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Visual Evaluation and Analysis of the Architecture for Scenic Tours Based on Psychophysical Methods

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ABSTRACT: As part of the infrastructure to facilitate tourist activities, the architecture for scenic tours is a key component of the landscape in scenic spots. The design and construction quality of such architecture has an important impact on tourist satisfaction. Through psychophysical methods and environment preference theory, this work conducts visual evaluation and analysis for a certain amount of the architecture for scenic tours in an attempt to locate the main factors of influencing public preference of such architecture and to better guide future design and construction of such architecture. In addition, this work combines the architectural design concepts and institutions of American and Taiwan national parks to propose a design policy of the architecture for scenic tours at the institutional level. The policy serves as management and policy-making reference for the administrative department for scenic tours.

1. Introduction
Presently, no explicit statements about the definition of the architecture for scenic tours exist in the academic circle and different persons process different understanding of scenery architecture and travel construction related to the architecture for scenic tour [1-3]. Shunbao Du thinks that scenery architecture not only provides the place for people to enjoy the scenery, but also becomes a part of the beauty and the construction with ornamental value and other functions belongs to this type.

The architecture for scenic tours in this paper refers to the particular type of architecture offering the necessary places for public to hold the tourism activities in the natural scenery (especially the places of interests), which mainly includes service managements, accommodations, public services, landscape recreation, emergency assistance including other different subclass building types [5] (seen in Table 1). Since the architecture for scenic tours locates on the fragile visual ecology area, more focuses on its visual impact assessment are required during the design and construction process so as to reduce landscape pollution caused by the mistakes in the process of plan and design.

| Table 1 Classification pattern of the architecture for scenic tours |
|---------------------------------------------------------------|
| general category | class | subclass |
| the architecture for scenic tours | service management class | management center (station); visitor center |
| | | hostel, homestay, mountain house |

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There are few researches about visual assessment of the architecture for scenic tours and four main schools (expert paradigm, psychophysical paradigm, cognitive paradigm and empirical paradigm) of visual impact assessment on landscape resources exist [6]. These schools have their own edges and limitations. Despite saving time, the expert paradigm relies on the subjective judgements of the experts which are totally different with empirical paradigm, thus making the supplements for each other. However, the research methods of psychophysical paradigm and cognitive paradigm are the objective and reasonable methods to make visual impact assessment on landscape resources by virtues of directly reflecting the preference of the public when the time and budget are allowed [7]. The paper analyzes the visual assessment of the architecture for scenic tours via using the methods of psychophysics and dimensional assessment of cognitive paradigm.

2. Research Methods and Design

2.1 Psychophysics Method
Psychophysics method is one of the significant methods for modern landscape assessment with its theoretical starting point that the relationship between landscape and landscape aesthetic is interpreted as the relationship between stimulus and response. This kind of method seeks for the function relationship between the aesthetic results and the landscape via measuring the public aesthetic response towards landscape [8]. The landscape assessment based on the psychophysics model includes three parts [9]: (1) obtain the metric of beauty via measuring the aesthetic attitude of the general public; (2) analyze the elements of landscape and measure the value of each element through SD method; (3) Construct the relation model between the scenic beauty and each element via multiple linear regression methods in statistics.

2.2 Environmental Preference Matrix
When analyzing the landscape elements, the cognitive paradigm needs to consider choosing one variation from all variation affecting the values of the beauty metric. However, the environmental preference matrix put forwards by Kaplan is adapted by researchers to get a better understanding of the psychological reaction of environmental preference. The elements of environmental preference assessment include: (1) Coherence focusing on the aggregation and uniformity property that appears in environmental elements; (2) Legibility emphasizing that the environmental elements are easily recognizable to protect the visitors from losing; (3) Complexity stressing on the composite characteristic that the environmental elements are various and ample; (4) Mastery underlining that environmental elements are novel and attractive.

