

An Affordance Study on Healing Public Space in University Campus—— A Case Study of Shenzhen Campus of Jinan University

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Abstract. The campus space of universities is an important part of cities' public environment and the main activity space for college students. This paper takes the self-developed PPGIS mobile terminal as the research tool, the perceptual map combined with a questionnaire as the research method, and 90 college students in Shenzhen Campus of Jinan University as the research objects to investigate the current affordance situation of the healing public space in universities and the affordance of ideal university space for college students. The findings are as follows: (1) The analytical structure of affordance on the healing campus space presents the characteristics: used affordance > perceived affordance > shaped affordance. (2) In the ideal environment, the number of perceived affordances has little change, while that of used affordance and shaped affordance increases, among which the latter increases the most. (3) In an ideal environment, "fitness equipment" is expanded into "activity facilities", "roads" into "characteristic roads", and "plants" into "ecological category". In addition, three types of environmental elements such as "sports venues", "landscape pieces" and "water bodies" are added. (4) The environmental elements that provide different levels of affordance in the current environment are all basic and meet the requirements of normal life, while the depth of those that provide different levels of affordance in the ideal environment has increased.

Keywords: public space; healing environment; affordance; public participation; big data.

1. Introduction

China's university campus is an important part of the urban public environment, which also faces the challenges brought by rapid urbanization and population expansion. According to the "National Report on the Quality of Undergraduate Education and Teaching in Colleges and Universities (2021)", by 2021, there were 2,852 institutions of higher learning in China, with 37 million college students studying and living on campus. The scale of China's higher education ranks first in the world. However, the accompanying stressors such as academic problems, interpersonal relationships and social competition lead to psychological and other healthy problems among college students. Compared with the past 10 years, more than 20% of Chinese college students suffer from different degrees of depression, and the proportion is growing[1]. Long-term depression or anxiety will not only make college students unable to concentrate, but also lead to a variety of other psychological and physiological diseases, such as mania, anxiety, neurosis, etc.[2]. Therefore, paying attention to the physical and mental health of college students and integrating the concept of "national health" into landscape design has become an important subject for the future construction of university campus and cities.

The public space of a university campus is a very broad concept, which includes all the places where students can freely communicate with students and teachers, such as roads, green areas, squares, surrounding buildings, etc.[3]. In recent years, the construction of Chinese colleges and universities has been rapid, and many colleges and universities have completed construction and put it into use in a short period. The planning and environmental quality of public space on campus have many unsatisfactory aspects[4-5]. Problems such as inadequate humanistic care[6], difficulty in adapting the original public space to the colorful contemporary campus life[4], excessive pursuit of grand scenes and neglect of humans[6] have emerged in the campus of universities.

The university campus is the most significant activity place for college students whose space design needs to be elevated to the standard of healthy places that care for unhealthy college students. Therefore, it is urgent to improve the space environment of the college campus.

2. Literature Review

2.1 Healing landscape

From the perspective of urban and rural planning discipline, domestic scholars point out that the research on macro-scale healing is relatively mature, while that on the meso scale and micro scale has become hot spots[7-9]. The exploration of rehabilitation landscape design for different places and users focuses on medical service institutions, residential outdoor environments, urban public spaces, leisure and vacation service facilities, campus landscape and other field[10]. Xiang Pengtian et al.[11]studied the typical public green space--- sanatorium park, and their construction experience has a referential significance for the current construction of small towns in China and the planning as well as the design of " health-preserving towns". Wang Siyuan et al.[12] explored the healing effect of the space form, space interface and sky visibility of the air yard on the health of white-collar workers, statistically analyzed the experimental data from both physiological and psychological aspects, and came up with several suggestions on the design of the air yard with a healing effect on office buildings. Xu Yishan et al.[13], starting from the perspective of the needs of the elderly, provided research support for the planning and construction of a healthy livable environment in communities. Xu Leiqing et al.[14]studied the healing function of the urban environment with two VR experiments, summarized the influence of green vision rate and street interface on street healing, and discussed the design strategy of healing streets against the background of urban renewal. Many studies have shown that exposure to nature helps people recover from negative states. However, the domestic research on healing landscape started late, and its theory and practice still need to be perfected and explored.

2.2 The theory of affordance

The theory of affordance was proposed by James J. Gibson, a famous American ecological psychologist, which is used to explain and illustrate the internal mechanism of the interaction between people and the environment. Gibson believed that the affordance of an environment refers to the attribute that the environment supports people (or animals) to carry out some specific behaviors[15]. At the same time, it changes according to different subjects.

Norman, an American cognitive psychologist, put forward the concept of "interactive design" on the basis of the theory of affordance in 1988, which was rapidly promoted after being introduced into the design community, and had a great impact on the field of landscape planning[16].

The affordance theory has been frequently applied in the field of planning and design by western scholars[17]. The research direction has evolved from theoretical exploration to the proposed methodology of combining theory with practice. However, it is rarely applied in China, and there are only a few cases of domestic environmental affordance studies that take children's environment as the object. The research on different places and different groups is not deep enough. Besides, there is almost no research on the public space of university campus. According to the affordance theory, the behavior of college students in university campus can be analyzed in detail. College students perceive the environmental affordance in the process of moving in campus, and different degrees of perception produce different behaviors. In this process, new affordance will be discovered or shaped.

2.3 The affordance of healing landscape in university campus

With the development of the design process, at the landscape design level, it is not only necessary to consider the rationality of the use and function of the design itself, but also increasingly focus on the relationship between people and the environment. The interaction between humans and the environment that affordance explores has something in common with the connotation of healing landscape design.

Based on previous research methods and achievements, the identification methods of different types of affordance are clearly defined. When studying the affordance of university campus space, we introduced the classification of affordance by Marketta Kytta[18]. He classifies affordance into perceived affordance, used affordance and shaped affordance. This classification can be used to explore the degree to which college students perceive the environment. Different degrees of perception produce different behaviors.

