

Integrated Optimized Design of Mobile Phone Interface Based on Human Factors Engineering

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ABSTRACT: Human factors engineering is a new rapidly developing interdisciplinary, which involves many subjects. Nowadays, with the continuous development of science and technology, mobile phone as a new medium has penetrated into people's daily life and work. As a platform of information exchange between human and machine, the mobile phone interface is now a new type of special and independent system which has beyond the scope of traditional interface design. The success of the web interface design is not just depends on its beautiful layout, harmonious color, and gorgeous animation effect, but also on its ease of use and people's acceptability. Practicability and artistic form of emotion is an eternal state of design. From a certain level, the continuous development and improvement of design is the continuous improvement of people's cognition, emotion and thought. Therefore, mobile phone interface is constructed by emotional design method, and human-machine interaction interface is perfected by applying human factors engineering knowledge.

KEYWORDS: Human factors engineering; Mobile phone interface; Human-machine interaction; Practicability; artistic form of emotion.

INTRODUCTION

With the popularization of Internet, the application of the website is more and more wide. In the past, design of web page is the job of the programmer or interactive researcher. At present, the working model is changing gradually and the division of labor is gradually refined, with a large number of excellent web design works appeared in China. The color, layout design and the planning of web structure all have made progresses. However, a prominent problem is that people tend to focus on the dynamic performance of the web interface and the realization of the function, and neglect the humanized design. Most people think that scientific, technical and functional qualities are the most important factors in the design of web interface. However, through the in-depth analysis of basic nature of the interface design, humanized factors are an indispensable part of design of web interface. A friendly and beautiful web interface should give people a comfortable visual enjoyment and friendly operating system, narrowing down the distance between people and computer [1]. Throughout the domestic books markets, most of the books are about the using method of web-related software and the realization of functions, or simply talk about the development of the web site and introduce the principles. Some books mention the relationship between the web interface and human beings as well as the importance of usability of the site to people's using, but no books have involved the impact of different cultures in the international contexts on website interface design. Therefore, it is necessary to integrate the emotional design into the design of the interface, and enhance the needs for emotionalizing.

This paper, combined with the basic theory of mobile phone interface design and cognitive psychology as well as other factors, summarize the necessity of emotional design of mobile phone interface respectively from the visual level, operational level, and reflective level. Besides, it constructs a method modeling of emotionalized design of mobile phone interface and expounds the importance and the application value of human factors in the design of mobile phone interface.

RELEVANT THEORETICAL SYSTEMS

Theoretical System of Emotionalized Design

Though emotionalized design started years ago, real achievements come into birth in the modern times. The most prominent theories are: Desmet's model of product emotion, and the "Kansei" engineering. The following parts are the introductions:

Desmet’s model of product emotion, mainly studies the relationship between product design and emotions produced by the product, as shown in Figure 1. There are four elements of the model, product evaluation, product attention, product (stimulus), and the emotions. The method is to present an image of a product designed based on participator’s expectation, attitude and individual attention to the participator. Then they are guided to report their emotions aroused by the image in the form of an animation. Besides, they should make estimation on whether they have felt some kind of emotion or not.

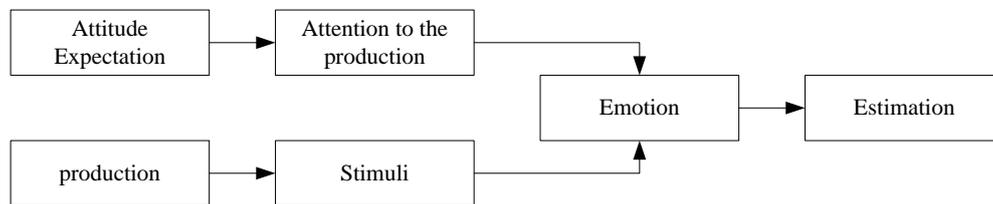


Figure 1. Model of product emotion.

Kansei engineering is to design products which meet the emotional and psychological needs of the users by quantifying people’s emotions and cognitions and transferring them into specific design elements with engineering methods, and aims at capture the emotional evaluation of users on the products [2]. Kansei engineering mainly includes three aspects: 1. exploring the customer’s feelings and needs from the perspective of human factors and psychology; 2. identifying the design characteristics on the qualitative and quantitative level from the consumer’s perceptual intention; 3. constructing a model of Kansei engineering and human-machine system.

