



The influence mechanism of visual perception of suburban platform landscape on tourists' behavioral intention: an empirical study on ecotourism based on TPB - SEM model

Changyu Liu¹, Sirui Wang¹, Jingwen Wang¹, Ruijing Gao² and Yanqiang Ding^{1,*}

¹ College of Landscape Architecture, Northwest A&F University Xianyang 712199, Shaanxi, China

² School of Economics and Management, Qingdao University of Science and Technology, Qingdao 266061, Qingdao, China

SUMMARY: *Objective: Based on the perspective of ecotourism research, this study constructed and empirically tested the integration model of the Theory of Planned Behavior (TPB) and landscape perception, and revealed the internal mechanism of the influence of visual perception of suburban platform landscape on tourists' behavioral intention through psychological cognitive variables such as attitude, subjective norms and perceived behavior control. It provides theoretical basis and practical guidance for optimizing ecotourism management strategies and improving tourists' experience quality. Method Taking the Daijiawan Soil and water Conservation Demonstration Park in Jintai District of Baoji City as the study sample, the OpenCV image processing technology, SBE beauty evaluation method, and questionnaire survey method were integrated to construct a landscape perception quantitative system containing 26 observation indicators. Based on the Structural equation model (SEM), the path model of "landscape visual attraction-psychological cognization-behavioral intention" was empirically tested. Results The results showed that: (1) landscape visual appeal had significant positive effects on attitude, subjective norm and perceived behavioral control; (2) Perceived preference is a key affective variable affecting attitudes and subjective norms; (3) Behavioral intention is mainly driven by attitude and perceived behavioral control, and has a significant positive predictive effect on actual tour behavior. Nature and environment perception factor is the most influential latent variable to explain behavioral intention. Conclusion The visual perception of suburban platform landscape indirectly affects tourists' behavioral intention through multiple intermediary paths. This study provides empirical basis and sustainable management practice enlightenment for the value transformation and sustainable development of ecotourism products.*

KEYWORDS: *suburban platform landscape; Visual attraction; Perceived preference; Theory of planned behavior (TPB); Structural equation modeling (SEM); Behavioral intention; Sustainable management*

1 Introduction

With the deepening of ecological civilization construction, ecotourism has become a critical path to drive suburban development [1]. Although the existing researches focus on the motivation or satisfaction of eco-tourists, they mostly focus on the macro level, and lack an

*15664759031@163.com

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integrated model that links the macro landscape environment with the micro tourists' psychological cognition and behavior decision-making. Especially in the context of fluctuating terrain (platform), how landscape perception, as an external stimulus, drives behavioral intentions through internal psychological variables such as attitudes and subjective norms has not been fully analyzed, and its internal mechanism, namely the "black box" problem, has not been fully analyzed. Studies have shown that quantitative data analysis can effectively clarify the ownership relationship of design tasks, improve the feasibility and efficiency of design, and thus promote the activation of ecological functions on the platform [2]. However, there are still problems in the deep application of quantitative methods, the systematic mining of tourists' psychological and behavioral variables, and the cross integration of multi-disciplines. Based on this, relying on the Theory of Planned Behavior (TPB), this study constructed an integrated model of "landscape perception, psychological cognition and behavioral intention" [3], and took Baoji Daijiawan Soil and Water Conservation Demonstration Park as an empirical case, aiming to: (1) reveal the influence path and effect strength of suburban terrace landscape perception on tourists' behavioral intention; (2) From the perspective of ecotourism, it provides empirical basis and policy enlightenment for optimizing landscape planning, improving management efficiency, promoting the value transformation of ecotourism products, and realizing sustainable development.

2 Theoretical framework and research hypothesis

2.1 Theoretical Basis

(1) Visual perception and preference

The development of suburban platform tourism relies on the interaction between landscape and people [4], and landscape plays a key role as a perception carrier [5]. Studies have shown that 87% of environmental information acquisition depends on visual channels [6], which provides an evaluation basis for perceptual preference research. Perceived preference can be defined as the subjective evaluation and preference selection of individuals or groups on the environment, resources or system states [7]. The perception preference model proposed by Kaplan points out that the model is jointly constructed by the recreation behavior dimension and the information processing dimension [8], and its complexity and mystery characteristics constitute the core demands of high-quality ecotouristic experience, and the two jointly promote exploration value and recreation value. By establishing the correlation analysis between perceived preference and Theory of Planned Behavior (TPB), it is found that tourists' attitude, subjective norms and perceived behavioral control have significant predictive effects on behavioral intention [9], and then positively guide tourism behavior decision-making. In the evaluation system of landscape space, visual attraction is the core index to measure the quality of space, which not only reflects the behavioral characteristics of viewers [10], but also stimulates the performance of tourists' viewing behavior. This mechanism echoes the concept formation theory of "destination attraction" in tourism economics [11].

(2) Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) originates from the field of psychology and is often used to predict human social behavior. Research shows that the theory has significant influence and wide application value in the fields of tourism participation [12], tourism adaptability [13] and green consumption strategy [14]. From the perspective of individual tourists, this theory explains the internal relationship and external logic among behavioral attitude [15], subjective norm [16] and perceived behavioral control [17, 18]. Based on the above research, the

relationship between visual attraction, perceptual preference and individual behavior can be systematically analyzed by considering human behavior from multiple dimensions. Therefore, by integrating the theory of visual perception and preference and the theory of planned behavior, this study intends to construct a role path of "visual perception, behavioral attitude, behavioral intention", so as to reveal the influence mechanism of suburban platform landscape on tourists' behavior decision-making.

2.2 Construction of conceptual model

Based on the above analysis, we can see that the three theoretical systems tend to be mature and interrelated. Visual attraction as an external variable indirectly affects behavioral intention through attitude and perceived behavioral control, while perceived preference as an affective variable modulates subjective norms (Figure 1). Therefore, in this study, visual attraction was used as the cognitive evaluation index, perceived preference was used as the emotional mapping index, and the theory of planned behavior was used as the design framework to construct the following conceptual model.

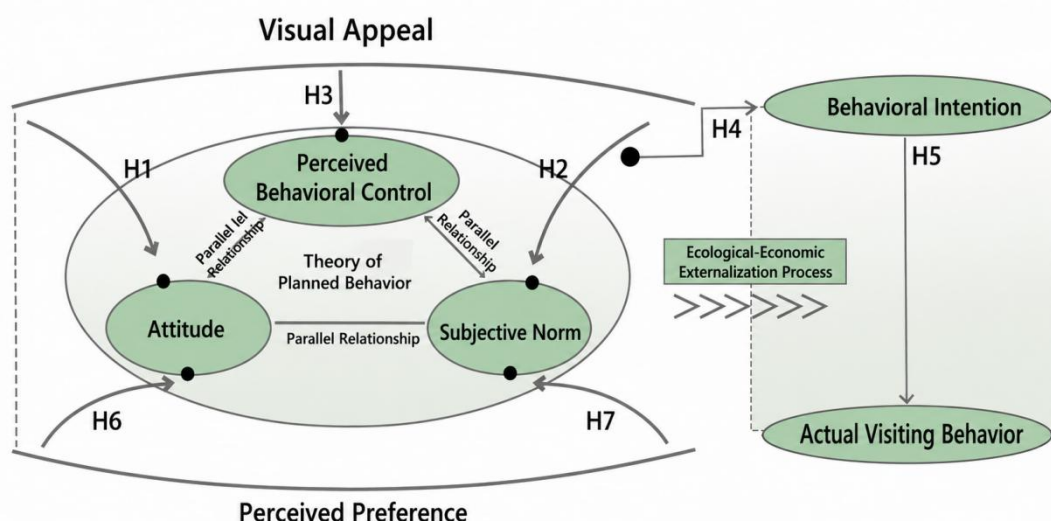


Figure 1: Conceptual model

2.3 Research hypothesis

Based on the conceptual model, this study explores the influence relationship between each variable, and puts forward the following research hypothesis:

- H1: Visual attraction has a significant positive effect on attitude;
- H2: Visual attraction has a significant positive effect on subjective norms;
- H3: Visual attraction has a significant positive effect on perceived behavioral control;
- H4: Attitude, subjective norm and perceived behavioral control have significant positive effects on behavioral intention;
- H5: Behavioral intention has a significant positive impact on actual tour behavior;
- H6: Perceived preference has a significant positive effect on attitude;
- H7: Perceived preference has a significant positive effect on subjective norms;

3 Research Methods

3.1 Overview of the study area

This study takes Baoji Daijiawan Soil and Water Conservation Demonstration Park as a typical case area. The platform is located in Jintai District of Baoji City, which is the transitional zone between the old and new urban areas of Baoji [19], and has the geomorphology and ecological characteristics of the typical northern urban platform. In order to respond to the policy orientation of Weihe ecological and cultural belt construction and meet the ornamental needs of tourists, the plateau park area is designated as the specific research scope (Figure 2). In this area, the linear spatial elements connect the landscape nodes to form a coherent landscape interface, and realize the organic integration of the landscape system of the platform park. On the basis of systematically combing the landscape elements in the site, this study integrates the characteristics of tourists' viewing behavior, and carries out empirical research from the perspectives of perceived preference, visual appeal and planned behavior theory. The structured interview method is used to collect systematic data from tourists and visual design professionals, and a multi-dimensional quantitative analysis framework is constructed to realize the comprehensive analysis of tourists' behavioral intentions.

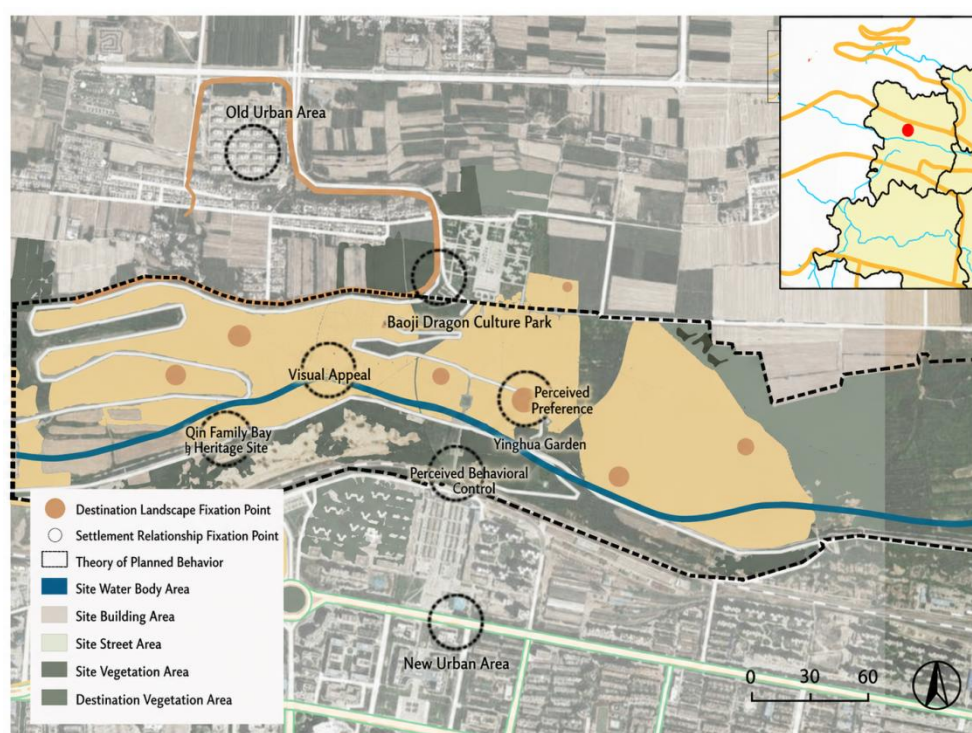


Figure 2: Research area of Baoji Daijiawan Soil and Water Conservation Demonstration Park

3.2 Variable measurement and data collection

(1) Variable definition and measurement items

As a core criterion of cognitive evaluation, visual appeal is the benchmark influencing factor in this study. Based on the existing literature review, combined with the environmental characteristics and current situation of the suburban platform, and referring to the theoretical framework proposed by Fan Rong *et al.* [20], this study deconstructs the visual attraction into the following seven measurement dimensions: spatial openness, vegetation cover, artificial

structures, color composition, material texture, water body, form and dynamic landscape elements.

As the external mapping of tourists' emotion, perceived preference can be divided into four dimensions of consistency, readability, complexity and mystery according to Kaplan's visual emotion classification theory [21]. Based on this theoretical framework, Professor LIU further proposed the new consideration factors of platform protection and perceived value assessment -- landscape diversity and landscape coordination at the ecological level [22]. From the perspective of human activities, the diversity of ecological landscape caused by the platform environment is easy to cause tourists' perception bias and aesthetic fatigue, so we should focus on the maintenance of landscape coordination. In terms of tourists' emotional experience, consistency, complexity and readability are more reflected in the modern urban landscape, and the core value of the platform environment is to provide exploratory experience, that is, to strengthen the mysterious dimension and explore its changing perspective of expression, and finally form the emotional expression mechanism with landscape coordination and mystery as the core.

In view of the single topography of the platform and the staggered distribution characteristics of the road, the landscape coordination should be reflected by three elements: hierarchy, order and connectivity. Based on the demand of terrace experience dominated by natural viewing in contemporary society, the mystery needs to be characterized by three elements: exploration, seclusion and novelty. The theory of planned behavior constitutes the basic principle of platform intervention design. The three attributes of subjective norm, attitude and perceived behavior control affect each other and act on individual behavior decision-making. The landscape elements of the platform can directly attract tourists' visual attention and affect their perceptual preferences. By analyzing the mechanism of these factors on visual perception and preference, tourists' behavioral intention and actual tour behavior can be predicted, and the prediction results provide a direct and indirect representation basis for tourism consumption behavior research.

Based on the theory of planned behavior, combined with the research status and expert opinions, this study used the Beauty Evaluation method (SBE) to obtain landscape aesthetic data (including specific indicators such as visual appeal and perceived preference). The psychological and behavioral data of tourists (including attitude, subjective norm, perceived behavioral control and behavioral intention) were obtained by questionnaire survey. According to the evaluation index factors defined by the theory of planned behavior, the tourists' behavioral intention and actual tour behavior were deduced, and then the quantitative system of visual perception of suburban platforms containing 26 indicators was constructed. The data were analyzed by the structural equation model, and the path coefficients of each index were calculated according to the conceptual model. Finally, the visual perception evaluation system was constructed and the quality of the platform landscape was evaluated [23] (Figure 3). In structural equation models, the relationship between latent variables and observed variables can be expressed as follows.

$$X = \Lambda\xi + \delta \quad (1)$$

where, X represents the observation variable matrix of visual attraction, perceived preference, attitude, subjective norm, perceived behavioral control, behavioral intention and actual tour behavior; ξ represents the latent variable matrix; Λ represents the factor loading matrix; δ represents the measurement error term. This formula is used to illustrate how the observed indicators collectively reflect the corresponding underlying psychological and behavioral constructs.