The influence factors of healing landscape design are divided into four types of influence factors on demand: concealment, expansion, internality and inclusion [19] (Figure 1). Every kind of influence factor on demand covers different mental states, and differentiated mental states determine the specific landscape needs of college students who are in different psychological states in campus space (Table 1). For example, college students under high pressure and irritability, they need positive psychological hints from the environment. In connection with the environment, only when it allows them to perceive the physical characteristics which can provide positive guidance, such as the operating platform for farming, will the college students in this state react to the environment and produce the corresponding subjective attributes, that are, to participate in farming with their hands. Therefore, they can obtain a sense of achievement, satisfaction and other positive guidance from this process, and their negative psychological states can be healed.

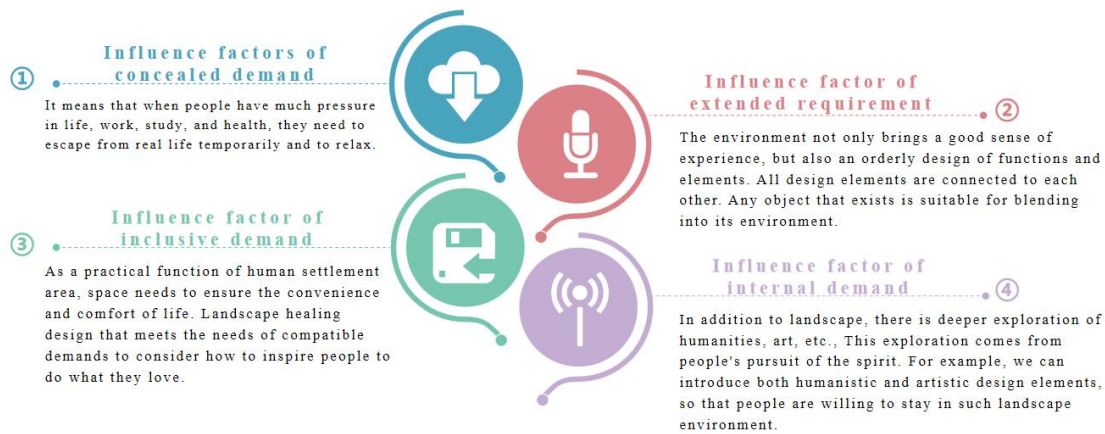


Fig. 1 Influence factors of healing landscape design

	Psychological states	Psychological needs	Behavioral characteristics	Healing landscape space of affordance	Environmental elements of healing landscape space of affordance
Influence factors of concealed demand	Escape from reality	Emotional emptiness, Xanadu	Desire to be alone, and self-enlightenment places	Garden of five senses, which stimulates human body from the visual, auditory, tactile, smell, taste five aspects	Ground, plants and water
	Different degrees of mental illness	Positive psychological suggestion	Harm their own body, easy to emotional collapse	Horticultural therapy, campus farming healing space to provide operating platform, display space, science gallery and so on	Ground, water, structures
	The sense of loss and regret	Relieve emotions, self-recognition	Fragile, sensitive, and deny themselves	Meditation garden, quiet and high-privacy space, such as small bamboo forest, grass, garden and other space	Climate, plants, service facilities
	High pressure, irritability	Abreaction	Sudden change of personality, abreaction on innocent people	In the playground, placement of abreaction exercise equipment, and provide percussion exercise	Fitness equipment
influence factor of	Pursue the sense of atmosphere	Good design	Preference of rich spatial layers	Design the viewing axis and visual point with the help of natural meteorological like	Weather, micro-climate

extended requirement	Pursue a sense of multi-functional experience	Good experience	Preference of rich functional levels	rain, sunset, etc. Intelligent and interesting interactive landscapes, such as landscape sketches that can make wishes, and the ground pavement that can be graffiti	Ground
	The pursuit of visual effect	Aesthetics	The pursuit of aesthetic value	Basic environmental facilities, for example, pay attention to aesthetic principles in color, style and texture on seats, pavement, etc.	Ground, plants and service facilities
Influence factor of internal demand	The pursuit of art	Artistic expression, spiritual satisfaction	Pursuit of individuality, thoughtful things	Set up artistic creation, performance space, and provide a place to display students' works or performance art	Structures
	Cultural indifference	Excessive obsession with a certain culture	Advocating shallow secular culture, keen on the West	Rational allocation of spiritual landscape	Structures and landscape sketches
	Cultural heat	Cultural indifference	Indifference to social mainstream, political culture, national ideals, and public interests	Set up spiritual space, edify sentiment, popularize campus culture, Chinese culture	Structures, landscape sketches, signs
	Interpersonal crisis	Integrate into groups	Pursue group activities and communication needs	Set up interactive space, such as space for communication, landscape facilities that can only be used by group cooperation	Landscape pieces, animals, plants and fitness equipment
Influence factor of inclusive demand	Higher standards of material demand	Comfort	Recovery of limb coordination and physical activity	Pay attention to the selection of road materials and the setting of enclosed space	Height difference, structure, service facilities
	Fear of trouble	Convenience	Need convenient and easy channels	Set up an express lane	Roads

Table 1. Behavioral characteristics, healing landscape environment of affordance and environmental elements of healing landscape of affordance corresponding to different psychological states and psychological needs of college students.

At present, there are few studies on environmental affordance in China, and there are almost no studies on the affordance of healing landscape in the university campus. Although basic living needs can be met, there are few public spaces for college students to do activities in campus, which leads to great limitations in the forms of activities for students. The current landscape environment can not meet the needs of students' outdoor activities and exchanges. How to improve the comfort level of the campus landscape environment and provide a better psychological and physiological healing environment for college students is the focus of this case study.