The design of mobile phone interface is the combination of art and technology, the unity of content and form. It is a new form of art, which should be combined with the behavior of people, the physiological structure of the human body, people's thinking mode and psychological situation, etc. On the basis of the basic function and performance of the original design, the interface is optimized, which makes users more convenient and comfortable during using and in line with users’ using psychology and physiological needs.

Relevant Theory of Mobile Phone Interface

User interface also known as human machine interface, is a medium for the user and machine to transmit information, which mainly includes the input and output of information. Mobile phone screen can be seen as the output device of “human - cell phone” system [3]. Generally speaking, mobile phone interface can be divided into three types: logic user interface, physical user interface and graphical user interface [4], as shown in Figure 2.

Basic Elements of Mobile Phone		
Logic user interface	Physical user interface	Graphical user interface
Information structure menu structure menu label menu icon soft key interface style operation sequence screen layout input domain topic voice	overall size length width height LCD key size, shape layout icon label background light receiver enclosure	object GUI texts icon, display telephone receiver etc. GUI screen GUI top menu list popup menu Function GUI telephone directory short message

Figure 2. Basic elements of mobile phone interface.

ANALYSIS OF DESIGN ELEMENTS OF MOBILE PHONE INTERFACE

Although the production process of the mobile phone interface is similar to that of common artistic form, it has its own characteristics. Therefore, design should be based on the requirements of human nature, with unified image, clear

content, reasonable technical support, and outstanding personality. Also, some design principles should be followed. In short, it can be summarized as right location, reasonable technology, strong utility, unified image and outstanding personality.

Analysis of Emotional Elements on Visual Level

Emotion on visual level is the user or consumer's instinct perception of the mobile phone's interface. From the perspective of three levels of Norman theory, emotions are reflected mainly on instinct, behavior and reflective levels. The aesthetic elements of the machine interface include color, graphics, text, layout, connotation, etc, as shown in Figure 3. These elements directly affect the user's mood on the visual level.

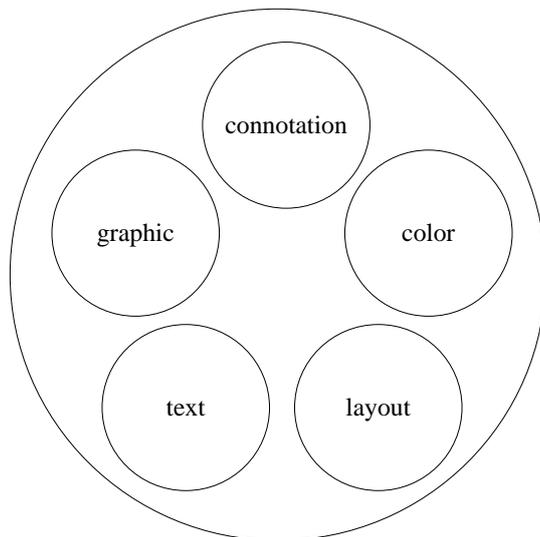


Figure 3. Visual emotional elements of mobile phone interface.

The connotation elements of mobile phone interface refer to symbol, metaphor and story, with specific descriptions in Table 1.

Table 1. Description of connotation elements.

Connotative Elements	Semantic Description of Elements	Examples
Symbols	Symbol is to use visual graphic signs to arouse people's memory of an abstract sense, idea or mood. It contains certain agreements.	In China, crane and pine tree symbolize the longevity, bat the couples, fish the rich and affluence, and peony the wealth and elegancy etc.
Metaphor	Metaphor is a rhetorical device, which uses one or a group of visual signs to express the related parallel connotation. It is constructed on the ground of the similarity of natures or relationships between the two things.	Heterogeneous isomorphism grafting displacement
Story	Story element is to use the role or symbol in a story as a design element, and spreads the concept of APP by the spread of the story.	Comics, hand-draws, story version

The graphical elements of the mobile phone interface include three aspects: shape, size and texture. Shapes can help to identify different objects. Its elements are: point, line, surface, and body. They are tangible visual elements, which form invisible psychological elements through people's intuitive reaction. The elements of the shape are described in Table 2.

Table 2. Description of shape elements.