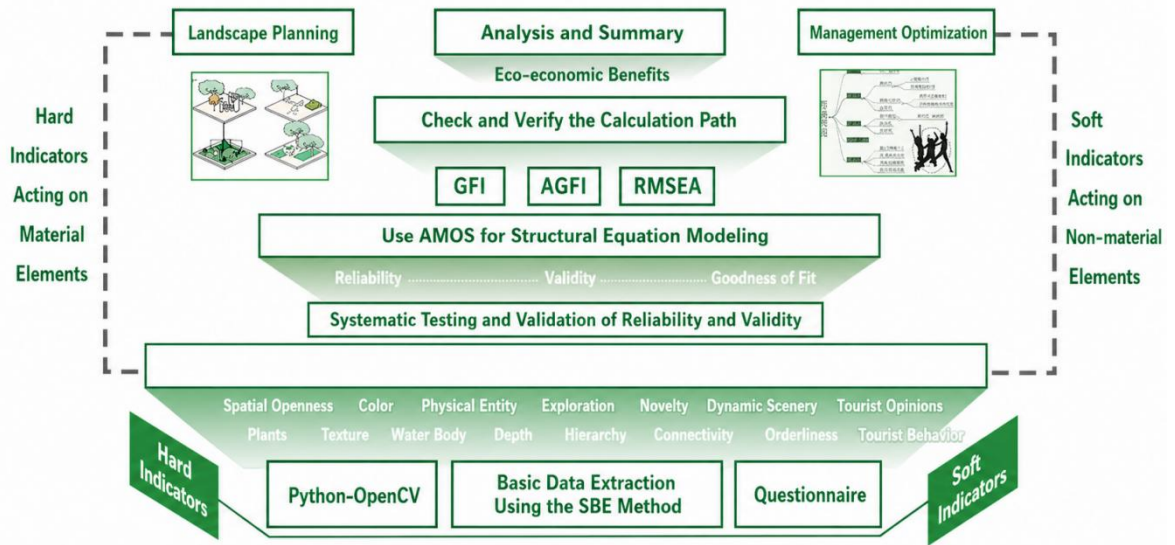


Figure 3: Research methods for visual perception of suburban platforms

(2) Data collection methods

Landscape image acquisition and processing: Basic image data are obtained by shooting [24]. The specific process is as follows: the platform in the study area is divided into four parts, and shooting points are laid out every 15 meters along the preset transect line. At each point, shots were taken in the front, rear and centripetal directions of the marching direction, respectively, and negative landscape elements were avoided. The shooting work is carried out in the time period with sufficient light conditions, fixed shooting parameters, unified use of the same type of mobile equipment, and the lens height is maintained at the eye level of the observer to minimize errors. More than 1000 original images were obtained in total. After the discussion of the research group and expert consultation, 80 images in each of the four parts were selected, and a total of 320 representative photos were quantified for analysis.

Scenic Beauty Estimation (SBE) is the mainstream method in the field of landscape aesthetic evaluation. This study used a slide show of landscape photos to guide the evaluators to score the landscape elements in the pictures, and finally obtained a total of 10 index data. It includes A3 (entity), A4 (color), A5 (texture), A6 (water), A7 (dynamic scene), B11 (exploration), B12 (depth), B13 (novelty), B21 (hierarchy), B22 (connectivity) and B23 (order). In order to eliminate the influence of different raters' rating scale differences on the results, this paper standardizes the original ratings, and its calculation formula is as follows.

$$SBE_i = \frac{R_i - \bar{R}}{\sigma_R} \quad (2)$$

where, SBE_i represents the standardized beauty value of the i th landscape sample, R_i represents the original average rating of the sample, \bar{R} represents the average rating of all samples, and σ_R represents the standard deviation of the rating. The higher the normalized SBE value, the more attractive the landscape sample is in the visual evaluation of tourists. In view of the individual differences in visual perception, this classification framework aims to unify the evaluation criteria and reduce the data errors caused by the fuzzy definition of elements (Figure 4).

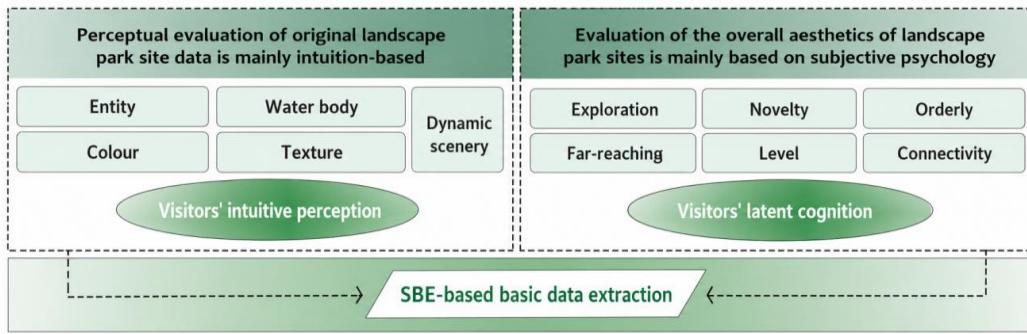


Figure 4: Analysis of the SBE factor

Questionnaire survey method: As an independent data collection tool, the questionnaire can be flexibly designed according to the research purpose to collect information about the attitude and behavior of the respondents, so as to serve the verification research of the theory of planned behavior. Among them, the core constructs such as subjective norms, attitudes, perceived behavioral control, behavioral intention and actual tour behavior need to be quantitatively measured through questionnaires (Figure 5). This study adopted the integration strategy of beauty Assessment method (SBE) and questionnaire survey. The SBE method focused on the assessment of landscape aesthetic value, and the questionnaire survey expanded the dimension of data collection. The combination of the two methods can not only obtain subjective aesthetic evaluation results, but also supplement multiple information through standardized questionnaires, so as to improve the accuracy of the research.

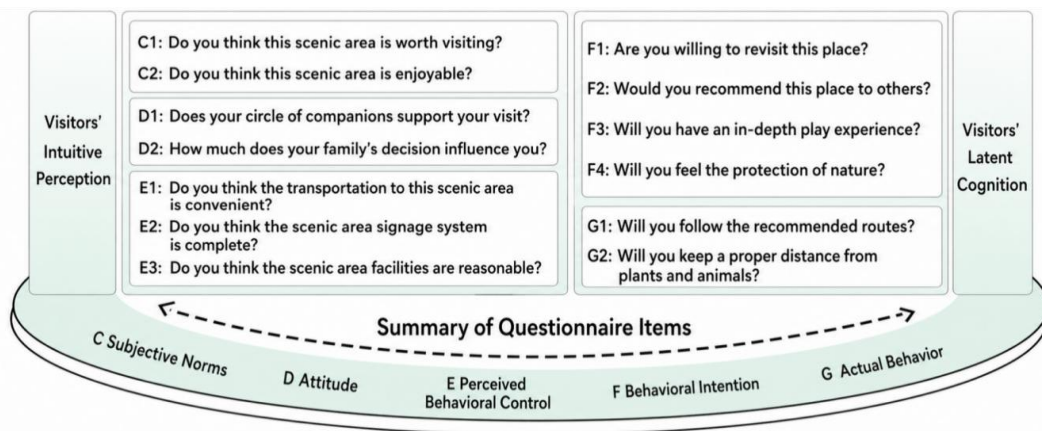


Figure 5: Summary of the emotional factors of the questionnaire

In this study, a questionnaire on the Influence Mechanism of visual perception preference of tourists in Suburban terrace Parks was constructed. The design of the questionnaire was based on the systematic consideration of the overall structure of the questionnaire and the control of the intervention degree of the Situational judgment method (SBE) in the questionnaire. The questionnaire consists of the following three core modules:

Part I: Collection of basic information of respondents -- an anonymous survey is used to collect demographic characteristics variables, including age, gender, occupation and education level.

