Improvement Strategies of Children's Toys Based on Sensitive Engineering and Kano Model—Target Children Aged 3-6 in China

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Abstract: With the continuous development of society and the continuous popularization of children's education, people pay more attention to children's training at this stage. Children aged 3-6 years belong to early childhood. During this period, children's body and mind are in a state of continuous development. Children's toys can actively guide children to understand things and help improve their physical and mental development. Based on the KANO model, this study understands the needs of users for toys at this stage, so as to combine the research methods of perceptual engineering to establish a connection between the product's perceptual semantics and the sample library, and finally summarizes the toy design needs suitable for children aged 3-6 years, providing relevant ideas for relevant designers, so that it is desirable to design and develop toys more conducive to children aged 3-6 years.

1. Introduction

At this stage, according to the statistics of the United Nations, the global annual population growth is about 85 million.

With the continuous decline of fertility in the world, some countries have also introduced a series of policies to encourage fertility. And with the continuous development of society and the continuous improvement of living material conditions, the cultivation of healthy children has become an important topic in today's society. In the current market, the design of children's toys is becoming more and more diversified, but there is a lack of consideration for users' emotions.

The design of children's toys should pay more attention to the development and design from the emotional perspective of children, so as to develop more suitable toys for children.

2. Behavior and Psychological Analysis of Children Aged 3-6

According to the development psychology of the United Nations World Health Organization, children aged 3-6 years are in early childhood. During this period, children's body muscles developed rapidly, and their small muscles developed slowly. They could do some fine activities slowly, and their behaviors were active and fun. [1] Psychologically, children's brains in this period

are like a blank sheet of paper, showing strong curiosity, full of interest in everything and good at imitation. Children in this period have strong learning ability and need proper guidance to help them establish correct cognitive concepts[2].

The influence of family on children at this stage is very profound, and the role of parents is of great significance in children's early education. However, parents play many social roles in society, and children's behavior and psychology will be affected by parents, and this influence is not static (Table 1).

Table 1: Influence relationship.
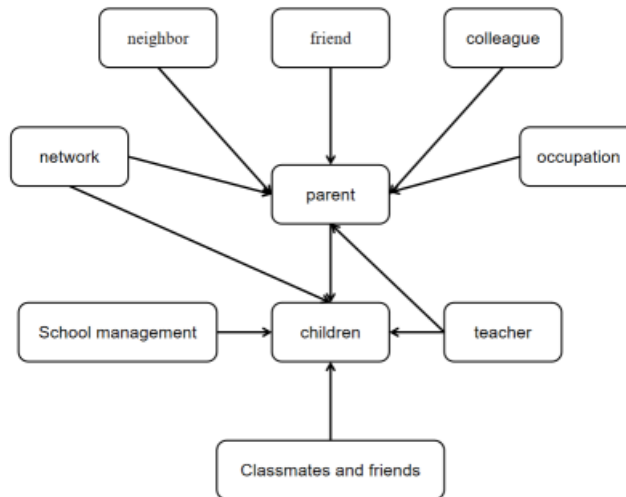
3. Design ideas and methods of children's toys

3.1. User analysis based on Kano model

The kano model was invented by Professor Shono of Japan. It is a tool for user needs, classification and prioritization.

According to Don Norman's Design Psychology, human emotional system consists of instinct, behavior and reflection.

Instinct layer refers to the feeling of the five senses. In the design of products, it is mainly reflected in the appearance, weight, materials, etc. This kind of experience is called sensory experience. The behavioral layer refers to the feedback to users through the instinctive level, and the next action that users decide to take is the interactive experience. Reflection is the unique relationship between users and products. It is the emotional experience that users get from products. It emphasizes that design should be carried out around these three levels[3].