3. Method

3.1 Research Scope

The research object is the Shenzhen Campus of Jinan University in Shenzhen, Guangdong Province (Figure 2-3). The research object is located in the center of Shenzhen, more accurately in the tourism and cultural district--- Shenzhen Overseas Chinese Town. This campus covers a small area of 4.43 hectares with about 1500 students. There are many problems in the landscape environment of the campus: the current one is single, which is reflected in inadequate green maintenance, single landscape sketch, monotonous style of activity space, etc. The study objects

include four dormitory buildings, a teaching building, a gymnasium, a hotel and two basketball courts.

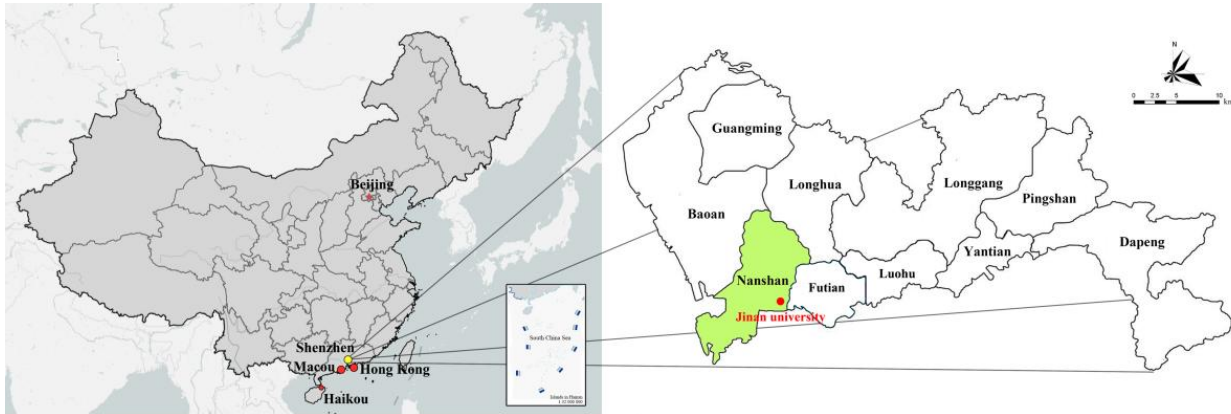


Fig. 2 The location of Jinan university Shenzhen campus



Fig. 3 The current situation of Jinan university Shenzhen campus

3.2 Research tools

The research tool adopted in this study is the self-developed PPGIS mobile data analysis platform, which can present professional geographic information analysis and mapping tools to the non-professional public in an intuitive and simple way, so that the public can participate in the decision-making and planning of urban renewal through the Internet. Traditional PPGIS is based on websites. The public needs to go through complicated steps and processes to submit data, which is not conducive to promotion. In this paper, the PPGIS front-end is adapted to the WeChat platform with 1.26 billion users, which can be easily shared with users to realize data collection (Figure 4).

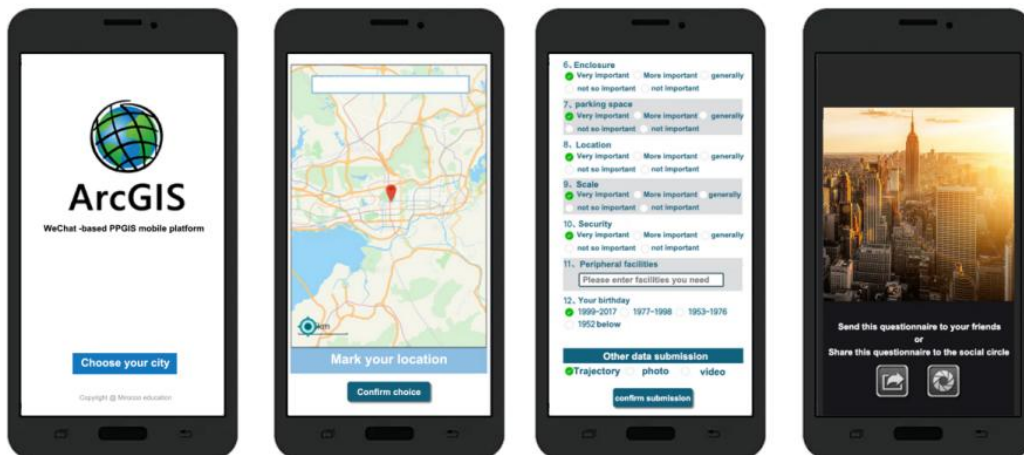


Fig. 4 Self-developed PPGIS mobile terminal operation page

The functional front end of the whole system has five modules (Figure 5). It embeds the basic map function through the API port of the Amap, and users can directly call the map information. In addition, the system also includes functional modules such as thematic data, planning and investigation, data management and personal information. PPGIS mobile terminal can obtain participants' geographic information data, personal attributes (gender, age, income, education, family composition, etc.) and activity attribute information (activity category, activity intensity, activity period, activity frequency, etc.). To ensure the accuracy of data, the pop-up questionnaire will preset test questions. The data collected by the system will be stored in the cloud server for later download and analysis.

