

An Empirical Study on the Impacts of Virtual Reality Advertising on Recall and Attitude According to Presence and Immersion

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Abstract. This study presence in VR advertising into three types presence. Presence studies have been attempted a lot, but the results about its effects on advertising varies because they are inconsistent depending on the researcher. Therefore, this study raises the need to study the effectiveness of virtual reality advertising by categorizing presence into three dimensions: Cognitive Presence, Emotional Presence, and Media Presence. Further, through an experiment, the study empirically verifies the kind of recalled information depending on the immersion which forms users' attitudes towards the content. This experiment sets the presence and immersion level of VR advertising as independent variables, and sets the Attitude toward advertising(Aad: Attitude toward Ad) and Attribute Related Memory(ARM), Global Related Memory(GRM) as dependent variables. It was manufactured separately for the experiment conducted in this study. 168 subjects (male: 102/ female: 66) participated in the experiment. However, 143 people except for the unfaithful answer sheet were used for the final analysis (male: 86/female; 57). The results revealed that positive attitudes were formed towards the advertisement used in the experiment when the level of emotional presence was the highest. In addition, higher immersion levels established positive attitudes towards the advertisement. and Cognitive presence's effects on memory, ARM such as product-attribute information was found to increase when the immersion level is high. However, GRM such as overall product evaluation was found to increase when the immersion level is low. For emotional presence, GRM was found to increase when the immersion level was high, while ARM was found to increase when the immersion level was low. Finally, media presence's effect on memory was found to be very low regardless of the immersion level. Previously formed attitudes towards the brand used for the AR advertisement in this experiment may have influenced the results and acted as an extraneous variable

Keywords: presence, immersion, VR advertising, recall, attitude

1. Introduction

Today's advances in Information & Communication Technology (ICT) and changes in the media environment have brought about changes in the way humans interact with technology, along with the advancement of corporate goods and services. The 4th Industrial Revolution and the development of technology have reorganized the social environment of mankind and created a new paradigm of experience by converging the real world and the virtual world to create an interactive virtual space with Immersive experience. As virtual space was recognized as another dimension that coexists with reality and an independent interface that creates a differentiated experience from offline, brands recognized the need to build personalized relationships with customers even in virtual environments.

Interest in Virtual Reality (VR) has increased in the field of information technology and communications (ICT). With VR advertising, consumers can experience products and services as they would in “real life,” in a virtual environment. Video and sound content are implemented in a 360-degree, immersive visual environment that enables various “presences” and interactions. Thus, VR advertising reinforces a positive brand image and new brand experiences (Han & Cho, 2019).

The user is immersed in and perceives the closest 3D visual field as the real world. To that end, head-mounted display (HMD) devices provide innovative and emotional experiences and are immersive. As these devices have become inexpensive and variously produced, the use of immersive VR has been on the rise. Immersive VR using HMD devices enables a user to identify with VR characters. Given that most reality we experience is constructed by our vision, replacing real life with a virtual environment by blocking the visual field maximizes the sense of immersion.

Presence is a theoretical variable that frequently appears in research on VR and augmented reality (AR). It is the immersive experience, the “feeling” that users have of actually being in the virtual world where they form an attitude towards the content. However, previous studies have considered presence as only a subjective and cognitive concept that exists only through media. Therefore, there is a need to analyze the “immersion levels” that media users reach through experiencing various types of presences, and examine the effects thereof. Moreover, users who experience VR advertising content form an attitude towards the advertisement in accordance with the immersion level. They store information in memory and retrieve it when making a purchase decision. What kind of information do users remember as they experience VR and AR advertising?

They remember the overall attitudinal information as well as detailed product-attribute information. Although many studies have been conducted on virtual reality,

there are no studies that have investigated how virtual reality advertisements form attitudes according to memory effects according to the type of presence.

Accordingly, this study categorizes presence in VR advertising into three types: cognitive, emotional, and media presence. Further, through an experiment, the study empirically verifies the recalled information depending on the immersion level which forms users' attitudes towards the content.

2. Theoretical Background and Hypothesis

2.1. Virtual reality

VR technology enables a user to perceive the virtual as real. The user is immersed in and perceives the closest 3D visual field as the real world (Robert, 2003). Head-mounted display (HMD) devices provide innovative and emotional experiences and immersion. As these devices have become inexpensive and variously produced, the use of immersive VR has been on the rise. Immersive VR using HMD devices enables a user to identify with VR characters. Given that most (70%) reality we experience is constructed by our vision, replacing real life with a virtual environment by blocking the visual field maximizes the sense of immersion (Krevelen & Poelman, 2010). As HMD devices block our peripheral visual field, immersive VR provides users with a greater sense of immersion and reality than non-immersive VR. Regarding immersion through immersive VR, Janet Murray (1997) stated that a user is likely to form a sense of reality and suspend disbelief in the virtual world by taking on a new identity and playing a role with a new emotional experience. Until now, 3D images have generally been designed to enhance immersion in virtual reality and facilitate immersion through a medium called Head Mounted Display (HMD). The advantage of such a device called HMD is that it is worn close to the user's visual position and blocks the environment of the surrounding reality, so that the sense of immersion is very high.