This paper investigates and analyzes users' satisfaction with various aspects of children's toys, extracts design elements that meet users' needs, and improves users' experience. According to users' satisfaction with product features, users' satisfaction is sorted into five levels, namely, basic type (M), expected type (O), excited type (A), undifferentiated type (I), and reverse type (R). So as to provide direction for the future development of children's toys (Figure 1).
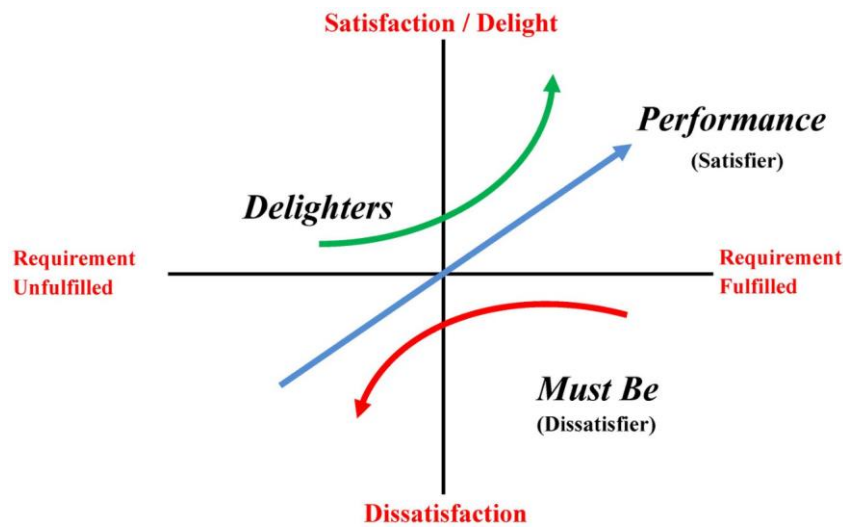
Figure 1: Kano model curve

3.2. Demand acquisition of target population

Through literature review, research and analysis, eight key needs for toys for children aged 3-6 were sorted out and classified[4], and each need was classified according to sensory experience, interactive experience and emotional experience (Table 2).

Table 2: Classification of children's toys demand.

Range	Demand	Serial no
Emotional experience	The image of entertaining education	S1
	Children's preferences	S2
Interactive experience	Enrich knowledge and develop intelligence	S3
	Simple operation	S4
	Perform simple movements, dances	S5
	Randomly record the growth process of children	S6
Sensory experience	Cartoon image appearance	S7
	Environmental protection and sustainability of materials	S8

Considering that children aged 3-6 could not complete the survey independently, parents were selected to assist in completing the survey. Parents of children aged 3-6 in China were sampled. Questioning the respondents with questionnaires or interviews. In order to make the survey more universal, boys and girls will be randomly selected. The respondents' evaluation of a certain demand is divided into five levels: very like, taken for granted, average, tolerable, and annoying. The corresponding score is 5, 4, 3, 2, and 1. The priority of each demand is ranked according to the user's satisfaction with each demand of the product, and the relationship between user demand and product quality characteristics is obtained. A total of 100 users were investigated, and 97 valid questionnaires were finally collected, with a recovery rate of 97%.

3.3. Data sorting

By sorting out the collected data, the maximum value of the characteristics corresponding to a certain experience collected is used as the product characteristics of this product. For example, for cartoon characters, the excitement type (A) parameter collected is 39%. Then, cartoon image can be considered as exciting (A) demand. The statistical results are shown in Table 3.

Table 3: Statistics of demand data.

Serial No	KANO Model Attribute Classification							classification
	A%	O%	M%	I%	R%	Better	Worse	
S1	37.2	12.3	38.5	10.6	0.4	0.5	0.5	M
S2	12.4	13.9	51.8	21.9	0	0.3	0.7	M
S3	10.5	23.2	46.7	19.6	0	0.4	0.7	M
S4	9.8	25.4	33.9	30.9	0	0.4	0.6	M
S5	40.7	28.7	22.1	8.1	0.4	0.7	0.5	A
S6	13.2	39.7	20.4	26.7	0	0.5	0.6	O
S7	29.3	40.2	20.9	9.6	0	0.7	0.6	O
S8	14.8	9.7	21.5	35.6	18.4	0.3	0.4	I