Table 2 environmental preference matrix

| Understanding | Exploration |
|---------------|-------------|
| Immediate     | Coherence   |
| Inferred      | Legibility  |
| Complex       | Mystery     |

As one part of landscape, all matrixes of architecture for scenic tours have their embodiments: the coherence reflects that the architecture is bending with the environment; the legibility demonstrates the invisibility of tourism building; the complexity reveals the complexity of its physique; and its mystery embodies the uniqueness of its style and form. Additionally, the naturality is one of the important elements which affects the preference assessment of public and the culture could also not be neglected [11]. Six pairs of adjective phrases seen in Table 3 of assessment elements are formed by using SD method and the evaluation scale of architecture for scenic tours is acquired by using Five Scaling Method (put forwards by Li Kete).
Table 3 Assessment elements of scenery tour building based on SD method

| Assessment element | Choice of SD phases       |
|--------------------|---------------------------|
| Environmental      | Conflicting with environment or bending with environment |
| Integration        | Oblivious or covert       |
| Invisibility       | Simple or ample           |
| Uniqueness         | Common or unique          |
| Naturality         | Artificial or natural     |
| Culture            | uncivilized or civilized  |

2.3 Research Designs

In this paper, 118 photos of scenery tour buildings coming from different areas, styles and scale in China are obtained. To control environmental variables, 16 photos of scenery tour buildings with different areas, styles as well as scale, whose background is natural vegetation, are selected.

The research reveals that the oblivious coherence in aesthetic attitude exists despite the assessments from different groups. Additionally, there is no significant difference between the experts and students with the major background, between the indoor assessment and outdoor assessment [8]. As a matter of convenience, the research selects 152 sophomores, juniors and seniors undergraduate students majoring in architecture, landscape architecture and urban and rural planning in one key university to grade 16 sample photos in PowerPoint (the lowest score is 0 and the highest score is 4). Moreover, Five Scaling Method assessment based on SD method is finished (seen in Fig1).

![Building 1](image1)
![Building 2](image2)
![Building 3](image3)
![Building 4](image4)

![Building 5](image5)
![Building 6](image6)
![Building 7](image7)
![Building 8](image8)

![Building 9](image9)
![Building 10](image10)
![Building 11](image11)
![Building 12](image12)

![Building 13](image13)
![Building 14](image14)
![Building 15](image15)
![Building 16](image16)

Fig.1 Photo selection of scenery tour building
3. Assessment Result Analyzing

3.1 Descriptive Statistical Analysis

The scores of the preference of 16 sample and 6 elements are obtained via using SPSS19.0 seen in Table 4. Three building samples with the highest degree of preference are Building 10 (the score is 3.38), Building 12 (the score is 3.06), Building 16 (the score is 2.72) and the building samples with the lowest degree of preference are Building 11 (the score is 0.97), Building 8 (the score is 1.02), Building 13 (the score is 1.47). Via observing the photos, the materials of the samples with the highest preference are timber, bamboo wood, stone which has strong natural quality while the materials of the samples with the lowest preference are artificial brushed finishing and veneering.

Table 4 The score list of perception and evaluation

| Number | Preference degree | Integration | Invisibility | Complexity | Uniqueness | Naturality | Culture |
|--------|------------------|-------------|--------------|------------|------------|------------|---------|
| Building 1 | 2.23 | 2.53 | 2.67 | 3.32 | 1.76 | 1.82 | 2.59 |
| Building 2 | 2.64 | 3.47 | 3.39 | 1.73 | 2.28 | 3.07 | 2.15 |
| Building 3 | 1.94 | 2.41 | 3.16 | 2.03 | 2.08 | 1.86 | 1.52 |
| Building 4 | 1.58 | 2.36 | 2.91 | 2.04 | 2.47 | 2.48 | 1.65 |
| Building 5 | 1.82 | 1.94 | 2.41 | 2.61 | 1.60 | 1.50 | 1.63 |
| Building 6 | 2.28 | 2.48 | 2.37 | 2.35 | 2.17 | 2.16 | 1.91 |
| Building 7 | 2.10 | 2.76 | 3.03 | 2.40 | 2.19 | 2.67 | 1.91 |
| Building 8 | 1.02 | 1.40 | 2.47 | 2.06 | 1.04 | 1.01 | .93 |
| Building 9 | 1.81 | 2.02 | 2.07 | 2.76 | 1.92 | 1.74 | 2.14 |
| Building 10 | 3.38 | 3.58 | 3.46 | 2.77 | 2.96 | 3.13 | 2.65 |
| Building 11 | .97 | .84 | 2.21 | 2.49 | .06 | .80 | 1.00 |
| Building 12 | 3.06 | 3.22 | 2.42 | 1.99 | 2.98 | 3.01 | 2.55 |
| Building 13 | 1.47 | 1.48 | 2.42 | 3.20 | 1.24 | 1.05 | 1.43 |
| Building 14 | 2.13 | 2.35 | 2.92 | 2.39 | 1.73 | 2.06 | 2.18 |
| Building 15 | 2.62 | 2.72 | 2.69 | 2.35 | 2.99 | 2.35 | 2.25 |
| Building 16 | 2.72 | 1.84 | 1.98 | 3.13 | 2.95 | 1.19 | 1.89 |

