



Research on the Path of Multi Sensory Interaction Design to Improve Tourism Experience in Ethnic Areas

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Abstract. Starting from the theory of "perception cognition behavior" in psychology, this paper explores the form of multi sensory interaction in the cultural tourism field, and studies the internal mechanism of the modern cultural tourism field. This paper puts forward the practical path of constructing participatory multi sensory interactive art to intervene. This paper analyzes the role of users' perception, cognition and behavior in each stage of national tourism experience. Through the evaluation and analysis of the cultural perception of the cruise experience cases of the two rivers and four lakes scenic spots in Guilin, Guangxi, China, this paper explores the path and development trend of multi-sensory interaction design to improve the tourism experience in multi-ethnic areas.

Keywords: Tourism experience; National culture; Multi sensory interaction

1 Introduction

American psychologist Albert Bandura put forward the theory of social cognition, among which the perception cognition behavior theory is also known as the "ternary theory". He believes that individual behavior is determined by the interaction of three elements: perception, cognition and behavior. Perception refers to an individual's perceptual perception of the external environment, which is the primary way to explore the world with multiple senses; Cognition refers to the processing and thinking of individual information, and the ability to sort out the perceived information; Behavior refers to an individual's actions and reactions, and is the feedback to cognitive information [1] [2].

2 Perceptual Breadth Affects Ethnic Communication

Hal Foster, a well-known art critic and art historian in the United States, believes that contemporary art should be rooted in the local area, not separated from the specific context, and avoid writing ethnography too broadly. National communication is the survival exchanges between ethnic groups in the primary stage and belong to the basic exchanges in the shallow physical space. [3] What the national cultural exchanges in

the new era build is a set of conceptual systems that are transmitted from person to person in the form of symbols [4].

Pierre Bourdieu's "field" theory analyzes social practice through relational networks. A field constitutes a dynamic system of objective positions; its inherent changes disrupt equilibrium, generating new fields [5]. Reconstructing tourism field spaces facilitates multi-relational convergence. Key aspects include: 1) Emphasizing locality and participatory art's decentralization, linking individual perception, space, and collective consensus; 2) Transforming tourist identity from bystander to collaborator, enabling "community of action" engagement in "people-goods-domain" interactions; 3) Leveraging identity fluidity for users to practice sensory-based "field perception," negotiating commonality and particularity.

3 Cognitive Depth Affects National Emotional Communication

3.1 Temporary Identity Cognition in Tourism Scenes

3.1.1 Application of Social Cognitive Theory in the Field of Cultural Tourism.

Perception in the context of tourism. In the Chengyang bazhai scenic spot in Liuzhou, tourists can experience the coherent national culture through connecting the scenic spots, such as listening to Dong songs, watching Yao dances, enjoying national costumes, and tasting snail powder. Sensory stimulation is the starting point of experience. Cognition in the context of tourism. Tourists interpret based on perceived information. Liuzhou's rich national culture can provide continuous interaction through design. The unique smell and taste experience of snail powder forms cultural symbol cognition, and guides tourists to pay attention to its era background and national roots, which affects the cognitive process.

3.2 Consolidating Identity Is Conducive to Ethnic Exchanges

First, the screenplay narrative constructs a temporary cultural identity system, so that tourists can realize cognitive advancement of cognitive acceptance, role immersion and emotional representation in embodied practice. The empirical data show that the empirical data of many scholars at home and abroad show that the ethnic tourism project using participatory art forms can effectively improve the retention rate of tourists' cultural memory [6][7]. Secondly, the creation of multi sensory officialdom follows the "five senses synergy" model, and forms embodied cognitive space through visual symbol system, auditory narrative coding, tactile interactive interface and other elements. Its cultural memory retention effect is significantly better than the virtual experience dominated by VR technology.

