# Discussion on Product Renewal Design Technology and Method – Taking University Dormitory Bed as an Example

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**Abstract.** By using the method of Kansei engineering and taking the demand of consumers as the first factor, this paper discusses the updating design technology and method of the product with the example about dormitory bed in the university to meet higher requirements according to the consumers' preferences. First of all, through preliminary investigation and analysis, the problems existing in college dormitory beds are obtained. The research method of Kansei engineering is used to update the design of dormitory beds in combination with SPSS software and computer-aided design software to try to establish a universal design technology and method suitable for various types of products. Experiments show that this method can be used to guide the updating of product manufacturing design and make the product further meet consumer requirement and market trend.

**Keywords:** product design · update design · Kansei Engineering

## 1  Introduction

Design is an engineering project with systematization, which can meet users' needs and solve their problems. Using an updated design approach for product iteration can lead the development of the product market to a better situation [1]. Most of the product design techniques and methods have a unified and standardized process, but with the progress and development of society, consumers' demand functions will show a diversified and rising trend [2]. Kansei engineering connects the concept of sensual emotions with engineering.This design concept is in line with the current consumer demand-driven market trend [3]. So how to update the design of finished products will be a effective way to improve product competitiveness and increase product audience. Kansei engineering links sensual emotions with the concept of engineering, and its design concept is in line with the current consumer demand-oriented market trend [4]. The use of Kansei engineering approach to product design can reduce errors in the design process which caused by incompatible design concepts, or reduce the exploration and complexity of the design [5]. Therefore, this paper takes the dormitory bed of college as an example to explore the feasibility and effectiveness of the product renewal design technology and method used in this paper. Mentality of designing.

## 1.1   Design Sense

The current product market has been close to saturation, many products have similar functions and shapes, but there also have many problems. This paper take the example of college dormitory beds to discuss the renewal design technology and method, this paper also hopes to open up a renewal design path suitable for a variety of the same type of products. This paper mainly uses the research method of Kansei engineering, which can objectively present the performance of important elements in the product design process and take consumer preference as the first factor of production [6]. The updated design based on this method can better meet the emotional needs of consumers and make the product better cater to the market.

## 1.2   Kansei Engineering

Kansei engineering was originally proposed by researchers at the Faculty of Engineering, Hiroshima University, Japan. They incorporated the residents' emotions and desires into the housing design, thus giving rise to "emotional engineering", the predecessor of "Kansei engineering" [7]. Later, kansei Engineering was discovered by more and more researchers because it was applied to car design. As a technology combining kansei and engineering, kansei engineering is mainly used to analyze people's emotional feelings and apply it to the field of design [8]. The main purpose of Kansei engineering is to establish the connection between perceptual intention and product attributes, and transform people's fuzzy perceptual feelings towards products into product design elements, so as to better guide product design.

## 1.3   Design Flow

Currently, most of our universities use bunk beds. According to the preliminary investigation, there are still many problems need to be improved, the biggest aspect is functional and experiential. Functional problems include improper region configuration and insufficient storage space. Experience issues include appearance, color incongruity, and small space. Dormitory bed not only to solve students' daily study or life problems, but also from the perspective of the manufacturer, how to reduce the cost, get the most market favor degree. The research method of Kansei Engineering can directly obtain users' perception intention of products. The first step is to understand the basic nature and characteristics of the product. Have a comprehensive understanding of the product, followed by selecting a sufficient number of sample photos and their related perceptual words, and finally using focus groups, expert interviews and other methods to filter and match the pictures and words. Then make a questionnaire and import it into SPSS software. Finally, according to the research results, the design elements that can affect users' feelings are obtained. Using these design elements and computer-aided design, the design of dormitory beds can be innovated.
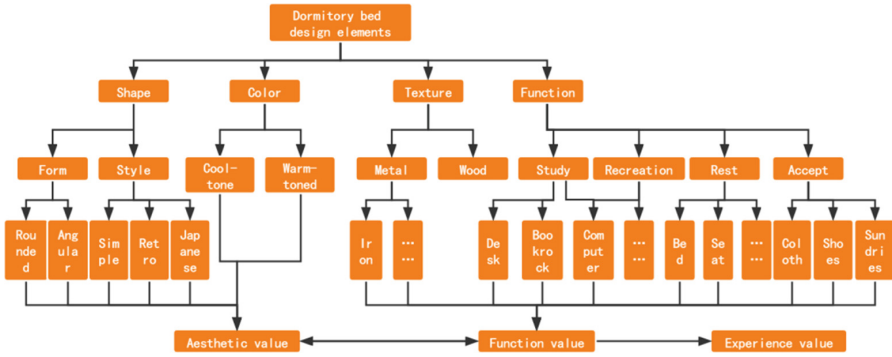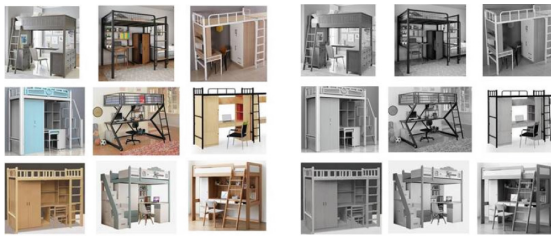
**Fig. 1.** Analysis of product design elements.



