Research on Design Style of Cartoon Medical Science Interface Based on Kansei Engineering

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Abstract. In this study, we analyzed the relationship between user's liking for medical science comics and their design elements and design styles based on Kansei Engineering method, and explored what styles were more popular, what style was more relevant to medical treatment and popular science. This study aim to inspire the design of medical science comics. Focus group method was used at the start stage. A survey based on questionnaire was utilized in the research and quantitative analysis was conducted. Results indicate that, (1) in the style of comics, the correlation between the style of exquisite and rough and the degree of user's affection is the highest; (2) the highest correlation with medical treatment is the style of complex and simple, and the highest correlation with science is the style of simple and gorgeous, complex and simple, and serious and lively; (3) the correlation between medical, popular science, and favorite degree is relatively low. The findings will have a certain reference role in the design of future medical science comics.

Keywords: Design style · Cartoon medical science interface ·
Kansei Engineering

1 Introduction

Nowadays, with people's improved health awareness and the developed Internet, more and more people are hoping to contact, understand and learn general knowledge of medical science via the Internet [1]. Meanwhile, as the general knowledge of medical science needs to be realized through user interface, different styles of interfaces will make users experience differently, and have an influence on their liking. However, the users' needs are usually seldom considered in the design of medical science interactive interface at present, therefore, it has been more and more urgent to discuss the design style of general medical science interface, and improve its user experience. Many users choose products through their perceptual judgement, while perceptivity is difficult to be explained. Nevertheless, in recent years, Kansei Engineering, an analytical method quantitatively studying the perceptual factors in a rational way of engineering, makes design more humanized [2], which can measure perceptual elements. Bai [3] has developed his idea and designed through Kansei Engineering by taking an air purifier as a practical case, and achieved good results. In this paper, we aimed to sum up the

comic styles of general medical science interface with better user experience which are favored by people through Kansei Engineering.

Currently, many scholars have done relative research on animated medical science interface design. Xu [4] started from the aspects of creativity, styling and expression techniques of medical science comics, and analyzed his creation. Yang, Chen, etc. [5] stimulated the interest of young people in scientific knowledge by integrating the emotional concept into the innovative design of the interactive interface of popular science exhibits, and achieved the goal of emotional education. Guo [6] explained the design of popular science interface, including interactive mode, art style setting and page layout elements. Combined with the current domestic and international popular science design, the interactive interface design of network science was discussed.

However, the existing literatures are focusing on the related creative approaches such as expression mode and interactive mode of designing medical science interactive interface, as well as cartoons of popular medical science, lacking relevant targeted research on the interactive interface style of animated medical science which has a great effect on the cognition and experience of users, influencing their cognition and acceptance of relevant knowledge. Therefore, we aimed to sum up the comic styles of general medical science interface with better user experience which are popular among people through Kansei Engineering.

2 Relative Definitions

2.1 Kansei Engineering

The term of Kansei Engineering" was first proposed by Kenichi Yamamoto, the former master of MAZDA Automobile Group, in his lecture with the title of "Theory of Automobile Culture" in University of Michigan, USA in 1986 [7]. Kansei Engineering, as a research method, mainly converts the feeling and affection need that are difficult to be measured by users, into visual design elements for combining "human" sensibility with the design features of "objects", to satisfy the emotional needs of consumers. Its core idea is emotion quantification and image analysis [8].

In terms of Kansei Engineering research, Zhang and Huang [9] proposed an innovative design framework for furniture modeling based on the inferential Kansei Engineering of forward quantification via their analysis on the necessity of Kansei Engineering applied to the innovative design of furniture; and they also provided a quite good guidance for the furniture design later on by combination with the innovative design of new Chinese-style sofa modeling.

In this paper, the research objective is mainly about the styles of cartoon medical science interface, and it is also a quantitative study on users' abstract and vague feeling of different-style medical science comics through Kansei Engineering, which can be converted into visual design elements, so as to get the styles that are favored by users and most consistent with the interface of animated medical science.

2.2 Degree of Liking

Liking can be viewed as an attitude, and this attitude will influence purchase decision direction and behavior, making consumers the behavioral tendency to buy specific products or not to buy other products [10]. Degree of liking means users' preference for product forms or functions in their subjective feeling, which may be dependent on many factors such as user's personal experience, characteristics of a product itself, and the environment of using product. It is a perceptual judgement.