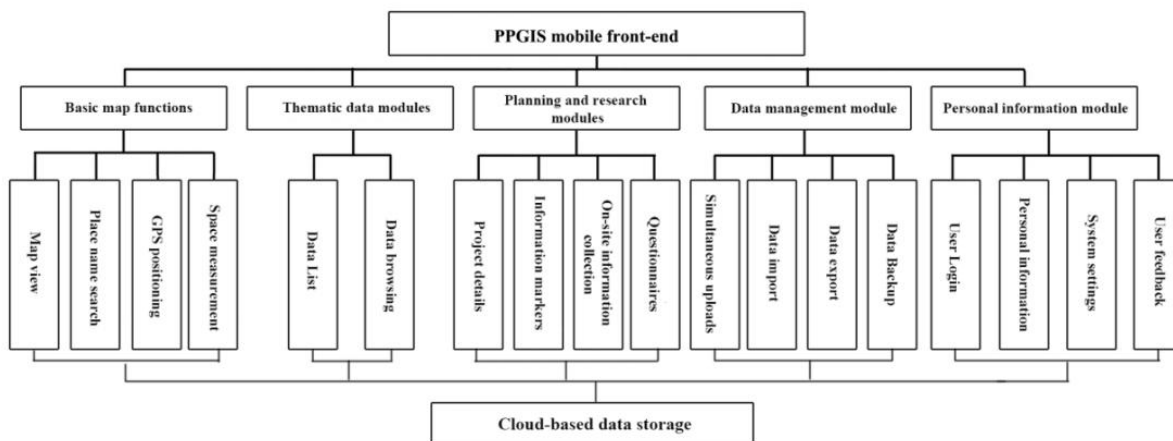


Fig. 5 Functional module diagram of PPGIS mobile terminal system

3.3 Data collection

First of all, the study selects college students living in the university and uses a perceptual map combined with a questionnaire interview to conduct a survey, recording the affordance provided by the current campus space to college students. Through the self-developed questionnaire in the PPGIS mobile terminal system, the research allows college students to write all the things they perceive in their daily activities, and write the ideal campus landscape environment in another questionnaire. Before the investigation, the participants' geographic information data, personal attribute information, and activity attribute information, as well as their feelings during outdoor activities, were obtained. After several surveys, the valid samples are as follows: 180 questionnaires in total, including 90 questionnaires on the current environment of 90 college students and 90 questionnaires on the ideal environment. Among the college students surveyed, 46 were male and 44 were female.

Behavior annotation was also used as an aid in the study. During the investigation, observers toured every place in the outdoor environment of the campus for 30 minutes at a time, quickly recorded the activity information they saw, and recorded the gender of students, type of activity, location of the activity, and whether the students had companions. The research lasted for one month with the behavior annotation method and finally obtained 906 records.

4. Results and Analysis

4.1 Affordance gained on the basis of the affordance level classification

By synthesizing the methods and achievements of previous studies on affordance, the author makes clear the identification methods of perceived affordance, used affordance, and shaped affordance. The changes in the number of activities of the students in Jinan University Shenzhen Campus obtained by the observers through the behavior annotation method are shown in Figure 6. To verify the effectiveness of the experiment, this paper first crawled Baidu heat maps for 7 consecutive days and discretized the research area into 19×18 20m×20m grids on the ArcGIS platform. Then, the 7-day heat map data were stacked and averaged, and the average value was linked to the grid, and the data is visualized to obtain the heat map of six periods on average in a week. Compared with Figure A, it is found that after manual visual interpretation, it is consistent with the results of the questionnaire survey (Figure 7).

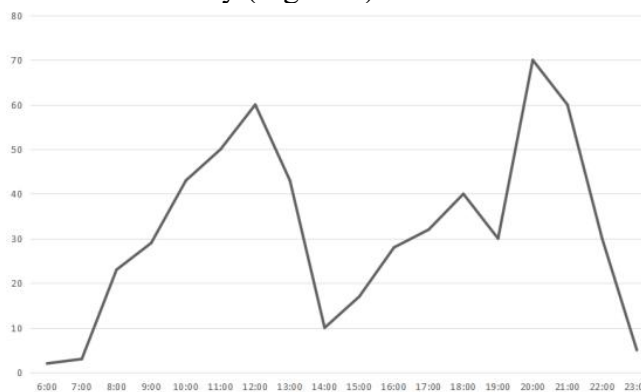


Fig. 6 Activity variation chart of college students in Shenzhen Campus of Jinan University
 Self-drawn by the author

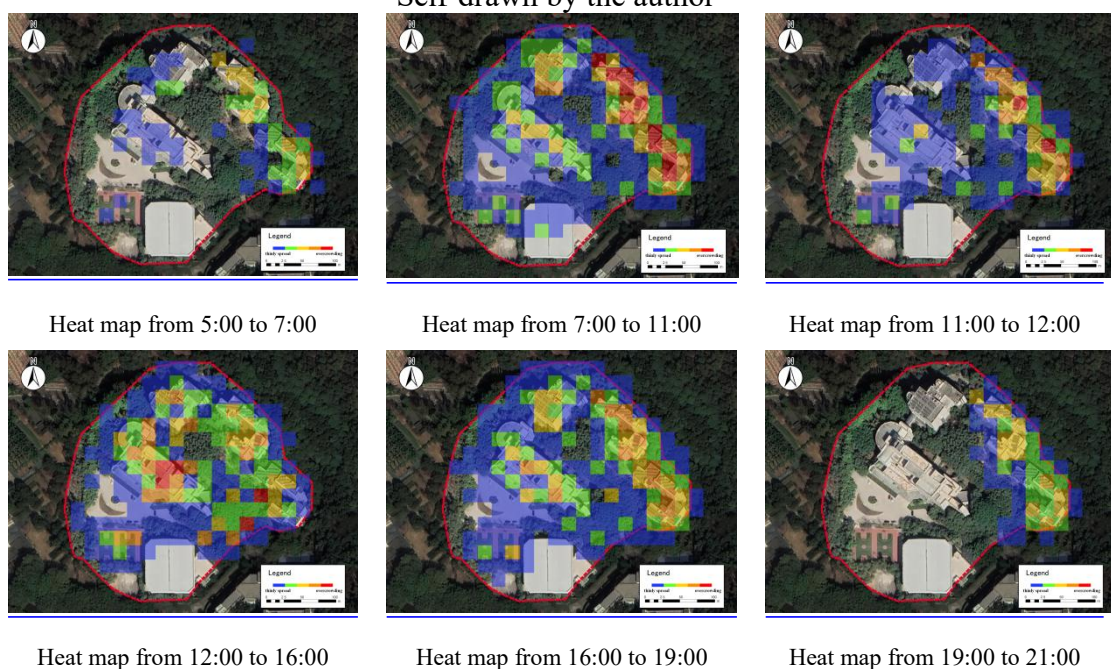


Fig. 7 Heat map of activity volume of college students in Jinan University Shenzhen Campus for 7 consecutive days
 Self-drawn by the author

We sorted out the data obtained by behavior annotation and questionnaire survey, and extract the perceived environmental elements, used ones, and shaped ones perceived by college students in the process of their current behavioral activities. The perceived environmental elements provide the perceived affordance, the used environmental elements provide the used affordance, and the shaped environmental elements provide the shaped affordance, The mechanism is shown in Figure 8.

