

# A Study of Repetition on Virtual Tourism: Understanding the Effect on Memory and Visit Intention

Halim Budi Santoso  
Information System Department  
Universitas Kristen Duta Wacana  
Yogyakarta, Indonesia  
ORCID: 0000-0001-8272-3066

Jyun-Cheng Wang  
Institute of Service Science  
National Tsing Hua University  
Hsinchu City, Taiwan  
ORCID: 0000-0001-8116-0820

Gabriel Indra Widi Tamtama  
Institute of Service Science  
National Tsing Hua University  
Hsinchu City, Taiwan  
ORCID: 0000-0002-4779-5563

Andhika Galuh Prabawati  
Information System Department  
Universitas Kristen Duta Wacana  
Yogyakarta, Indonesia  
ORCID: 0000-0004-7998-7457

Nila Armelia Windasari  
School of Business Management  
Institut Teknologi Bandung  
Bandung, Indonesia  
ORCID: 0000-0001-6298-9553

Hans Gunawan  
Information System Department  
Universitas Kristen Duta Wacana  
Yogyakarta, Indonesia  
hans.gunawan@si.ukdw.ac.id

Matahari Bhakti Nendya  
Department of Informatics  
Universitas Kristen Duta Wacana  
Yogyakarta, Indonesia  
ORCID: 0000-0002-4708-9087

**Abstract**—Virtual Reality is an emerging technology that can help to promote the destination through various stimulation, including sensory stimulation (mainly on digital human senses), content stimulation (using content to enhance engagement), and technological stimulation (through the technology landscape and capabilities). However, prior studies overlooked the effect of combining different stimulation methods. Additionally, users are exposed to stimulation more than once. This research tries to investigate the effect of this stimulation on visit intention and users' memory (recall and recognition). We used the combination of three factors: content stimulation (through different narrative styles), technological stimulation (through modality interactivity), and repetition. Our study contributes to the literature on immersive technology and tourism destination promotion. Practically, destination management should be aware of the effects of stimulation on users' intentions that may help or hinder the effectiveness of the promotion.

**Keywords**—Virtual Reality, Destination promotion, Visit Intention, Recall memory, recognition memory

## I. INTRODUCTION

Virtual Reality (VR) is an emerging tool to promote tourism destinations, allowing users to experience before they go [1]. This significant effort can help to promote tourism destinations since they can offer enjoyable, authentic, and entertaining experiences. Although it can help to provide something that can increase the positive affectivity of individuals, another research stream relies on providing informative and persuasive content, known as informational advertising [2, 3]. Informational advertising offers some valuable references, such as product features (i.e., attributes, applications, and performance), resulting in some cognitive reactions (such as attention, acceptance, and learning) [3]. As a route of persuasion, both experiential and informational approaches are mutually exclusive in which customer cognitive and affective responses are activated simultaneously.

Previous studies emphasize the significance of content in virtual tourism for facilitating learning and influencing users' perceptions, making it a powerful tool for promoting products or services to target audiences [4-6]. Narratives are key in transporting users to new dimensions and shaping their attention, comprehension, and attitudes toward destinations [5, 7, 8]. Storylines can follow linear or nonlinear forms, with nonlinear narratives requiring users to connect disparate elements, stimulating cognitive engagement, while linear narratives typically offer straightforward storytelling [9, 10]. Interactivity is another crucial factor, as interactive media, including VR, provides immersive experiences and innovative ways to deliver persuasive messages. VR, representing the future of tourism through concepts like Metaverse Tourism [11], incorporates modality interactivity—using text, audio, video, and tactile inputs—to enhance user experience and engagement.

Combining those three corresponding treatments may help or hinder the effectiveness of virtual tourism. Furthermore, users are often exposed to VR, not only once, but it can be repetitive, similar to television advertising. Although some speculative thoughts have been shared, there is no empirical evidence with a robust research methodology to give robust empirical evidence. Then, we would question whether repetition significantly improves users' attention and attitude toward the destination further and how it can reflect on the individual's memory (recall and recognition memory).