In this research, degree of liking refers to users' judgement of preference for the design style of cartoon science interface according to their personal subjective factors. Through degree of liking, the popularity and acceptability of various cartoon styles among users can be evaluated.

3 Research Process

3.1 Method

"Focus Group", as a research method, refers to material collection for the specific topic prepared by researchers through communicative dialogue among team members [11]. At present, this method is widely applied in multiple research fields including user experience (UE).

In this research, the approach of focus group was used to collect cartoon pictures and adjectives, and initially classify them according to their characteristics. All members of the focus group screened samples together to identify samples of cartoon features and the appropriate samples of adjective pairs for discussing in group, drafting and revising the questionnaire. Later, a survey based on questionnaire was utilized in the research and quantitative analysis was conducted.

3.2 Research Process

The research process includes several stages. First, picture samples and adjective-pair Kansei words were collected to screen and classify, and representative samples for deconstructing the cartoon samples were determined. Then, a survey based on questionnaires was conducted to investigate the degree of liking and adjective-pair matching degree of sample cartoons. Later, the data quantitative was analyzed questionnaire results, while an experiment was conducted to verify the relationship between questionnaire results, degree of liking and cartoon design elements. (As shown in Fig. 1)

3.3 Selection of Experimental Samples

As the factor determining the design style of cartoon medical science interface is mainly the style of cartoon itself, more than 130 cartoon pictures were collected as the initial samples by random and relative personal subjective factors were collected via the internet. A focus group composed by designers and medical students were set up to classify all cartoon samples according to their overall styles. These cartoon samples
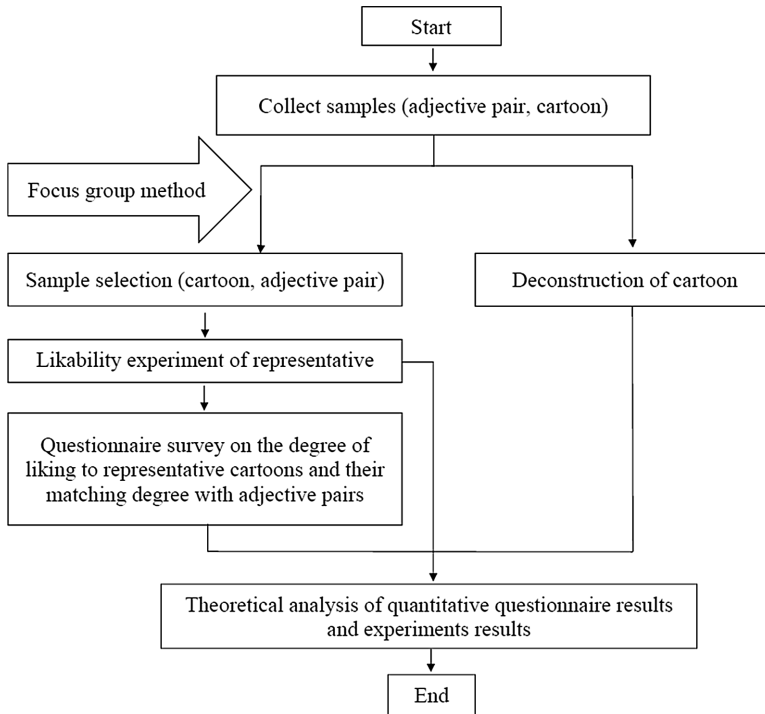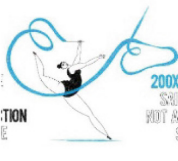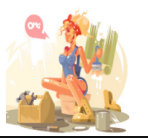
Fig. 1. Research process

were divided into 5 kinds of styles, including 3d style (4 samples, 2%), flat style (30 samples, 22%), linear style (23 samples, 17%), linear combined with flat style(30 samples, 22%), and painting style (52 samples, 37%).

Then samples were determined according to the number of samples represented in each category based on its percentage [12], and the number of featured samples should cover the classification of each sample. Thus 10 featured samples was taken into research in the next survey. According to results of collected cartoon classification, the featured samples include 1 piece of 3d style, 2 pieces of flat style and linear style each, 2 pieces of linear combined with flat style, and 3 pieces of painting style, which are shown in Table 1.