To sort the priority of each attribute. Use the Better Worse coefficient to calculate the absolute values of Better and Worse[5]of the eight items S1~S8:

$$\text{Better} = \frac{(A+O)}{(A+O+M+I)} \tag{1}$$

$$\text{Worse} = -1 * \frac{(M+O)}{(A+O+M+I)} \tag{2}$$

After calculating the average value of Better and Worse (0.46,0.58) as S1~S8, take (0.46,0.58) as the origin, and take the absolute value of Better and Worse as the abscissa and ordinate of the coordinate system to draw the sensitivity matrix coordinate map. So that the data can be displayed more clearly, see (coordinate map). "R indicates the degree of influence of each requirement on the use of users. The larger the" R "value, the greater the influence of this requirement on users. Therefore, the importance of each requirement to users can be determined by the value of "R"[6] (Figure 2).
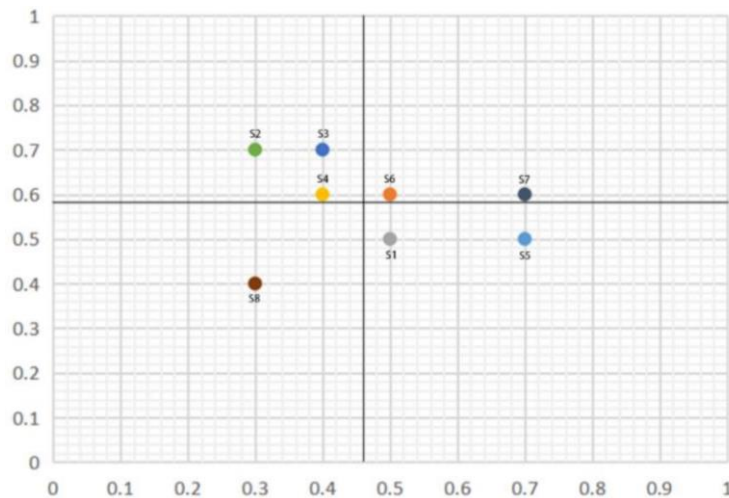

Figure 2: Sensitivity Matrix.

3.4. Analysis of research results

According to the survey and analysis, among the eight service needs, there are two expected needs: "random recording of children's growth process" and "cartoon image appearance"; There are three "children's preferences", "enrich knowledge, develop intelligence" and "simple operation" in the excitement demand; In the basic needs, there are two "images of entertainment education" and "simple movements and dances"; There is a total of "environmental protection and sustainability of materials" in the same demand.

It is sorted by the demand level of basic demand>eager demand>excited demand> undifferentiated demand. According to the sorting of the sensitivity matrix coordinate map, simple actions and dances>images of entertainment education>cartoon image appearance>random recording of children's growth process>children's preferences>rich knowledge, expand intelligence>simple operation>environmentally sustainable materials.

From the above analysis, we can see that the public believes that entertainment and education are essential service needs for children's toys. Enriching knowledge, expanding intelligence, children's preferences, and simple operation are exciting needs, which have positive feelings for users. Excitement demand belongs to surprise service. Although this kind of service will not affect users' satisfaction with the product, it will greatly improve the user experience if there is such demand. Therefore, in terms of product design, we should try our best to meet users' exciting needs [7].

4. Children's Toy Design Based on Kansei Engineering

4.1. Specific processes

4.1.1. Extract perceptual vocabulary

The perceptual vocabulary is collected through literature review, actual research, network collection and other methods, and finally determined through the following steps[8].

4.1.2. Preliminary screening

According to simple actions, images of dance and entertainment education, appearance of cartoon images, random records of children's growth process, children's preferences, rich knowledge, intelligence development, simple operation, a total of 100 perceptual words were collected, the similar meanings of words in the 100 perceptual words were removed, and 36 representative perceptual words were preliminarily screened[9].

4.1.3. Final screening

36 perceptual words were collected into a questionnaire, and 25 design related technicians and 25 families' children and parents were invited to participate in the questionnaire. After the survey, 6 perceptual words were obtained and matched with corresponding antonyms. The words were as follows: intelligent traditional, educational ordinary, interactive rigid, warm cold, steady light, simple complicated[10].

4.2. Establish perceptual sample library

Through product research, online media and other channels, we collected photos of children's toys and other related products, collected 50 kinds of children's toys, and used kj method to evaluate and analyze, finally selected the six most representative products (Table 4).