Social identity theory, proposed by Tajfel et al. in the 1970s [8], encompasses social identity and self-identity. It posits that individuals classify themselves into social groups, fostering ingroup preference and outgroup bias by emphasizing group similarities and shared characteristics. Applied to minority cultures encountering modernity,

this theory enhances ethnic narrative logic and reveals internal preferences/external biases amid transitional self-identity [9]. Its classical cognitive pathway—"cognitive stimulation → cognitive representation → cognitive environment reconfirmation → cognitive schema formation" [10]. Operationalizes through field-based organization, perception, and interpretation. Cognitive schemas emerge via symbiotic attachment within creation platforms, structuring identity construction.

4 Tourists' Experience Behavior Affects Ethnic Integration

4.1 Combination of Participatory Art and Tourism Experience

Participatory art, characterized by diversified interactions, continuously evolves through cooperative, negotiative processes. As defined by New York artist Tom Finkelpearl, it constitutes a community-based art form founded on interaction, relationships, cooperation, activities, and dialogue—created by groups with unlimited participation [11]. This aligns conceptually with recent tourism experience projects and participatory art's local practice. For instance, the Baima Huatian construction society project (co-founded by Xiang Yong and Beijing Normal University) exemplifies shared construction principles [12].

4.2 Impression Formation Promotes Tourism Experience Behavior

Impression formation has multiple characteristics of comprehensiveness, indirectness, and rigidity, so for the experience of ethnic minority tourism areas, the intervention process of impression formation is even more important. Participating in behavior can provide an impromptu sense of surprise in the tourism experience. By designing touch-points and planning interactive activities, spontaneous behavior can be triggered. The tourism experience formed by the temporary social identity and impression created through participatory art, in order to achieve a sustained experience in the field.

5 Case Study: Taking the Cruise Experience of Two Rivers and Four Lakes Scenic Spot in Guilin, Guangxi as an Example

The two rivers and four lakes scenic spot in Guilin, Guangxi, is also an important space for the integration and interaction between Zhuang, Yao, Miao and other ethnic groups and the Han nationality, which contains rich national cultural heritage. The two rivers and four lakes cruise experience is also a classic Guilin tourism project. Through the collection, identification, classification and coding of cultural symbols in two rivers and four lakes scenic spots, we can effectively sort out the places and elements with significant regional and national dual cultural brand.

5.1 Extraction of Cultural Symbols for Cruise Experience

This study classifies cultural symbols in Guilin into material and intangible categories. Material cultural symbols are tangible entities possessing stability, longevity, and historical continuity. They serve practical and symbolic functions, directly perceptible through senses. Intangible cultural symbols encompass non-material expressions transmitted through behavior and ritual. Characterized by dynamism and abstraction, they require experiential engagement or interpretation for perception and constitute the internal cultural logic of heritage. Through systematic collection, identification, classification, and coding of tourism cultural symbols in Guilin's Two Rivers and Four Lakes Scenic Spot, culturally significant places are catalogued. Tourist perception needs are summarized across five dimensions: historical buildings, natural landscapes, lighting landscapes, five senses experiences, and national culture.

5.2 Data Analysis

The questionnaire is divided into two parts: the first part is the background question to collect the relevant information of the tested object; The second part is the subject question. Select the five major aspects of cultural symbol perception and 16 specific gene elements as the specific items of the cultural symbol perception questionnaire (see Table 1). The main questions refer to Likert 5-point isometric scale, and the gene perception is divided into five levels to quantitatively collect the data of tourists' perception of cultural symbols in Guilin's two rivers and four lakes cruise experience.

Based on the statistical analysis of the questionnaire, a total of 250 questionnaires were issued, of which 245 were valid. The number of male and female respondents in the questionnaire survey is almost the same, with tourists aged 15-60 as the main distribution group, and people of other ages are slightly covered, as balanced and comprehensive as possible. The experimental data were analyzed by SPSS software.

First, the reliability test was conducted, and the cronbach's alpha coefficient was used to measure. Cronbach's alpha reliability coefficient is 0.711 (see Table 2), and the reliability of each dimension is higher than 0.6, and is about 0.7 (see Table 3), indicating that the reliability quality of the survey data is ideal and can be used for data analysis.