Additionally, how can these three factors be combined? Is it effective to make them all into a single treatment? Prior studies overlook understanding this issue. Destination managers should understand how to optimize this issue to enhance the pre-travel experience. Pre-travel experience using VR is important because it can influence the decision-making process. Therefore, those three corresponding factors should be optimized to enhance the pre-travel experience. This research would like to answer the

following questions: *How do repetition, narrative styles, and modality interactivity affect users' visit intention and memory?*

Following the introduction, supporting literature is discussed. We rely on two pieces of literature: narrative in the tourism context and media interactivity. The research methodology is discussed in the third section. We created a VR stimulus by taking a puppet museum in Indonesia. Participants wore VR Head Mounted Devices (HMD) so they can have a fully immersive experience. The data analysis is discussed in the next section, followed by findings and discussion. Lastly, we also provide the study limitations, managerial contributions, and theoretical contributions.

## II. LITERATURE REVIEW

### A. Narrative Transportation in the Tourism Context

Narrative can create a persuasion effect by creating an immersive sense called transportation into a narrative world that refers to *a convergent process where all mental systems and capacities become focused on events occurring in the narratives* [8].

Transported individuals through different narrative media, such as texts, audio, and visuals, are focused on a pleasant state, enhancing persuasion messages by triggering telepresence to the audiences or readers [12]. Narrative can provide customers with meaningful information regarding specific products or brands through story characters or plots that convey customer beliefs. For example, a character within the story can be a role model or implicit influencer that has information and influences audiences or readers. Consequently, transportation into a narrative world makes customers less likely to counterargue persuasive messages [8].

Transportation into the narrative world can provide rich detail and factual information to help individuals understand persuasive messages. Interpreting persuasive messages in the narratives requires individuals' cognitive resources, mainly attention, presence, loss of self, and distance from the real world [13]. Narratives can help individuals deal with cognitive organizing to get a comprehensive meaning [5]. Story receivers are transported through the narrative world through two main components: empathy and mental imagery. Stories can bring people to imagine by triggering mental imagery as a cognitive organizing process and continue to change people's ways of thinking, perceiving, and making decisions [8]. In addition, story receivers can create vivid images through the plot to feel like they are experiencing the events themselves.

Although it requires high cognitive resources, a narrative can stay longer in an individual's memory than a descriptive message [12]. With this promising result, many hospitality and tourism scholars have been studying using narrative messages for destination promotion. Narrative in the hospitality and tourism context has been applied in several forms, including mini-movies [14], users' reviews, and users' trip stories.

Destination images as tourists' knowledge, impression, and imagination can be created through induced images [15, 16] by altering images through information collected during pre-travel. Narratives through storytelling can help tourists form destination images by creating imaginations before travel [17].

Narrative destination stories have several functions, including describing several attractions and facilities in the tourist attractions, enabling tourists to comprehend the tourist attractions, forming a prior knowledge about the destination, and shaping the destination image during the pre-trip. Consequently, it is expected to increase the likelihood of visiting the destination. Tourism destination marketing teams can incorporate to form the narrative message they want to convey, allowing tourists to develop specific mental imagery and create pre-travel destination images.

### B. Linear and Nonlinear Narratives

Have you watched *Memento* or *Kill Bill* parts 1 and 2? If you like Korean movies, watch *The Handmaiden* or *Joint Security Area*. If you enjoy a miniseries, you can watch *Money Heist* seasons 1 – 5 on Netflix. Those movies and miniseries are nonlinear movies that have become popular recently. The linear and nonlinear story is different in the sequence of the story. Liu, Liu, Chen and Liu [18] conceptualize a linear narrative as a sequential story from the beginning to the end in the form of a relay with no branches. Meanwhile, a nonlinear narrative is a narrative with some branches, possibly having two endings, and audiences should integrate each episode with others to understand the whole story [10, 19].

