Study on Campus Square Spatial Quality Evaluation Based on Campus Culture: A Case of South China University of Technology Wushan Campus

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Abstract. The square is an important place to express campus culture. The spatial features of the square are primarily reflected through spatial quality, and the spatial elements of the square also serve as carriers of square culture. In previous studies, scholars have explored the spatial quality evaluation of campus squares and the relationship between campus squares and campus culture. However, there is limited research on the study of square spatial quality from a cultural perspective. Therefore, this paper combines qualitative and quantitative research methods to establish a cultural perspective-based evaluation index system for campus square spatial quality. It selects instances for evaluation and summarizes the specific spatial features of squares with well-crafted cultural space. It is hoped that this will augment the relevant research and provide a reference basis for square design.

Keywords: Spatial Quality, Campus Culture, Campus Square, POE.

1   Introduction

Currently, the cultural aspect of campus development is becoming increasingly important, and squares serve as vital venues for expressing campus culture[1][2]. Therefore, researching the cultural expressions of campus squares is of significant importance for campus development. The spatial elements of squares not only serve as carriers of square culture but also represent specific objects for evaluating square spatial quality[3][4]. Thus, this paper seeks to study square spatial quality from the perspective of campus culture.

In the realm of square and public space quality, there have been scholars who have undertaken research. Zhou Jin (2003) explores urban public space development, implementation, planning, control, and guidance from the perspective of enhancing urban public space quality. He emphasizes the importance of the user's perspective and proposes a well-structured, objective, and comprehensive evaluation index system for public spatial quality[5]. Vikas Mehta (2014) constructed the Public Space Index (PSI) from five perspectives: inclusiveness, pleasurability, safety, comfort, and mean-

ingful activities, to evaluate the quality of public spaces[6]. İmran Gümüş (2021) conducted a geometric qualitative and quantitative analysis of the spatial quality of two squares, considering over 50 spatial quality parameters, focusing on spatial configuration and space syntax [4].

In the realm of the relationship between campus squares and campus culture, there has been scholarly research conducted. Liu Wanli (2011) summarized specific design methods for fostering a campus cultural ambiance through the use of cultural symbols in campus square design[3]. Li Shanshan (2023) summarized the characteristics of campus culture and the constituent elements of campus cultural square space design[7].

Currently, the construction of spatial quality indicators for public spaces primarily emphasizes physical environmental elements and behavioural usage factors, while paying relatively less attention to psychological and socio-cultural factors[8]. Additionally, research on spatial quality has predominantly concentrated on street spaces, with limited exploration of campus squares.

Therefore, this paper combines a quantitative and qualitative scientific approach to construct an evaluation index system for square spatial quality from a cultural perspective. Typical square space at the South China University of Technology Wushan Campus were selected as practical case studies for verification, facilitating a discussion on the specific spatial features that reflect campus culture. The aim is to provide references and foundations for square design and, in turn, to establish the practical significance of preserving and developing campus culture.

2   Materials and Methods

2.1   Construction of evaluation indicators set

In order to comprehensively and accurately analyse square spatial quality, this paper adheres to the principles of objectivity, comprehensiveness, and operability when selecting evaluation criteria and constructing an evaluation index system.

Spatial quality refers to the degree to which a space satisfies the activity requirements of the population in terms of both quantity and quality. Previous research has mainly constructed evaluation criteria from three aspects: usage activities, image perception, and operational support[5]. Evaluation of the spatial cultural characteristics has been conducted from the aspects of spatial geographical features, historical and cultural preservation, and cultural activities[8].

Campus culture is an important component that reflects the unique characteristics of university campus spaces. Previous research has not constructed evaluation criteria for campus square spaces from a cultural perspective but has mainly explored the cultural aspects of campus square spaces from the dimensions of material culture, spiritual culture, and behavioural culture[7].

Overall, the quality of public space has been mainly evaluated in previous research from several aspects, including physical space, psychological environment, sense of place, cultural connotations, and spatial vitality[9][10][11]. These evaluation indicators primarily revolve around the composition of physical space, subjective spatial

perception, and spatial vitality. The assessment of cultural space or the cultural characteristics of space primarily involves aspects such as physical space, cultural spatial imagery, and the overall environment[12].

This study focuses on the quality of campus square space from a cultural perspective. Building on a review of relevant literature and considering the distinctive features of campus squares as cultural spaces, it is grounded in the system of human-space-environment. The primary indicators are constructed around five aspects: cultural imagery, cultural landscape, spatial vitality, traffic environment, and overall environmental quality.

