Study of Virtual Museum Tourism Experience from the Perspective of Creative Communication Management

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Abstract: Based on the theory of creative communication management, this paper takes Suzhou Museum, Dunhuang Museum and Louvre as examples, uses a combination of qualitative and quantitative analysis, and takes perceived quality and visitor satisfaction as indicators. It uses IPA analysis of virtual museums in six dimensions: convenience, novelty, richness, simulation, experience and functional realization, and studies the effect of virtual museum marketing communication. The study also analyzes the technical means and specific designs that can be used in the process of building and developing virtual museums, and explores the future development direction of digital museum construction.

Key words: Virtual Museum; Creative Communication Management; Suzhou Museum; Dunhuang Museum; Louvre.

1. Introduction

Museums are the habitat of people's cultural life and have the social responsibility to pass on culture and educate the public. The development of digital living space has created a background for the digitization of museums with a variety of practices, but affected by lots of factors such as geography, culture, technology, etc. The response effect varies, and there is little research on the measurement of the actual effect of virtual museum construction. Therefore, it is necessary to analyze and compare representative case sites with the theoretical framework of communication and measure the marketing effect of virtual museums and the quality of audience experience, so as to provide reference for the development of virtual museums.

2. Theory and Literature Review - Creative Communication Management

2.1 Theory Formulation and Development

Communication and marketing in the Internet era are dedicated to providing personalized information services to audiences, In this context, the theory of Creative Communication Management (CCM) (Chen Gang, 2008) emerged, emphasizing that the new communication should be built through three strategic stages and dynamic communication solutions on the Internet platform in the digital living space.

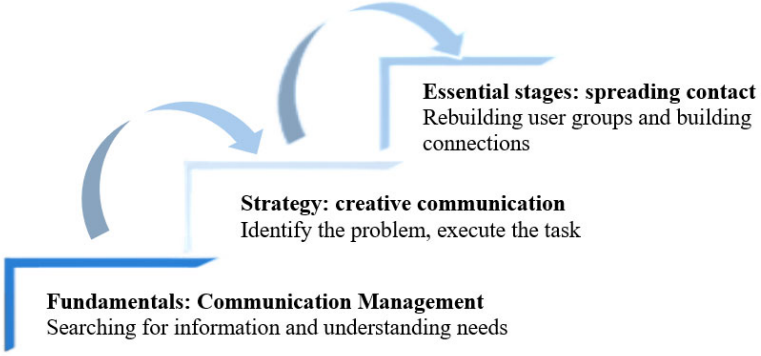

Figure.1 Creative communication management stages
(Figure source: compiled by the author)

The communication element is the key to creative communication management, and it is the most discussed topic on that is shaped by the many interactions between communicators and audiences (Shen Hong,2012).Through communication and negotiation, the communicator and the recipient expand the brand strategy and realize the marketing value, and the audience moves from being a mere "consumer" to a "lifer" who interacts, discusses, actively contributes, and receives "digital services".

The content management platform constitutes the framework for creative communication management so that content production is based on scenarios and topics and interacts with audiences through data analysis (Chen Gang, 2017).

2.2 Theory Application and Practice

The application practice of creative communication management has received academic attention. Gao Hongyang et al. analyzed the process of establishing communication elements and mobilizing audience enthusiasm in Liuzhou. For content industries such as film and television dramas (Liu Limin, 2021) and publishing organizations (Sun Yuanhua and Li Dong, 2018), the theory promotes industry transformation. On the teaching of advertising planning and creativity (Chen Gang, 2017), it can be the theoretical basis for rebranding values.

Digital museums and the application of various digital technologies in physical museums is a new application practice of the theory. In the process of interaction between visitors and museums, it is supposed to create innovative communication elements, and combine the individual characteristics of visitors, in order to create a more experiential and creative tour experience for visitors. Therefore, this paper introduces this theory into the study of digital museums.

3. Research Methodology

This paper adopts a combination of qualitative and quantitative analysis, and uses IPA analysis to analyze the data. The communication effect of the virtual museum itself is more related to the sense of experience obtained by the audience, and the research on tourism experience is more mature in the tourism industry, so it is easy to refer to the relevant scale. Therefore, this paper introduces the concept of tourism experience and chooses the experience quality of tourists as the measurement object, combining the theory of creative communication with the perceived quality of tourism experience.

3.1 Quantitative analysis

3.1.1 Travel Experience

The essence of tourism is experience. The research on tourism experience in China covers the interaction between the tourist's psychology and the object (Xie Yanjun, 2005), and the spiritual satisfaction of the tourists in participatory activities (Dou Qing, 2003). Foreign research results are more diversified. Urry considered tourism experience as a kind of "gaze" (1992), and Csikszentmihalyi constructed the concept of mind-flow experience of customer experience to analyze how tourists reach a state of exhilaration and forgetfulness (1998).