In addition, either linear and non-linear approaches have one endpoint, or it might be possible to have a different endpoint. Nonlinear narratives can bring audiences to connect different scenarios or stories. Additionally, it can attract individuals who enjoy the stories to connect and build their perspectives. Individuals can create perceptions from unconnected and unrelated things [20]. In terms of nonlinear narratives, it might be possible to enhance the cognitive process of story building due to its structure [21].

The benefits of linear and nonlinear storytelling have been discovered in some service contexts, including advertising [21] and education [10, 22]. In advertising, nonlinear narratives can activate brain processing but require a shorter video duration [21]. Furthermore, nonlinear narratives can enhance the user experience and attention with a sense of efficacy [23]. Additionally, in the education context, nonlinear narratives will help students create systematic thinking since nonlinear narratives can help boost the cognitive process of connecting unconnected stories [20, 22].

### C. VR and Destination Promotions

In tourism studies, exposure to the destination's advertorial will help tourists construct expectations. Tourism is a unique experience where visual representations of destinations trigger a successful image creation and affect attitude toward the destination [24]. Rapid technology development created a new instrument for promoting tourist destinations. VR has transformed tourists' exposure to visual representations of tourist spots by creating a realistic virtual environment [25] and a sense of presence. Realistic graphics and consistency with real-world objects can improve the sense of presence in a virtual environment. Therefore, high realism with detailed information about tourist destinations will help tourists evaluate and influence decision-making before traveling.

Utilization of VR to promote destination bears fruitful and favorable outcomes. VR can provide an immersive sense in the virtual environment with a high presence. Prior research has shown that presence in an immersive online environment can influence cognitive behaviors through learning about the contents [26]. Learning about the promoted destinations can help tourists understand some tourist destinations' characteristics. In addition, it can also allow travelers to gain their visitation purposes [27].

Moreover, Brocato [27] determines that the evaluation of a destination involves users' affective, which relates to the emotional state regarding tourist destinations. Through effective evaluations, tourists understand whether destinations are likable, pleasurable, enjoyable, and attractive [27]. Similarly, an immersive environment has influenced the affective dimension, such as enjoyment [28], flow experience [29], and users' emotions [30]. Hence, experiencing the virtual environment using VR can lead to cognitive and affective dimensions of tourist experiences. Another research stream also highlights the importance of multisensory stimuli in digital tourism ecosystems, which can influence emotions and cognitions.

#### D. Modality Interactivity and Its Consequences

Media interactivity is mainly discussed in communication research and intersects with human-computer interactions [31, 32]. Recently, service scholars have also reflected on the importance of media interactivity in enhancing value creation due to technology application in the context of service [31]. Interactivity as low involvement affordances can consider visual and verbal inputs rather than cross-modality sensory inputs [33] and can create a pleasurable and fun experience. Interactive brand communication in virtual games can enhance users' engagement and attitude toward in-game advertisements [34]. Hence, interactivity is one of the crucial elements during the product evaluation in the VR experience, leading to indirect attitude and intention change [33].

Interactivity as a technological factor can be in different forms, including modality interactivity, source interactivity, and message interactivity [32]. Modality interactivity can be a feature that can enhance two-way communication interaction with technology. Modality interactivity offers richer user controls during interaction with technology. In addition, in the seamless virtual environment, user control can help to create a memorable tourism experience [35]. Source interactivity refers to how information source influences audiences' perspectives and attitudes. As information gatekeepers, sources should be able to create someone's perspective through different choices and relationships [36]. Lastly, message interactivity refers to how the message is delivered and shown to the users, such as by involving hypertext or website paging.