This paper has constructed an evaluation index system through a literature review. With the aim of evaluating campus square spatial quality from a cultural perspective, it includes five primary indicators and seventeen secondary indicators. Analytic Hierarchy Process (AHP) was used in this study to determine the indicator weights. Relevant experts were invited to score and compare the indicators, determining the relative importance of each indicator and obtaining factor weights, resulting in the following set of indicators (Table 1):

Table 1. Evaluation Indicators for Campus Square Spatial Quality

Objective Layer	Criteria Layer	Weight	Indicator Layer	Weight	Factor Explanation
A1 Evaluation of Campus Square Spatial Quality from a Cultural Perspective	B1 Cultural Imagery	40.26%	C1 Regional Characteristics	12.73%	Degree of reflecting regional characteristics
			C2 Historical and Cultural	10.42%	Degree of historical and cultural richness
			C3 Sense of Place Memory	6.01%	Degree of carrying place memories
			C4 Campus Spirit	7.54%	Degree of reflecting campus spirit
	B2 Cultural Landscape	27.88%	C5 Architectural Style	9.00%	Importance of architecture in reflecting campus culture
			C6 Landscaping and Greenery	4.84%	Landscape greening rate
			C7 Cultural Symbols	2.76%	Quantity of cultural symbols reflecting cultural features
			C8 Landscape Environmental Ambiance	8.34%	Degree of the quality of the landscape environmental ambiance
	B3 Spatial Vitality	10.69%	C9 Pedestrian Count	2.43%	Pedestrian count within 15 minutes: From 8:00 AM to 8:00 PM, a random 15-minute interval is selected every two hours to record the number of pedestrians, and the average is calculated based

			on the weekday-weekend ratio
	C10 Staying Count	4.62%	Staying count within 15 minutes: From 8:00 AM to 8:00 PM, a random 15-minute interval is selected every two hours to record the number of people staying, and the average is calculated based on the weekday-weekend ratio
	C11 Frequency of Hosting Events	3.90%	Frequency of hosting events within a year
	C12 Vitality Assessment	2.01%	Degree of vitality in the square space
B4 Traffic Environment 4.69%	C13 Accessibility	3.70%	Accessibility of the square space
	C14 Smoothness	2.04%	Smoothness of the square space
B5 Overall Environmental Quality 16.22%	C15 Campus Cultural Atmosphere	7.58%	Degree of reflecting the campus cultural atmosphere
	C16 Square Environmental Ambiance	6.50%	Overall environmental ambiance quality
	C17 Square Attractiveness	4.58%	Attractiveness of the square space

In this paper, a combined approach of both subjective and objective evaluations is employed to score each factor (Table 2). The evaluation system uses a 5-point scale to assign values to each factor, which are categorized into five levels. The scores for the five levels are assigned in descending order as '5 points, 4 points, 3 points, 2 points, 1 point'.

Table 2. Recommended Scoring Standards for Each Indicator

Indicator Layer	Score Criteria				
	5 Points	4 Points	3 Points	2 Points	1 Points
C1 Regional Characteristics	Highly expressive of regional characteristics	Expressive of regional characteristics	Moderately expressive of regional characteristics	Slightly expressive of regional characteristics	Not expressive of regional characteristics
C2 Historical and Cultural	Complete preservation of historical and cultural elements	Moderate preservation of historical and cultural elements	Partial preservation of historical and cultural elements	Nearly absent historical and cultural elements	No historical and cultural elements
C3 Sense of Place Memory	Abundant in place memory	Moderate amount of place memory	Some place memory	Few place memories	Lack of place memory