3.1.2 Quality of Experience

Tourism products have obvious non-storability, difference, intangibility and indivisibility, so the experience perception measurement of tourism products focuses more on tourists' emotional experience and psychological response. Two types of experience quality measurement methods are currently available, namely attribute-based measures and event-based measures, The former is the mainstream and adapted to this study.

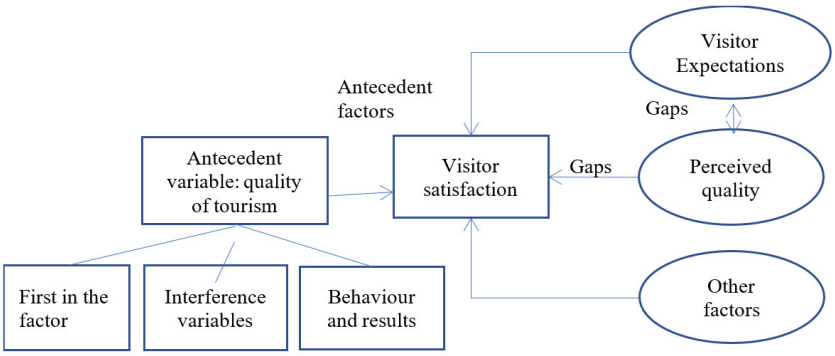

Figure.2 Perceived quality and tourist satisfaction
(Figure source: complied by the author)

The current models for measuring visitor satisfaction include Service Quality Approach(SERVQUAL),Importance-Performance Analysis (IPA), Tourist Satisfaction Theory (TS) and Regression Factor Analysis, among which IPA analysis is more widely used and better operationalized, thus this paper adopts this method for quantitative research.

3.2 Qualitative Analysis

Museum digitization is rapidly evolving with technical support:

Table.1 Management strategies for digital museums in selected countries
(Organized according to the publicly available information)

Country	System	Introduction
Canada	National Heritage Digital Strategy	Long-term cooperation with various museums and accumulated rich online resources
Germany	European Online Cultural Heritage Programme	By connecting national heritage institutions Online heritage conservation efforts
Japan	Global Digital Museum Programme	The Japan Museum of Ethnology and the Tokyo Research Institute have collaborated with the development of digital collections and curatorial education as the core
Egypt	Cultural and Natural Heritage Documentation Centre	Using the media to enhance public outreach and build bridges with the world

In 2020, National Cultural Heritage Administration announced a series of support policies involving the digitization of museums. Under the impact of the COVID-19 pandemic, "cloud exhibition" has flourished with more than 2,000 online exhibitions in 2020 and a total of more than 500 million visitors (Liu Yuzhu, 2020).

Suzhou Museum, Dunhuang Museum and Louvre all have unique heritage resources and digital development models that are representative, so this paper uses them as examples for qualitative analysis.

4. Case Summary

4.1 Suzhou Museum

Suzhou Museum, representing the culture of Jiangnan water town, is the pilot demonstration unit of "intelligent museum" in China, with a collection of more than 40,000 pieces of cultural relics and a complete range of categories.

(1) Scene design and digital construction

The virtual exhibition hall of Suzhou Museum replicates I.M. Pei's concept of "design with light" and is immersive and interactive, presenting the complete architecture of the building, the exhibition hall and the surrounding garden scenes to visitors, and providing thematic guidance along multiple routes. In addition, the virtual museum offers measurement to provide visitors with a precise perception of distance.

(2) Content Design and Theme Presentation

Suzhou Museum's virtual exhibition hall is designed for visitors with several thematic routes, such as crafts made by Suzhou, museums and architecture of Suzhou, etc., and reproduces the exhibition layout of various thematic exhibitions, such as the exhibition "Painting Screen: Tradition and Future", which is synchronized with the WeChat platform instantly through VR panoramic technology.

(3) Interactive Experience and Leisure Design

Suzhou Museum develops various kinds of interesting interactive games. For examples, visitors can experience the placement of stationery, landscape painting DIY, Ming furniture assembly, "restoration" travel through the scene in the painting, etc.

Figure.3 Interactive game at Suzhou Museum
(Figure source: screenshot from Mini Program)

(4) Public Service Education and Lecture Explanation

Suzhou Museum offers educational experiences and public service lectures, such as seal-making and Jiangnan in Yuan Dynasty. The "Recreation-Cloud Classroom" platform combines traditional Chinese culture and Suzhou's unique culture to build a cloud education system, making the museum more open to the public and better fulfilling its public welfare and education functions.