This study focuses on modality interactivity in the virtual environment during product evaluations. Modality interactivity can be in the form of user interaction that allows users to change the content in real-time using a controller (for example, a mouse for a desktop computer or a handheld controller in VR) by clicking, dragging, and flipping [37]. Therefore, interactivity in this study is operationalized as users' ability to access the content through various interactive features in the virtual environment using a handheld controller. We manipulate high and low

modality interactivity by providing different interactive features during exposure to tourism advertisements in the virtual environment.

User interfaces with richer modality interactivity can influence users' attention and improve the mental representation of technological interaction [37]. Enabling interactive evaluation allows a two-way flow of information between customers and service providers that influences users' engagement. Furthermore, in an interactive communication environment, participants should be able to exert control over the information exchanged. As users perceive the interaction is high, they create a higher cognitive engagement and enhance the learning experience. Although high interactivity receives more attention during product evaluation, it also affects users' cognitive resources and influences information processing and recall [37].

### III. RESEARCH METHODOLOGY

Undergraduate students participated in a randomized laboratory experiment. Before data collection, individuals are randomly assigned to one of three conditions: (1) repetition (1 vs. 3 repetitions), (2) narrative style (linear vs. nonlinear), and (3) modality interactivity (low vs. high). Three skilled research assistants aided the data collection. The three research assistants explained the technique that the study team had developed. To validate the study process, we conducted experimental experiments. Before the experiment began, we obtained their approval, and participation was anonymous and voluntary. Figure 1 shows the research methodology.

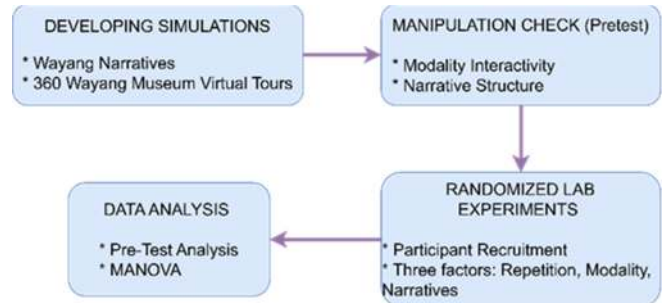


Fig. 1. Research Methodology

We created a virtual tour of a museum dedicated to cultural heritage. Three features that can assist people in navigating and digitally viewing the museum collection have been introduced to the high-modality interactive virtual museum. The radar map element, which can be realistically rotated 360 degrees using a handheld controller, aids visitors in understanding the museum's location. Users can view and interact with the museum collection—in this case, puppet collections—using the 3D representation capability. Users can zoom in, zoom out, and rotate those museum collections with this capability. Figure 2 shows the virtual museum and some rooms available on the virtual tours.



Fig. 2. Virtual Puppet Museum: (i) Museum Entrance; (ii) Puppet Room Collections

In the meantime, we conducted several preliminary procedures to produce the narratives used in this study, such as a content validity check to guarantee the story's resilience. The authors thoroughly studied the literature on the Wayang museum and certain Wayang stories before creating a story. We also verify the content by taking the YouTube virtual tour and reading various museum evaluations. One of the researchers then went on a guided tour to visit the museum and better understand its significance. Next, we create three stories using both linear and nonlinear storytelling forms. Four graduate students are asked to read our draft stories and offer comments. Additionally, we asked them if two types of narrative structures indicated linear or nonlinear stories.

#### A. Manipulation Check

We did a manipulation check to ensure that our treatments were successful. 26 participants joined in this pretest. We asked about modality interactivity, such as *to what extent this virtual tour provides interactive features and user controls*. (1: *not interactive at all*; 7: *very interactive*). The result shows mean  $Interactivity_{low} = 4.1667$ ;  $Interactivity_{high} = 5.7692$ ;  $t_{stat(23)} = -3.767$ ;  $p < 0.001$ , indicating that modality interactivity manipulations were successful. We also follow up the participants by asking for user control measurements by asking: (1) *When using a virtual tour, I felt that I had much control over the content of the VR environment*; (2) *When using a virtual tour, I felt that I could control my visual perspective*. The participant should answer using the 7 Likert Scale (1: strongly disagree; 7: strongly agree). The result of independent sample t-test shows Mean User Control<sub>low</sub> = 3.5417; User Control<sub>high</sub> = 5.8462;  $t_{stat(23)} = -11.857$ ;  $p < 0.001$ , supporting the first result of interactivity.