Secondly, validity tests were conducted on the experimental results. KMO statistical analysis and Bartlett's Test of Sphericity were selected for validity analysis. The KMO statistical value of this study was calculated to be 0.711 (see Table 4), and the statistical value was ≥ 0.70 , indicating good validity. And the P-value of the sphericity test of the scale is 0.000, which is less than 0.05, indicating a strong correlation between the items in the questionnaire and further factor analysis can be conducted.

Finally, the principal component analysis method is used to conduct factor analysis on 16 cultural symbol items, and extract the common factor with the eigenvalue greater than 1 and the orthogonal rotation of the maximum variance. Only retain factor variables with a load greater than 0.5. Finally, the explanatory variance table and the factor load data are obtained (see Table 5). The total variance interpretation rate of this data is 67.404%, which has reached the standard of 60%, indicating that the retained five factors are appropriate.

Table 1. Cultural symbol survey scale

Total target layer A	Criterion layer B	Subcriterion layer C	Factor layerD
The evaluation system of cultural symbol perception in the cruise experience of two rivers and four lakes	B1 Material cultural symbols	C1 Historical architecture	D1 Song Dynasty city wall ruins
			D2 Ancient Nanmen site
			D3 Cliff stone carvings
			D4 Xiaoyao building
			D5 Beautiful scenery of two rivers
		C2 Natural landscape	D6 Four lakes scenery
			D7 Elephant trunk mount
			D8 Riverside lighting
			D9 Night view of sun and moon Twin Towers
	B2 Intangible cultural symbols	C3 Lighting landscape	D10 Guilin rice noodle taste experience
			D11 Osmanthus fragrance olfactory experience
			D12 Auditory experience of fishing drum
		C4 Five senses experience	D13 Night lighting visual experience
			D14 Tactile experience of Zhuang brocade national costumes
			D15 Folk song duet interaction
			D16 Hydrangea throwing interaction
		C5 National culture	

Table 2. Cronbach's α overall reliability analysis table

Number of items	Sample size	Cronbach's Alpha
16	245	0.711

Table 3. Cronbach's α dimension reliability analysis table

Dimension	Number of items	Sample size	Cronbach's Alpha
C1 Historical architecture	4	245	0.741
C2 Natural landscape	3	245	0.706
C3 Lighting landscape	2	245	0.689
C4 Five senses experience	5	245	0.857
C5 National culture	2	245	0.730

Table 4. KMO and Bartlett's Test

KMO	Value	0.711
Bartlett's Test of Sphericity	Approx. Chi-Square	1062.902
	df	124
	sig.	0.000

Table 5. Total variance interpretation and cumulative variance contribution rate

Factor	Eigen			% of Variance(Unrotated)			% of Variance(Rotated)		
	Eigen Value	% of Variance	Cumulative % of Variance	Eigen Value	% of Variance	Cumulative % of Variance	Eigen Value	% of Variance	Cumulative % of Variance
1	3.456	21.616	21.616	3.456	21.616	21.616	2.844	17.759	17.759
2	2.132	13.332	34.940	2.132	13.332	34.940	2.177	13.612	31.380
3	1.885	11.791	46.734	1.885	11.791	46.734	2.062	12.901	44.269
4	1.848	11.539	58.275	1.848	11.539	58.275	2.038	12.749	57.018
5	1.460	9.134	67.404	1.460	9.134	67.404	1.658	10.379	67.404
6	0.868	5.418	72.820						
7	0.708	4.429	77.256						
8	0.615	3.835	81.087						
9	0.576	3.609	84.696						
10	0.488	3.045	87.739						
11	0.432	2.680	90.420						
12	0.409	2.550	92.970						
13	0.353	2.191	95.155						
14	0.310	1.931	97.093						
15	0.252	1.566	98.658						
16	0.215	1.335	100.000						

SPSS descriptive analysis was used to make statistics on the mean, standard deviation and ranking of the degree of perception of each gene indicator (see Table 6). The total average value of the 16 perceived indicators of the importance of cultural symbols in the cruise experience of two rivers and four lakes by the evaluators is 3.58, and the overall perception is relatively neutral, so there is still room for experience improvement.

