. When operating the product, attention should also be paid to the design details to meet the user's aesthetic needs for the product and improve user-friendliness.

4.2 Select samples

This article collected 30 groups of more representative household clothing disinfection products on the market and used consistent angles and lighting to take photos of the products. After expert screening and confirmation by disinfection industry professionals, 10 photos of household clothing disinfection were finally determined. Product pictures serve as basic samples.

4.2.1 Group experiment.

The test invited 20 test subjects and asked the test subjects to conduct a one-to-one similarity comparison of these 6 samples to obtain the final score. This article uses a seven-point Likert

scale to evaluate the sample products. The degree options range from 0 to 7, with 0 being the least similar and 7 being very similar. Finally, the mean value of the similarity data is calculated.

4.2.2 Select representative samples.

The processed similarity matrix was imported into SPSS software. After analyzing the samples through the systematic clustering method, it was found that it was most appropriate to divide the categories into 7 categories. Then, through K-means cluster analysis, the categories were designated as 5 categories. Calculate the distance between each observation and its distance from the center of each cluster. All samples are then summarized and sorted through the results of the clustering method. The smaller the distance between the observation object and the center point, the higher the degree of similarity, and the sample can be determined to be a representative sample of the type.

4.2.3 Determine product perceptual vocabulary.

Through extensive literature review, research on existing products on the market, and user observations and interviews, we collected relevant perceptual words. Combined with multiple feedback verifications, screenings, and the necessity of related functions, we finally determined 60 perceptual words. The identified 6 sample pictures of household clothing disinfection products were combined with 10 sets of perceptual vocabulary using a 7-point Likert scale to generate a survey questionnaire. 20 subjects were invited to take the test and asked to make subjective evaluations of the products shown in the pictures. All those tested had experience in using household clothing disinfection products. An image score matrix was established by counting the mean of the image scores of each sample (Figure 1), and finally, 10 groups of perceptual words were obtained: Comfortable-Depressing, Hygienic-dirty, Safe-Dangerous, Simple-Complex, Light-Bulky, Advanced-Backward, Warm-Cold, Luxurious-Cheap, Technological-Traditional, Pleasurable-Resistant

Perceptual Vocabulary	Sample Number					
	1	2	3	4	5	6
Comfortable—Depressing	4.25	2.85	4.05	4.2	3.2	4.4
Hygienic—Dirty	5.15	3.15	3.95	2.25	2.4	3.65
Safe—Dangerous	3.45	4.1	3.75	2.7	1.3	3.55
Simple—Complex	3.2	4.05	2.55	2.4	1.45	3.35
Light—Bulky	5.05	3.45	2.95	1.15	1.1	4.1
Advanced—Backward	5	2.3	2.35	1.7	1.75	3.4
Warm—Cold	4.55	2.35	2.45	3.45	3.4	3.65
Luxurious—Cheap	5.1	3.05	2.7	1.85	4.25	4.5
Technological—Traditional	5.7	2.9	1.75	3.75	3.35	3.5
Pleasurable—Resistant	4.4	2.15	2.5	2.15	3.35	4

Figure 1. Emotional vocabulary.

4.2.4 Extract product design elements.

By combining the semantic analysis of the above samples, it is concluded that the lines and main functions of the product appearance will directly affect the user's perception.

4.2.5 Perceptual expression of product intention vocabulary and its application.

In summary, the core elements of the design of household clothing sterilizers have been established[6]. The design elements obtained after decomposition are rounded corners, planes, straight lines, and rounded and stable structures. In the expression between perceptual words

and design elements, perceptual words are used as invariants, and design elements are used as variables. The numerical value of the relationship between the two is shown in the figure. The values in the figure reflect the different degrees of importance of design elements to perceptual words. Among them, 10 groups of perceptual words are numbered 1-10, with each design element on the left. "+" indicates the degree of influence of positive words, and "-" indicates the degree of influence of reverse words (Figure 2).

	1	2	3	4	5	6	7	8	9	10
Rounded Corners	+	−					+			+
Flat			+	+	+		+			
Straight Line			+					+	−	
Mellow	+					+			+	+
Stable Structure		−		+	+	−	−	+		−

Figure 2. Vector diagrams**.**

It can be seen that products with more rounded corners are more comfortable and give users a pleasant and warm feeling; flat products give users a higher sense of security and look intuitive, easy to use, simple, and lightweight; linear products also have high safety Sexy, at the same time, it also has the characteristics of luxury and tradition; products with a rounded overall shape not only bring comfortable feeling to users, but also have advanced and high-tech features; products with stable structure have the disadvantage of being cold, but at the same time Can eliminate user resistance. After analyzing the users' emotional needs for warmth, safety, simplicity, intuition, and ease of use, the design elements that should be used are rounded corners, roundness, and planes.

5 Design practice

Based on the above analysis, the product should have rounded corners, roundness, and plane characteristics. Integrate these into the design of the product and make the following design:

5.1 Overall product picture

The entire product adopts a warm white tone (Figure 3) to reduce the cold feeling and better integrate into the home environment. All turning corners are designed with large rounded corners, taking into account safety and improving user-friendliness. There is a purple germicidal lamp and a clothes hanger on the top of the product. (Figure 4). A flat-panel storage shelf is set at the bottom of the interior to facilitate the placement of other items. An air outlet is provided under the shelf to help clean odors. The rotary button on the top of the exterior of the product can be used to set the sterilization time and degree. The middle LED screen displays the current working mode. Including the remaining disinfection time, disinfection intensity, and disinfection mode. There is an aromatherapy box at the bottom, where you can replace your favorite aromatherapy tablets.

Figure 3. Not working

Figure 4. Working state.

5.2 Product details

A child lock mode is set above the external display of the product (Figure 5). Considering the height of children, this function is set on the top of the product to prevent children from accidentally touching it and improve product safety.

Figure 5. UV Light.

6 Conclusion

This article stands from the perspective of health protection. By using the knowledge of emotional engineering, the functions and design, and analysis of the product and appearance design of household clothing disinfection machines are studied and analyzed. , And choose UV sterilization technology as the disinfection method of this product, not only to meet the needs of clothing disinfection function in the family scene, but also to improve the safety of the product, enhance the user's experience of disinfection in clothing at home, combined with perceptual engineering methods Design the appearance of the product, optimize the product experience, and finally design this model that is in line with the background of the times, is suitable for the use of scenarios, and meets the user's expected household clothing disinfection machine.

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