Research on Emotional Design of University Guide System Based on Cultural Heritage and User Experience

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Abstract

The university guide system is not only a functional facility for transmitting information but also an important medium for carrying and spreading university culture. As the emotional needs of the target audience continue to grow, this study incorporates the concept of emotional design. This study takes Beijing University of Technology as the research object. Based on emotional design theory, we conducted systematic investigations through literature review, field surveys, and user interviews. The material, behavioral, and spiritual genes of university culture are extracted, the "culture-emotion" demand matrix is constructed, and the weight of user emotional needs is clarified. Combined with the Kano model and the Better-Worse index, the importance and priority of user needs are analyzed and transformed into design practice. In designing the guide system, this paper conducts research on the three levels of instinct, behavior, and reflection. Through the optimization design of elements such as shape, font, color, etc., the visual appeal and functionality of the system are enhanced; through the system specification design at the behavioral level, the ease of use and efficiency of the guide are ensured; and through the expression of cultural images at the reflective level, the identification and sense of belonging of teachers and students to the university culture are strengthened. The research results show that emotional design has significant results in improving the user experience of the guide system and spreading university culture, which provides theoretical support and practical guidance for the design of the university guide system.

Keywords: Emotional design, Guide system, Kano model, University culture

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Introduction

The guide system is a public facility that delivers accurate and clear graphic information to the audience to achieve the purpose of guidance. In addition to its main function, the guide system in colleges and universities has more educational significance (Lynch, 1990). It undertakes the responsibility of cultural and environmental education and is also a reflection of the overall cultural image of colleges and universities. As the national "Double First-Class" strategy enters a new construction cycle, this characteristic of the college guide system has become more and more apparent, and it has also been given more emotional connotations. The target audience's demand for the college guide system is based on the guidance function of a single expression and has placed emotional expectations on spreading the school's brand image, integrating the school's symbolic meaning, and carrying the school's historical context. The survey shows that at this stage, the design of college guide systems is mostly limited to functional realization, ignoring the emotional interaction with the target audience, and it is difficult to fully meet the needs of teachers, students, and visitors for campus cultural identity and belonging. Colleges and universities are in urgent need of creating a guide system with a unique appearance design, standardized behavior guidance, and profound cultural heritage. In this context, the user-centered emotional design idea has become the focus of attention in the design of college guide systems.

Research Objectives

Utilize emotional design methods to prioritize the emotional needs arising from cultural identity within the target audience of university signage systems and implement visual recognition cases to facilitate the emotional translation of university culture while extracting design elements for creating these signage systems.

Literature Review

A Review of the dynamics of the university guidance system

Colleges and universities belong to the category of public environment guidance. The guidance signs of colleges and universities are mainly designed to guidance of various spaces outside and inside campus buildings (office buildings, teaching buildings, libraries, laboratory buildings, and student dormitories). The purpose is to guide the target users so that they can move in the space system and find their destination. In the 1960s, American colleges and universities began to remove school gates and walls, which resulted in the entire campus becoming a unique complex integrated with the city. To solve the problem that the campus

environment is too large and integrated with the city, it is difficult to identify. Colleges and universities began to introduce guidance systems to help people identify spatial information and define the scope of the school. For example, Pennsylvania State University in the United States has 24 branches across the country. Through a set of perfect graphic symbol designs, it has achieved the overall unification of the environmental construction of multiple campuses and created a positive campus image (Dilworth, 2001). In recent years, the guidance signs at colleges and universities in developed countries, including Europe, the United States, and Japan, have begun to evolve from merely serving simple functions to incorporating elements of humanity and public art.

There is a relative lack of research on the design of university signage in China. The number of papers on related research is relatively small, and in related books, signage is often cited as a case study, that lacks systematic theoretical research. The first article on the study of university signage design is "New Signage System in the North District of the Central Academy of Fine Arts" (Xiao & Hao, 2007). At present, research on the design of university signage mainly focuses on redesigning the existing campus signage system through two main lines: service and culture and exploring the integration path of the school's historical accumulation and cultural context in the university signage system (Liu, 2011; Zhan, 2015; Zhu & Wang, 2016). Research on humanized design from the perspective of improving the functionality of campus guidance systems (Kong, Yao, & Zhang, 2018). Previous studies have systematically examined design methods, standards, and elements in campus environments. These investigations identify users' intuitive perceptions as critical design factors, which establish perceptual references for university signage design. (Zeng & Liu, 2016; Li, Zhu, & Zhang, 2021).