Part II: The visual perception evaluation framework of suburban platforms -- Based on the systematic review of literature on visual attraction, perceptual preference and adaptive cycle theory, an evaluation system containing three dimensions (natural attributes, emotional

experience, and adaptive characteristics) is constructed, with a total of 14 structured items. The attractiveness of the images was rated according to the beauty rating scale (1: very attractive; 2: not attractive; 3: less attractive; 4: moderately attractive; 5: more attractive; 6: attractive; 7: very attractive).

Part III: Respondents can make suggestions for improvement of the suburban platform -- all items adopt a 7-point scale (1: strongly disagree -- 7: strongly agree), which is extended to a 7-point scale based on a 5-level Likert scale to collect data information.

Operation process:

1. Firstly, make an overall overview of Daijiawan Terrace Park to assist evaluators to establish aesthetic reference benchmarks;
2. Quickly display all the sample images to make them familiar with the image content, and clarify the evaluation dimensions and scoring standards;
3. The sample images were played back one by one, and each image was presented for 10 seconds for evaluators to complete the scoring of each dimension;
4. Fill in the rating items in the Comments and suggestions form.
5. Carry out prediction experiments, invite experts to review, and optimize the semantics of the item expression according to the expert opinions.

Computer vision analysis method: OpenCV is an open source computer vision and machine learning software library. This method extracts the sky and vegetation areas in the image based on HSV color space, and calculates the proportion of their area to quantify the two evaluation indicators of spatial scale and vegetation. The spatial scale is characterized by the openness: the higher the openness, the larger the visible range, and the spatial scale increases accordingly. The sky area is identified by OpenCV, the proportion of sky pixels is used as the quantitative feature of spatial openness, and the spatial scale is divided into four levels: [0,10] is the first level, (10,20] is the second level, (20,30] is the third level, and (30,100] is the fourth level (Table 1). The calculation formula of spatial openness is as follows.

$$O_i = \frac{P_{sk_{y,i}}}{P_{total,i}} \times 100 \quad (3)$$

where, O_i represents the spatial openness of the i th sample image, $P_{sk_{y,i}}$ represents the number of pixels in the image that are identified as sky regions, and $P_{total,i}$ represents the total number of pixels in this image. This index is able to transform the wide view of the platform landscape into comparable numerical features.

Vegetation is the core element of the platform landscape space. Its unique plant community not only has the function of landscape beautification, but also has a positive impact on the sustainability of the platform ecosystem. Therefore, in the study of Daijiawan platform plants, color configuration has become one of the key elements [25]. In this study, the proportion of vegetation green viewing rate in the total landscape visual amount in the photos of the selected sampling sites was used as the core evaluation index of visual attraction. The formula for calculating the green viewing rate of vegetation is as follows.

$$G_i = \frac{P_{veg,i}}{P_{total,i}} \times 100 \quad (4)$$

where, G_i represents the green visibility of vegetation in the i th sample image, and $P_{veg,i}$ represents the number of vegetation pixels identified by OpenCV. Through this formula, the influence of plant landscape on tourists' visual perception can be transformed into quantitative indicators, which provides a data basis for subsequent visual appeal evaluation.

Existing studies have shown that when the green vision rate reaches 25% [26], the comfort of human perception reaches the optimal state. Accordingly, the green viewing rate was divided into four levels of gradient: [0, 25]% and (70, 100]% were defined as the first level, (25, 40]% as the second level, (40, 55]% as the third level, and (55, 70]% as the fourth level (Table 1). It should be pointed out in particular that the peak value of spatial visual attraction and comfort appeared when the spatial scale and vegetation green viewing rate reached a dynamic balance, but the higher the vegetation green viewing rate, the stronger the visual attraction was.

Table 1: Classification criteria for two indicators

Assigned Value	Plant Green View Rate (A2) / %	Spatial Scale (C21) / %
1 point	[0,25], (70,100]	[0,10]
3 points	(25,40]	(10,20]
5 points	(40,55]	(20,30]
7 points	(55,70]	(30,100]

4 Empirical analysis results

4.1 Sample Characteristics and data quality

In order to systematically obtain the feedback data of the crowd on visual attraction, this study used a combination of online and offline methods to carry out the survey. The online questionnaire was used to evaluate and analyze the visual appeal of landscape architecture students, and the views of residents and tourists were collected offline in the platform area. After multiple days of data collection, a total of 316 valid questionnaires were collected (the effective recovery rate was 90%). After eliminating the samples with incomplete answers and missing values, 301 valid samples were entered into the reliability, validity and structural equation model analysis. SPSS 25.0 and AMOS 26.0 statistical software were used for data analysis, and Structural equation model (SEM) was constructed to quantify the path relationship between observed variables and latent variables.

The statistical characteristics of the sample are as follows: the ratio of male to female is balanced (close to 1 : 1); The age of respondents is concentrated in the mid-20s (75%); The ratio of residents/tourists to landscape design/landscape architecture students around the middle platform Park was close to 1:8:1. The sample data structure is balanced and representative of the group [27].

4.2 Measurement model checking

(1) Reliability analysis

Table 2: Cronbach reliability analysis

Variable	Number of Items	Sample Size	Cronbach's α Coefficient
Visual Attraction	7	301	0.809
Perceived Preference	6	301	0.819
Attitude	2	301	0.850
Subjective Norm	2	301	0.850
Perceived Behavioral Control	3	301	0.837
Behavioral Intention	4	301	0.823
Actual Visiting Behavior	2	301	0.809

Table 2 shows that the Cronbach's α coefficients of the seven dimensions are all greater than 0.8, indicating that the dimensions of the questionnaire have good internal consistency, and the reliability of the scale meets the requirements of empirical analysis.

(2) Validity analysis

Table 3: Tests for exploring factors KMO and Bartlett

KMO value		0.937
Bartlett's test of sphericity	Approximate chi-square	6767.806
	df	325
	p value	0.000

Table 3 of the applicability test results of factor analysis shows that $KMO=0.937>0.6$, and Bartlett's spherical test is significant ($p<0.05$), so the sample data are suitable for carrying out factor analysis.

Table 4: Table of variance explanation rates

Factor No.	Characteristic root			Rotate the front difference explanation rate			The variance explained rate after rotation		
	Characteristic root	Variance explained rate %	Cumulative %	Characteristic root	Variance explained rate %	Cumulative %	Characteristic root	Variance explained rate %	Cumulative %
1	12.482	48.006	48.006	12.482	48.006	48.006	5.592	21.509	21.509
2	2.340	8.999	57.005	2.340	8.999	57.005	4.897	18.834	40.343
3	1.826	7.023	64.028	1.826	7.023	64.028	3.239	12.458	52.801
4	1.433	5.512	69.540	1.433	5.512	69.540	2.643	10.165	62.965
5	1.352	5.201	74.741	1.352	5.201	74.741	1.870	7.190	70.156
6	1.168	4.491	79.232	1.168	4.491	79.232	1.840	7.077	77.233
7	0.686	2.638	81.870	0.686	2.638	81.870	1.206	4.637	81.869
8	0.422	1.622	83.491	-	-	-	-	-	-
9	0.395	1.519	85.011	-	-	-	-	-	-
10	0.376	1.448	86.458	-	-	-	-	-	-
11	0.355	1.364	87.822	-	-	-	-	-	-
12	0.315	1.210	89.033	-	-	-	-	-	-
13	0.300	1.153	90.186	-	-	-	-	-	-
14	0.286	1.100	91.286	-	-	-	-	-	-
15	0.267	1.028	92.314	-	-	-	-	-	-
16	0.238	0.916	93.231	-	-	-	-	-	-
17	0.221	0.851	94.082	-	-	-	-	-	-
18	0.213	0.818	94.900	-	-	-	-	-	-
19	0.203	0.781	95.681	-	-	-	-	-	-
20	0.201	0.771	96.452	-	-	-	-	-	-
21	0.184	0.708	97.160	-	-	-	-	-	-
22	0.175	0.675	97.835	-	-	-	-	-	-
23	0.153	0.589	98.424	-	-	-	-	-	-
24	0.143	0.552	98.976	-	-	-	-	-	-
25	0.135	0.518	99.494	-	-	-	-	-	-
26	0.131	0.506	100.000	-	-	-	-	-	-

Table 4 The study shows that seven common factors are extracted. The cumulative variance explanation rate after rotation is 81.869%, which proves that the factor fitting degree is reasonable.