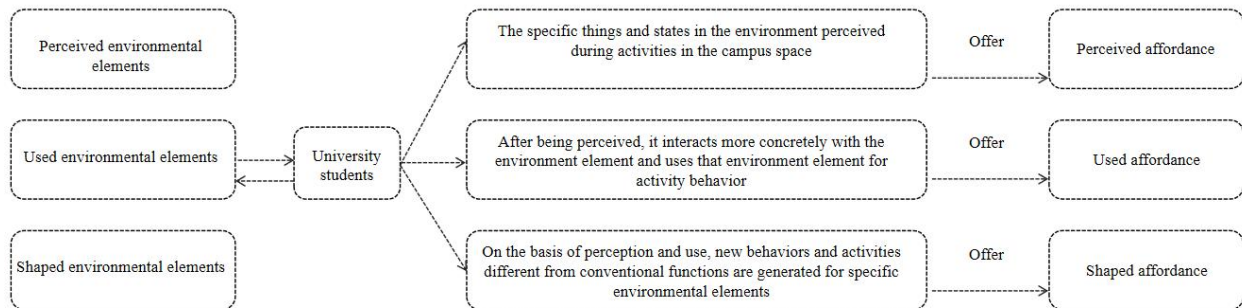


Fig. 8 The categories of environmental elements and the affordance provided by them Self- drawn by the author

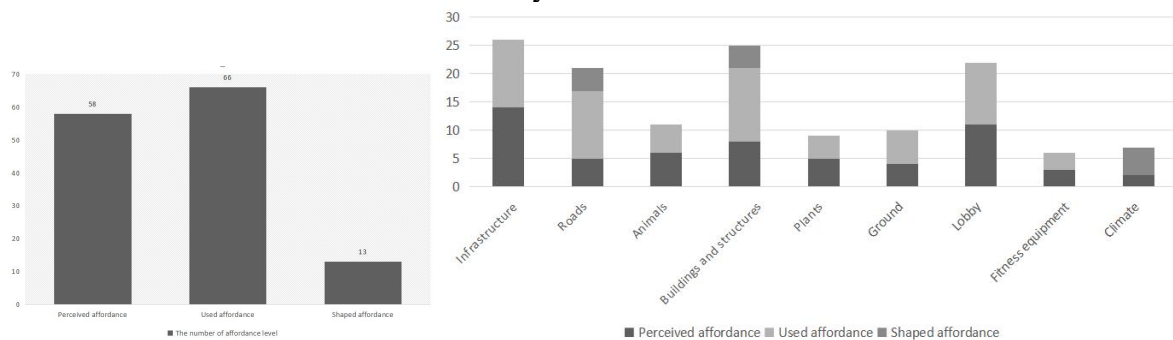


Fig. 9 Affordance of current campus space in healing landscape based on affordance level classification Self-drawn by the author

Fig. 10 Affordance structure at different levels corresponding to various environmental elements

The research results showed that the current campus space in Shenzhen Campus of Jinan University provides a variety of affordances for college students, among which the perceived affordance and the used affordance are more, while the shaped affordance is less (Figure 9).

4.2 Affordance gained on the basis of the affordance level classification

We extracted the healing psychological state of college students in the current environment, and based on this psychological state, we analyzed their psychological needs and summarized their behavioral characteristics. Under the classification of the healing psychological state, the affordance of college students in outdoor activities interacting with the environment was recorded (Table 2).

Table 2. Behavioral characteristics, examples of affordance, and environmental elements of providing landscape of affordance healing corresponding to different mental states and psychological needs of college students.

	Healing psychological states	Psychological needs	Behavioral characteristics	Examples of affordance	Environmental elements of healing landscape space providing affordance
influence factor of escaping demand	Escape from reality	Emotional emptiness, Xanadu	Desire to be alone, and self-enlightenment places	Smell the fragrance of jasmine floating through the balcony, watch the growth changes of plants, and	Ground, plants and water

				touch the plants and feel nature	
	Different degrees of mental illness	Positive psychological suggestion	Harm their own body, easy to emotional collapse	Gawk in the lobby lounge space, gaze at the view from the roof, and cry on the hidden path	Ground, plants and service facilities
	The sense of loss and regret	Relieve emotions, self-recognition	Fragile, sensitive, and deny themselves	See snails, stray cats, snakes, hear bullfrogs cry after rain, and feed cats	Climate, animals, plants,
	High pressure, irritability	Abreaction	Sudden change of personality, abreaction on innocent people	Use gym equipment to work out	Fitness equipment
influence factor of extended demand	Pursue the sense of atmosphere	Good design	Preference of rich spatial layers	See the sun, white clouds and the rainstorm, and feel the hot sun	Weather, micro-climate
	Pursue a sense of multi-function	Good experience	Preference of rich functional levels	Basic life activities such as walking, cycling, photography on the ground, learning in the teaching building, sleeping in the dormitory building, etc	Ground, buildings
	The pursuit of visual effect	Aesthetics	The pursuit of aesthetic value	In terms of color and style, the ground pavement should pay attention to aesthetic principles and reasonable collocation of plants	Ground, plants
influence factor of needing demand	The pursuit of art	Artistic expression, spiritual satisfaction	Pursuit of individuality, thoughtful things	Arrange the venue for singing and dancing, take art photos of rain scenes, and stand on the roof to see the sea in the distance	Buildings, climate
	Interpersonal crisis	Integrate into groups	Pursue group activities and communication needs	Party in the open air, communicate with people in the lobby, and meet for fitness	Buildings, fitness equipment
	Fear of trouble	Convenience	Need convenient and easy channels	In order to save time, take a bumpy and laborious path	Roads
	Pursue what you love	Meet the needs of self-worth	Do something you love, pursue your own worth, etc	Being volunteers at nucleic acid testing	Ground