The development history of guide signs has proved that in the actual environment, guide signs are not only for viewing but more for interacting with people and the environment, thus providing users with a comfortable service experience. In general, compared with Western developed countries, the design and application of guide signs in Chinese universities are still in an early stage of development. Although preliminary practice and exploration have been carried out in the direction of user emotional needs, the practical application of emotional design theory is still in the exploratory stage. Therefore, this study uses emotional design to address the emotional needs of users, focusing on the practical functions and cultural connotations of the university guide system.

Research Methodology

This study advocates leveraging the methodological advantages of both quantitative and qualitative research, combining quantitative research that emphasizes quantitative empirical data with qualitative research that emphasizes linguistic empirical data. Based on emotional design, empirical research is conducted by transforming university culture into campus signage designs for the campus:

1. Data collection: This study employs the data collection method of intuitive engineering, beginning with the organization of relevant theories such as university culture and emotional design. On the one hand, by conducting focus group interviews in sequence, emotional vocabulary related to specific cultural themes can be obtained from which implicit cultural genes can be condensed. On the other hand, through field investigations, explicit cultural genes can be identified from the buildings, landscapes, departments, institutions, and other physical states of Beijing University of Technology.

2. Data analysis: Initially, an expert focus group used the KJ method to construct a "cultural emotion" demand matrix. After that, the emotional needs items were recorded, and the Kano model (Kano, Seraku, & Takahashi, 1984) We used to rank the importance of users' emotional needs. Finally, the modern design method is used to complete the transformation of design elements, and the design is carried out according to the three-level theory of emotion, and the emotional design strategy of the college campus guidance system is proposed through design practice.

Results

1. Constructing a “Culture-Emotion” needs Matrix

1.1 Beijing University of Technology Cultural Gene Acquisition

Once we have established that cultural genes serve as the research object, we proceed to collect them through visits and investigations. Since it is a preliminary expression collection, this stage does not distinguish the outer visual attributes, middle functional attributes, and inner cultural attributes of cultural genes. Through the data collection of field surveys of school institutions, a large number of cultural perceptual words were obtained. Based on a comparison of existing research on the cultural development of Beijing University of Technology, we reviewed and organized the collected words, removed any that were too similar, unclear, or not useful for design, and created an initial set of cultural gene data for the university.

Based on the characteristics of the non-numerical data of perceptual vocabulary at this stage, the KJ method is used to create cards from the collected perceptual vocabulary, and school experts are invited for semi-structured interviews to combine and enhance the meanings of many perceptual words, organize everyday language and terms by their connections, group similar cards together, and create suitable titles, which represent the cultural gene structure of Beijing University of Technology. Finally, according to the three-level composition of material culture, behavioral culture and spiritual culture of university culture, the multi-attribute cultural genes are classified.

Table 1 Beijing University of Technology cultural gene structure table

Cultural genes	The cultural composition of universities
Representative forms, standard colors, environmental colors, architectural colors, university impressions, school logos, and campus buildings	Material Culture
Public places, campus landscapes, learning scenarios, communication carriers, route guidance, regulatory documents, cultural and sports activities, celebration activities	Behavioral Culture
School motto, school philosophy, school spirit, city characteristics, regional location, famous figures, subject characteristics, representative objects, historical nodes, historical memories	Spiritual Culture

Source: Author

1.2 Matrix construction based on binary relations

On the basis of the overall framework, the researcher further analyzed the relationship between university cultural genes and emotional design based on Saussure's symbol "signifier, signified" theory. Cultural structure and emotional cognition are essentially a progressive relationship from material to concept. Through the analysis of the material symbol of "signifier" and the specific concept of "signified", the structural level of university culture is matched step by step with the emotional cognition level of the target audience. The outer layer of material culture relates to our basic emotional understanding, the middle layer of behavioral culture connects to our more developed emotional responses, and the inner layer

of spiritual culture ties to our deeper, thoughtful emotional awareness.

