

Effects of Interactive Experiences on Memory in a Virtual Museum

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1 Introduction

Designing content for virtual museums is challenging since it needs to engage visitors while conveying substantial knowledge. Virtual content is categorized into interactive and non-interactive types, with the former promoting user engagement through real-time interaction, whereas the latter lacks interactivity and mainly contains static information [1]. The impact of memory and attractiveness on both types requires focused research to create valuable content, aiming for an optimal and immersive visitor experience [2] [3]. This study used VR technology to explore how interactive and non-interactive content in virtual museum settings affects visitors' memory and perceived attractiveness. Three rooms simulated exhibition halls, each showcasing interactive elements by video viewing, 3D manipulation, and exhibit information buttons, while three other rooms had non-interactive content. Two separate experiments were conducted, evaluating participants' memory and attractiveness perceptions. Participants engaged with all setups, answered recognition memory questions type including visual information, and evaluated attractiveness.

2 Methods

2.1 Interactive and non-interactive contents

The selection of the theme of the content significantly impacts valid experimental results. Here, Thai cuisine was chosen due to the limited familiarity with it. The virtual museum classified Thai cuisine into six regions, using interactive and non-interactive content to highlight unique culinary traditions. Interactive content was designed for real-time engagement, featuring info display buttons, video play buttons, and physical manipulation of 3D objects.

Figure 1 (A) shows the interactive content by pressing buttons for popup info and videos or physically holding 3D models. Figure 1 (B) shows the non-interactive content, allowing passive observation of static images, videos, and information.

2.2 Participants

Forty-eight Japanese participants from a local university were divided into 24 for each experiment (Male

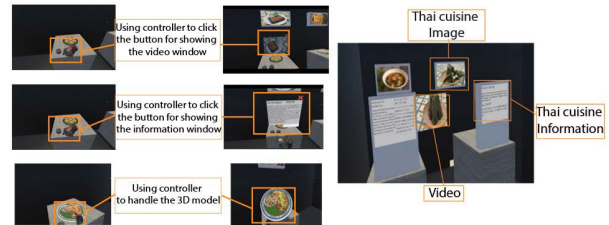


Figure. 1 (A) These types of interactive content and (B) non-interactive content features.

= 15, Female = 9 and Male = 13, Female = 11) who lacked experience in Thai cuisine. The average age of the participants was 21.1 (SD = 1.37). Participants were invited to wear head-mounted displays (HTC VIVE) and hold the controller with their dominant hand to engage in virtual museum observation.

2.3 Experimental design

The experimental design was divided into two experiments. Experiment 1 aimed to compare the effects of interactive and non-interactive content on memory and attractiveness. The participants spent seven minutes exploring each of the six exhibition halls, half interactive and half non-interactive content, followed by two questionnaires assessing recognition memory (30 questions) and selecting attractive content (24 options). Experiment 2 focused on each feature of the interactive content aligned with Experiment 1. Three halls showcased three different interactive content and one with non-interactive content. Each participant had seven minutes to explore each hall, followed by two questionnaires (20 questions and 16 options) to evaluate a similar objective as Experiment 1. Controlling the order effects, both experiments involved systematic rotations of groups between content types, interactive features, and halls.

3 Results and Discussion

The interactive content showed significantly higher scores (correct answer rate) than non-interactive content, indicated by the t-test in Experiment 1 (Figure 2). Although the button-activated information display scored the highest and handling 3D objects scored the lowest, no significant difference was observed for

each interactive and non-interactive content feature by ANOVA in Experiment 2 (Figure 3). These results suggest that combining interaction features in the virtual environment enhanced memory performance, but a single feature was not sufficient for enhancement. Whether the effect of interactive content differs when visual information is included in questionnaires or not was also investigated (Figure 4). The analysis of the effects of the question formats revealed that interactive content had significantly higher scores when questions contained pictures but were not significant without pictures, highlighting the effectiveness of interactive content with nonverbal information. The score of attractiveness (selection rate of contents) showed no significant difference between interactive and non-interactive contents by t-test in Experiment 1 (Figure 5). In Experiment 2, ANOVA showed no significant difference in attractiveness between each interactive and non-interactive content (Figure 6). The average score of interactive content was notably higher than non-interactive content only in the memory questionnaire, suggesting interactive content's role in memory enhancement without affecting attractiveness.

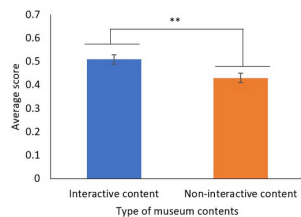


Figure 2 Memory scores in Experiment 1

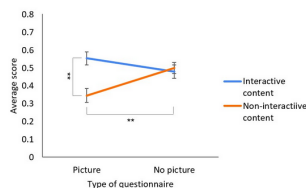


Figure 3 The questionnaire scores in different question formats in Experiment 1

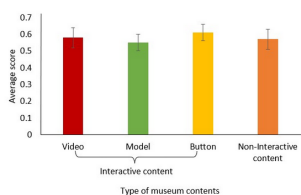


Figure 4 Memory scores of each feature in Experiment 2

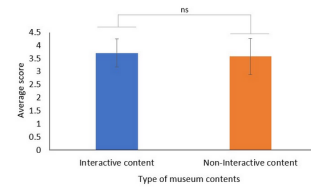


Figure 5 Attractiveness scores in Experiment 1

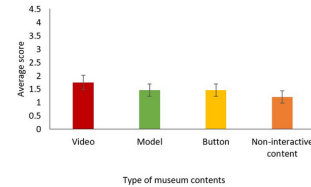


Figure 6 Attractiveness scores in Experiment 2

4 Conclusion

This study demonstrated that interactive content, encompassing various features such as the ability to press a button to view a video, access additional information by pressing a button, and manipulate a 3D object freely, significantly enhanced non-verbal visual memory compared with non-interactive content. However, no significant difference was found in attractiveness with interactive and non-interactive content. The results suggest that interactive content, such as those used in this study, affects memory but not attractiveness. These findings underscored the importance of interactive content in VR museum environments, particularly in improving visitor memory to optimize the visitor experience.

References

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