4.2 Dunhuang Museum

The Dunhuang Museum is an early practitioner of digital museums in China, playing a good role in the conservation of heritage at Dunhuang, the world's largest and richest surviving Buddhist shrine.

(1) Scene Design and Digital Construction

The Dunhuang Museum is committed to building a rich library of digital content. Since 2014, the digital display center has been fruitful and various temporary physical exhibitions have also been online over time.

(2) Interactive Experience and Leisure Design

Dunhuang Museum presents programs that interact with visitors through both online and offline platforms.

The "Cloud Dunhuang Tour" offers interactive programs such as the audio series and animated skits. The Mini Program of "Dunhuang Scarf" allows visitors to design their own silk scarves by using Dunhuang cultural elements. The game "Dunhuang Museum Wonder Night" is published in

conjunction with NetEase Cloud, and an online art exhibition is displayed in collaboration with 360 Pictorial. Visitors can also use the digital interactive platform, to give a virtual restoration for the severed arm of the Buddha "gestures".

Table.2 Dunhuang Museum digital construction history
(Complied by the author)

Year	Digital museum construction
2014	"Dunhuang Mogao Caves Digital Exhibition Centre "established
2016	Launch of the Digital Dunhuang Resource Library, which provides high-definition images and panoramic tours of more than 30 caves spanning ten dynasties and a collection of archaeological research data with detailed explanations
2017	Development of the Dunhuang Art Image Database, which showcases the decorative motifs and frescoes of Dunhuang to visitors in four online tour routes
2018	Completion of fidelity fresco collection in 150 caves, structural scanning in 120 caves and panoramic roaming services in 110 caves
2021	Over 100,000 images have been collected

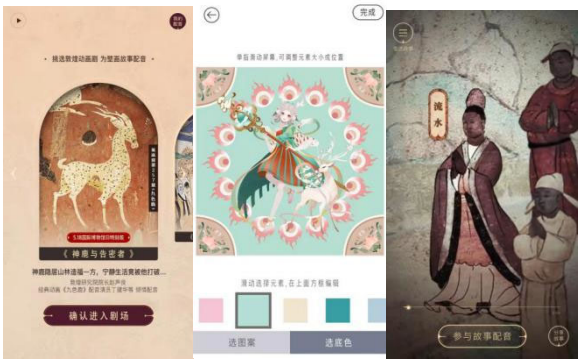

Figure.4 Dunhuang Museum Interactive Game
(Figure source: Dunhuang Museum official Mini Program)

(3) Marketing and Cultural and Creative Brands

Dunhuang Museum is actively linking museum resources to create cultural and creative brands, including games, music and make-up, and finance. The brand linkage permeates all aspects of people's lives, further creating a "presence" cultural experience, promoting the release of the audience's desire to consume, and creating a cultural IP belonging to the Dunhuang Museum.

Table.3 Dunhuang Museum co-branding cases
(Organized according to the publicly available information)

Fields	Cooperation cases
Handicap	"Seeking Immortality" Dunhuang Event "King's Glory" Dunhuang Skin
Dining	"Leroy Tea"Oriental Tea Beverages
Music	QQ Music Dunhuang Ancient Song Competition
Makeup	Kazran, Tangerine make-up and others join forces to protect the "Dunhuang colours"
Cars	Aesthetic renaissance project in association with automotive brand DS

(4) Digital Protection and Intelligent Management

Factors such as light, humidity, weathering, natural shedding and increasing numbers of visitors cause irreversible damage to Dunhuang in the depths of the desert. Technology helps preserve Dunhuang's precious materials, and virtual reality both reduces direct contact between visitors and artifacts and expands the space and means of communication.

4.3 Louvre Museum

The Louvre is one of the four largest museums in the world and the first to digitize its collection with more than 400,000 objects.

(1) Scene Design and Digital Construction

Since the opening of the website in 1995, the Louvre Digital Museum has undergone four revisions and construction, and now contains more than 480,000 objects, offering high resolution images from all angles and free downloads for visitors. The collection database is regularly maintained and updated by professional staff to facilitate visits and academic research. Online visitors were already about equal to the number of offline visitors in 2001, with 10.5 million visits to Louvre online in 2020 and an even greater surge after the 2021 update.