Table 4: Product case diagram.

1	2	3	4	5	6

4.3. Questionnaire design based on semantic difference method

The collected pictures of six product cases were numbered 1-6, and six groups of perceptual words were combined with the product cases to make a questionnaire using semantic difference method. The perceptual values are respectively 3, 2, 1, 0, - 1, - 2, and - 3. The respondents rate the products according to their own perceptual perception. A total of 100 questionnaires were issued and 95 valid questionnaires were recovered. The data chart is as follows (Table 5).

Table 5: Cognitive semantic evaluation.
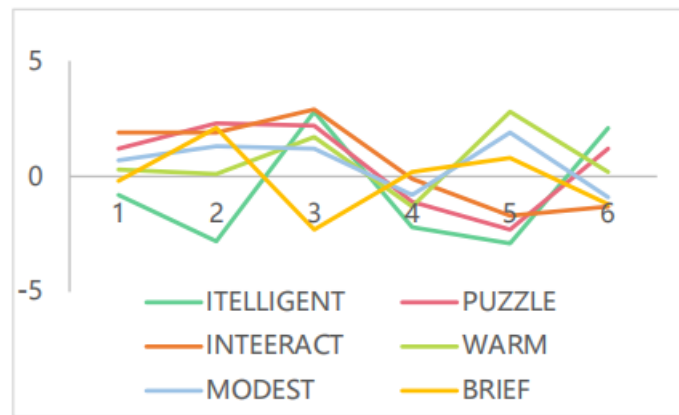
4.4. Data analysis

Through the analysis of the perceptual vocabulary of the product case, the "intelligent" perceptual vocabulary of No. 3 product is at the highest point of the ordinate, which shows that the intelligent robot dog is more intelligent in the user's cognition. It can be seen from the abscissa that the products No. 2 and No. 3 are highly evaluated for the perceptual vocabulary of "puzzle". The intelligent robot dog and building blocks are beneficial to children's intellectual development. "Interaction" corresponds to No. 3 product. The corresponding product of "Warm" is No. 5 product. "Steady" corresponds to No. 3 product. "Simplicity" corresponds to No. 2 product. Compared with other products, the appearance and color of No. 2 product is simpler, without complicated appearance details.

4.5. The relationship between kano model and kansei engineering

The user needs are associated with product cases and perceptual semantics, as follows in Figure 3:
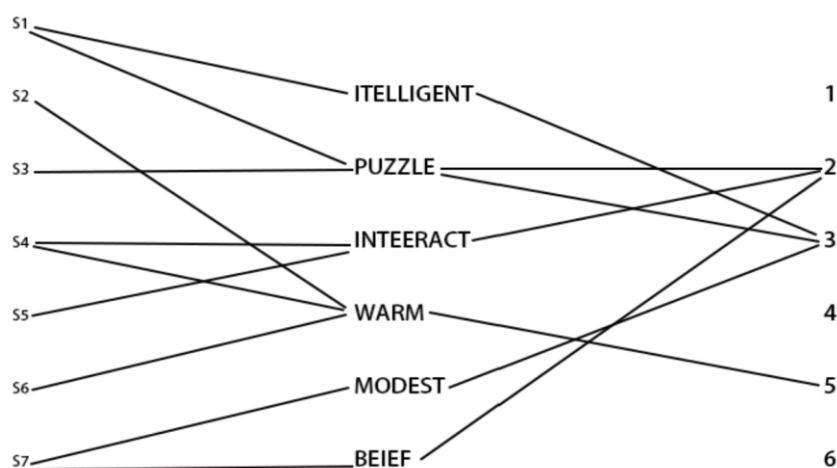
Figure 3: Connection of user needs, product cases and perceptual semantics.

5. Summary

It is concluded from the above experiments that No. 2 and No. 3 products meet the instinctive level needs of users. Designers should take No. 2 and No. 3 products as a reference to extract key elements for instinctive level design. The products that meet the needs of product behavior level and emotion level are No. 2, No. 3 and No. 5 products. When developing products, designers should refer to the key elements extracted from No. 2, No. 3 and No. 5 products to design behavior level and emotion level.

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