The psychological needs related to the current campus space and mental state can be summarized under the influence factors of escaping demand. Students in low moods prefer to be close to nature, feel the climate change in nature, and have contact with animals or plants and other vital environmental elements in nature. According to the interview results, some college students can temporarily escape from things that make them depressed through these environmental elements, some can feel positive vitality from animals or plants and be encouraged, and others are cured in the wonderful changes of natural life. The demands for an environment such as atmosphere, function

and visual design can be classified under the influence factor of extended demand, which reflects the requirements of college students for the texture of experience in the current space. College students are eager to satisfy this psychological state of healing by changing the abundant plant configuration and fresh air after a rainstorm. The psychological state of healing under the demand influence factor of need is mainly due to their deeper exploration of culture, humanity, art and other fields. For example, college students are eager to form good interpersonal relationships in the current environment to meet their social needs, which are mainly realized through different forms of interaction with people. Under the influence factor of compatible demand, the healing state of college students in the current space needs to pursue what they love. They are in the stage of strong pursuit to realize something to achieve self-value. Besides, they need to obtain a sense of achievement to reflect self-worth.

By further associating environmental elements with different levels of affordance, in college students' campus space activities, 9 environmental elements which have affordances such as animals, plants and climate were gained. The amount of affordance varies at different levels for each environmental element, which is shown in Table 3.

Table 3. Different levels of affordance content and quantity corresponding to different environmental elements in current situation.

Environment elements	Examples of perceived affordance	Examples of used affordance	Examples of shaped affordance	Total number of affordance and number of affordance at different levels
Infrastructure	See the delivery cabinet, see the trash can, read the contents on the display board, and hear the campus broadcast	Throw garbage, sit on a bench, take out, take delivery, put an umbrella on the umbrella rack	-	27 (10/17/0)
Buildings and structures	See the teaching building, dormitory building and hotel building	Gawk in the lobby lounge space, and gaze at the view from the roof,	Stand on the roof to see the sea in the distance	24 (7/13/4)
Lobby	Seeing the flow of people and hearing the voice of endorsement	Communicate with people, eat, Study and fall in love on the tables and chairs in the lobby	-	21 (11/10/0)
Roads	Feel the bumps on the broken road and see the water on the road	Cycle and walk	Place a frame on the ground for photography, and take a rough and laborious path to save time	22 (5/13/4)
Animals	See snails, stray cats, snakes, hear bullfrogs cry after rain	Play with and feed the cat		12 (9/3/0)
Ground	See the different colors and styles of flooring	Walk and jog	-	12 (4/8/0)
Plants	Smell the fragrance of jasmine floating through the balcony, watch the growth changes of plants, and touch the plants and feel nature	Pick up fallen flowers	-	10 (6/4/0)

Climate	See the sun, white clouds and the rainstorm, and feel the hot sun	-	Take artistic photos of rain scenes	8 (3/0/5)
Fitness equipment	The gym equipment is cold to touch	Use gym equipment to work out	-	6 (3/3/0)
Note: The numbers in brackets are the number of perceived affordance, the number of used affordance, and the number of shaped affordance				

According to Table 3 and Figure 10, among the environmental elements, " infrastructure services" and " buildings and structures" contribute the most to the total amount of affordance generation in the current campus environment. Among them, infrastructure services and buildings are the basic guarantees for students' activities in campus space. Every aspect of student's daily life is inseparable from them. For example, students expressed that they need to interact with the takeout racks for food, with the delivery cabinets for delivery, and with the teaching buildings for class. These two kinds of environmental elements are the foundation for students' survival, but they are not interesting. Most students only interact with these elements when necessary. Therefore, the number of used affordances is the largest, and the shaped affordance is almost non-existent. Secondly, the environmental elements with more affordance are " lobby" and " road". " Lobby" provides the possibility of group discussion, dating, endorsement and other activities. The perceived affordance is equal to the used affordance, and there is no shaped affordance. " Road" provides the only way for students to pass, such as cycling and walking, so the number of used affordances is the largest.

The research found that the number of affordances that the current space provides is small, which is related to the area of the research object. The current space of Shenzhen Campus of Jinan University can provide less space for leisure activities. Many college students expressed that they were helpless about this situation during the interview. It is difficult to perceive, carry out and shape as many activities as possible with not rich environmental elements. " Animal ", " plant ", " climate ", though available in small quantities, during the interview, the students indicated that the activities occurred in interaction with plants (such as smelling the fragrance of jasmine floating through the balcony, watching the growth changes of plants, touching the plants and feeling nature, etc.), those with animals (such as seeing snails, stray cats, snakes, hearing bullfrogs cry after rain, feeding cats, etc.), and those with climate (such as seeing the sun, white clouds and the rainstorm, feeling the hot sun, etc.) make people feel bright and happy. All of the items are environmental elements in the current space that can heal unhealthy states of students from a natural angle.

4.3 Affordance analysis of ideal healing university campus space

Comparing the affordance of college students' ideal campus space with that of the current environment (Figure 11), it is found that the number of college students' perceived affordance has not changed much, while the number of used affordance and shaped affordance has increased, with the largest increase in the latter.