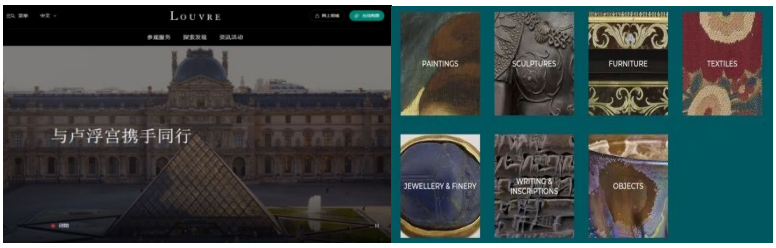

Figure.5 Louvre interface
(Figure source: Louvre official website)

(2) Interactive Experience and Leisure Design

Visitors to the virtual museum can watch video presentations in sign language and audio commentaries on more than 700 works of art, and appreciate the collection in 3D with their naked eyes. Louvre has also developed applications for smartphones and iPads, such as the mobile app "Louvre HD Free", which provides visitors with displays and detailed descriptions of the collection, as well as the opportunities to socialize and share.

(3) VR Projects and Cooperative Development

Louvre is actively working with the technical team. In 2014, the Louvre collaborated with Nintendo to develop the game "Louvre", which includes 104 works of art by the world's most famous artists, and "The Nintendo 3DS" handheld video-game-controlled tour guide system also provides visitors with a real-time location-based interactive map.

5. Contrast Analysis

5.1 Qualitative Comparison

All three museums are actively using various types of modern technology to build their own distinctive digital museums.

Table.4 Comparison of Museum Features
(Complied by the author)

Dimensionality	Suzhou Museum	Dun huang Museum	Louvre
Design of the scene	A fusion of traditional and modern design concepts	Panoramic reproduction of the original	Modernity in abundance
Digital construction	Focus on the introduction of an exhibition system for the collection and on the thematic design of the route	Focus on digital repository collection	Early start of practice, innovative and comprehensive technical security
Content themes	Showcasing the characteristics of the collection and the local flavour	Showing the beauty of artistic images and cultural elements	A beautiful blend of classical and modern technology
Interactive experiences	Both online and offline, with an online focus and social aspect	Both online and offline, with a more diverse online approach (short films combined with interactive games)	Combination of online standalone app and offline experience
Education for the public good	Experiential and popularised, with a wide range of formats and audiences	Science lectures are the main focus, but in a single format	Services for all types of visitors, including children and disabled people, with separate entrances on the website
Business Management	Commercial, curatorial and exhibition layout	Public benefit attributes, focusing on the use of strategic cooperation to stimulate public awareness of heritage conservation	Focus on the use of digital technology for the conservation of artworks
Cultural and creative products	Based on the characteristics of the museum's collection	Multi-brand linkage, cross-border cooperation	Focus on personalised experiences for different groups of people

Suzhou Museum focuses on social education and public interaction, fully considering the needs of users of different age levels. It strengthens social attributes and creating a "virtual community" with designs such as check-in, knowledge quizzes, likes, sharing, discussions and membership points.

Dunhuang Museum is paying more attention to heritage conservation. Digital collection with emphasis on the use of various types of friendly technologies reduces the damage to the caves by various types of modern technology. Launching public welfare activities, such as " Dunhuang Museum of the Future", which is designed in cooperation with Tencent Public Welfare, is available for visitors to simulate the weathering process of the murals by blowing on their cell phones to awaken their awareness of heritage conservation.

Louvre Museum values the experience for online visitors. The online platform allows visitors to break the limits of time and space with its high pixel detail and full range of restoration techniques. Louvre also has a broader audience. For instance, as the 500th anniversary of Leonardo da Vinci's death, the Louvre and HTC VIVE Arts have joined forces to create "Mona Lisa: A Vision Beyond the Boundary", in order to provide a 3D mode a platform for global visitors to experience the famous painting.

5.2 Cause Analysis

In terms of cultural background, Suzhou Museum's virtual exhibition has a unique watery flavor, which is reflected in its design. Dunhuang Museum serves the preservation of the Mogao Caves cultural heritage, designed with a more ancient style. Louvre has an early origin, mature development, and is open to the world.

In terms of technical support, Suzhou Museum has richer technical resources and applies more diverse technical means in the construction of the digital museum. Dunhuang Museum is slightly more homogeneous in comparison, with many of its web pages only showing graphics and text. The visitor's operation is only a simple click and browse, which is slightly less interesting, and many interactive projects require cooperation with other technical support providers. Louvre, on the other

hand, has access to the latest technological applications and uses advanced technologies to provide examples and practices for other museums around the world in digitization.

In terms of social functions, Suzhou's well-developed online education industry has clearly influenced the tendency and focus of Suzhou Museum. Dunhuang Museum, limited by the fragility of its collections and the remoteness of its geographical location, inevitably favors the preservation of digital heritage records and virtual experience displays. Louvre, with its extensive collections, is a leader in virtual museums, satisfying visitors' viewing needs and effectively fulfilling its role of collection display responsibilities.

