

## The Influence of Media Types on the Presence Perception and Behavioral Intention of Virtual Tourists: a case study of Sanxingdui Heritage Site

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Received: 13-May-2023

Revised: 08-June-2023

Accepted: 02-July-2023

**Abstract**— Different types of tourism media have different effects on tourists' interest and behavioral intentions. Based on the SOR model, this study tests 489 college students from 9 universities in mainland China on their virtual tourism experiences. The study selects four media types materials (text and graph, short video, photo roaming, and digital roaming) for virtual tourism experiences of Sanxingdui heritage site in China to test the media on the virtual tourists' sense of presence, interest differences, and net recommendation values. Results show that all four virtual tourism media types have a positive impact on the degree of interest of virtual tourists. Among them, the media content of digital roaming has the most significant effect. Differences of the impact of the four media types on the sense of presence and net recommendation values have been distinguished, i.e., digital roaming having a much higher net recommendation value than the other three types. The study also analyzes the performance of demographic characteristics such as gender and academic background in these differences, and find that male subjects have an overall bigger interest differences than female subjects. Female, high-grade, and arts-majored subjects are comparatively more sensitive to live short video media type contents than their counterparts.

**Index Terms**—Presence, Behavioral Intention, NPS, Virtual Tourism

### I. INTRODUCTION

Virtual tourism, esp. the virtual heritage tours (VHTs), has become increasingly popular in recent years, allowing people to experience tourist destinations without physically traveling. The media type plays a significant role in virtual tourism experience as it determines the level of immersion and interactivity experienced for virtual tourists. Different types of media, such as panorama photos and videos, virtual reality (VR) simulations, and augmented reality (AR) overlays, can provide varying degrees of realism and engagement.

For academicians, even the few previous researches have delved into the impact of media types on presence perception in virtual environments, little is known about how different media types impact the presence perception and behavioral intention of virtual tourists (Cho & Lee, 2016; Huang & Chen, 2018). Generally, there is a dearth of research exploring the effect of media types on the behavioral intention of virtual tourists. This study aims to fill this research gap.

The Sanxingdui Museum in China is an ideal case study to explore this issue because of its cultural significance and popularity among tourists, esp. when it has recently implemented virtual reality and digital roaming technology. The Sanxingdui archaeological site is known for its mysterious and unique artifacts that were discovered in the 1980s and have been the subject of research and study by scholars and researchers ever since. In 2021 and 2022, During the COVID-19 pandemic in China, in order to assist in the archaeological excavation work at Sanxingdui, China Central Television launched three seasons of special live broadcasts titled "New Discoveries at Sanxingdui".

Therefore, in order to explore the relationship between different types of virtual tourism media and tourists' sense of presence and behavioral intentions, this study selects Sanxingdui archaeological discoveries as the case study and destination for virtual tourism, and conducts an experimental study on virtual tourists' spatial sense of presence and recommendation attitudes using four types of information content stimuli: network graphic and text information, short videos, 720° photo museums, and digital museums related to Sanxingdui archaeological work.

## II. RESEARCH BACKGROUND AND MOTIVATION

The motivation of the study highlights the potential contributions of the research to the academic and practical fields. While virtual reality technology has the potential to revolutionize the tourism industry, there is still limited understanding of how different media types influence the presence perception and behavioral intention of virtual tourists, particularly in the context of VHTs (Gretzel & Wang, 2008; Sung & Lee, 2018).

Studying the influence of media types on the presence perception and behavioral intention of virtual tourists can provide important insights into the effectiveness of different media types in enhancing the virtual tourism experience. For example, previous researches have shown that virtual reality (VR) can provide a more immersive and realistic experience for virtual tourists compared to other media types, such as 2D images or videos (Chen et al., 2019). However, little research work has been conducted on the influence of media types on virtual tourists' behavioral intention, such as their intention to visit the actual site or recommend it to others.