Table 5: Table of factor loading coefficients after rotation

Name	Factor loading coefficient							Common degree (common factor variance)
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	
A1	0.775							0.738
A2	0.817							0.775
A3	0.845							0.816
A4	0.815							0.789
A5	0.770							0.742
A6	0.790							0.778
A7	0.819							0.808
B1		0.785						0.781
B2		0.800						0.795
B3		0.791						0.764
B4		0.837						0.852
B5		0.798						0.789
B6		0.782						0.786
C1					0.887			0.907
C2					0.893			0.910
D1						0.891		0.910
D2						0.873		0.906
E1				0.852				0.850
E2				0.830				0.814
E3				0.853				0.857
F1			0.779					0.766
F2			0.766					0.808
F3			0.794					0.814
F4			0.776					0.797
G1							0.671	0.856
G2							0.687	0.880

Table 5 uses the maximum variance rotation method (varimax) for factor rotation. It can be seen from Table 5 that the common degree of all observed variables is higher than 0.4, indicating that there is a significant correlation between variables and factors, and confirming the rationality of the model in the sense of ecological economics.

4.3 Structural model checking and hypothesis verification

(1) Model goodness of fit

Table 6: Model goodness of fit Table

Test Indicator	Chi-square/df Ratio (CMIN/DF)	GFI	AGFI	RMSEA	CFI	NFI
Reference Standard	Between 1 and 3	>0.80	>0.80	<0.10	>0.80	>0.80
Output Result	2.182	0.871	0.843	0.063	0.949	0.910

Six fitting indexes including chi-square degree of freedom ratio (χ^2/df), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI) and root mean square error of approximation (RMSEA) were used to test the construct validity of the model. The data in Table 6 show that all indicators reach the recommended value standard, the model has good goodness of fit, and the model fits the data well.

(2) Path analysis test results

The results of structural equation modeling analysis showed that except for the direct effect of visual attraction on subjective norms, which did not reach the 0.05 significance level, the other paths showed significant positive effects.

$$\eta = B\eta + \Gamma\xi \quad (5)$$

where η represents the endogenous latent variables such as behavioral intention and actual tour behavior, ξ represents the exogenous latent variables such as visual attraction and perceived preference, B represents the path coefficient matrix between the endogenous latent variables, Γ represents the influence coefficient matrix of the exogenous latent variables on the endogenous latent variables, and ζ represents the structural error term. The formula can summarize the causal transmission relationship between landscape visual attraction-psychological cognization-behavioral intention.

Table 7: Structural Equation Model (SEM) path analysis table

Path	Standardized Path Coefficient	Unstandardized Path Coefficient	S.E.	C.R.	P
Behavioral Intention (F) → Actual Visiting Behavior (G)	0.615	0.782	0.058	13.544	***
Perceived Behavioral Control (E) → Behavioral Intention (F)	0.336	0.290	0.044	6.632	***
Subjective Norm (D) → Behavioral Intention (F)	0.173	0.126	0.037	3.394	***
Attitude (C) → Behavioral Intention (F)	0.236	0.186	0.040	4.609	***
Visual Attraction (A) → Perceived Behavioral Control (E)	0.419	0.474	0.059	8.008	***
Perceived Preference (B) → Subjective Norm (D)	0.374	0.491	0.082	5.970	***
Visual Attraction (A) → Subjective Norm (D)	0.117	0.155	0.083	1.863	***
Perceived Preference (B) → Attitude (C)	0.316	0.383	0.076	5.036	***
Visual Attraction (A) → Attitude (C)	0.186	0.229	0.077	2.969	***

As shown in Table 7, all paths of structural equation model (SEM) showed significant positive effects (* p * < 0.05): latent variable E had the most significant influence on latent variable F ($\beta = 0.336$), indicating that improving tourists' sense of control over tour activities (such as providing clear guide and convenient facilities) was the most effective way to promote their tourism behavior intention. The positive effect of latent variable B on latent variable D ($\beta = 0.374$) is stronger than that of latent variable A ($\beta = 0.117$), indicating that the word-of mouth communication and social recommendation among tourists are more dependent on emotional

resonance (such as mystery) rather than pure visual impact. The latent variable F has a significant positive effect on the latent variable G ($\beta = 0.615$), which confirms the applicability of the theory of planned behavior in the context of eco-tourism. The latent variable D had a significant positive effect on the latent variable F ($\beta = 0.173$), but the effect strength may be regulated by contextual factors such as information cue and group atmosphere. Latent variable C has a significant positive effect on latent variable F ($\beta = 0.236$), indicating that attitude can be used as an important limiting factor to predict tourist behavior. Latent variable A has a significant positive effect on latent variable E ($\beta = 0.419$), indicating that there is a reasonable association between material elements and tourist perception elements. Latent variable B had A significant positive effect on latent variable C ($\beta = 0.316$) and latent variable A had a significant positive effect on latent variable C ($\beta = 0.186$), indicating that there was a strong relationship between tourists' physiological perception and psychological perception. The above analysis results fully confirmed the positive influence relationship between the elements in the structural equation model (see Figure 6).