5.3 Experience Problem Analysis

SPSS analysis reveals significant variations in tourists' perception intensity of cultural symbols during the Two Rivers Four Lakes cruise experience. This study prioritizes examining low-perception symbols to identify causation and proposes optimization strategies for these underperforming aspects, aiming to enhance visitor engagement and address deficiencies in traditional scenic area presentation. Analysis indicates suboptimal tourist satisfaction within the C4 multi-sensory experience dimension. The long-established cruise operation, developed during earlier tourism phases, now struggles to meet modern visitors' demand for diversified, in-depth experiences.

Table 6. Analysis of evaluators' perception of cultural symbols

Evaluation of cultural symbols	Evaluation factor	Perception mean value	Sort
C1 Historical architecture	D1 Song Dynasty city wall ruins	3.78	6
	D2 Ancient Nanmen site	3.90	4
	D3 Cliff stone carvings	3.31	12
	D4 Xiaoyao building	3.66	8
C2 Natural landscape	D5 Beautiful scenery of two rivers	3.92	3
	D6 Four lakes scenery	3.96	2
	D7 Elephant trunk mount	3.98	1
C3 Lighting landscape	D8 Riverside lighting	3.62	10
	D9 Night view of sun and moon Twin Towers	3.65	9
C4 Five senses experience	D10 Guilin rice noodle taste experience	3.81	5
	D11 Osmanthus fragrance olfactory experience	3.28	13
	D12 Auditory experience of fishing drum	3.12	14
	D13 Night lighting visual experience	3.03	16
	D14 Tactile experience of Zhuang brocade national costumes	3.09	15
C5 National culture	D15 Folk song duet interaction	3.46	11
	D16 Hydrangea throwing interaction	3.72	7
Mean		3.58	

5.4 Solutions

Sensory Optimization: Enhance weaker perception channels by integrating symbols into themed narratives.

Tactile: Offline workshops during voyages utilize ethnic fabric samples and clothing-changing to experience costume attributes. Ball-throwing activities facilitate tourist-performer interaction, conveying folk narratives.

Auditory: Upgrade fishing drum to "soundscape theater" via ship audio systems, blending instrument rhythms with Li River soundscapes.

Gustatory: Route-based tea pairing in Zhuang brocade-patterned underglaze porcelain ware. Implement three-stage fragrance narrative: voyage start , core scenic area, return voyage. **Visual:** Combine riverside lighting and stages with shore-based folk stories and naked-eye 3D performances. Interactive gestures recompose bronze drum/bird-fish patterns in projections. (see Fig.1, Fig2)

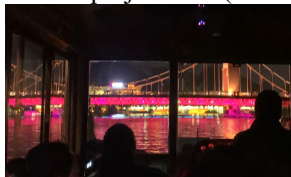


Fig. 1. Viewing the Riverside Landscape from **Fig. 2.** Viewing the Naked Eye 3D Performance
Inside the Cruise Ship from Inside the Cruise Ship

5.5 Testing and Evaluation

Collaborative five-senses experience design transforms passive viewing into multidimensional cultural engagement. Prioritizing evening routes leverages nighttime sensory focus. Early-stage qualitative research employs in-depth tourist interviews to continuously refine narrative flow and experience connections. Later-stage quantitative analysis of test data optimizes touchpoint distribution. To test sensory design's impact on cognitive depth usability, the SUS evaluates onboard five-senses design. Multidimensional evaluation integrates perception, cognition, and behavior indicators.