6. Quantitative Analysis - Quality of Experience and Communication Effectiveness Evaluation

6.1 Questionnaire and Scale Design

Fewer existing measurement scales focus on virtual tourism destinations. Yang Wenjuan et al. conducted an empirical study on the quality evaluation of virtual tourism experience (2012), using the Deffel method to determine five indicators and weights. Liu Jiaxue used mean value to measure the effect of tourists' perception of museum tourism experience and summarized a scale for measuring the quality of museum tourism experience (2014). This paper synthesizes various museum studies and combines virtual tourism scenarios to propose scales.

The scale contains three parts. The first part is the basic sample profile, which is used to summarize the characteristics and motivations of the statistical sample, including eight question items such as age, gender, education, and museum perception. The second part measures tourists' perceptions of the importance of each evaluation factor (serial number marked as IMP), which is divided into five evaluation indicators: convenience, novelty, richness, simulation, and experience, and supplemented by a sixth dimension, functional realization. It uses a five-point Likert scale with a total of 16 evaluation factors. The third part measures tourists' evaluation of their sense of experience and satisfaction with the three case sites of Suzhou Museum, Dunhuang Museum, and Louvre (labeled SU, DUN, and LOV respectively), repeats the evaluation factors in the second part, and supplements the seventh dimension, marketing effectiveness (serial number labeled EFF). Four question items are set to measure all respondents' willingness to visit the site and willingness to purchase cultural creations (labeled EFF-1 and EFF-2). For those who visited the case sites, additional questions are added to measure the value added and the willingness to revisit after visiting the online museums (marked as EFF-3 and EFF-4). The seventh dimension is only used to analyze the tourists' reactions and gains after visiting the online platform, and not as an evaluation factor for the virtual museum.

Table.5 Evaluation indicators and evaluation factors
(Revision and compiling in light of reference literature)

Evaluation indicators	Evaluation factors and serial numbers
(**CON**) Convenience	1 ease of operation and operational comfort, 2 information comprehensibility
(**NOV**)Novelty	1 novelty of the technology 2 visual impact and creativity of the virtual scene
(**ENR**)Enrichment	1 diversity of virtual landscapes 2 diversity of virtual exhibits 3 richness of virtual activities 4 richness and professionalism of guided tours and interpretation services
(**SIM**)Simulation	1 Objective realism of the virtual scene 2 Objective realism of cultural conformity 3 Simulation of the browsing process
(**EXP**)Experiential	1 experiential and character-immersive, 2 interactive between audiences
(**FUN**)function implementation	1 Evaluation of the educational function of museums 2 Evaluation of the heritage conservation function 3 Evaluation of the museum's leisure tourism experience function

Considering that the respondents do not know much about Louvre Museum compared to Suzhou Museum and Dunhuang Museum, and that its digital construction and operation mode is advanced to some extent, the author collect data related to the Louvre Museum separately in the questionnaire. In order to avoid the initial questionnaire being too long and affect the performance of the responses, and to reduce the mutual influence of importance and satisfaction, the importance questionnaire and the satisfaction questionnaire are collected separately one week apart.

6.2 Data Collection

A total of 273 questionnaires are collected, with 244 valid ones. Among the collected samples, 61.9% are female, 64.3% have a bachelor's degree or equivalent. The frequency of daily visits to museums is mostly "occasionally" and "sometimes", and about 80% of the samples visit Suzhou Museum and Dunhuang Museum on site. The impressions of Suzhou Museum and Dunhuang Museum are "ordinary or no impression" and "better", and the impressions of Louvre are "better" and "very good".

6.3 Reliability and Validity Analysis

The reliability analysis is conducted separately for the scales of importance and satisfaction in Suzhou Museum, Dunhuang Museum and Louvre by SPSS 26.0. The results show that the Cronbach's Alpha coefficients of the samples are all around 0.9, and the samples perform well in terms of reliability.

Table.6 Sample reliability analysis
(Based on retrieval data)

Indicators	Aspects	Numerical	Indicators	Aspects	Numerical	Indicators	Aspects	Numerical
CON	Importance	0.853	ENR	Importance	0.916	EXP	Importance	0.799
	Suzhou Museum	0.919		Suzhou Museum	0.955		Suzhou Museum	0.929
	Dunhuang Museum	0.925		Dunhuang Museum	0.959		Dunhuang Museum	0.931
	Louvre	0.921		Louvre	0.935		Louvre	0.927
NOV	Importance	0.861	SIM	Importance	0.877	FUN	Importance	0.865
	Suzhou Museum	0.920		Suzhou Museum	0.927		Suzhou Museum	0.953
	Dunhuang Museum	0.934		Dunhuang Museum	0.950		Dunhuang Museum	0.952
	Louvre	0.912		Louvre	0.925		Louvre	0.929

Similarly, exploratory validity analysis is conducted separately for the scales of importance and satisfaction in Suzhou Museum, Dunhuang Museum, and Louvre, and the results are shown in the table below.