This research is dedicated to understand how different virtual media types, namely the text-graphic contents (TG), the short-videos (SV), the photo-roaming programs (PR), and the digital-roaming programs (DR), impact the presence perception and behavioral intention of virtual tourists of VHTs. The findings of this study will provide insights for tourism operators and marketers on how to design and promote virtual tourism experiences.

In sociology, the concept of social being appeared very early and juxtaposed it with Heidegger's ontology, resulting in the theory of social presence (Social Presence Theory). Presence Theory), emphasizing the role between the type of medium present and the perception of the subject, and published a large number of research results (Frank Biocca, Harms, & Burgoon, 2003; Garramone, Harris, & Anderson, 1986; Rice, 1993; Short, Williams, & Christie, 1976; Child Star & Luo Jun, 2001; Yu Wujin, 2001).

With the development of virtual reality technology, the research on social presence and spatial technological presence gradually converges, forming a comprehensive sense of presence emphasizing the spatial environment, technology and the perception of others. Lombard and Ditton (1997) thus describe presence as "an illusion of being actually mediated but not being mediated." They also elaborate on six conceptual forms of presence: media richness, authenticity, media delivery, and immersion sense, social participation through media, and the sense of media as subjects of social participation. Researchers have found that the greater the number of human senses to which a medium provides stimulation, the greater the medium's ability to create a sense of presence (Leung, Chang, Cheung, & Shi, 2022; Steuer, 1995).

Furthermore, understanding the influence of media types on the presence perception and behavioral intention of virtual tourists can have practical implications for the cultural institutions that offer virtual tourism experiences. For example, the findings of the study can help the Sanxingdui Museum to optimize its virtual tourism offerings and improve the visitors' experience on the use of media types in enhancing virtual tourism experiences.

## III. RESEARCH OBJECTIVE

The research objectives are the specific goals that the study aims to achieve. In this study, the research objectives are as follows:

- i. To identify the media type(s) that are most effective in enhancing the presence perception of VHTs tourists in the Sanxingdui Museum.
- ii. To determine the influence of media types on the behavioral intention of VHTs tourists, i.e., their intention to recommend it to others.
- iii. To explore the interactions of these influences;
- iv. To examine the differences of these influences, vary in terms of the demographic characteristics, such as age, gender, profession and incomes, etc.
- v. To explore the moderating effect of individual characteristics, such as prior knowledge and familiarity with the Sanxingdui Museum, on the relationship between media types and presence perception/behavioral intention.

These research objectives are aligned with the research questions and the overall aim of the study, which is to understand the influence of media types on virtual tourists' experience and behavior. By achieving these research objectives, the study can provide insights into the effectiveness of different media types in enhancing VHTs experiences and provide practical implications for cultural institutions.

#### IV. RESEARCH METHODS

This study is designed by adopting an online experimental survey approach to investigate the influence of media types on the presence perception and behavioral intention of VHTs tourists in the context of Sanxingdui Museum. This will allow for a comprehensive understanding of the research phenomenon.

The online experimental survey will be designed to gather data on the independent variable, which is the type of media used to present Sanxingdui Museum, and the dependent variables, which are the presence perception and behavioral intention of virtual tourists. The survey will be administered to a sample of virtual tourists who have experienced Sanxingdui Museum using different media types, including text-graphic contents (TG), the short-videos (SV), the photo-roaming programs (PR), and the digital-roaming programs (DR). The sample subjects will be recruited through social media and online tourism platforms.

In order to solve the measurement efficiency in large-scale research, a simpler version of the SPES came into being (Hartmann et al., 2016), which is a 10-item scale, through the measurement space Self-Location (SL: Self-Location) and Possible Actions (PA: Possible Action) two dimensions. Due to its high-efficiency features, this measurement tool has been widely used since its introduction (Coxon, Kelly, & Page, 2016). This study adopts SPES as the spatial presence scale. The survey will include questions on the level of presence perception behavioral intention by using the Spatial Presence Evaluation Scale (SPES) (Biocca, et. Al., J. 2001), and the Net Promoter Score (NPS) (Reichheld, 2003) for each media type.