3.2 Correlation Analysis about preference degree of scenery tour building

Correlation analysis is a method of statistical evaluation used to study the strength of a relationship between two continuous variables. The correlation coefficient r represents the values of linear function strength and direction between two variate and the high correlation exists when the value of r is greater than 0.7. In addition, R² represents the proportion of variance explained which reflects the integrating degree of linear regression model between independent variable and dependent variable [12].

Table 5 Value and meaning of correlation coefficient r

| R of correlation coefficient (absolute value) | Relational degree |
|---------------------------------------------|-------------------|
| 1.00 | complete correlation |
| From 0.70 to 0.99 | high correlation |
| From 0.40 to 0.69 | moderate correlation |
| From 0.10 to 0.39 | low correlation |
| Below 0.10 | weak correlation or no correlation |

The research about assumption correlation of 6 items (seen in Table 6) is put forwards, which means that there exists the appreciable impact between the preference of scenery tour building and Integration, Invisibility, Complexity, Uniqueness, Naturality and Culture respectively.

Table 6 Assumption of research

| Assumption | Impact |
|------------|--------|
| Assumption 1 | Appreciable impact between the preference of scenery tour building and Integration (H₁) |
| Assumption 2 | Appreciable impact between the preference of |
Assumption 3 Appreciable impact between the preference of scenery tour building and Invisibility (H2)
Assumption 4 Appreciable impact between the preference of scenery tour building and Complexity (H3)
Assumption 5 Appreciable impact between the preference of scenery tour building and Uniqueness (H4)
Assumption 6 Appreciable impact between the preference of scenery tour building and Naturality (H5)

Those assumptions are examined via the correlation coefficient r and determination coefficient R2 in linear regression by using SPSS19.0. Aimed at Assumption 1 seen in Table 7 and 8, the testing result is that the value of t is 5.981, the correlation coefficient r and standardized coefficient are 0.848 and R2 is equal to 0.699 after adjustment under 0.01 standard deviation. This result reveals that under 0.01 standard deviation, there exists the high linear correlation between the preference and Integration whose value of R2 is 69.9%. Therefore, the assumption 1 is standing.

Table 7 Recapitulation statement of regression analyzing between preference and Integration

| model | R | R^2 | t   | error |
|-------|---|-----|-----|-------|
| 1     | 0.848a | 0.719 | 0.699 | 0.37108 |

a. predictive variable (constant): Integration

Table 8 Coefficientsa of regression analyzing between preference and Integration

| model | unstandardized coefficients | standardized coefficients |
|-------|-----------------------------|---------------------------|
|       | B  | standard error | t      | Sig.  |
| 1     | (constant) | .316 | .314 | 1.006 | 0.331 |
|       | Integration | .768 | .128 | .848 | 5.981 | .000 |

a. dependent variable: preference degree

Based on the above principal, H2 is obtained successfully via regression analysis: under 0.01 standard deviation, the value of t is 1.445, the correlation coefficient r and standardized coefficient is 0.360 and R2 is equal to 0.068 after adjustment, which demonstrates that there is a week correlation between invisibility and preference; the result of H3 reflects there is no correlation between complexity and preference (r=0.018) so that the assumption 3 is not standing; the result of H4 shows that there exists the high correlation between uniqueness and preference (r=0.859) whose R2 is equal to 71.9%, proving that the assumption 4 is standing; the result of H5 explains that there is a high correlation between naturality and preference (r=0.741) whose R2 is equal to 54.9% so that the assumption 5 is standing; culture has a high correlation with preference (r=0.866), the R2 value of which is 73.2%, therefore the assumption 6 is standing.