**Fig. 2.** Comparison before and after fading

## 2 Experiment and Design of Dormitory Bed Emotion Intention

### 2.1 Analysis of Product Design Elements

Referring to Fig. 1, it can be seen from the design element analysis table that the design of dormitory beds can be divided into four aspects, namely shape, color, material and function. It also can be subdivided into many smaller categories [9]. Finally, according to the semantics of design elements, it can be summarized into three aspects: aesthetic value, functional value and experience value.

### 2.2 The Date Collection

#### 2.2.1 The Sample Collection

Pictures of 100 dormitory beds were obtained through websites, books, and field research. Based on the collected samples, blurred images and images with wrong angles are eliminated, and similar images are filtered. In the end, nine typical samples were obtained. In order to ensure the influence of color and material on the feelings of respondents in the follow-up questionnaire survey, the selected 9 samples were treated with fading [10], Refer to Fig. 2.

**Table 1.** A selection of sensible words and phrases

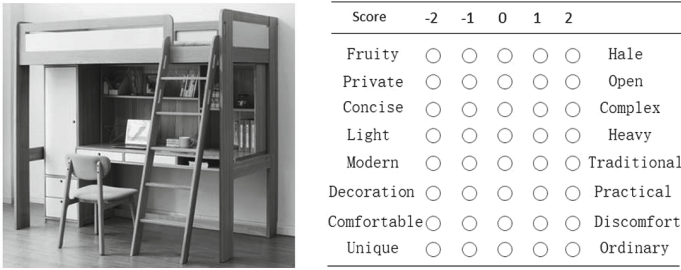| Aesthetic value | | | Experience value | | | Function value | |
|---|---|---|---|---|---|---|---|
| Fruity | Modern | unique | private | Light | Confortable | Concise | Decoration |
| - | - | - | - | - | - | - | - |
| hale | traditional | ordinary | open | heavy | discomfort | complex | practical |



**Fig. 3.** Sample questionnaire.

### 2.2.2 The Establishment of Perceptual Lexicon

When users use dormitory bed, they will have a lot of feelings about the product, Therefore, we collected a large number of adjectives through books, consultation with experts, and Internet queries. In order to ensure the accuracy of the subsequent word selection, the collected word models were deleted and combined to obtain the most suitable adjectives for describing dormitory beds. Finally eight groups of words were left after discussion with professionals, as shown in Table 1.

The eight selected words belong to aesthetic value, experiential value and functional value respectively. Next, the filtered images are matched with words, and making questionnaire.

### 2.2.3 The Questionnaire Design

Use semantic difference method to match the filtered words with the filtered images one by one. Sample numbering of images and creation of a 5-point scale. The value can be −2, −1, 0, 1, or 2. −2 corresponds to the perceptual word on the left, 2 corresponds to the perceptual word on the right [11]. Questionnaire fillers select their own tendencies according to their feelings towards the picture sample and give the score. For the specific questionnaire, please refer to Fig. 3.

### 2.2.4 The Date Analysis

According to the results and data statistics of the questionnaire, the average score of perceptual words of typical samples is obtained, as shown in Table 2.

**Table 2.** Abersgr vslues of perceptual words in sample

|    | Intimate | Simple | Fruity | Light | Modern | Unique | Decorate | Comfort |
|----|----------|--------|--------|-------|--------|--------|----------|---------|
| Y1 | 0.61 | −1.27 | 0.56 | −1.24 | −1.44 | −0.02 | 0.80 | −0.73 |
| Y2 | 0.49 | 0.12 | 0.61 | 1.02 | 0.88 | 1.41 | 1.22 | 0.15 |
| Y3 | −0.39 | 0.32 | −0.20 | 0.61 | −1.05 | 0.02 | 0.54 | −1.12 |
| Y4 | 0.66 | −0.90 | −0.66 | −0.24 | −1.00 | −0.07 | 0.78 | −1.07 |
| Y5 | 1.49 | −1.27 | 1.02 | −1.54 | −1.41 | −1.46 | −0.41 | 0.22 |
| Y6 | 0.88 | −1.32 | 1.10 | −0.93 | 0.27 | 1.20 | 0.85 | 0.20 |
| Y7 | −1.05 | −0.29 | 0.41 | 0.34 | −0.17 | 0.59 | 0.98 | −0.49 |
| Y8 | 0.10 | −0.27 | −0.12 | 0.07 | −0.41 | 0.34 | 0.85 | −0.68 |
| Y9 | −0.76 | 0.32 | 0.32 | 0.17 | −0.78 | −0.44 | 0.73 | −1.17 |