NPS (Net Promoter Score), also known as Net Promoter Score, is an index that measures the likelihood that a customer will recommend a certain company or service to others. It was first introduced by Frederick Reichheld of Bain & Company in 2003 (FF Reichheld, 2003). Its purpose is to solve the problem that enterprises spend a lot of time and money to measure customer satisfaction but cannot obtain key indicators that affect performance growth.

The Net Promoter Score survey is implemented by asking a short-answer question: How likely are you to recommend our company to a friend or colleague? Respondents are divided into Promoters, Passively Satisfied, and critics (Detractors). Its calculation formula is:

$$NPS = (N \text{ of Promoters} / N \text{ of Total Sample}) \times 100\% - (N \text{ of Detractors} / N \text{ of Total Sample}) \times 100\%$$

Among them, Promoters (scores between 9-10): are people with fanatical loyalty, they will continue to buy and refer others. Passive (score 7-8): Overall satisfied but not fanatical, will consider other competitor's products. Detractors (score 0-6): They were not satisfied with the experience or have no loyalty.

The data collected through the online experimental survey will be analyzed using both descriptive and inferential statistics. Descriptive statistics, such as mean, standard deviation, and frequency distribution, will be used to summarize the survey data. Inferential statistics, such as correlation analysis and regression analysis, will be used to investigate the relationship between different media types, presence perception, and behavioral intention.

#### V. RESEARCH RESULTS

##### A. Experimental control report

Independent samples t-test showed significant differences in tourists' sense of presence among the four types of virtual tourism media ( $M_{TG}=4.7759$ ,  $M_{SV}=4.5139$ ,  $M_{VR}=4.8840$ ,  $M_{DR}=5.2296$ ,  $p<0.05$ ). Virtual tourism media types have a significant effect on the audience's sense of presence perception (one-way ANOVA,  $F=4.241$ ,  $p=0.006<0.05$ ), and there is a weak correlation between the strength of the sense of presence and the

change in tourism interest value (Pearson correlation coefficient  $r=2.496$ ,  $p=0.000<0.05$ ). The Cronbach's Alpha value for the sense of presence scale was 0.878, and the Cronbach's Alpha values for the pre/post the test measurement of tourism interest were 0.903 and 0.949, respectively.

### B. Overall experimental report

After consolidating the subjects, media types, interest differences, and NPS values of the experiment, the report is shown in Table 1:

Table1: Overall experimental report

Subject	Media Type	Presence	Difference of Interest	NPS
Gender	Male	TG	4.95	5.71
		SV	4.72	-3.70
		PR	5.11	5.26
		DR	5.24	21.51
	Female	TG	4.43	-30.56
		SV	4.36	-33.33
		PR	4.74	-6.78
		DR	5.21	21.43
Grade	Low	TG	4.87	0.14
		SV	4.73	-13.33
		PR	4.81	-2.74
		DR	5.25	21.85
	High	TG	4.43	-30.43
		SV	3.99	-38.89
		PR	5.11	0.00
		DR	5.08	18.75
Major	Arts	TG	4.87	0.00
		SV	4.49	-18.97
		PR	4.89	-7.32
		DR	5.20	21.95
	Science	TG	4.19	-50.00
		SV	4.78	-40.00
		PR	4.83	26.67
		DR	5.54	16.67

### C. Media Types and Interest Differences

A measurement was taken on the travel interest of participants towards the destination before and after viewing/reading virtual tourism media, and significant differences in travel interest were found among different media types, as shown in Table 2:

Table 2 The influence of different media types on the change of interests

Media Type	test	n	Mean	Changes	t	df	Sig.
Text & Graph	Before	106	5.27	0.17	-1.245	105	0.216
	After	106	5.44				
Short Video	Before	63	5.10	0.37	-2.189	62	0.032**
	After						