The Elements of Shape	Semantic Description of Elements	Emotional Features
Point	Pont is the smallest visible unit of form, and is the expression form of the position, without direction and shape.	at the center of the picture: stable, serious stagnant at the top of the picture: enhance the energy with dynamic beauty at the bottom of the picture: a sense of stability
Line	Line, in graphic design, is used to show the shape and the width of the graph as well as its position in the whole design in two-dimensional space.	straight line: hard, simple, tenacious, calm curve: natural, soft, stretch, sexy thick line: straightforward, heavy, powerful long line: continuous short line: rapid visual stimulation and discontinuous
Surface	Surface refers graph made by moving tracks of lines, which has width and length but no thickness. It is a combination of point and line.	Regular surface: stability and sense of order Irregular surface: dynamic, natural
Body	Body demonstrate itself in three-dimensional space.	Line body: direction Surface body: stability, range Block body: senses of weight, fulfillment and stability

Text elements in the mobile phone interface. Text information is a very important element in the design of mobile phone interface, which takes a lot of space in interface design. The performance of the font is full of infinite charm, which improves the speed of content transmission. Among the current designed fonts, expect for the four basic fonts, Microsoft font and font in Founder fonts are selected and used most frequently. In the interface, the most frequently used English font is San-serif. In the specific design process, the size of the text is chosen according to the size of the phone screen. The main factors of text include the identification, readability, and text layout which are shown in as Table 3.

Table 3. Description of text elements.

Elements	Semantic Description	Example
Identification	When texts appear in the interface, whether users can read them normally.	font, size, line width, word width
Readability	Whether it is the user language, whether the meaning is clear.	problems about “professional terms” tips about functions, etc
Text layout	arrangement of texts in graph	problems about color, boldface, alignment, contrast ratio, linked styles, etc

Color elements in mobile phone interface. In the mobile phone interface, color makes the most intuitive feelings, and also left people with profound impressions. It affects the experience and clicks of mobile phone users, and mainly includes color and contrast [5]. The color elements are described in Table 4.

Table 4. Description of color elements.

Elements of Color	Color Emotions	Examples
Hue	Cold and warm, sense of space	Cold provides feels of deepness, transparency, thinness, coolness; warm provides feelings of thickness, heaviness, excitement, approach etc.
Lightness	Expanse and contract magnificent and plain jump and pure	Bright color with high saturation makes people feel pleasant, while dull color with low saturation makes people feel depressed.
Purity	Soft and hard, light and heavy	Dark color due to its high density makes people feel heavy, while light color because of its low density will produce a giddy feeling.

Layout elements of mobile phone interface. The layout elements of the mobile phone interface mainly refer to arrangement of the structure of visual elements in the interface. And design elements are as follows: orientation, location, arrangement combination. These elements can be seen clearly in the list and the icon of the interface can also help to make the entire interface uniform and efficient [6]. Orientation refers to the direction of an object. The position is used to express the information transportation among structures of each element. The reading order of the screen is the “visual flow”, which can help to locate the elements in sequence. In design, the most important information is generally placed in the top left corner of the screen. Arrangement combination can be designed according to the guidance of Gestalt psychology. There are 5 basic principles: the principle of proximity, the principle of similarity, the principle of continuity, the principle of closure and the principle of symmetry. The first two principles are related to the grouping of interface elements, and the last three principles are related to the user’s visual system.

Analysis of Emotionalized Elements on Using Level

Interaction between user and mobile phone interface can demonstrate how users use the phone. Generally speaking, there are three types of user operation of the mobile phone: single handed operation, arms-holding operation, and double-hands operation. The operation level of the interface is related to the user’s pleasure and efficiency in using the product, so a good behavior design contains three elements: functionality, understanding, utility [7]. In fact, emotions produce in the process of using the product will affect the evaluation on the product. If the product cannot be fully understood, it may not be used. It is certain that negative emotions make the user dislike this product, so the negative experience will result in overall negative evaluation on the product. Therefore, good behavior design should be humanized.

Analysis of Emotionalized Elements on Reflection Level

The influence factors on reflection level are mainly the emotional memory, the degree of pleasure and the feeling of empathy. Emotional memory refers to when users use a certain class of or a APP, the Internet use and function of this APP can be quickly crossed into mind, with a very deep impression. The degree of pleasure is the degree of joy, pleasure, physical and mental relaxation of the users when they use the APP interface, which reflects the users’ inner state [8]. The feeling of empathy refers to inner empathy when using the APP.