**Table 3.** Cofactor variance table.

|    | Initial | Extract |
|----|---------|---------|
| Private – Open | 1.000 | 0.711 |
| Concise– Complex | 1.000 | 0.740 |
| Fruity – Hale | 1.000 | 0.683 |
| Light – Heavy | 1.000 | 0.884 |
| Modern – Traditional | 1.000 | 0.952 |
| Unique – Ordinary | 1.000 | 0.887 |
| Decoratiom - Practical | 1.000 | 0.771 |
| Comfortable – Uncomfoetablr | 1.000 | 0.895 |

Import the typical sample vocabulary average value into SPSS software, and use dimensionality reduction in SPSS software to perform factor analysis and principal component analysis. Then the common factor variance table can be obtained. The common factor variance table indicates the interpretation of the original information about the variable by the extracted common factors and the extent to which they achieve. The more the extracted values close to one, the more valid the factor analysis of this variable. According to Table 4. it can be seen that the extraction values are between 0.638 and 0.952. Therefore the results of the factor analysis are valid.

Through the explanation of the total variance diagram and according to Fig. 4, we can see that the number of components with eigenvalues greater than 1 is two, and it has a significant change in slope. The first and second eigenvalues are much greater than 1. The third component has an eigenvalue less than 1 and is located at a distinct inflection point. Therefore, we take two principal components, Principal component one and principal component two. In addition, it can be seen from Table 5 that the contribution value

**Table 4.** Total variance interpretation table.

| composition | Initial eigenvalue | | | Extract the sum of squares of loads | | |
|---|---|---|---|---|---|---|
| | Total | Percentage of variance | The cumulative | Total | Percentage of variance | The cumulative |
| 1 | 3.907 | 48.838 | 48.838 | 3.907 | 48.838 | 48.838 |
| 2 | 2.616 | 32.969 | 81.534 | 2.616 | 32.696 | 81.534 |
| 3 | 0.818 | 10.222 | 91.756 | | | |
| 4 | 0.475 | 5.940 | 97.696 | | | |
| 5 | 0.104 | 1.297 | 98.993 | | | |
| 6 | 0.045 | 0.559 | 99.552 | | | |
| 7 | 0.030 | 0.381 | 99.933 | | | |
| 8 | 0.005 | 0.067 | 100.00 | | | |
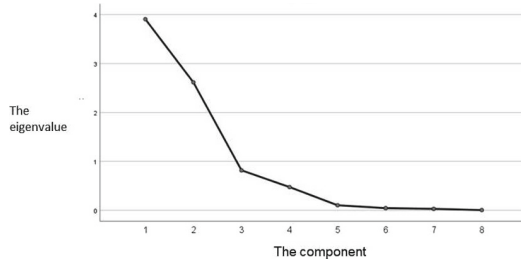


**Fig. 4.** Gravel figure.

**Table 5.** Component matrix.

| | 1 | 2 |
|---|---|---|
| Private – Open | −0.770 | 0.343 |
| Concise– Complex | 0.819 | −0.262 |
| Fruity – Hale | −0.482 | 0.671 |
| Light – Heavy | 0.940 | −0.012 |
| Modern – Traditional | 0.554 | 0.803 |
| Unique – Ordinary | 0.631 | 0.699 |
| Decoratiom - Practical | 0.808 | 0.345 |
| Comfortable – Uncomfoetablr | −0.412 | 0.851 |

of the first two variances accounts for 81.534%. Therefore, the extraction of principal components is correct.

**Fig. 5.** Dormitory bed renewal design.

According to the component matrix in Table 5., the top two perceptual words in principal component 1 are "light - heavy" and "concise - complex", And the top two components of principal component 2 are "comfortable - discomfort" and "modern - traditional".

Through summary and analysis, it can finally be concluded that the most perceptual words which can influence the dormitory bed are light, simple, comfortable and modern. The four words will guide the subsequent design updates.

## 3   Kansei Engineering Guides Innovative Design

According to the previous article, it can be found that the most important thing about the innovative design of university dormitory beds is light, simple, comfortable and modern. Therefore, the design process should reduce the volume of the dormitory bed to create the feeling of lightness; And Simplify the design content, it should not design overly complex features; In the overall style it should be modern and minimalistic. After the overall improvement and update of the design, it should give a comfortable viewing experience, appropriate experience feeling. According to all the above design requirements, the dormitory bed is updated by using computer aided design, and the general intention is shown in Fig. 5.

## 4   Conclusion

The above experimental design result shows that taking the perceptual demand of consumers as the most important factor of production can make the products designed and manufactured more favored by consumers. The updated design of the product can disassemble the product into different production factors. After questionnaire survey, data analysis software is used to obtain the factors that most affect the use of the product and refine them. In the later design and manufacturing process, the mining and upgrading of this factor is emphasized. On the whole, kansei engineering can provide a clear direction and idea for product design and manufacturing update, and this method can be applied to more different products.

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