	After	63	5.46				
Pic	Before	97	5.36	0.42	-3.668	96	0.000***
Roaming	After	97	5.78				
Digital	Before	165	5.60	0.31	-3.060	134	0.003**
Roaming	After	165	5.91				

Note: \* \* stands for significant at  $P<0.05$  level ; \*\*\* stands for significant at  $P<0.01$  level

From Table 2, it can be seen that overall, participants' tourism interests were significantly increased after viewing the virtual tourism media. However, the impact of different types of media varies. Media type 1, the TG, did not show a significant difference ( $t=-1.245$ ,  $p=0.216>0.05$ ), with only a small increase in tourism interest (from 5.44 to 5.27, an increase of only 0.17). The difference before and after the simulation of DR in media type 4 was more significant, with an increase in tourism interest of 0.31. Media type 2, SV and PR, showed a significant increase in tourism interest by 0.37 ( $t=-2.189$ ,  $p=0.032<0.05$ ) and 0.42 ( $t=-3.668$ ,  $p=0.000<0.05$ ) respectively.

Therefore, it can be conclude that the text-graphic media cast no influence onto the tourism interest while the other three do more significantly in Sanxingdui heritage site. Among them, the PR, SV, and DR showed a significant increase in tourism interest by 0.42, 0.37, and 0.31 respectively, indicating that these three virtual tourism media types have a greater effect on increasing tourism interest than the text-graphics virtual tourism media contents.

In order to further study how virtual tourism media affects tourism interest, this study conducts sub-group analysis using relevant variables. First, the sample is divided into two groups based on three different factors (gender, grade, and major). Independent sample t-tests are used to compare the differences in tourism interest between different samples. Then, paired sample t-tests are used to compare whether there are changes in tourism interest before and after viewing and reading different media types for each sample group. Finally, both aspects are analysed comprehensively to determine whether the influence of virtual tourism media on people's tourism interest is moderated by some factors. The results are shown in Table 3:

Table 1The influence of the characteristics of the subjects

variable	Before				After				Change				
	TG	SV	PR	DR	TG	SV	PR	DR	TG	SV	PR	DR	
Gender	M	5.53	5.63	5.53	5.75	5.56 **	5.56	5.74	5.94	0.03	-0.07	0.21	0.18
	F	4.78	4.69	5.25	5.26	5.22 **	5.39	5.81	5.86	0.44	0.69	0.56	0.60
Grade	L	5.94	5.20	5.40	5.61	5.82	5.42	5.68	5.93	-0.12	0.22	0.29	0.32
	H	4.63	4.83	5.25	5.56	5.19	5.56	6.08	5.75	0.56	0.72	0.83	0.19
Major	A	5.34	5.02	5.34	5.59	5.61	5.40	5.67	5.95	0.27	0.38	0.33	0.36
	S	4.86	6.00	5.47	5.75	4.36	6.20	6.40	5.50	-0.50	0.20	0.93	-0.25

Note: \* \* represents significant at  $P<0.05$  level

In TG virtual tourism media types, grade and major subjects moderate the impact of virtual tourism media types on tourism interest. In short-video based media types, gender and grade moderate the impact of tourism advertising on tourism interest, while major doesn't have a moderating effect. In PR media types, gender, grade, and major (either the subjects are majored in arts or in science) all moderate the impact of tourism advertising on tourism interest. For DR media type, both gender and professional type moderate the impact of tourism advertisements on tourism interest, while grade plays a lesser moderating role. In addition to the digital museum, the independent sample t-tests of gender on graphic information, short video information and photo virtual tourism on the sense of presence are all significant (the independent test result of media type is  $F=25.903$ ,  $p=0.000$ ).