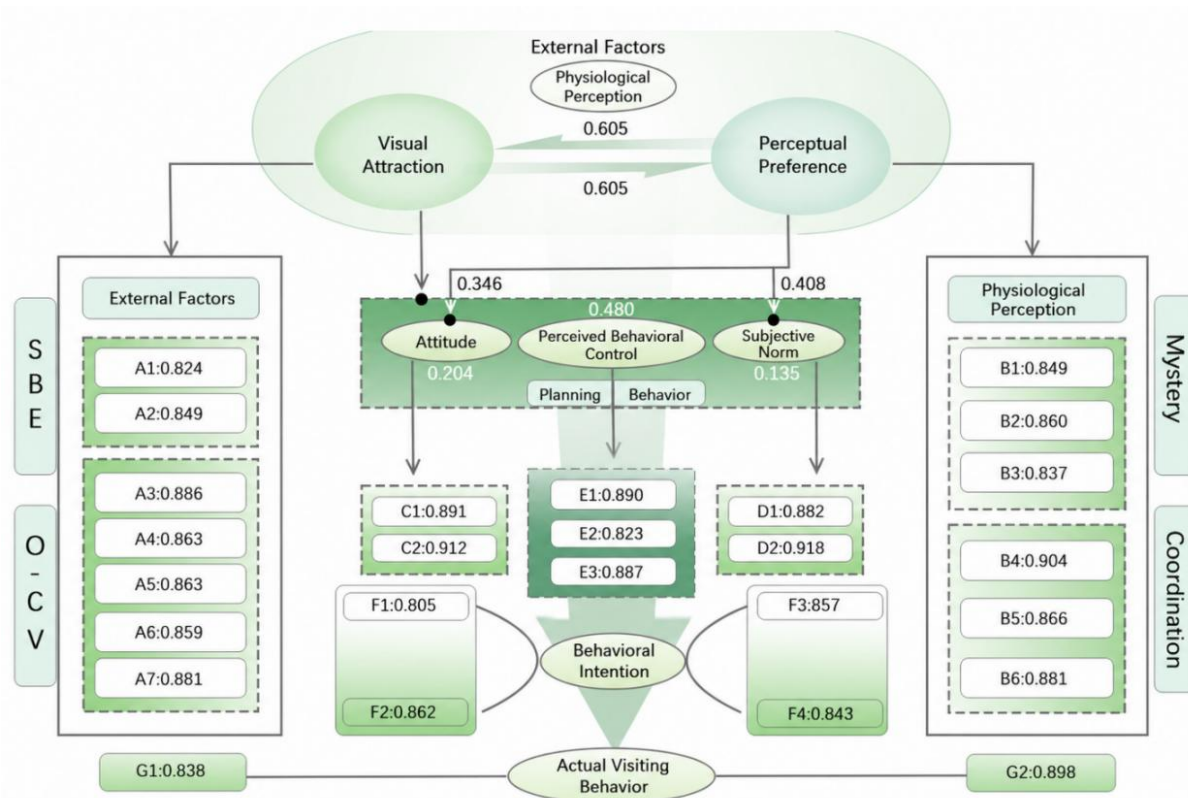


Figure 6: Structural Equation Model (SEM) analysis of the influence mechanism of planning behavior in suburban platforms

5 Conclusion and discussion

5.1 Research Conclusion and Discussion

It is found that there is a significant positive correlation between the elements of the path model. This study constructed and verified the integrated model that the landscape perception of suburban platform affected tourists' behavioral intention through multiple psychological cognitive paths, and confirmed the effectiveness of the theoretical transmission mechanism of "landscape environment-emotional cognition-behavioral intention" in the context of

ecotourism. The results show that enhancing tourists' perceived behavior control is the primary driving factor to promote behavioral intention, and the shaping of environmental mystery is the core trigger factor to stimulate positive emotional response and positive word-of-mouth transmission.

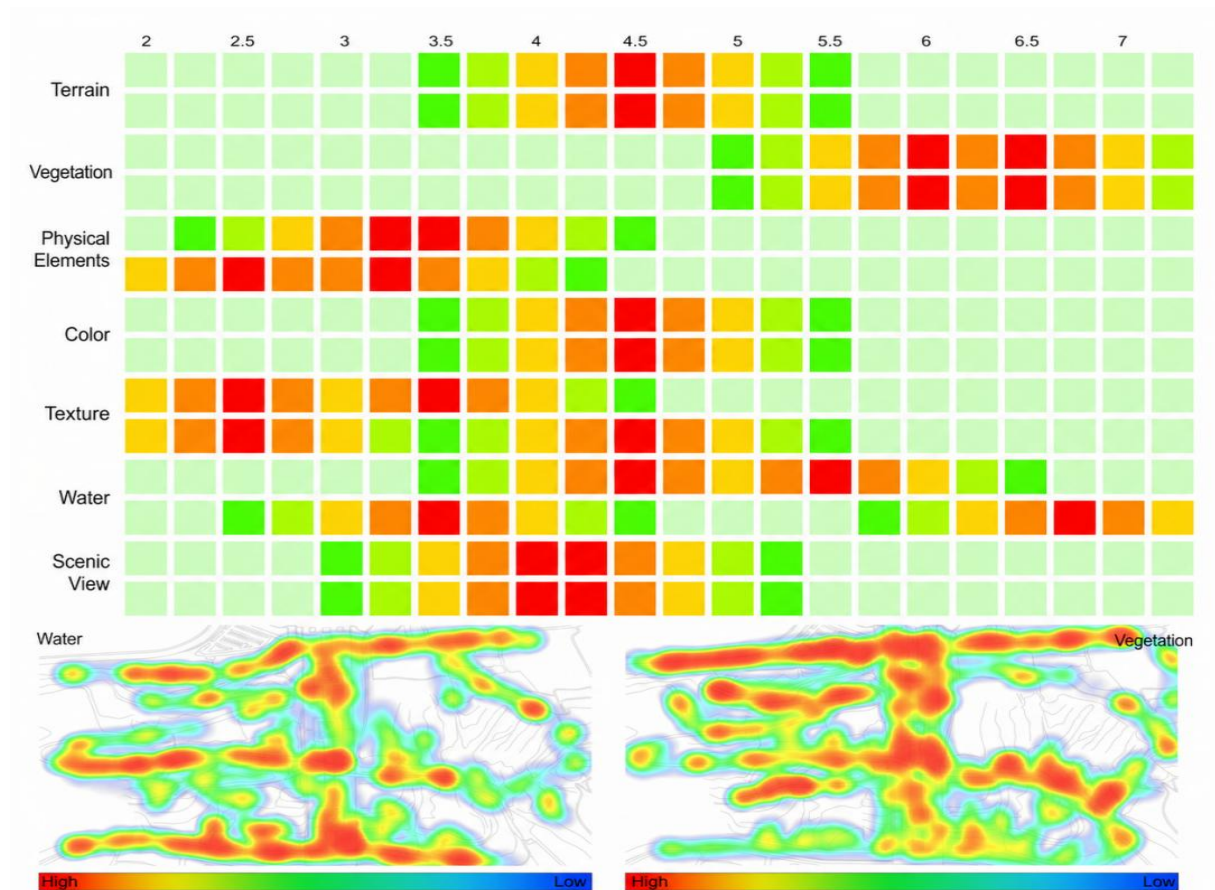


Figure 7: Distribution of visual attraction quality value and attraction heat area in Daijiawan Plateau Park

Based on the results of the questionnaire survey (Figure 7), the following findings can be drawn: the respondents at the top of the mountain show a strong intention to attract the visual elements of open space; The respondents paid more attention to the terrain elements in the flat section. Respondents along the river have the most significant preference for water elements. The mountainside respondents not only show high attraction intention to plant elements, but also have significant utility in the theoretical framework of planned behavior, which fully confirms the relevance of mountainside visual perception and landscape planning strategy. Therefore, scientifically using the value of visual attraction factors of consumers in different locations and coordinating its relationship with perceived preferences and behavioral intentions can build a tourism management model that fits the characteristics of the platform and the psychological needs of tourists.

As the core elements, plants in the suburban terrace landscape have a stronger influence on human visual stimulation and psychological experience, and have a significant effect on attitude, subjective norms and perceived behavior control. Therefore, the core attraction of ecotourism products should be based on plant elements, and its transformation path to tourism products should be explored. The influence of spatial openness on behavioral intention was lower than that of plants, which indicated that this factor affected behavioral decision by imperceptibility

and was an implicit feature in visual perception. When planning space openness, tourists' environmental comfort and space carrying capacity should be considered simultaneously, so as to improve the quality of tourism experience and strengthen ecological sustainability.

The element of mystery has the most significant influence on perceived preference, which directly affects the attitude and subjective norms, and effectively promotes the tourists' willingness to revisit and recommend, that is, enhances the place loyalty. For the value evaluation of this element, it is necessary to pay attention to the guiding influence of the composition of the interviewed group on the experimental results. Although the sample includes professional groups, the stability of the model in different groups is good, and it is recommended to take it as the deepening direction of subsequent research.