Table.7 Sample validity analysis
(Based on retrieval data)

Scale	Aspects	KMO Sampling Adequacy Measure	Bartlett's sphericity test		
			Approximate cardinality	Degrees of freedom	Significance
Importance	Suzhou Museum	0.933	3708.032	120	0
Satisfaction		0.966	5687.702	120	0
	Dunhuang Museum	0.961	6466.349	120	0

Louvre	0.949	5428.134	120	0
Overall	0.958	18686.456	1128	0

6.4 Significance-Performance Analysis

The weight of each factor is obtained by measuring the visitors' evaluation of the importance as shown in the table below.

Table.8 Importance analysis
(Based on retrieval data)

Factor	Importance	Factor	Importance	Factor	Importance	Factor	Importance
CON-1	4.74	ENR-1	4.61	SIM-1	4.71	EXP-2	4.64
CON-2	4.7	ENR-2	4.67	SIM-2	4.73	FUN-1	4.68
NOV-1	4.63	ENR-3	4.66	SIM-3	4.63	FUN-2	4.7
NOV-2	4.64	ENR-4	4.72	EXP-1	4.7	FUN-3	4.68

Furthermore, the IPA quadrant map is drawn according to the data, and the importance-performance analysis maps of Suzhou Museum, Dunhuang Museum and Louvre Museum are obtained.

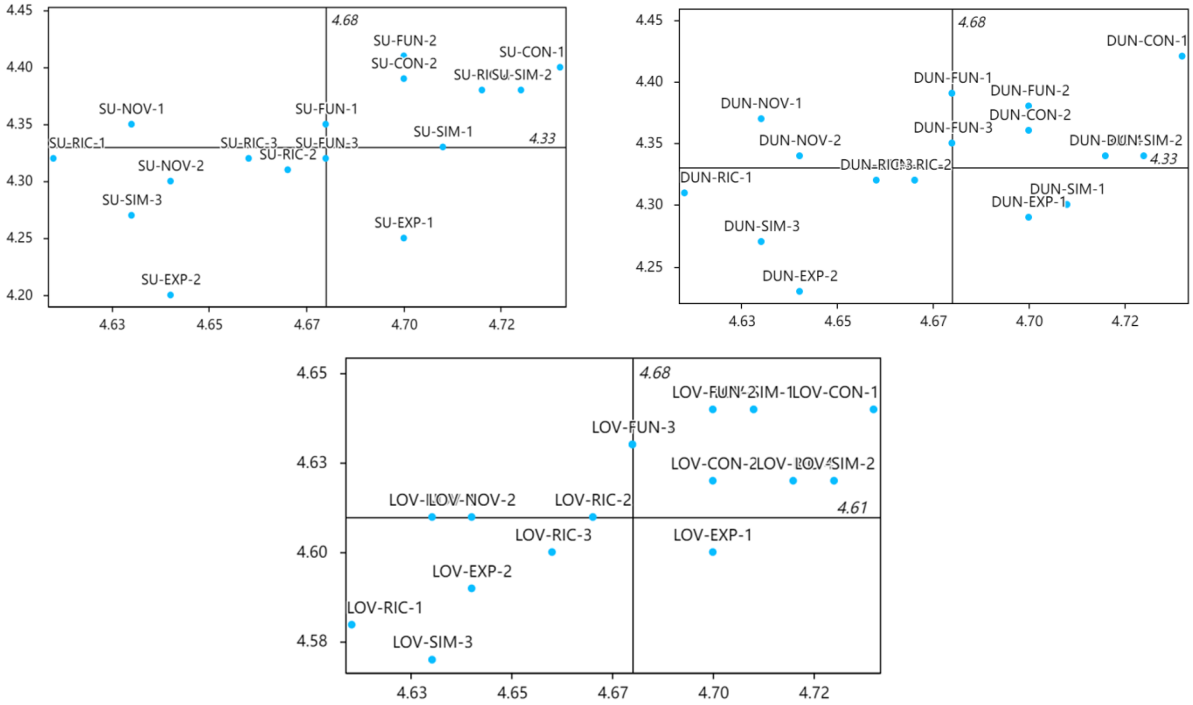

Figure.6 IPA quadrant maps
(Based on retrieval data)

6.5 Results Discussion

In the third part of the scale, visitors' ratings are all at a level between 4 points and 5 points, indicating visitors have an overall good perceived quality and experience. The gap between above scale and the perceived importance of visitors is small, indicating that overall visitor satisfaction is at a high level.