One hundred adjective pairs were randomly collected without difference. The focus group was also used to eliminate those adjective pairs irrelevant to the mental feelings arisen from cartoon styles, and then these adjective pairs suitable for this research were selected. In addition, the adjective pairs 'medical-non medical' and 'popular science-non popular science' which are targeted at popular medical science were added on purpose. Later, the adjective pairs were screened according to the possible mental feelings of users, in order to deprive these adjectives of commendatory or derogatory tendency for reducing interference. Thus the following adjective pairs are determined into next survey research: plain-gorgeous, cold-warm, exquisite-rude, beautiful-ugly

Table 1. Cartoon representatives

Picture 1 (S1)	Picture 2 (S2)	Picture 3 (S3)	Picture 4 (S4)	Picture 5 (S5)
Picture 6 (S6)	Picture 7 (S7)	Picture 8 (S8)	Picture 9 (S9)	Picture 10 (S10)

cute, solemn-lively, classical-modern, round-rigid, complex-simple. At last, the adjective pair "like-dislike" was intentionally added to evaluate the users' attitudes.

3.4   Questionnaire Survey of Cartoon Preference

Ten pictures selected by the focus group in the early stage with ten pairs of adjectives were combined together in a questionnaire to analyze them by five-section scale of Likert scale with a score of −2 to 2 to investigate users' feelings and degrees of liking to different pictures. In total, one hundred and six copies of the questionnaire were actually collected and analyzed. Judging from the reliability analysis of the questionnaire, the Cronbach coefficient is over 0.7 ($p < 0.05$), which shows the questionnaire is reliable (Table 2).
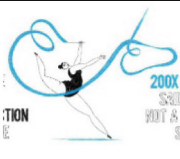
Table 2. Reliability statistics
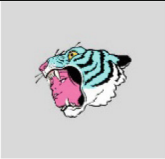
Cronbach coefficient	Cronbach coefficient based on standardized project	Items
0.700	0.798	106

Results of questionnaire survey showed that those people between 18 and 25 accounted for 88.57%, and undergraduates accounted for 90.48%. It can be basically thought that the majority of respondents to the questionnaire are college students, which is of great reference significance to investigate the popularity of different styles of comic medical science interface among college students.

3.5   Deconstruction of Design Elements in Cartoon Styles and Test of Experimental Results

First, the cartoon styles are deconstructed as start. Cartoon styles can be divided into thick-line, thin-line, and non-linear ones according to the types of their lines. They can be divided into multiple-color and single-color ones in terms of how many colors are adopted. They can be divided into flat and stereoscopic ones on their stereoscope. Results of deconstruction are showed below in Table 3.

Table 3. Deconstruction of cartoons

Picture I (S1)	Picture II (S2)	Picture III (S3)	Picture IV (S4)	Picture V (S5)
Thin lines, stereoscope, and multiple colors	Thick lines, flat, and single color	Non-linear, stereoscope, and multiple colors	Thin lines, flat, and single color	Thick lines, flat, and single color
Picture VI (S6)	Picture VII (S7)	Picture VIII (S8)	Picture IX (S9)	Picture X (S10)
Non-linear, flat, and multiple colors	Non-linear, stereoscope, and multiple colors	Thin lines, stereoscope, and multiple colors	Non-linear, flat, and single color	Thin lines, stereoscope, and multiple colors

Considering the results of survey may be inaccurate due to too long questionnaires, too many questions, and other possible subjective reasons, these pictures were printed and numbered from 1 to 10 in order to verify results of questionnaire survey. Then, ten interviewees were asked to order these pictures according to how they like and dislike these pictures to show how much they like different style cartoons.

4 Quantitative Theoretic Analysis and Results

4.1 Analysis on Correlation of Questionnaire Results

Analysis on correlation of questionnaire results can figure out the pair of adjectives tightly related to how much the users like cartoons. Pearson correlation coefficient and P value of confidence are compared in the analysis on correlation. Correlation is significant when the confidence stands at 0.05 (double test).