5.2 Regional Characteristics and comparative analysis

This research site selected Baoji Daijiawan tableland Park, which has the comprehensive characteristics of the northern tableland, so there is a significant difference between the research results of the southern tableland and the northern tableland. The tourism management strategy based on small-scale water township landscape was adopted in the southern region, while the empirical data of Daijiawan platform showed that the public paid more attention to the perceived preference for spatial openness. This tendency not only reflects the change of public preference under the influence of environmental factors, but also reveals the potential demand for the openness design of the northern platform. In addition, the hot and humid environment in southern China is conducive to the continuous growth of plants, and the seasonal variation of vegetation is weak and the species richness is high, so the evaluation dimensions of plant species and hierarchical structure are often ignored in the design of southern platforms. This phenomenon is highly consistent with the data of this study: the data show that the public has a significant preference for plant species configuration and hierarchical structure [28]. This preference not only effectively improves the aesthetic quality of the platform tourism environment, but also promotes the sustainable development of the suburban platform landscape in the field of ecological economy and tourism management by enhancing the practical effect of the theory of Planned Behavior (TPB). Compared with the study by Dai Xiaojun et al. (2021), this study is the first to incorporate landscape visual perception into the TPB framework, revealing the key role of "mystery" as an affective variable. This finding not only enriches the theoretical connotation of TPB in the context of ecotourism, but also provides a new idea for the experience design of suburban platform landscape, which is more conducive to explaining the interaction mechanism between consumer behavior and sustainable development.

5.3 Theoretical Contribution and Practical Enlightenment

(1) Theoretical contribution

This study expanded the application scope of the Theory of Planned Behavior (TPB) in the field of ecotourism, and constructed a more perfect behavior explanation model by introducing "landscape perception" as a key external variable. The research results provide a management framework centered on tourist experience for the cross field of visual perception such as tourism management practice in the future, which is helpful to the sustainable development of the ecological and economic system of the suburban platform. At the same time, this study expanded the applicability of the theory of planned behavior and the theory of visual perception in the northern regional context, and laid a theoretical analysis foundation for the ecological economic transition of the northern platform under the framework of the theory of planned behavior.

(2) Practical enlightenment

- ① For destination managers: perceived behavioral control has a significant direct impact on behavioral intention. It is necessary to pay attention to the dynamic monitoring of tourists' perceived behavior control level, and effectively reduce tourists' decision-making cost and uncertainty by optimizing the guide system, improving service facilities and itinerary design.
- ② For marketing planners: both visual attraction and perceived preference have direct effects on planning behavior attitude. In the marketing and promotion of the suburban platform, we should go beyond the simple scenic display, and focus on the "mystery" and "exploration value" of the platform, so as to deeply stimulate the emotional resonance and exploration desire of potential tourists.
- ③ For planners: the analysis of tourists' behavior intention shows that plant configuration has both aesthetic value and economic value. Local plant species with ecological benefits, ornamental characteristics and cultural connotations should be preferentially selected, and a plant landscape system with both uniqueness and sustainability should be constructed to effectively strengthen the brand image of the destination.

5.4 Sustainable ecotourism management strategy of suburban platform based on SEM influence path

In this study, Structural equation modeling (SEM) was used to systematically explain the multiple paths through which the landscape perception of suburban platform affected the behavioral intention of tourists (Figure 6, Table 7). The empirical analysis shows that managers can effectively regulate tourists' psychological cognitive mechanism (attitude, subjective norm and perceived behavior control) through targeted intervention of landscape environmental elements (visual attraction, perceived preference and other dimensions), and then guide their behavioral intention and actual consumption behavior. Based on the above impact paths, this study proposes a systematic management strategy to promote the sustainable development of ecotourism on the suburban platform (Figure 8).

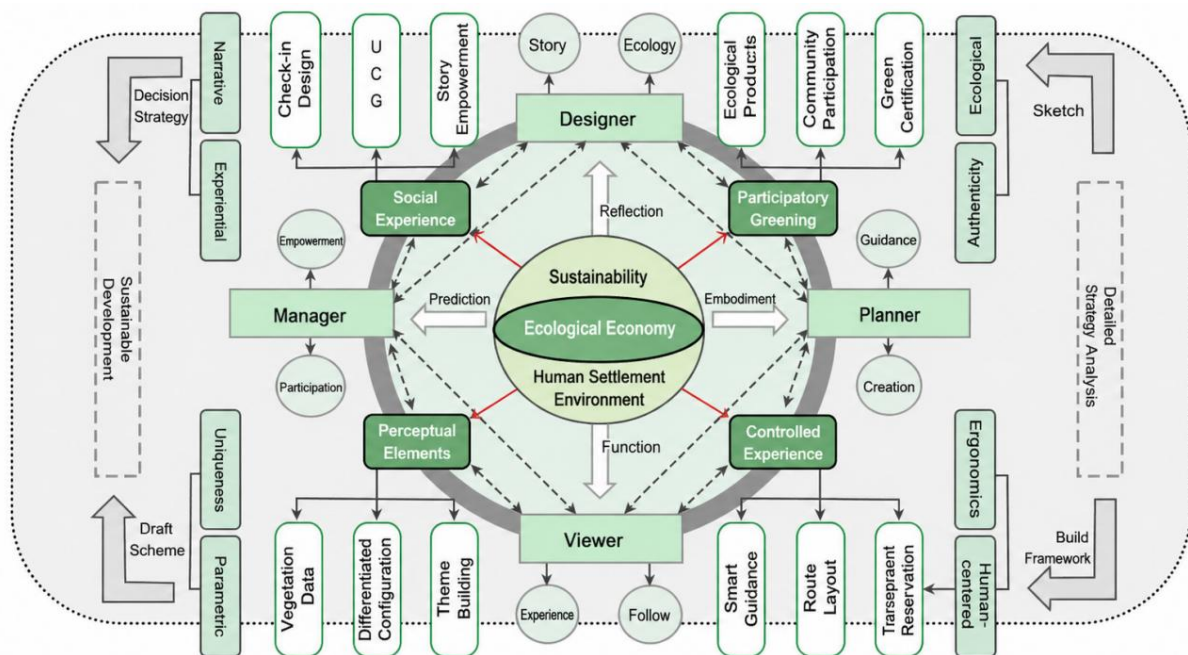


Figure 8: The practice analysis diagram of the suburban platform strategy

- (1) Strengthen the key perception elements and accurately improve the destination attraction

This study confirmed that plants ($\beta=0.849$) are the core elements of visual appeal. Therefore, one of the key links of management strategy is to construct plant communities with high aesthetic value and ecological value. This is not only aimed at improving the greening level, but also an effective way to directly shape the attraction of the destination, influence the psychology and behavior of tourists, and achieve economic goals. To this end, the following recommendations are made:

Data-driven vegetation management: regularly use OpenCV and other technologies to monitor the green vision rate and set it as a key management index to ensure that the green vision rate of the core tourist area is maintained in a comfortable range (such as 40%-55%), and avoid blindly pursuing too high coverage rate; **Differentiated configuration:** The model results showed that slope vegetation had a significant impact on behavioral intention, and it was necessary to focus on building characteristic plant landscapes with multi-level structure and rich seasonal changes. The highland focuses on maintaining a wide view, forming a dense space sequence; **Theming:** Create "mystery (higher β)" as the core experience. By designing a winding waterway, creating a confined space for local plants, and setting up landscape sketches to guide exploration, the complexity and mystery of the environment are consciously enhanced, thus significantly enhancing tourists' positive emotions and willingness to share. Similar to previous studies, direct influence can more effectively generate perceived control effects and act more efficiently at the behavioral level. The significance of the perceived behavior control factor (0.480) in this study based on AMOS further proves that plant design can not only visually attract tourists, but also effectively promote their specific behaviors [29], so as to realize the preset economic goals.