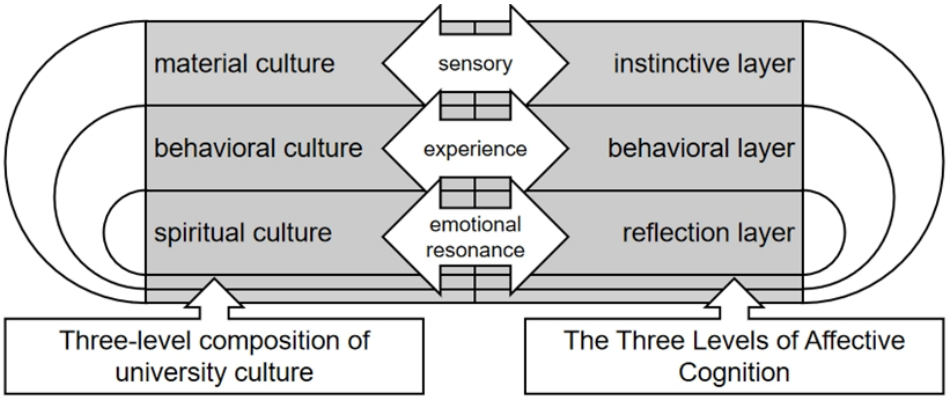

Figure 1 Schematic diagram of binary correspondence

Source: Author

Based on the internal relationship of data, the levels and categories of user needs were clarified with the idea of classification and refinement. The recoding process yielded a total of 13 emotional level needs.

Table 2 "Culture-Emotion" Demand Matrix

Cultural genes	Emotional needs	Coding	Requirement Description	Emotional Levels
Representative elements	Conform to the aesthetics of form	A1	Create styling elements that are in line with the target audience's visual aesthetics and are easily recognizable and memorable	Instinct layer
Standard colors Ambient Color Building Color	Maintain color balance	A2	Use balanced color elements that connect and express the school's specific meaning	
University impression	Select applicable elements	A3	Select style elements suitable for visual transformation	
Graphic Logo School Logo	Use school logo	A4	Use logo elements such as school emblem, school logo, school motto	
Campus Buildings	Embedded landmark building	A5	Extract and apply typical architectural elements	
Public Places Campus	Integrate into a harmonious	B6	Harmony with the campus environment	Behavioral Layer

Cultural genes	Emotional needs	Coding	Requirement Description	Emotional Levels
Landscape environment				
Learning scenario Transmission carrier	Extended use function	B7	Meet the target audience's daily usage functions and convey clear visual information	
Route guidance Regulatory documents	Guide behavioral norms	B8	Guide the target audience to use visual images according to the system or norms	
Cultural and Sports Activities Celebrations	Rich activities	B9	Reflect the behavioral characteristics of the target audience	
School motto School Philosophy School Spirit	In line with the school's philosophy	C10	Contains the connotation of school spirit and educational philosophy	Reflection Layer
City Features Regional Location	Mapping the school location	C11	Match the regional culture where the school is located	
Famous people Discipline Features Representative items	Possess group awareness	C12	Use cultural elements that are widely known by the target audience	
Historical Nodes Historical Memory	Following historical tradition	C13	Follow the practices formed by the target audience in the long-term operation of the school	

Source: Author

2. Analysis of the Target Audience Emotional Needs Weight

Through the previous stage of research, a corresponding relationship was established between the cultural genes of the Beijing University of Technology and the target audience's emotional needs for visual images. This stage will conduct a weighted analysis of the target audience's emotional needs based on the research steps of the Kano model.

2.1 Kano questionnaire design and distribution

The Kano quality attribute requires setting up a two-way questionnaire for each demand indicator, which includes positive and negative parameters, asking questions from the positive and negative directions of satisfaction and dissatisfaction. A Carnot questionnaire was designed based on Table 3 for user research, and 13 target audience needs were coded and expanded to a total of 26 positive and negative questions.