A DESIGN CASE OF MOBILE PHONE INTERFACE BASED ON HUMAN FACTORS ENGINEERING

Flat Design of Mobile Phone Interface

Compared with the traditional hierarchical interface design which uses “high and sharp” fir shaped information structure, the flat interface design moves up the lower layer information and reduce or cancel the category label of the middle layer, making its structure in a “broad and flat” bush-shape. Flat interface design greatly shorten the length of information access path, making the software of mobile phone respond faster, and users find the target information more quickly [8]. Through a variety of navigation and information layout, it effectively avoids the page switch, and at the same time, its open information interface is conducive to the user to observe the global information, making it easy for the user to know his current location. However, while the flat interface design realize the transparency of

information access, it also to a certain extent, increases the complexity of visual communication in a single page [9]. In order to better understand the characteristics of flat interface, the author compare the interface design with hierarchical interface design from the aspects of information organization structure, interface clarity, information access / return path and navigation control.

Specific Implementation of Emotionalized Design of Mobile Phone Interface

(1) Determine the design theme of the APP. First of all, determine the design theme and design style of mobile phone APP. Based on the results of researches on users, and the internal discussion of designers as well as other methods, determine the emotional semantic vocabulary of the related theme. For example, if designers want to design a APP interface about females. Before the design, a group of keywords for this theme should be selected. This group of words, according to the theme of “female”, can be: lovely, gentle, stylish, sexy, etc.

(2) Collect emotional semantic vocabulary. Users, designers and decision makers can be participated in collecting emotional semantic vocabulary, which can reasonably guide the research object to make divergent thinking, and enable them understand the definition of emotional semantic words in their hearts during the divergent process. The users’ interview is mainly to find the users’ understanding of the APP theme. Users are asked the users derive a number of new vocabularies on the basis of the core vocabulary.

(3) Extraction emotional semantic vocabulary. This stage is to classify all the emotional semantic vocabulary according to its three types. All of the emotional semantic words can be divided into three categories: visual mapping, psychological mapping, and physical mapping. Table 5 is extraction and classification of the emotional semantic vocabulary.

Table 5. Examples of classification of emotional semantic vocabulary.

	Freshness	Comfort
Visual mapping	Tidy, bright, clean, green, blue, cold color	Soft, pink, beige, lovely, soft lighting, comprehensive, green
Psychological mapping	Quiet, fresh air, sunshine after the rain, empty and broad, listening	Lazy, calm mood, open mind, empty state, sleeping, relaxing, walking, face without makeup
Physical mapping	Tender leaves, grass, leaves, mountains, blue sky and white clouds, clear water, literary and artistic youth, clover	Sports clothes, lake, pajamas, carpet, beach, sponge, sunshine, dandelion

(4) Collect emotional pictures. After the emotional semantic vocabulary is selected, a large number of corresponding pictures should be collected by fully using of the Internet and magazines. Then, according to pictures colleted by each person and coordinating with the corresponding questionnaire survey, understand the reasons for choosing the picture and dig more stories and details. Then extract the pictures to generate emotional board.

(5) Output of emotional board. Make cluster of the collected materials based on emotion semantic vocabulary, and then extract the main color, color scheme, material and other features from emotional board as the final presented visual style.

(6) Output of design. Finally, make design output of the extracted related elements. On the one hand, make Gauss blur of emotional board in PS, and extract color using a color dropper, forming the color scheme which is corresponding to the interface [11]. On the other hand, combined with the analysis of derived keywords, extract the physical textures and materials with higher frequency in the emotional board, and the font and graphics texture of the image to form the main textures and fonts of the interface.

CONCLUSION

With the development and popularization of the Internet, people’s life has changed dramatically under the influence of science and technology. Mobile phone provides this information for people first time the information is produced, so the design of the mobile phone interface is very important. It is not simply a list of elements and information, but a combination of art and technology, and a kind of emotional care for the end user. Not only the technology is needed to

be mastered to support some functions of the phone, but also interface should be designed which suits user's using emotion and meet user's needs.

Based on this problem, this paper puts forward that humanized elements should be integrated into the design of the interface of the web page. To sum up, based on the principle of web interface design, design a web interface to meet people's cognitive psychology and emotional attribution according to principles of aesthetics. The continuous development and improvement of humanized design is a continuous improvement of people's thoughts and emotions.

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