Poster

Effect of Spatial and Temporal Dilation of a Brand Logo Printed on a VR Shopping Bag

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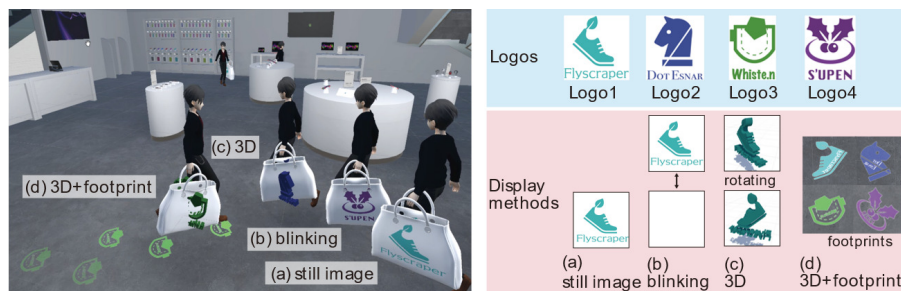[3]Faculty of Engineering, Information and Systems, University of Tsukuba, Tsukuba, Japan

Figure 1: *Experimental environment and the logo display method in shopping bag.*

Abstract

Interaction opportunities in virtual environments (VE), such as stores and events using virtual reality (VR), are increasing, and advertisements for brand recognition may be introduced to VE in the future. The objective of this research is to find a way to display advertisements in a VE that is more likely to attract the attention of consumers. Additionally, this study investigates the differences in consumer reactions depending on the advertisement's display method. In the experiment, VR customer avatars who hold shopping bags were walking in a store. Fictitious Logos were attached to each shopping bag. Each type of logo was presented in four different ways. From the results of the questionnaires, the display method that attracted the participants' eyes using temporal dilation, such as footprints that disappear over time, was significantly more memorable than the methods that did not use it. In addition, the mean of the impressive value of the blue logo, which is close to the color of the floor, was smaller than that of the other color's logos at the one percent level of significance in 3D + footprint display. This also revealed that it is necessary to use a conspicuous color that will not be buried in background colors, such as the floor color.

CCS Concepts
• Human-centered computing → Virtual reality; • Information systems → Display advertising;

1. Introduction

Opportunities for interaction in a virtual environment (VE), such as Virtual Reality (VR)-based stores and events, are increasing. If VR-based interactions become even more active in the future, advertisements to establish brand recognition could be introduced to VE. Unlike the real environment, the VE has no physical constraints, so it is possible to do things that are not possible in the real environment, such as freely moving or displaying objects. For example, complex gimmicks that attract the user's attention could easily be implemented, such as displaying a store's logo in 3D as an advertisement, or dynamically displaying a brand motif. In this study, experiments were conducted using shopping bags, which are frequently used as advertisements [Hag16]. Printing a store's logo

on a shopping bag can promote the store to consumers other than those who purchased the product. Prior research has shown that people tend to perceive advertisements more positively when the chroma and lightness of the colors are higher [GCYD97, AV06]. However, this is in a real environment, and no research has been conducted on advertising presentation methods in VE.

The purpose of this study was to investigate the differences in consumer responses to advertisements displayed in a VE, with the aim of finding a display method that is more likely to attract the attention of consumers. Specifically, we displayed dynamically changing advertisements that incorporated display methods that were unique to the VE with shopping bags, and investigated changes in awareness depending on the display method.

2. Method

The study was tested by placing eight VR avatars simulating customers in a shop set up in a VE, as shown in Figure 1. Each avatar was given a shopping bag and a fictitious logo, also shown in Figure 1, was pasted on each shopping bag for each of the two avatars. Furthermore, the display method was changed for each type of logo. The following four display methods were used: (a) display of still images, (b) blinking display of still images, which can also be achieved in real space, (c) 3D display, which extends the advertisement spatially, and (d) 3D display + footprint display, which extends it temporally.

For each participant in the experiment, a random combination of logo type and display method was presented. In the experiments conducted in this study, the participants were told to walk around freely, without being given any information about shopping bags or logos. The experimental procedure for this experiment is as follows: Firstly, experimental participants were asked to practice using the controller controls to familiarize themselves with the VE operation. Secondly, participants were free to walk around the shop for two minutes. After that, they were asked to complete the following questionnaire: (1) Have you seen the logo (surely seen it, think you have seen it, haven't seen it)? (2) Whether the logo made an impression. (3) Whether the logo is of interest or not. (4) Did you want something with that logo? (5) Did you find the logo annoying? (6) Did you find the bag annoying? Here, the respondents were asked to rate the five survey items, (2) to (6), on a seven-point Likert scale, with the exception of the item regarding whether they had seen the advertisement.