Table 3 Kano Questionnaire (Example)

Property		Satisfy	As it should be	No problem	Reluctantly accept	Dissatisfied
How do you feel about this emotional need?	Have		○			
	Not available				○	

Source: (Chen & Qiu, 2019)

This study distributed questionnaires in two ways: online and offline. Collected a total of 105 questionnaires. After screening out invalid questionnaires, 100 valid questionnaires were obtained, and the questionnaire recovery rate was 95.24%. The Cronbach's alpha value for the recycled questionnaires was 0.902, which exceeds 0.9, indicating that the reliability of the research data is very high. In the validity test, the KMO value was 0.779, greater than 0.7, and significance of the Bartlett sphere test was 0.000, less than 0.05, indicating that this questionnaire has good validity and is suitable for information extraction.

By performing Kano calculations and summarize each user demand to determine the proportion of each of the five categories. The questionnaire’s statistical results are compared with the Kano evaluation table, and the category attribute corresponding to the highest proportion is the final category attribute for the demand. The statistical questionnaire results are shown in Table 4.

Table 4 Statistical results of the Kano model

No	Emotion	A	O	M	I	R	Q	Results	Type
A1	Conform to aesthetics of form	6.00%	17.00%	42.00%	35.00%	0.00%	0.00%	Required attributes	M
A2	Maintain color balance	37.00%	14.00%	13.00%	36.00%	0.00%	0.00%	Charm attribute	A
A3	Select applicable elements	17.00%	50.00%	11.00%	22.00%	0.00%	0.00%	Expected properties	O
A4	Use school logo	41.00%	21.00%	10.00%	27.00%	0.00%	1.00%	Charm attribute	A
A5	Embedded landmark building	19.00%	26.00%	10.00%	44.00%	1.00%	0.00%	Indifferenc e attribute	I
B6	Blend into the environment	19.00%	16.00%	24.00%	41.00%	0.00%	0.00%	Indifferenc e attribute	I
B7	Extended use function	10.00%	44.00%	11.00%	35.00%	0.00%	0.00%	Expected properties	O
B8	Guide behavioral norms	38.00%	25.00%	7.00%	30.00%	0.00%	0.00%	Charm attribute	A
B9	Rich activities	9.00%	20.00%	11.00%	59.00%	1.00%	0.00%	Indifferenc e attribute	I
C10	In line with the school's philosophy	8.00%	27.00%	34.00%	31.00%	0.00%	0.00%	Required attributes	M
C11	Mapping the school location	11.00%	40.00%	22.00%	27.00%	0.00%	0.00%	Expected properties	O
C12	Possess group awareness	9.00%	43.00%	20.00%	28.00%	0.00%	0.00%	Expected properties	O
C13	Following historical tradition	48.00%	24.00%	1.00%	27.00%	0.00%	0.00%	Charm attribute	A

Source: Author

2.2 Kano questionnaire results optimization analysis

The study introduces the Better-Worse index proposed by C. Berger et al. to correct and optimize the model results.

The calculation formula for satisfaction increase coefficient (SSI) is:

$$B(S_{SI}) = \frac{}{A + O + M + I} \quad (1)$$

The satisfaction reduction coefficient (DSI) is:

$$W(D_{SI}) = \frac{}{A + O + M + I} \quad (2)$$

In order to further study the importance of different demand factors on the needs of the target audience, the influence coefficient (E I) of each function can be calculated for comparison. The influence coefficient represents the target audience satisfaction sensitivity, and the formula is as follows:

$$E_I = \sqrt{S_{SI}^2 + D_{SI}^2} \quad (3)$$

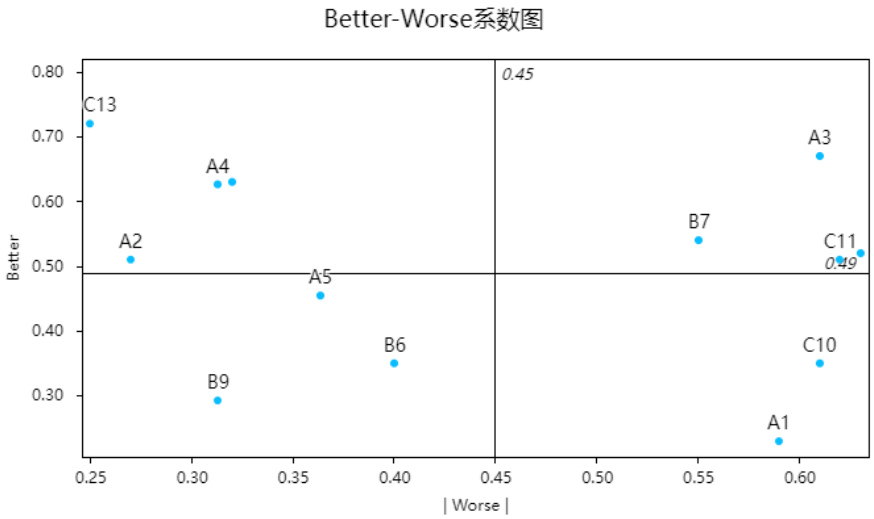

Figure 2 Four-quadrant distribution of emotional needs

Source: Author

Equations (1) and (2) demonstrate that the four-quadrant classification does not create any new demand category items, confirming the accuracy of Kano's statistical results. Furthermore, the impact coefficient is calculated through equation (3), and the priority of the user's emotional needs is obtained as follows:

1) Required attribute (M): C10>A1 ;

2) Expected properties (O): A3>C12>C11>B7 ;

3) Charm attribute (A): C13>B8>A8>A2 ;

4) Indifference attribute (I): A5>B6>B9 .

The above research points out the direction for the subsequent design projects, according to the classification of emotional needs, the demand for necessary attributes will be used as the necessary elements of design expression, the demand for expected attributes will be used as an important basis for the transformation of design elements, the demand for charm attributes will be appropriately integrated, and the demand for indifferent attributes will be appropriately selected according to cost factors.

3. Emotional Design of College Guidance System

The design is carried out according to the three levels of emotional design: the user has the initial impression of the guide sign through visual sensory experience (instinct level), generates the use of feeling (behavior level) in the process of using the function of the guide system, and feels its semantic information, connotation and personalized settings through the communication of the overall information of the guide system, so as to establish an emotional connection (reflection level).

3.1 Visual design of the visceral layer

At the instinctive level, users mainly rely on intuitive information sensing to obtain the initial reaction to the external environment. Therefore, the instinctive level is also the design level that is easiest to cater to the user group. The reaction it causes is biological, and physiological characteristics such as gaze, feeling and sound play a leading role. Combined with the calculation results of the Kano model, the design of the university guide system at the instinctive level mainly focuses on the necessary attributes: conforming to the aesthetic sense of form (A1); expected attributes: selecting applicable elements (A3); attractive attributes: maintaining color balance (A2), using school logos (A4). Since the target audience's reaction to the guide sign mainly comes from visual perception, the appearance presents an intuitive impression to the user, and the design transformation of emotional attributes corresponds to the shape, text, and color of the guide sign.

Styling design: The design of the guide system of Beijing University of Technology is mainly rectangular, from larger spatial guide signs to smaller index door signs, they all adopt the overall and regional structure of rectangles to amplify the impact and visibility of information. Concise straight lines are more suitable for applications in various scenarios and levels, they do not create visually distracting elements and enhance the degree of communication of information transmission. The area divided by different rectangles is distinguished by information in the physical space, which accelerates the user's understanding of the guidance information. Just as industry gives a sense of hard and heavy straight lines, although these feelings are a bit stereotypical, in terms of the actual visual presentation of

the user experience, the use of straight lines is more in line with the general perception of the cultural temperament of the technical university by the target audience. This is a coupling method that enhances the strength of information memory and makes it easier to achieve emotional resonance.