In summary, gender, grade, and major subject can moderate the effects of these four types of virtual tourism media on tourism interest: for TG, SV, and DR virtual tourism media, the subjects' gender is an important variance of information. Subjects' grade has a significant moderating effect on tourism interest, indicating that age and gender are extremely important in this type of virtual tourism media. Therefore, a comprehensive grasp of SV skills for heritage management is crucially important.

#### D. The relationship between media type, interest change, and presence perception

The values of tourism interest change (the difference between pre- and post-tourism interest) and presence perception vary with changes in media type. In this study, these changes are reported in Figure 3.

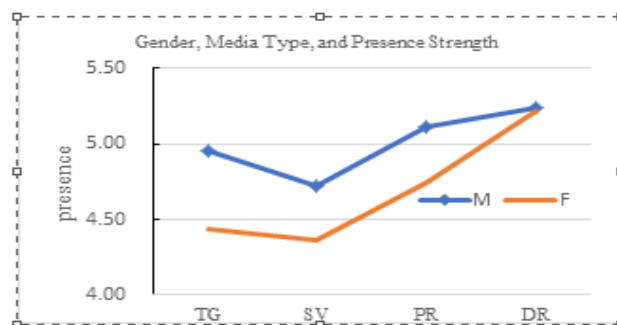


Figure 3 The relationship between the sense of presence and the change of interest

From Figure 3, it can be seen that the values of tourism interest change (the difference between pre- and post-tourism interest) and presence perception vary with changes in virtual tourism media type. The strength of presence perception is related to the degree of tourism interest change, showing a general trend that the more vivid the form of virtual tourism is, the higher the degree of tourism interest change and the strength of presence perception. The PR virtual roaming type of media has the most significant impact on participants' tourism interest and highest level of presence perception constructed. SV media shows high tourism interest but low presence perception, which may be due to short videos becoming increasingly common and losing their novelty. TG virtual tourism media has low levels of both tourism interest and presence perception, with the weakest effect in constructing presence perception.

To further understand the interaction between virtual tourism media types and the strength of presence perception, this study also examines gender differences among subjects,

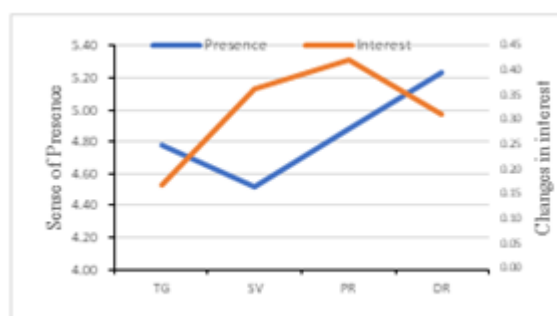


Figure 4 Relationship between gender and presence intensity

As shown in Figure 4, both male and female participants show an overall increasing trend in presence perception when exposed to different media types. However, a decreasing trend in presence perception is observed for short video media, possibly due to its commonality. Except for DR, independent sample t-tests show that gender had a significant effect on the impact of TG media content, SV media content, and PR content on presence

perception. In these three types of media, males have higher levels of presence perception than females ( $F=25.903$ ,  $p=0.000$ ). The results also visually indicate that males generally have higher levels of presence perception than females after viewing different media types.

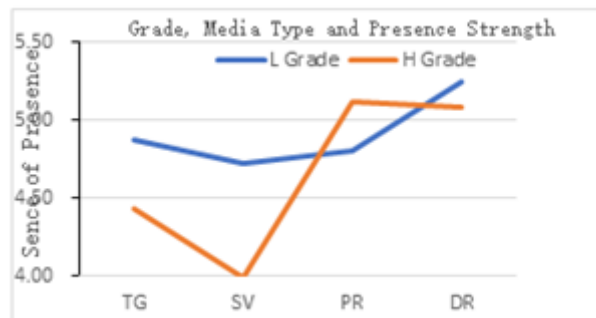


Figure 5 The relationship between grade and the sense of presence

From Figure 5, it can be seen that different grades showed different trends in response to different types of virtual tourism media. However, a decrease in presence perception is observed for all grades when exposing to video media content. Further analysis reveals that SV media has a significant effect on presence perception, while grade level doesn't show a significant effect on material type ( $F=2.757$ ,  $p=0.098$ ). The PR media content has a significant effect on presence perception, while other media types don't show significant effects. Additionally, higher-grade students are more sensitive to different types of virtual tourism media in terms of presence perception and show a steeper linear trend, while lower-grade students show relatively slow changes in their presence perception.