In the VE experiment, video was presented using a head-mounted display (HMD) (Oculus Quest2, Meta, resolution: 1832×1920 each, 503 g). The controller was supplied with the HMD used in the study. This experiment was conducted with 15 experimental participants in their 20s (male: 11; female: 4).

3. Results and Discussion

The questionnaire responses obtained from the experiment were used in the analysis. Table 1 shows the results of the analysis of variance for the display methods for each item of the questionnaire. If the respondent did not see the logo, each item was set to 1. No significant differences were found for all items. Therefore, since whether the display is impressive or not is an important factor in advertising displays [SA11], further analysis was conducted on the responses of questionnaire (2), which is related to the impression. The results of the one-way ANOVA among the display methods regarding the impression were shown in Table 2, which analysis is not separate the logos. A significant difference ($p < 0.01$) was found for the 3D + footprint display method. The mean of the questionnaire responses for the 3D display + footprint display method shown in Table 3 indicates that the mean for Logo 2 was significantly lower. This may be due to the small difference in hue between the blue logo and the floor, which was less noticeable and less impressive.

This shows that, it can be seen that the recognition rate of Logo 2, which is a blue logo, was lower than that for the other three logos. Therefore, without the Logo 2, t-test was conducted on the remaining three logos to test whether there was a difference in "was it memorable" depending on the presence of the footprints. The results of the t-test are shown in Table 4, which shows that $p <$

Table 1: *Results of one-way ANOVA for the display methods for each questionnaire item: there were no significant differences.*

Questionnaire	df	f	$p-value$
Whether the logo made an impression	3	0.103	1.058
Whether the logo made an interest	3	0.070	1.076
Did you want something with that logo?	3	0.670	0.574
Did you find the logo annoying?	3	0.453	0.716
Did you find the bag annoying?	3	0.318	0.812

Table 2: *Results of one-way ANOVA for display methods for the questionnaire item regarding the logo impression: there was a significant difference for the 3D display + footprint display.*

Display Method	df	f	$p-value$
Display of still images	3	0.091	1.063
Blinking display of still images	3	0.236	0.870
3D display	3	2.219	0.143
3D display + footprint display	3	7.471	0.005

Table 3: *The mean value on the impression of each logo in the 3D display + footprint display: Logo2 (blue) is noticeably small.*

Logos	mean	Logos	mean
Logo1 (cyan)	5.750	Logo2 (blue)	1.800
Logo3 (green)	3.333	Logo4 (purple)	6.667

Table 4: *The t-test results for the impression regarding the presence and absence of the logo footprints, excluding Logo 2.*

df	t	$p-value$
43	-1.630	0.055

0.1. This indicates that footprints are more likely to leave a lasting impression.

The above results show that a presentation method using temporal dilation, such as the footprints used in this experiment, is effective when displaying advertisements in VE. This may be due to the effect of the temporal change in the footprints and the unusual appearance of the footprints as a logo, which could combine to make them more memorable. However, care should be taken to use a logo that does not differ in hue from the floor.

In conclusion, this study clarified that it is even easier to create an impression using temporal change, which is the presentation methods only feasible in a VE and not bound by physical constraints. This extends conventional methods of creating memorable advertisements, two-dimensional features such as making the images more vivid [KOK*13], and makes them even easier to catch user's attention.

References

[AV06] AMPUERO O., VILA N.: Consumer perceptions of product packaging. *Journal of consumer marketing* (2006). 1

[GCYD97] GORN G. J., CHATTOPADHYAY A., YI T., DAHL D. W.: Effects of color as an executional cue in advertising: They're in the shade. *Management science 43*, 10 (1997), 1387–1400. 1

[Hag16] HAGBERG J.: Agencing practices: a historical exploration of shopping bags. *Consumption Markets & Culture 19*, 1 (2016), 111–132. 1

[KOK*13] KUKKA H., OJA H., KOSTAKOS V., GONÇALVES J., OJALA T.: What makes you click: exploring visual signals to entice interaction on public displays. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2013), pp. 1699–1708. 2

[SA11] SUGIYAMA K., ANDREE T.: *The Dentsu Way: 9 Lessons for Innovation in Marketing from the World's Leading Advertising Agency.* McGraw-Hill, 2011. 2