C4 Campus Spirit	Strongly reflects campus spirit	Moderately reflects campus spirit	Fairly reflects campus spirit	Minimally reflects campus spirit	Does not reflect campus spirit
C5 Architectural Style	Many buildings reflect campus culture, and their style is good	Some buildings reflect campus culture, and their style is good	Some buildings reflect campus culture, and the style is average	A few buildings reflect campus culture, and the style is poor	No buildings reflect campus culture
C6 Landscaping and Greenery	Good landscape greening	Moderately good landscape greening	Adequate landscape greening	Poor landscape greening	Very poor landscape greening
C7 Cultural Symbols	Many cultural symbols reflecting campus culture, and their quality is good	Several cultural symbols reflecting campus culture, and their quality is good	Some cultural symbols reflecting campus culture, and the quality is fair	Some cultural symbols reflecting campus culture, and the quality is poor	No cultural symbols reflecting campus culture
C8 Landscape Environmental Ambiance	Good landscape environmental ambiance	Moderate landscape environmental ambiance	Adequate landscape environmental ambiance	Poor landscape environmental ambiance	Very poor landscape environmental ambiance
C9 Pedestrian Count	80 and above	60-80	40-60	20-40	0-20
C10 Staying Count	40 and above	30-40	20-30	10-20	0-10
C11 Frequency of Hosting Events	Large events (with 20 or more participants) 12 times or more per year; small events 9 times or more per month	Large events 8-11 times per year; small events 7-8 times per month	Large events 5-7 times per year; small events 5-6 times per month	Large events 3-4 times per year; small events 3-4 times per month	Large events 0-2 times per year; small events 0-2 times per month
C12 Vitality Assessment	Space vitality is good	Space vitality is relatively good	Space vitality is moderate	Space vitality is relatively poor	Space vitality is poor
C13 Accessibility	Good accessibility	Relatively good accessibility	Moderate accessibility	Relatively poor accessibility	Poor accessibility
C14 Smoothness	Good traffic flow	Relatively good traffic flow	Moderate traffic flow	Relatively poor traffic flow	Poor traffic flow
C15 Campus Cultural Atmosphere	Good campus cultural atmosphere	Relatively good campus cultural atmosphere	Moderate campus cultural atmosphere	Relatively poor campus cultural atmosphere	Poor campus cultural atmosphere
C16 Square Environmental Ambiance	Good square environment ambiance	Relatively good square environment ambiance	Moderate square environment ambiance	Relatively poor square environment ambiance	Poor square environment ambiance
C17 Square Attractiveness	Good square attraction	Relatively good square attraction	Moderate square attraction	Relatively poor square attraction	Poor square attraction

2.2   Research subject

South China University of Technology Wushan Campus is located in Tianhe District, Guangzhou, Guangdong Province, China. It was originally founded in 1926 as part of the Sun Yat-sen University. The early campus planning of the Wushan Campus was meticulously designed, and many of the original campus buildings still exist. The campus has a rich history and cultural heritage, and its squares effectively reflect campus culture. Therefore, it was chosen as the research subject.

Taking into account practicality, the squares on campus that serve as significant venues for various activities were selected as typical sample spaces reflecting campus culture. The selected squares are as follows: No. 1: South Gate Square (Figure 1), No. 2: Square in front of Building No.1 (Figure 2), No. 3: Square in front of Duxing Building (Figure 3), No. 4: Square in front of Yifu Humanities Building (Figure 4).
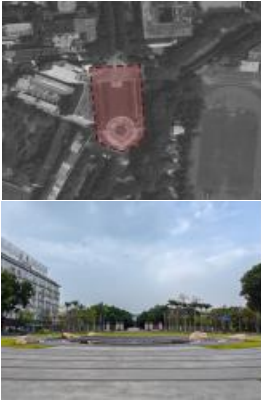
Fig. 1. South Gate Square

Fig. 2. Square in front of Building No.1

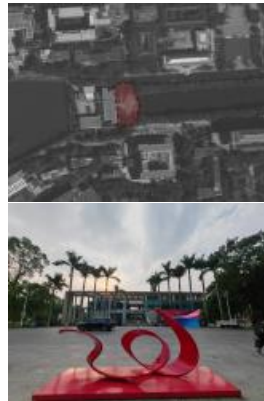**Fig. 3.** Square in front of Duxing Building

Fig. 4. Square in front of Yifu Humanities Building

3   Results & Discussion

During the research process, firstly, conducting on-site surveys of various squares within the campus and gathering relevant data. Secondly, observing people's behavior in square spaces and collecting square space evaluation questionnaires. Finally, following the evaluation recommendations in Table 2, ratings were given to the four squares, and a weighted evaluation method was used to calculate the comprehensive evaluation results (Tables 3 and 4).

Table 3. Evaluation Results of Campus Square Criterion Layer

Criteria Layer	Indicator Layer	No. 1	No. 2	No. 3	No. 4
B1 Cultural Imagery	C1 Regional Characteristics	2.96	4.02	4.68	4.73
	C2 Historical and Cultural	2.89	4.92	3.98	2.97
	C3 Sense of Place Memory	4.01	4.82	4.87	3.85
	C4 Campus Spirit	3.94	4.88	3.88	2.79
B2 Cultural Landscape	C5 Architectural Style	3.05	3.88	4.93	3.97
	C6 Landscaping and Greenery	3.98	4.96	3.98	2.96
	C7 Cultural Symbols	4.03	4.74	4.06	3.04
	C8 Landscape Environmental Ambiance	4.86	4.89	4.02	3.02
B3 Spatial Vitality	C9 Pedestrian Count	4.05	4.05	2.96	3.96
	C10 Staying Count	3.45	4.96	4.09	2.04
	C11 Frequency of Hosting Events	2.05	4.88	4.97	3.04
	C12 Vitality Assessment	1.94	4.76	3.87	3.03
B4 Traffic Environment	C13 Accessibility	2.76	4.94	4.67	3.86
	C14 Smoothness	3.96	4.92	4.06	1.56
B5 Overall Environmental Quality	C15 Campus Cultural Atmosphere	2.76	3.76	4.93	3.94
	C16 Square Environmental Ambiance	2.94	4.98	3.85	1.89
	C17 Square Attractiveness	3.04	4.87	4.06	2.03