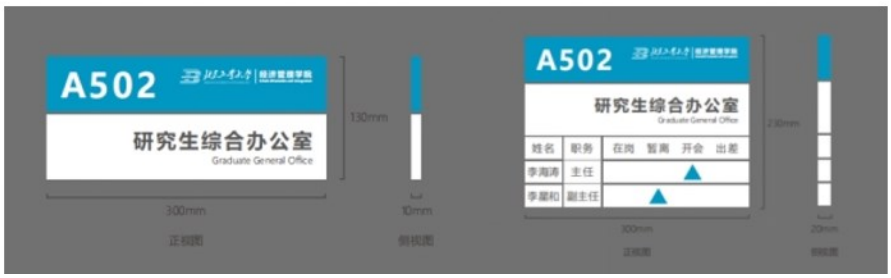

Figure 3 Comparison of scales of guide system

Source: Author

Font design: The "Source Han Sans" font used throughout the design of the Beijing University of Technology's signage system is a Pan-CJK font family, provided in an open source manner under the Github+Apache2.0 license. The open source attribute avoids possible commercial copyright disputes. The Source Han Sans family has seven font weights (Extra Light, Light, Normal, Regular, Medium, Bold, and Heavy), which can meet the font application at different levels. For example, the floor index card shown in Figure 4 uses the Bold font for the first-level title unit name and the Normal font for the second-level title office name. The thickness of the font reflects the subordinate relationship of the administrative division and conforms to the general emotional cognition of users. The font has no complicated patterns and serifs, the corners are smooth and the transitions are natural, which makes the transmission of guidance information clear and concise. Combined with the unified and standardized spacing between characters, it meets the emotional expectations of the target audience to quickly obtain the target location information.

Figure 4 Comparison of font levels in the guide system

Source: Author

Color design: The main color of the guide system design of Beijing University of Technology is "Beijing University of Technology Blue" (Figure 5). Studies have shown that color is a relatively strong element in people's instant perception, and the proportion of people's feelings within 20 seconds of the first contact is as high as 80%. Therefore, the use of Beijing University of Technology's standard color - Beijing University of Technology Blue is an important starting point for the emotional design of the school's guide system. This color represents a long-established visual identity developed over the university's history. The appearance of Beijing University of Technology's blue color will give users a psychological hint of "this is Beijing University of Technology", thereby enhancing the sense of identity of the guide system. The relationship between color and emotion is complex. It can inspire the user's associative ability. In the use of the main color, it is assisted by neutral tones such as white, black and gray. It can bring users stylized feelings such as refreshing, solemn and modern in different scene applications.

Figure 5 "Gongda Blue" application design diagram

Source: Author

3.2 System Specifications at the Behavioral Layer

At the behavioral level, the target audience develops experience and habits through the use of behavior, so the focus of behavioral design is to use functions to achieve the expected purpose of use. Donald A. Norman believes that excellent behavioral design should have four elements: function, understandability, usability, and feeling. Combined with the results of the Kano model calculation, the emotional needs that the behavioral design of the university guide system focuses on include expectation attributes: extended use functions (B7); charm attributes: guiding behavioral norms (B8).

The Beijing, the design of the University of Technology's sign-guiding system incorporates an emotional behavior layer that emphasizes the enjoyment and effectiveness of functional use. Based on the spatial distribution and aggregation characteristics of colleges and universities, it simulates the behavior habits of different user groups such as students, teachers, alumni, off-campus experts, and International personnel, and sorts out the language, hierarchy, and category of the sign-guiding system to create a "three-dimensional, multi-level,

all-round" sign-guiding system that maximizes the coverage of the target audience's functional use needs and creates an emotional sign-guiding system composed of multiple subsystems that are "dispersed in form but concentrated in spirit."

Building guidance subsystem: This includes the first-level index of building name, the second-level index of institution name, etc. The building guidance subsystem is mainly installed on the facade of building, covering 23 buildings on the main campus. According to the different conditions of facade area, material, and color, three different proportions and color installation specifications are designed to ensure a striking visual experience. The building name is selected for high-position installation on the building, and the institution name is set at the door of building. Users always maintain the best visual distance on route of action, which improves the user experience in actual environment.