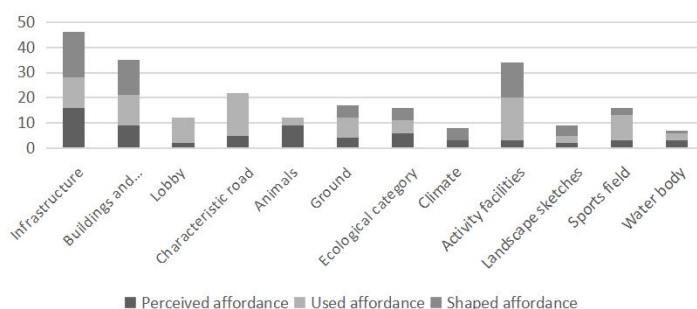
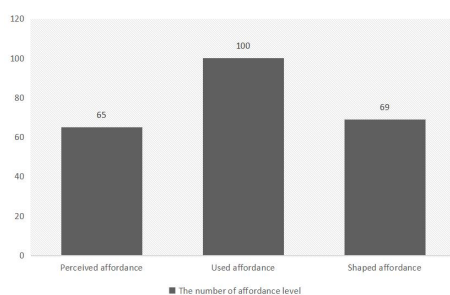


Fig. 11 The affordance of ideal campus space in healing landscape based on affordance level classification

Fig. 12 Affordance structure at different levels corresponding to various environmental elements in an ideal environment

In addition, college students have added many environmental elements that are not available in the current campus space in the ideal environment. The environmental elements that provide different levels of affordance in the current environment are relatively basic, such as the ground, animals, plants, fitness equipment, roads, and so on, which are the basic elements to meet people's normal life. While in the ideal environment, the depth of the environmental elements that provide different levels of affordance has increased, and these newly added or changed environmental elements are conducive to promoting a better life.

The category of environmental elements with positive affordance has been adjusted from the current 9 categories to 12 categories (Table 4 and Figure 12). Three types of environmental elements in the current environment have been expanded, and another three types of environmental elements added. "Fitness equipment" was expanded to "activity facilities," "roads" to "characteristic roads," and "plants" to "ecological category." The adjusted and expanded environment elements reflect the students' demand for higher-standard activities.

Among them, the expansion of "fitness equipment" to "activity facilities" reflects college students' demand for higher standards of campus infrastructure. The increase of the used affordance and shaped affordance of such environmental elements reflects the vision of college students to improve the affordance of campus activities. Only a single piece of fitness equipment can not meet the needs of college students for activities. Therefore, they are eager for rich types of activity facilities, such as beating and venting sports equipment, intelligent and diverting interactive facilities and other more interesting and diversified ones. "Roads" have been replaced by "characteristic roads". For example, the university hopes to add rugged fun paths and express lanes to improve traffic efficiency, which reflects the psychological and physiological needs of college students for higher material demands. "Plants" become "ecological category", the perceived affordance, the used affordance, and the shaped affordance are all increased. Moreover, college students are eager to increase the ecological types of activity areas such as various types of gardens. At the same time, some students expressed their hope that the garden could be used as a test base for students' professional learning, and that they would like to use the creatures in the garden as specimens and plants as teaching aids for professional courses, so as to increase the shaped affordance. There are also college students who want to set up an interactive garden, where they can experience planting trees and watering, expressing their desire to improve the used affordance of the garden.

Table 4. The content and quantity of affordance at different levels corresponding to different environmental elements in the ideal environment

Environment elements	Examples of perceived affordance	Examples of used affordance	Examples of shaped affordance	Total number of affordance and number of affordance at different levels
Infrastructure	See the delivery cabinet, see the trash can, read the contents on the display board, and hear the campus broadcast	Throw garbage, sit on a bench, use the vending machine and rest in the seat shaped as a tree	Play board games, play script killing, and play escaping from the room	46 (16/12/18)
Buildings and structures	See the teaching building, dormitory building and hotel building	Gawk in the lobby lounge space, and gaze at the view from the roof, go through the rain proof corridor, dance on the stage	Stand on the roof to see the sea in the distance, party in the open air, sing in the rain proof corridor, fall in love in the enclosed private space, and accompany small animals in the animal storage	35 (9/12/14)

Lobby	Seeing the flow of people	Communicate with people, eat, study and fall in love on the tables and chairs in the lobby	-	23 (2/10/0)
Characteristic road	Feel the bumps on the broken road and see the water on the road	Cycle, walk, and pass quickly	-	22 (5/17/0)
Animals	See snails, stray cats, snakes, hear bullfrogs cry after rain	Play with and feed the cat	-	12 (9/3/0)
Ground	See the different colors and styles of flooring	Walk and jog	Graffiti floor pavement	12 (4/8/5)
Ecological category	Watch flowers and garden scenery, smell the fragrance of jasmine floating through the balcony, watch the growth changes of plants, and touch the plants	Pick up fallen flowers, rest in the eco-garden, meditate in the meditation garden, and plant trees in the Experience Garden	Plants can be used as teaching aids for professional courses and biological specimens	16 (6/5/5)
Climate	See the sun, white clouds and the rainstorm, and Bask in the sun	-	-	8 (3/0/5)
Activity facilities	The gym equipment is cold to touch	Use gym equipment to work out, blow off sports equipment, play the interactive facilities of wisdom	Place to meet friends, party here, sit here, play with mobile phones, and make phone calls	32 (3/17/14)
Landscape sketches	See the portrait sculpture	Play fun landscape sculpture, take photos in the internet-worth landscape	Take a promotional video in front of the sculpture, take a photo with the landscape sketch, make a wish in front of the landscape sketch, and be encouraged by the spiritual sculpture	9 (2/3/4)
Sports field	See the basketball court, see the volleyball court	Play basketball on the basketball court, play volleyball on the volleyball court, run on the playground, swim in the pool	Cheer for your friends in basketball games and volleyball games	16 (3/10/3)
Water body	Watch the fountain, watch the fish in the artificial lake, touch the water in the fountain with hands	Feed the ducks in the artificial lake and play with the water in the fountain	Have a water fight	6 (3/3/1)

Note: bold characters in the first column are (compared with the current campus environment) new classification and new environmental element types; the bold characters in the second and third columns are(compared with the current campus environment) affordance of new or expanded capacity. The numbers in brackets are the number of perceived affordance, the number of used affordance, and the number of shaped affordance .