We continue our manipulation check by asking respondents to listen to the narratives and answer questions on the narrative structure (1) *The story of Wayang has a clear structure with the introduction, climax, and ending*; (2) *The story of Museum visit has a clear structure with the introduction, climax, and ending*; (3) *The story of Wayang has chronological order*; (4) *The story*

*of visiting museum has different characters with chronological order*; (5) *The story of visiting museum has a sequential order*; (6) *The story of the visiting museum showed many unrelated scenes* (1: Strongly disagree; 7: Strongly Agree). Then, we analyze using an independent sample t-test. The result shows there is a significant mean difference in the narrative structure between linear and nonlinear stories (Mean  $NS_{Linear} = 5.4362$ ;  $NS_{NonLinear} = 3.3577$ ;  $t_{stat(24)} = -7.101$ ;  $p < 0.001$ ). It shows that our manipulation for this research works well.

#### B. Experiment Procedure and Item Measurement

An Oculus Quest 2 HMD with a headset and two-hand controllers was used for data collection, allowing participants 5–10 minutes to acclimate to the virtual environment and learn the controls before recording began. Participants exposed to multiple sessions had 3-minute breaks between repetitions, during which they watched YouTube VR videos, and 5-minute breaks were required after each repetition, including the final round. Visit intention was measured using a Likert scale (1: Strongly disagree; 5: Strongly agree) based on three statements about visiting, revisiting, and recommending the destination after a virtual tour. Memory was assessed through recall and recognition tasks: recall involved rewriting events from the story to test memory of sequence and details, while recognition included answering ten multiple-choice questions about specific messages or events to evaluate familiarity and comprehension..

### IV. FINDING AND DISCUSSION

#### A. Study Findings

We did pre-analysis steps to ensure no confounding factors in the findings. We did two pre-analysis steps. First, we check the experiment time between each repetition. As a result, there is no significant difference between 1 and 3 repetitions. Second, we check the destination familiarity and power users. Familiarity is a customer's prior knowledge from direct or indirect exposure. A power user is a measurement that checks an individual's capability and capacity to operate technological devices. Familiarity can influence the decision-making process when visiting a destination, whereas power users can influence individuals' ability to operate computers and new technological devices. As a result, there is no difference between respondents for different treatments.

This research has three factors: modality interactivity, narrative styles, and repetition. We measured three dependent variables: visit intention, recall, and recognition memory. We run MANOVA Univariate to test the effect of those three dependent variables. All the dependent variables have passed the homogeneity test. Table I shows the MANOVA results.

TABLE I. MANOVA RESULTS

Interaction	Statistic	Visit Intention	Recall Memory	Recognition Memory
Modality	$F_{(1)}$	.251	1.128	.231
Interactivity x Narrative Styles x Repetition	Significance	.617	.289	.632
Modality	$F_{(1)}$	7.634	.006	3.980
Interactivity x Narrative Styles	Significance	.006	.939	.047



Modality Interactivity x Repetition	F <sub>(1)</sub>	7.630	.029	38.659
	Significance	.006	.865	.000
Narrative Styles x Repetition	F <sub>(1)</sub>	.509	14.858	.060
	Significance	.476	.000	.807
Modality Interactivity	F <sub>(1)</sub>	11.610	4.323	10.423
	Significance	.001	.039	.001
Narrative Styles	F <sub>(1)</sub>	8.054	.162	.667
	Significance	.005	.687	.415
Repetition	F <sub>(1)</sub>	5.888	.014	6.901
	Significance	.016	.906	.009

We found some significant effects of modality interactivity, narrative styles, and repetition on visit intention, recall memory, and recognition memory, as shown in Table I, highlighted in blue. This table also shows that the interaction between (1) Modality Interactivity and Narrative Styles and (2) Modality Interactivity and Repetition can influence the visit intention and recognition memory. Meanwhile, the interaction between narrative styles and repetition can influence memory recall. Individual factors of modality interactivity, narrative styles, and repetition influenced those three dependent variables differently.