5.6 Design of Ethnic Tourism Paths under Sensory Experience

Initially, the experience carries ethnic cultural background, breaking potential stereotypes through scene foreshadowing. This strengthens "person-product-domain" situational relationships and dialogue, enhancing story scene rationality through preconceived identity. Post-experience enables reflection, yielding three-dimensional impressions spanning visual image production to cultural generation. Participatory art facilitates field space construction via multisensory interaction design, rapidly forming tourist local identity and deepening impression formation. Utilizing subject-object interaction, tourism experience progresses from shallow to deep integration through "perception-cognition-behavior" progression anchored in sensory experience. This enables tourist-scene dialogue, integration, mutually beneficial engagement. (see Fig.3)

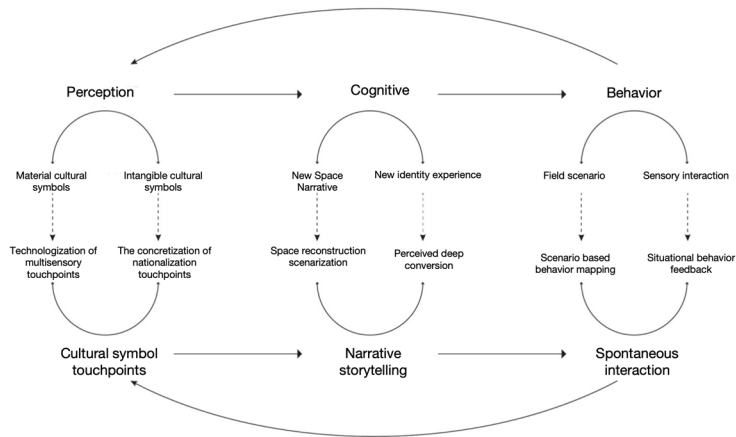


Fig. 3. Flowchart of Ethnic Tourism Experience with Multi sensory Interaction

6 Conclusion

The key points of applying multi sensory interaction design in ethnic tourism areas are: firstly, to eliminate subjectivity and avoid the tourist destination's full control over the tourism experience, and to guide the sustainable impact of the tourist destination

through the reconstruction of diverse ethnic communication methods; Secondly, linking values and constructing interactive experiences with ethnic culture from multiple senses, starting from shallow to deep levels; Thirdly, transform tourism attributes and transform traditional sightseeing into multi-level experiential integration; Fourth, trigger public participation.

Starting from the perspective of perception cognition behavior, this paper explores the method of transforming multi sensory interaction design from "perception" to "behavior" of social participation in the travel experience of ethnic tourism areas. It proposes to use participatory art as a comprehensive medium to reconstruct the field space and connect the experience process in ethnic regional tourism.

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References

1. Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall.
2. Lin SP, &Liu C.Y,& Yang C.Y. (2018). Relationship Between Lifestyles That Promote Health and Quality of Life inPatients With Chronic Schizophrenia: A Cross-Sectional Study. *Journal of Nursing Research*, 26(3):207-215.
3. Foster, Hal. (1996). "The Artist as Ethnographer." In *The Return of the Real: The Avant-Garde at the End of the Century*, 171-204. Cambridge, MA: MIT Press, 1996.
4. Bourdieu, P. (1992). *An Invitation to Reflexive Sociology*. Chicago: University of Chicago Press.
5. Hall, S. (1996). Cultural identity and diaspora. In P. Mongia (Ed.), *Contemporary Postcolonial Theory* (pp. 110-121). London: Arnold.
6. Zhao X, &BELK R W.(2008). Politicizing consumer culture:Advertising's appropriation of political ideology in China's social transition. *Journal of Consumer Research*, 35(2):231-244.
7. Chen, X., et al. (2021). Multisensory Experience and Cultural Memory. *Journal of Heritage Studies*, 25(3), 456-472.
8. Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. *The Social Psychology of Intergroup Relations*, 33, 47.
9. Dong, Q, &Su, Y.(2021).The interdependence and mutual promotion between diversity and Sustainable Tourism -- concept, practice and the governance of China. *Journal of tourism*,36 (05): 1-4
10. Li, Z.(2022). The "author" of social participatory art . *art research*, (04): 77-87
11. Xiang Y.(2023). Theory and method of cultural industry enabling Rural Revitalization -- Taking the innovative practice of Baima Huatian construction society as an example. *Art Management* , (01): 83-95
12. LAZARUS R S.(1991).*Emotion and Adaptation*.New York:Oxford University Press,39

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