In addition, college students add a lot of environmental elements that are not present in the campus space. The three new environmental elements added are "sports venues", "landscape sketches" and "water bodies". These newly added environmental elements, such as fountains, rain proof corridors, spiritual sculptures, and even the stage and internet-famous landscape, also reflect that college students want to add many activities that are not available in the current campus environment, which is a manifestation of the pursuit of a better life. Among the newly added "sports venues", college students hope to add basketball courts, football courts, natatoriums and volleyball courts to play basketball, volleyball, swimming and cheer for friends in competitions. The new "landscape sketch" enriches the spiritual world of college students and enhances their recognition and perception of campus culture. What's more, college students hope to add more landscape sketches at the school gate or in places with a wide sight so that they can shoot publicity videos, take photos with landscape sketches, and make vows in front of the sculptures, thus increasing the used affordance and shaped affordance. They added a fountain in the "water body" element, hoping that the water in the playing fountain can increase the shaped affordance. The addition of this healing landscape element coincides with the realization of a certain degree of healing through touch in the five sense therapy. College students also hope to increase activities such as watching fountains, playing with water, and feeding wild ducks on artificial lakes.

After comparing the quantity of affordance at different levels corresponding to different elements of the current situation and the ideal environment, it is found that the top two providers of total affordance have not changed; they are still "infrastructure" and "buildings and structures", but the quantity of affordance at different levels has changed, especially the shaped affordance. The affordance of "infrastructure" in the current environment is 0, but that in the ideal environment is the largest among the three types. Among them, "tables and chairs" have been mentioned repeatedly by college students. Seats are the main medium for rest and communication. Through interviews, it can be seen that college students in Shenzhen Campus of Jinan University have various demands for seats. Some hope to replace metal tables and chairs in the current environment with more comfortable materials (such as leather), some hope to increase the number of seats, and others hope that tables and chairs can provide more diversified activities such as playing board games and doing homework. Although environmental elements such as "buildings and structures" also have shaped affordance in the current environment, the quantity is very small. In the ideal environment, the number of the shaped affordance jumps to the top, which is far greater than the perceived affordance and the used affordance. In addition, in an ideal environment, children not only hope to be dazed in the rest space of the lobby and look at the scenery from the roof, but also hope to optimize buildings and structures and carry out more diverse activities, such as holding parties in the open air, singing in the rain proof corridor, dating in enclosed private space, accompanying small animals in the animal storage, dancing on the stage, etc., which increases the used and shaped affordance.

5. Discussion and conclusion

It is found that the affordance provided by the current space is far from enough for college students. In the present environment, the used affordance > perceived affordance > shaped affordance, and the specific ratio is 58:66:13; in the ideal environment, the shaped affordance > used affordance > perceived affordance, and the specific ratio is 65:100:69. Qu Chen et al[20] found that the affordance structure of the neighborhood environment in children's outdoor physical activities presents that the used affordance > perceived affordance > shaped affordance, which is similar to the results in this paper, but the reasons for the similar results vary due to different subjects. Noor Ain Yatiman et al[21] found that the structure of affordance displayed by children in rural environments presents the characteristic of perceived affordance > used affordance > shaped affordance, which is different from the results of this paper. This may be because in the urban environment, the affordance structure of different main functions and the main population varies greatly.

The environmental elements that contribute the most to the total affordance of campus public space are "infrastructure" and "buildings and structures", which provide the most used affordance. Among them, the types, functions, geographical location, comfort of infrastructure, the use functions of buildings and structures, and the enclosure degree of space are the key contributing factors to the used affordance. The environmental elements that provide the most perceived affordance are "lobby" and "infrastructure", indicating that these two types of environmental elements are relatively complete in the current campus environment. In addition, consistent with previous research results, this study also found that the shaped affordance of the investigated environment was very limited. The campus environment bears the daily life of students, and more environmental elements that can provide shaped affordance are needed to meet the active and creative characteristics of college students.

Compared with the present environment, the quantity of shaped affordance in the ideal environment is greatly increased and occupies the largest proportion. Students hope that the ideal environment can provide more shaped affordance, such as endorsing in the garden, rehearsing programs in the enclosed space, holding parties on the basketball court, playing board games on the leather sofa, etc. The number of used affordances has also increased, which is respectively reflected in the expanded environmental elements, such as "activity facilities" adding interactive facilities for hitting, venting and playing wisdom, "ecological category" adding ecological garden and meditation garden, etc. And the newly added environmental elements, for example, "sports field" has added various types, "landscape sketches" has added the possibility of interactive play, and "water body" has added the possibility of playing in the water and other interaction. The number of perceived affordances has not changed much, which, to some extent, indicates that the current environment can provide students with a rich perception, and there is not much possibility of optimization in the ideal environment.

The research results reflect that students hope to pursue more diversified activities in the existing space. The shaped affordance of such environmental elements as "infrastructure" has increased from zero to the largest number in the ideal environment, reflecting the students' demand for the possibility of the optimization and transformation of infrastructure. The second largest increase is the shaped affordance of "activity facilities". Students hope to have activities such as making phone calls and chatting with friends in places with activity facilities. The affordance of "sports venues" has also increased a lot, reflecting the urgent needs of students for sports activities. The implantation of these environmental elements can alleviate the psychological and physiological conditions of college students who are not in a healthy state. At the same time, college students in a healthy state can also obtain positive guidance.

Through the students' demand for affordance in the ideal environment, the paper explores the direction of the optimization of college students' activity space. The affordance of specific categories of the newly added three environmental elements "water body", "landscape sketch" and "sports field", as well as the optimized and expanded environmental elements "activity facilities", "characteristic road" and "ecological category" can provide a basis for the optimization of the healing space in a university campus. Of course, there are some limitations in this study. After such elements are injected, the deeper effects are not yet clear. For example, the extent to which environmental elements play a healing role in college students and how to rationally allocate environmental elements to scientifically and effectively heal the unhealthy state of college students still need further research. In addition, future research will introduce more data for the study of university public space, to provide scientific support for the design of university public space.

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