### B. Discussion

VR provides destination management with rich and vivid media. Modality interactivity as a way of communication can offer a channel for communication between users and technology. VR can make people to be present in the virtual world. Adding modality interactivity may require the ability to operate the devices. It also needs some additional cognitive resources to operate this device. Consequently, it may hinder the user's ability to memorize some information about wayang operations, resulting in less memorization.

The interaction effects between modality interactivity and narrative styles facilitate users in encoding the incoming information. However, the high modality interactivity with linear narratives can increase visit intention compared to other treatments. Virtual reality influences people to visit their destinations since individuals can make their preferred decisions. The influence of repetition (no repetition) and linear narratives is found in visit intentions. The utilization of nonlinear narratives encourages individuals to continue to develop positive output intentions. On the other hand, linear narratives start to have a negative consequence on intention. Combining nonlinear narratives with a high modality of interactivity will make people engage and pay attention to the content in addition to repetition.

## V. CONCLUSION

Our study shows how modality interactivity and narrative styles might affect the visit intention, recall memory, and recognition memory. As a process to repeat the intended information, repetition has some incremental or decremental effect on dependent variables. Align with the two-factor theory [38, 39], additional direct repetition continues to have a positive or negative effect, depending on the stimulation. VR can provide different stimulation, including content and technological stimulation. Modality interactivity can be a technological stimulation, while narrative styles can be one of the content stimulation.

### A. Limitations and Future Research Direction

The current study demonstrates how repetition through modality interactivity and narratives can influence virtual destination promotion. We employed a between-subjects experimental design, wherein participants were assigned to treatment conditions. This approach, while common, may be influenced by individual characteristics such as gender, educational background, and cognitive limitations in processing information, potentially introducing cognitive bias. To address this, future research could explore the repetition effect using a within-subjects experimental design, which might mitigate cognitive bias and enhance the robustness of findings. Additionally, extending the study to include diverse demographic variables, such as age and cultural background, would provide deeper insights. For example, Boduroglu, Shah and Nisbett [40] found that cultural differences affect visual information processing, with Western cultures tending toward analytical thinking and Eastern cultures adopting a holistic approach. Future studies could expand on this understanding to explore cultural variations in virtual destination promotion.

Our study focused specifically on cultural heritage museums, but future research could examine other types of tourism destinations. Wang and Sparks [41] categorize destinations into environmental types (nature and built) and activities (high-arousal and low-arousal). Natural environments, with their abundance of exploration opportunities, may yield different results than built environments. Arousal levels also influence attention, with positive emotions broadening focus and negative emotions narrowing it [39]. Further research could investigate these effects in virtual destination promotions, including how sensory environments impact the wear-in and wear-out effects.

### B. Research contribution

This study contributes to destination promotion literature by exploring how repetition in virtual environments influences cognitive processing, particularly for high-involvement services like cultural heritage museums. Unlike prior research on single exposures, our findings highlight the role of modality interactivity and narrative styles in shaping customer-brand experiences. Effective virtual destination promotions require integrating engaging content with technological features while addressing users' cognitive limitations. Since memory retrieval is critical for destination decision-making, high-modality interactivity, nonlinear narratives, and repetition can enhance memory retention and associations. By aligning persuasive content with technological design, destination managers can improve long-term memory storage, sustain the wear-in effect, and increase tourists' intent to visit

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