3.3 The analysis of preference to scenery tour building
By analysis above, the following conclusions are made in the research: (1) correlation: under 0.01 standard deviation, the preference presents a good linear correlation with culture, uniqueness,
integration and naturality, whose r value is from 0.741 to 0.866; (2) predicted explanatory power: under 0.01 standard deviation, the value of $R^2$ after adjustment is from 0.549 to 0.732 and the rank of predicted explanatory power is culture $>$ uniqueness $>$ integration $>$ naturality when these four elements make the regression of single variables.

3.4 Explanation of Typical Scenery Tour Building

Thought analyzing, the culture, uniqueness, integration and naturality could be considered as the reference elements for describing the quality of scenery tour building. The scores of these four elements in the building samples with the highest scores and lowest scores are visually represented via spider chart (seen in Fig.2). From the spider chart, the higher-score building processes the larger scope of the spider chart while the lower-score building owns the smaller scope of the spider chart. Intriguingly, the Building 16 obtains an ideal preference assessment with its uniqueness although its scores of culture, integration and naturality is not high.

![Spider Chart](image)

**Building 10**

**Building 12**

**Building 16**

**Building 13**

**Building 8**

**Building 11**

**C**: Culture  **N**: Naturalit  **U**: Uniquene  **I**: Integration

Fig. 2 spider chart about the elements of typical scenery tour building

The common features among those typical scenery tour buildings are acquired as followed: (1) from the aspects of building materials, the buildings whose surface or supporting structure are using the natural materials (or the color of material is the same as natural material) such as wood and bamboo are more popular while the buildings using artificial materials such as rendering finishing do not enjoy great popularity; (2) from the respect of the building size, the smaller buildings enjoy great popularity while the larger buildings, especially the building with large lateral length, are unpopular.

4. Conclusion and Suggestion

The preference degree of scenery tour building for general public is strongly relative with the culture, uniqueness, integration and naturality of the buildings instead of the complexity and invisibility. Therefore, when designing the scenery tour buildings in future, the engineers are required to have a clear object that the culture and uniqueness of nature environment need taking into consideration and
the methods of city construction design need avoiding taking into the scenery. The engineers should be prudent to the material and size of the building. Ministry of Housing and Urban-Rural Development and Management Department of Beauty Spots should make the management statute of beauty spot construction more detailed, especially the concrete norms and statutes of scenery tour building which are suitable for the local. In the case, some measures taken by America and Taiwan could be referred to [13-15]. Some beneficial trials concerning the construction system of scenery tour building in China could be conducted via the following respects.

4.1 Constructing the impeccable access system of scenery tour building
After analyzing scenic environment and defining naturalness, designing and constructing the scenery tour building acquires its basis and design criteria and the scenery tour building with different naturalness and types has relative access standards. The degree of access is low for the building which has a larger scale of tourists and an oblivious effect on environment. Only the low-density development areas and common development areas are allowed to establish scenery tour buildings, thus lowering the influence of natural environment caused by leisure activities.

4.2 Strengthening the guidance of scenery tour building on material selection
When selecting the materials of scenery tour building, the local materials are the first choice since the local materials make less pollution during transportation and construction process. Furthermore, there are no problems caused by energy consumption and environment pollution except labor force by virtue of adapting the construction technologies of traditional architecture, such as assembling and lashing. In addition, urbanization materials and fine processing materials need avoiding, which lessens the naturality of scenery tour building. For instance, the stainless-steel handrail is hard to blend with the natural environment so that their metallic luster needs eliminating via using paint, paint-drying and other methods if needed [16].

4.3 Forming simulation mechanism of landscape environment
Visual simulation is beneficial for deciders and engineers to experience the actual situation of scenery tour building before developing and constructing. A good result of visual simulation needs to reflect the visual senses of equipment in environment, including the volume, form, hue and even texture. Before conducting the scenery tour building, the visual simulation is a significant method to lower the distraction and influence to environmental landscape, which is finished via survey analysis of environmental landscape and visual simulation of the infrastructure [17].

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