6.5.1 First Quadrant -Dominance Retention Zone

This area indicates that visitors place a high value on this measure and that the museum performs well. The evaluation factors that fall in this area are: all three museums in the convenience indicator indicate that they are all easy to operate and easy to understand the information; two evaluation factors in simulation, i.e., simulation of virtual scenes and authenticity of cultural conformity; all evaluation

factors in functional realization, with the Dunhuang Museum performing particularly well in heritage conservation, but with average levels of feedback in the leisure experience function.

6.5.2 The Second Quadrant -Oversupply Area

This area indicates that visitors feel better about it, but its importance is ordinary. Compared to the other quadrants, this area has fewer evaluation factors and all of them are novelty indicators. All the novelty evaluation factors for the three museums are located here, except for the scenic creativity of Suzhou Museum. The urgency of developing such factors is ordinary with limited resources.

6.5.3 The Third Quadrant -Continuous Improvement Zone

Visitors perceive the factors in this quadrant to be of low importance and of average satisfaction. The evaluation factors in this area are more dispersed: richness is mostly found in this area, including the diversity of virtual landscapes in the three museums, the diversity of virtual exhibits in Suzhou Museum, the creativity of virtual scenes, and the richness of virtual activities in the Louvre. In addition, the diversity of virtual landscapes in the three museums, the simulation of the browsing process, and the interaction among visitors are all in this quadrant.

6.5.4 The Fourth Quadrant -Urgent Rectification Area

This quadrant indicates that visitors consider this factor important but the museums are performing average and need to focus resources on rectification. This area focuses on experiential indicators, including the sense of experience and character immersion of the three museums, and is generally the next step for the virtual museum to improve. In addition, Dunhuang Museum's objective realism in virtual scenes is also in need of improvement in this quadrant.

6.6 Marketing Effectiveness

Felipe et al. argued that attitudes in virtual reality can change with multimedia experience, presence, and ideological preferences (2022). In this paper, there is no significant concentration of respondents in terms of age, education, status, and understanding and perception of museums. But the feedback on visitors' willingness to visit and purchase cultural creations in the field after visiting a virtual museum is concentrated between 4 points and 5 points, indicating that the actual conversion of virtual museums is comparatively great. For visitors who have visited the museum in person, the virtual museum is also important for increasing their knowledge and willingness to revisit. This indicates that the online virtual museum has achieved a good communication effect. The low purchase intention of Louvre may be related to the low number of categories of cultural and creative products.

Table.9 Marketing effectiveness analysis -Expected value evaluation
(Based on retrieval data)

Factors	Suzhou Museum	Dunhuang Museum	Louvre
Willingness to visit the virtual museum after a field trip	78.705	79.871	77.262
Willingness to buy cultural creations after visiting a virtual museum	74.033	79.759	70.598
New insights gained from visiting the virtual museum (for visitors who have been there before)	3.491	2.174	
Willingness to revisit the virtual museum (for those who have been there before)	2.891	2.122	

7. Experience Summary and Future Prospects

7.1 Data Comparison and Experience Summary

7.1.1 Three Stages of Creative Communication Management

From the theoretical perspective of creative communication, the virtual museum creates a new communication platform for museum brand IP, which meets the requirements of three different stages of creative communication as well as a marketing tool.

At the basic stage, virtual museums need to build a complete creative communication management system and establish a complete publicity and marketing strategy to cope with changes in the communication environment. In a comprehensive comparison of the three museums, all of them follow the general trend of digital communication, continuously improve the quality of the virtual museum experience and optimize the technical means. All of them provide high-quality personalized services to the audience's preferences, facilitate the visiting experience and create richer interactive experience programs. In the development of communication strategies, all museums have incorporated creative elements, presenting innovation in various aspects such as page design and event marketing.

A necessary stage of creative communication is to achieve communication contact, with a prerequisite to establish effective communication channels. Three museums have their own characteristics. The online activities of the virtual museums also invariably transform the audience into communicators. The data show that the ease of operation is all located in the dominant holding area, which lowers the threshold of audience access and operation. The good evaluation of the museum leisure tourism function experience increases the audience's willingness to communicate autonomously. These two factors provide the means and willingness for audiences to communicate on their own, resulting in an exponential increase in communication effectiveness.

7.1.2 Communication Element of Creative Communication Management

As the core of creative communication marketing, the communication element is the cultural unit that museums must grasp in their construction and promotion. All three museums have accurately grasped the important characteristics of their own. Their design and operation have maintained a unified style, giving audiences a sense of unity and allowing visitors to accurately grasp the museum style. The virtual museum is consistent with the offline museum, not only in the appearance of the relevant web design, but also in the cultural heritage of the museum in the smallest detail to each visitor, forming a complete brand image of the museum in the minds of the audience.