Although the technologies comprising VR can be broadly classified as device-related hardware technologies, platform technologies, and content-creation technologies, a significant number of detailed technologies are also required. Major technology companies such as Google, Apple, Facebook, and Samsung expect the VR market to grow. Therefore, they have been making various attempts to develop better content through partnerships with companies that can collaborate with their technologies, as most current content will be replaced with VR content in the future. Although there are still many problems caused by cognitive dissonance in VR simulations, companies are preparing for the short- and long-term. Recently, at the Cannes International Advertising Festival, VR advertising production for industries such as food and beverage, fashion, and automobiles has been demonstrated by companies such as Coca-Cola, McDonald's, and Volvo, respectively. Although there is no objective index or research on the effects of VR advertising, it is clear

that VR advertising provides consumers with experiences and presences for a new brand experience beyond existing advertising content.

2.2. Presence and immersion

Presence is the illusion that a user experiences while using and consuming media, the experience of feeling as if a virtual situation were real (Reeves & Nass, 1996). The user perceives that he/she exists in VR media rather than experiencing reality in a VR environment. When users experience presence, immersion in the information environment increases, which positively affects attitudes or memories (Yarramreddy, Gromkowski & Baggili, 2018). Although VR researchers have classified different types of presence, it can be broadly divided into three dimensions: cognitive presence, emotional presence, and media presence (Garrison, 2007; Lombard, Recih, Bracken, Dittion, 2000).

Cognitive presence can be understood as the process of acquiring a new cognitive information system by integrating the user's prior knowledge with new information on a product or service. Emotional presence is the process in which emotions such as joy, excitement, and sadness are expressed through emotional immersion. Media presence is the process of creating the illusion that the world of AR exists, without media (smartphones). Research that applied these three types of presence to VR advertising found that all contribute to forming a positive attitude. However, for cognitive and media presences, it was found that the effects on memories on product-attribute information is high; and for emotional presence, it was found that attitude is formed by remembering comprehensive information about a product (Lee, Hwang & Kim, 2020).

The advancement of digital technology and information and communication contributes to the development of realistic media while driving the growth of the smart media industry, providing users with the closest environment with no distinction between reality and virtual. Users recognize and mistake the five senses that humans can feel as a whole and create a new user experience by expanding the virtual space to the real space (Shim, Yang, Choi, 2018). As the development of technology and the user's experience converge, they experience a presence that provides a personalized experience and recognizes that virtual reality actually exists.

Furthermore, immersion is a variable that is personalized through media experience and immersion. As introduced by Csikszentmihalyi (1977), immersion is the best experience that an individual feels through media, and mental and physical excitement in an immersive state (Kim & Kim, 2017). When individuals are immersed or undistracted while continuously using media for a certain period of time, they form feelings of pleasure, curiosity, and excitement, experiencing immersion. Users experience immersion in online experiences through mechanical interactions, resulting in enjoyment and self-reinforcement through networks (Trevino & Webster, 1992). Further, immersion is generated by

technologies and a sense of challenge. Technologies require proficiency in media use as well as induce interest and excitement in the mediated environment. Better immersion occurs as technologies and challenges become more advanced (Hoffman & Novak, 1996).

2.3. Memory information processing

When consumers are exposed to information or advertisements, what kind of information do they remember and use for judgment? According to previous studies related to memory, consumers comprehensively assess non-evaluative information on advertisements or product-attributes qualitatively rather than quantitatively; in other words, they classify non-evaluative information to form an attitude towards the content [13, 14]. Attribute-Related Memory (ARM) refers to the information recollected by an individual as they remember specific attribute information on a product or service presented in advertisements. Consumers comprehensively evaluate this attribute information to form an attitude towards the content, which is called Global-Related Memory (GRM). For example, an ARM can be detailed product-attribute information such as a camera's design, lens performance, sensitivity, and weight; in this case, GRM would be making a judgment such as "this camera seems to have excellent performance," as an individual evaluates the camera's attribute information.

A positive attitude towards an advertisement will be formed regardless of the type of presence, because VR media is immersive, without distinction between reality and VR. Cognitive presence is the experience of acquiring new knowledge and information about a product. Accordingly, If the immersion level is high, an individual remembers product-attribute information, and if the immersion level is low, an individual is likely to judge the product through attitudinal information. On the other hand, for emotional presence, if the immersion level increases through AR advertising, individuals are likely to make attitudinal and emotional judgments rather than recall detailed product-attribute information, owing to interest and immersion. Accordingly, they will recall comprehensive and evaluative GRM. If the immersion level is low, ARM is likely to increase due to increased search for product-attribute information in the advertisement rather than attitudinal information. Regarding media presence, users do not recognize that a smartphone presents AR; instead, they accept the virtual AR as the real world. Thus, GRM is more likely to be recalled than ARM regardless of the immersion level. Based on this discussion, the following hypothesis are established:

H1: Although attitudes toward VR advertisement content will all be positive regardless of the presence type, it will be more positive when the immersion level is high and less positive when the immersion level is low.