The correlation coefficient in Table 4 indicates that the "elegant - rough" embraces the strongest correlation with how much people like cartoons, and the "beautiful–ugly" was the second. The "medical - non-medical", the "simple - gorgeous", and "popular science - non-popular-science" have weak correlation with how much they like cartoons. Users like elegant/warm/beautiful/modern/simple cartoons with the topic of medical popular science. Meanwhile it can be seen that how much the users like different cartoon styles impacts little on medicine and popular science.

Table 4. Correlation with how much the users like cartoons

Pairs of adjectives	Pearson correlation coefficient	P value of confidence
Popular science - non-popular-science	0.008	0.982
Medical - Non-medical	− 0.254	0.480
Simple - Gorgeous	0.022	0.952
Cold - Warm	0.694*	0.026
Elegant - Rough	− 0.751*	0.012
Beautiful - Ugly	− 0.715*	0.020
Serious - Lively	0.462	0.179
Classic - Modern	0.626	0.053
Round - Pointed	− 0.538	0.109
Complex - Simple	0.057	0.876

* $p < 0.05$

In addition, analysis on the relationship between other pairs of adjectives and popular science and medicine shows that users think that those with simplicity and popular science possess more features of cartoons involving medicine. They think that simple and serious style possesses more characteristics of cartoons with the theme of popular science.

4.2 Analysis on Correlation Between How Users like Cartoons and Deconstructed Elements

How much users like cartoons in different styles was calculated as from 1 point to 10 points according to results or survey. The average of points for each picture was calculated to reflect how much the users like it (Table 5).

Table 5. Evaluation of how much users like cartoons in different styles

Orders of pictures	S5	S1	S2	S4	S8	S10	S7	S3	S6	S9
Points	4.3	6.8	7.6	6.4	2.7	5.6	6.3	2.6	5.6	8.0

Results showed that users like picture 10 the most. Meanwhile, how much the users like other pictures is corresponding to results of questionnaires, which proves the confidence of questionnaire results.

Then, experiment results on how much the users love these cartoons are basically corresponding to those in the questionnaires, which proved high confidence of questionnaires.

How much the users like the deconstructed elements was ordered as follows in Table 6.

Table 6. Points of how much users like deconstructed elements

Orders	1	2	3	4	5	6	7
Sort	Pictures with single color	Picture with thick lines	Pictures in flat styles	Pictures with thin lines	Pictures with multiple colors	Pictures with stereoscopic style	Pictures with non-linear style
Average value	6.6	6.6	6.4	5.4	4.9	4.8	4.8

Results of research indicate that users like the pictures with thick lines, flat styles, and single color the most.

5   Design Application

A series of cartoons interfaces involving medical popular science were designed according to principles based on research and analysis as mentioned above (As shown in Fig. 2). In terms of style, thick lines and flat image form a contemporary style which gives people warmth, comfort, and freshness and caters to people's tastes on cartoon styles at present was applied in design. Warm colors can relieve people's discomfort brought by medicine, therefore warm colors were apply in design for the purpose. To make people feel comfort. In terms of lines design, thick lines make people feel secure and stable. Therefore, more curves are adopted by designers to express their emotions, which make them feel cordial.

Fig. 2. Part of cartoons interfaces involving medical popular science

6 Conclusions

With the development of the economic level, people pay more and more attention to health and medical knowledge. Comic Medicine Popularization Programs and APPs have attracted more and more attention as media that can be widely disseminated, but they are relevant because of their own professionalism. There is a lack of research in this area, which has led to the current comic medical APP interface design can not meet people's needs. In this paper, Kansei Engineering methods were utilized to explore people's perceptions of medical comics. First, focus group method were adopted to select representative carton images and adjective pairs from a more professional perspective to ensure professionalism of the results. Then, by quantitative analysis, the user's favorite medical science comic styles were explored. Results indicate that, (1) In the style of comics, the correlation between the style of exquisite and rough and the degree of user's affection is the highest; (2) The highest correlation with medical treatment is the style of complex and simple, and the highest correlation with science is the style of simple and gorgeous, complex and simple, and serious and lively; (3) The correlation between medical, popular science, and favorite degree is relatively low. Therefore, it is recommended to use these styles in cartoons involving medicine APP, which will be more popular. The findings will have a certain reference role in the design of future medical science comics.

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