In fact, the digital museum plays the dual role of communication subject and communication intermediary with communication element -experience. In terms of the purpose of its foundation, the digital museum provides a place of cultural entertainment for visitors who cannot participate in offline tours. In terms of its function, it fulfills the mission of providing a cultural living space for the public instead of offline museums. And in terms of its form, it offers a variety of activities dedicated to creating interesting experiences similar to those offline. The satisfaction measured in this paper also reflects its communication effect to some extent.

7.1.3 Construction of Creative Communication Management Platform

In the era of digital communication, creative communication management platforms play an important role and are crucial for content distribution, communication effects feedback and collection, and technical support. In the communication context of digital museums, they are first and foremost a communication platform that bridges the visitor and the physical museum, and also establishes an emotional connection between the audience and the cultural spirit of the museum. The smooth and convenient technical support of digital museums brings visitors a stronger sense of experience. From the results of this paper's research, respondents generally consider convenience to be a very important indicator.

As digital museums mature, they can stand on their own as a new communication subject. Accordingly, digital museums need to establish a new communication management platform with visitors. At present, most major digital museums adopt an integrated marketing approach, and the audience can learn about the recent and latest developments of digital museums in news media, museum official websites, and other channels. However, this type of information tends to be more fragmented, and a more centralized and specialized communication medium needs to be built in the future.

7.2 Future Outlook

7.2.1 Improve the Technical Level and Lower the Entry Barrier

The survey finds that respondents generally considered the ease of operation and comfort of running the platform to be most important. Compared to the Dunhuang Museum, Suzhou Museum and Louvre brought higher satisfaction to visitors, indicating that the more advanced and richer technical support plays a decisive role in the communication effect of marketing. For visitors who cannot visit the museum in person, the secondary processing of the museum's cultural content by the media determines the total information that the audience ultimately receives. Therefore, the future direction of digital museums focuses on introducing advanced technologies to enrich the form of activities and bring a better quality experience.

7.2.2 Expand Audience Groups and Create Individualized Content

The study finds that although Suzhou Museum provides more experiential activities and plays a certain educational role, the respondents' evaluation of the educational function of Suzhou Museum is lower than that of Dunhuang Museum and Louvre Museum, which mainly focus on academic lectures, suggesting that the public welfare educational activities of Suzhou Museum does not receive good feedback. On the one hand, it may be limited by COVID-19 pandemic's restriction on people's offline activity space, and on the other hand, many of these activities are targeted at teenagers and ignore other groups. In the future, it is supposed to consider launching individualized activities for different groups of people, such as families and children, research and education, and volunteer services to expand the audience.

7.2.3 Inclusion of Diverse Groups and Active Access to Support

A comparative analysis of the data shows that Dunhuang Museum's heritage conservation function is particularly well realized. As a public service organization, the museum cannot operate without the support of government and community resources. The museum itself must continue to seek ways to break the boundary, attract public funds, awaken public awareness of heritage conservation, and use public support from all walks of life to apply to heritage conservation and restoration to achieve a virtuous cycle of funding.

8. Conclusion

In the digital age, virtual museums play a greater role in heritage conservation, education, public welfare, and leisure tourism, responding to the requirements of more flexible and precise communication in the context of creative communication and meeting a wider range of target users (Chiarenza, 2019). It is undeniable that virtual museums cannot completely replace in-person experiences, but immersive visual environment is also an effective way to promote cognition and learning in the technological age (Felipe, 2021). Therefore, it is an inevitable trend to expand the scope of technology and promote the integration of physical and virtual museums to create participatory and digital museums, to optimize the communication effect and bring visitors a richer visiting experience.

In theory, this paper extends the application of creative communication theory and makes an innovative exploration for the expansion of the theory of news communication and cultural tourism industry. It combines the academic research on virtual tourism and physical museums and analyzes virtual museums in both qualitative and quantitative method. In practice, it also provides some practical reference for the growing museum digitalization business, and refines the analysis of the virtual museum experience and indicators.

However, this paper also has certain limitations. One is that it is limited by the time respondents can give to complete the questionnaire. The official website platform of each museum is used to represent its digital operation strategy, without allowing respondents to experience each digital matrix, such as APP, small program, etc., and it fails to ensure that the users have an in-depth experience of

each platform. Secondly, the respondents who fill in the importance questionnaire and the satisfaction questionnaire are not guaranteed to be completely consistent. Thirdly, the correlation between communication effect and visitor satisfaction is not further proved, and these factors are also the direction to be worked on in the next study.

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