#### E. Media types and NPS

After measuring participants' net promoter scores (NPS) following their viewing experience of different types of virtual tourism media content, it's found that different media types result in varying levels of NPS.

The experimental report is presented in Table 4.

			TG	SV	PR	DR	total
Recommend Type	critics	count	43	29	36	34	142
		Proportion	40.57%	46.03%	37.11%	25.19%	
	passive	count	27	18	27	38	110
		Proportion	25.47%	28.57%	27.84%	28.15%	
	Recommender	count	36	16	34	63	149
		Proportion	33.96%	25.40%	35.05%	46.67%	
total	count		106	63	97	135	401
	Proportion		100.00%	100.00%	100.00%	100.00%	
NPS			-6.61	-20.63	-2.02	21.48	

From Table 4, it can be seen that in TG media, the most common type of respondent is a critic, while the least common type is a passive viewer. In SV media content, the most common type is a critic, while the least common type is a promoter. In PR media content, the most common type is a critic, while the least common type is a passive viewer. In DR, the most common type is a promoter, while the least common type is a critic.

Based on the calculation formula for net promoter scores, the following results were obtained: NPS for SV

content (-20.63%) < NPS for TG content (-6.61%) < NPS for PR content (-2.02%) < NPS for DR (21.48%). Among these four types of media, tourists have a positive recommendation for digital heritage museum roaming media content, while the others have negative values, indicating that the digital virtual roaming media type has a relatively high level of satisfaction.

## VI. CONCLUSION AND DISCUSSIONS

Based on the comprehensive analysis of VHTs tourists' presence perception, interest changes, and net promoter score, we can draw the following conclusions of the overall experience effects of different types of virtual tourism media:

Firstly, in general, all four types of virtual tourism media, including text and graph, short video, virtual photo roaming, and digital roaming, all have positive impacts on the level of interest of VHTs tourists. However, there are differences between them in terms of audience presence perception and net promoter score. Among them, the influence of digital heritage museum tour varies according to the level of interactivity of virtual tourism media. The higher the interactivity, the higher the degree of increased tourism interest and presence perception.

Secondly, specifically, in terms of tourism interest, males are more sensitive than females to changes in virtual media types, and subjects in science-related fields are more sensitive to changes in virtual tourism media than those in arts and humanities-related fields. Changes in virtual tourism media types will significantly affect their level of tourism interest.

Thirdly, in terms of presence perception, different types of virtual tourism media correspond to different levels of presence perception among VHTs tourists, and there is a significant relationship between the two ( $t = -26.109$ ,  $p = 0.000 < 0.05$ ). Different demographic characteristics also correspond to different levels of presence perception. The changes in presence perception and tourism interest show a consistent trend.

Fourthly, in terms of net promoter score, the NPS values of short video (-20.63%) < text and graph (-6.61%) < photo roaming (-2.02%) < digital roaming (21.48%). This indicates that the net promoter score of the digital heritage museum tour ranks first. Participants have a high level of satisfaction and recommendation for the digital heritage museum tour media, while they have low levels of satisfaction and recommendation for short video media.

Fifthly, overall, compared to the addition of dynamic images, people's feedback on the addition of photo roaming tours, interactivity, and task role selection is more obvious. For tourist destinations, making VHTs experiences and providing specialized explanations in VHTs promotion activities can greatly enhance the advertising effects.

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