(2) optimize tour experience and sense of control, and reduce the threshold of behavior decision-making

The results show that perceived behavioral control is the strongest predictor of tourists' behavioral intention ($\beta=0.336$). This shows that compared with simple landscaping, reducing tourists' decision-making uncertainty and improving the convenience and controllability of their tour process can more effectively promote tourism consumption decision-making. To this end, the following recommendations are made:

Smart guide system: Develop small programs or provide intelligent guide maps to display the density of tourist attractions, waiting time in line and the location of service facilities (such as toilets and rest points) in real time, so as to reduce the "searching cost" and "time cost" of tourists, so as to directly enhance their sense of control. **Tour design and facilities layout:** Based on the heat map (Figure 7) analysis, service facilities are added to the tourist dense areas; In the tour blind area, landmark landscapes or interesting paths are designed to guide, so as to balance the space load and improve the overall tour ability. **Reservation and information transparency:** establish an online reservation system and provide detailed tour guidelines (such as expected tour duration and route recommendation), so that tourists can form stable psychological expectations before travel, and effectively reduce their perceived risks.

Based on the Beauty Evaluation Method (SBE) analysis, the elements of entity (0.886), texture (0.809) and spatial openness (0.824) have high confirmatory factor loading, which confirms the importance of reducing the decision-making threshold of tourists by optimizing the environment for behavior control. The results of the questionnaire, Figure 7, also showed high values of visual perceived quality, which further confirmed that the visual guidance effect of the site itself had a significant positive impact on visitors. In conclusion, the ecological and economic benefits that can be promoted by optimizing the tour environment are considerable.

(3) To guide positive social norms and build destination brand reputation

Subjective norm ($\beta=0.173$) had a direct positive effect on behavioral intention, and was itself significantly driven by perceived preference ($\beta=0.374$). Therefore, creating a tourism

experience with high memory and sharing value is a key mechanism to stimulate tourists' independent communication behavior and build a benign word-of-mouth economy. Accordingly, the following policy recommendations are proposed:

Create landmark landscape nodes: select core scenic spots according to the SBE evaluation system, design photography points or experience projects with both landscape novelty (B13) and environmental coordination, guide tourists to share through social media, and use their social networks to achieve low-cost and high-credibility destination marketing; Establish a User-Generated Content (UGC) incentive mechanism: planning activities such as photography contests and travel notes collection, implementing ticket exemption or in-kind rewards for winners, systematically collecting and spreading positive word-of-mouth, and converting it into destination brand equity; Deepening narrative empowerment and cultural infiltration: injecting ecological connotation and local cultural narrative into the characteristic platform landscape (such as the terrace, warping dam and forest and grass compound pattern), improving the knowledge depth and value perception of the experience, making the content shared by tourists more cultural appeal, and then affecting the cognitive structure of their social circle.

In view of the homogenization of tourism strategy in the platform park, the path analysis based on AMOS visual attraction model showed that there was a significant positive correlation between the subjective norm dimension D1 (0.882) and the behavioral intention dimension F2 (0.862) (* $p < 0.001$), which confirmed that tourists had a significant tendency to conform to landscape publicity information. This finding provides a theoretical basis and practical path for using group behavior to construct a benign word-of-mouth communication network.

(4) Promote community participation and green development to achieve long-term sustainability

The successful implementation of sustainable ecotourism highly depends on the extensive support and deep participation of the community. Only when the economic benefits generated by ecological protection are effectively returned to the community can a long-term management mechanism be constructed. To this end, the following recommendations are made:

Value realization of ecological products: Encourage and support local residents to develop and sell handicrafts and ecological agricultural products based on the characteristic plants of the platform (such as pennisetum, wicker), so that tourists can extend the ecological experience beyond the tour activities, and ensure that residents can obtain direct economic benefits from protection actions. Community participation in management: local residents are recruited as ecological conservators, guides or interpreters, whose rich local knowledge helps to deepen the tourist experience, create local employment opportunities, and strengthen the identity of residents as the main body of the platform protection. Green certification and brand building: actively apply for domestic and foreign authoritative eco-tourism related certification (such as green scenic spot certification), and take this certification as a core marketing element to attract high-quality customers with strong environmental awareness, so as to enhance the brand value and core competitiveness of the destination.

6 Research limitations and future prospects

This study focuses on the investigation and analysis of visual perception preference, and systematically discusses the spatial dimension and emotional dimension by analyzing the correlation between natural factors, perception factors and planned behaviors. However, the color, form and volume of plant landscape show dynamic changes with the change of seasons, which weakens the targeted effect and affects the realization of ecological and economic benefits. There are also significant limitations in the process of investigation: subjects are prone to visual fatigue when they rapidly switch and interpret photos, which leads to the degradation

of the evaluation quality of the samples in the later stage, the preference expression and emotional feedback tend to be blurred, which leads to the misjudgment of image quality, and ultimately weakens the effectiveness of data and decision-making reference value.

Based on the theoretical framework of visual attraction and perceived preference, moderating variables such as tourist types (heavy tourists and new tourists) and cultural background can be introduced in future research to verify the universality of the model and provide new ideas for the development model of suburban ecological economy. At the same time, the overall influence mechanism of planned behavior factors on the internal mechanism and environmental perception needs to deeply explore the internal action path of transforming "behavioral intention" into actual tourism consumption (including ticket, accommodation and catering expenditure), so as to more accurately reveal the economic value of landscape and provide a basis for the policy making and management practice of suburban tourism. Under the background of a new round of urban renewal, how to rely on the ecological advantages of the suburban platform, coordinate the needs of urban development and the characteristics of crowd behavior, and combine the theory of environmental psychology and management science to explore the long-term mechanism of the platform landscape on the physical and mental health of tourists still needs to continue to deepen research. How to integrate modern technological means (especially the prediction model and impact mechanism analysis of seasonal landscape change) has become a core issue in the field of ecological economics. Despite the multiple challenges of tourists' emotional complexity and technical adaptability, this study believes that the platform landscape not only plays an important ecological regulation function, but also has the social value of improving the urban environmental experience and enhancing the public's physical and mental recovery perception. Its natural value and social function still have room for further expansion under the background of intelligent management.

Author's Profile

Yanqiang Ding was born in Qingdao, Shandong Province, China in 2003. He graduated from Northwest A&F University, where he obtained a master's degree. Currently, he serves as an associate professor at the School of Landscape Architecture and Art of Northwest A&F University. His main research areas are rural revitalization and landscape design.

Changyu Liu was born in Weihai City, Shandong Province, China in 2003. He graduated from Shandong University of Arts and Sciences with a bachelor's degree. Currently, he is studying at the Landscape Architecture Art College of Northwest A&F University. His main research fields are rural revitalization and landscape design.

Sirui Wang was born in 2005 in Sanmenxia City, Henan Province, China. Currently, he is studying at the Landscape Architecture Art College of Northwest A&F University. His main research direction is landscape design.

Jingwen Wang was born in Hunan Province, China in 2003. He graduated from Northwest A&F University with a bachelor's degree. Currently, he is studying at the Landscape Architecture Art College of Northwest A&F University. His main research field is landscape design.

Ruijing Gao was born in Weihai, Shandong Province, China in 2003. He graduated from Shandong University of Commerce and Technology and obtained a bachelor's degree. Currently, he is studying at the School of Economics and Management of Qingdao University of Science and Technology. His main research field is economic statistics.

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