Table 4. Campus Square Criteria-Level Evaluation Results

	South Gate Square	Square in front of Building No.1	Square in front of Duxing Building	Square in front of Yifu Humanities Building
B1 Cultural Imagery	3.3201	4.6085	4.3608	3.6698
B2 Cultural Landscape	3.8649	4.4722	4.3914	3.4021
B3 Spatial Vitality	2.9070	4.7343	4.1088	2.8545
B4 Traffic Environment	3.3064	4.9309	4.3922	2.8127
B5 Overall Environmental Quality	2.9072	4.5411	4.2695	2.6151
Total Score	3.3494	4.5828	4.3222	3.2946

From the scoring results, all four squares received scores above 3.29, indicating that each square space effectively reflects the campus culture. Among them, the front square of Building No.1 received the highest overall score, followed by the square in front of the Duxing Building and the square in front of the Yifu Humanities Building. The lowest quality square is the South Gate Square (Figure 5).

An analysis of the scores for each criterion factor revealed the following (Figure 5):

- In terms of cultural imagery, the overall evaluation of each square is very good, with the front square of Building No.1 receiving the highest score.
- In terms of cultural landscape, there is little difference in the scores for each square, and all of them have well-preserved human landscapes, such as the Sun Yat-sen statue and the school name inscription.
- In terms of spatial vitality, there is a significant difference in the scores for each square, with the front square of Building No.1 receiving the highest score, followed by the square in front of the Duxing Building. This indicates that these two squares have a higher utilization rate of space.
- In terms of traffic environment, there is a significant difference in the scores for each square, with the square in front of the Yifu Humanities Building being the lowest. This is mainly due to poor traffic flow, leading to frequent congestion.
- In terms of overall environmental quality, there is a significant difference in the scores for each square, with the front square of Building 1 receiving the highest score.
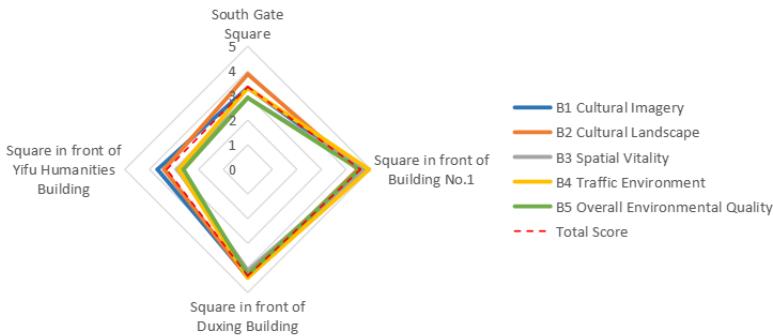

Fig. 5. Radar Charts of Evaluation Results for Each Square

4   Conclusions

Based on the evaluation results for the campus square spaces, squares with higher scores exhibit well-established humanistic landscapes and well-designed traffic environments. They have a wealth of cultural elements, and their architectural and landscape elements have good aesthetics. Overall, they present a positive humanistic image, and their overall environmental quality is good, with higher spatial vitality. On the other hand, lower-scoring squares, such as the South Gate Square, have open and underutilized spaces, offering limited areas for activities, resulting in lower spatial vitality. Additionally, the square in front of the Yifu Humanities Building receives lower scores across various aspects, and it faces severe traffic congestion issues. Therefore, when designing campus square spaces, it is crucial to consider humanistic landscape and traffic environment design, aiming to enhance the overall environmental quality and increase spatial vitality.

This study has initially established an evaluation index system for the quality of campus square spaces based on campus culture. Through the evaluation and analysis of several campus square instances, the feasibility of the index system has been validated. On one hand, the study systematically reviewed the constituting elements of the quality of campus square spaces; on the other hand, in conjunction with a cultural perspective, it preliminarily defined the evaluation indicators for campus square spaces. This lays the foundation for evaluating campus square spaces under the context of campus culture, holding the potential for further development and promotion. To some extent, it enriches the related research on campus square spaces, while providing decision-makers, designers, and the public with an effective tool to understand the cultural design of campus square spaces.

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