Figure 6 Volumetric Guidance Subsystem - Organization Name Secondary Index
Source: Author

Spatial guidance subsystem: It includes campus map and spatial general index, node guide sign, road guide sign, etc. A three-dimensional campus map is designed in the spatial general index at the entrance so that users can obtain behavioral guidance information as soon as they enter the campus and understand the overall layout of the campus; node guide signs are placed at important spatial nodes in the campus and integrated into the flat campus map, so that users can clearly understand their location and the direction of their destination; road guide signs are set at forks to strengthen the guidance of vehicles in the case of pedestrian and vehicle diversion.

Figure 7 Effect diagram of the spatial guidance subsystem
Source: Author

In-building guidance subsystem: It includes multi-level information indexes such as general index, sub-index, floor index, information board, direction board, house number, floor number, auxiliary information sign, etc. This subsystem serves as the final step to guide users to their final destination. It is mainly aimed at users' needs for matters with clear time nodes such as classes, experiments, meetings, etc., to ensure that users reach their destination in the order of building doors, elevators or stairs, floors, rooms, and house numbers from the moment they enter the building. In addition, considering the fast information replacement cycle of the in-building guidance system, designs and materials that are easy to replace are selected to save costs while creating a more accurate way for users to obtain information.

Figure 8 Effect diagram of the building guidance subsystem
Source: Author

3.3 Emotional interpretation of the reflective layer

As the carrier of school culture, the college guide system always pays attention to the user's emotional feedback in the emotional design of the reflective layer, integrates the school's cultural value orientation based on the user's social cognition, guides the user to obtain positive emotions, and generates emotional judgments from the emotional organs with the development of rationality in reflection. Combined with Kano's calculation results, the focus of the reflective layer design of the college guide system includes the necessary attributes: conforming to the school's philosophy (C10); expected attributes: mapping the school's location (C11) and having group cognition (C12).

Cultural naming: With the continuous changes in the physical space of the campus, the Beijing University of Technology's sign system named public spaces such as buildings, roads and squares at the beginning of its design. The user's acceptance is always the first factor in the naming process, and the emotional response of experience, association and memory is mainly considered. Therefore, in addition to using indicative words such as sequence words, directional words, functional words, and appearance words that conform to the user's social cognition, the naming also fully considers the school's overall planning, cultural heritage, and usage functions. Comprehensive factors such as the use of the name also try to sublimate the campus's material environment in the process of humanities. Taking the naming process of Sanshi Square as an example, the square in front of the Student Comprehensive Service Building was originally the third canteen, which is the area where students have the most frequent activities. The naming of this square retains the homophonic "three foods" of the demolished third canteen and integrates the concepts of cognition, identification, and insight to be named Sanshi Square. The naming retains the teachers and students' beautiful memories of the third canteen as the center of student activities and at the same time conveys the concept of academic style in the new era. This reflective layer design, which is both a cultural heritage and a cultural innovation, allows users to establish a connection with the school culture by thinking about the name, thereby understanding the emotions conveyed in the guide system.

Conclusions

In general, the design of the emotional guidance system in colleges and universities operates on three levels of interaction and regulation: instinct, behavior, and reflection. It needs to fully consider the universality and particularity of the target audience, conform to the behavioral habits of various users, and strive to meet the emotional expectations of the

target audience. The guidance system at Beijing University of Technology is developed gradually through emotional design. From the initial basic functions that meet the use of the target audience, it has evolved into a guidance system with the characteristics of beauty, clarity, rationality, standardization, and harmony. The establishment of an emotional design system makes the guidance system no longer a material carrier for expressing a single message but a special carrier for enhancing the cultural soft power of colleges and universities through the mapping and dissemination of the school's brand image, as well as the carrying of the school's symbolic meaning and historical context. Therefore, advocating for emotional design in the development of guidance systems at colleges and universities represents a significant direction for future progress. This article provides case practice for the design of the guidance system of colleges and universities, enriches the research content of emotional design, and hopes to provide a reference for the innovation and in-depth research in the next step.

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