H2: Regarding cognitive presence in VR advertising, ARM will increase if the immersion level is high; however, GRM will increase if the immersion level is low.

H3: Regarding emotional presence in VR advertising, GRM will increase if the immersion level is high; however, ARM will increase if the immersion level is low.

H4: Regarding media presence in VR advertising, GRM will be recollected more than ARM, regardless of the immersion level

3. Research Methods

3.1. Experimental design

This experiment sets the presence (cognitive, emotional, media) and immersion level (high vs. low) of VR advertising as independent variables, and sets the Attitude toward advertising (Aad: Attitude toward Ad), Attribute Related Memory (ARM), Global Related Memory (GRM) as dependent variables.

3.2. Experimental procedure

Hyundai Motor's Ionic VR advertisement was selected as the virtual reality experiment. For the experimental conditions, the VR images provided by Hyundai Motor Company were edited and used according to this experiment.

The experiment was conducted in a separate virtual reality experience booth on the first floor of COEX. The advertisement for virtual reality was selected as The Hyundai Motor's Ionic Motor was manufactured separately for this study and was experimented. 168 subjects (male: 102/ female: 66) participated in the experiment. However, 143 responses (86 males and 57 females) were used for the final analysis, as there were invalid answer sheets. The experiment was conducted from July 22 to July 19, 2020.

The experiment used HMD equipment (Galaxy Gear VR) to experience virtual reality. After experiencing a VR advertisement video of 1 minute 30 seconds, the participants were asked to respond to questions about presence, immersion, attitude, ARM, and GRM. The subjects participated in the experiment after obtaining an explanation and consent procedure. Subjects were asked to manipulate pre-crafted virtual reality ads. I fully listened to the guide's explanation and directly manipulated and experienced virtual reality advertisements. The virtual reality booth was created similar to the driving environment where there is a handle that can be driven directly, accelerator pedal, and brake system. After the experiment, the subjects who participated were given coffee gift icons.

3.3. Experimental manipulation

Hyundai Motor's Ionic VR advertisement was selected as the virtual reality experiment. For the experimental conditions, the VR images provided by Hyundai Motor Company were edited and used according to what is required for the experiment. A total of 1 minute and 30 seconds of VR video was edited using a video VR stitching program and additional information was provided for memory effect. In other words, as users experienced VR advertisements of automobiles

through virtual reality, they manipulated the individual attribute information of the vehicle, ARM. To this end, five attribute information related to the vehicle's fuel economy (22.4km/l, which is the country's highest fuel economy), multi-link suspension, dynamic driving performance, and semi-autonomous system were inserted into the VR advertisement video. Through these manipulations, consumers were asked to write and measure which information, attribute-oriented memory and evaluation-oriented memory, among the attitude and memory effect on advertisements, is more remembered.

3.4. Measurement

To measure the effect of VR to the subjects, the researchers first classified presence into three types: cognitive presence, emotional presence, and media presence. Each of the three items was measured on a 7-point scale, then summed and analyzed based on the median. Cognitive Presence is composed of 3-item and 7 points scale on how much content is understood and knowledge acquired through the virtual reality environment. Emotional presence was composed of three questions on a seven-point scale, such as excitement, fun, and feelings about the surrounding environment while experiencing a virtual reality advertisement. Media presence was measured on a 3-item 7-point scale for the user's feeling of driving a car or being inside a virtual reality media. The immersion level responds on a seven-point scale of three metrics, which results in low vs high. It was divided into high immersion level groups.

4. Results

4.1. MANOVA analysis

Two-way MANOVA was done to determine the effect of the independent variables which presence and immersion of virtual advertising to the dependent variables, which are the ad attitude, ARM, and GRM.

As a result of MANOVA analysis, the main effect on the two independent variables, presence and immersion, was significant at the 99%, with Wilks' Lambda values of $F=19.11$ and $F=49.29$. The interaction effect on the two independent variables also showed a significant result at the level of 99% with Wilks' Lambda value of $F=9.77$.

As a result of detailed ex post ANOVA analysis, the main effects on the presence are the subordinate variables, advertising attitude ($F=13.44$, $p<.01$), ARM($F=36.60$, $p<.01$), GRM($F=23.48$, $p<.01$) showed a significant difference, and the immersion was also advertising attitude ($F=58.80$, $p<.01$), ARM ($F=85.67$, $p<.01$), GRM($F=14.63$, $p<.05$)) All showed significant differences. The interaction effects of independent variables on presence and immersion are also statistically significant ($F=5.32$, $p<.05$), ARM ($F=11.87$, $p<.01$), and GRM ($F=14.28$, $p<.01$).

There was a significant difference. Table 1 shows the MANOVA and ANOVA results between the two independent and dependent variables.

Table 1: Results of MANOVA & ANOVA

| Main Effect | MANOVA | | df | ANOVA | | |
|--------------|---------------|---------|----|---------|---------|---------|
| | Wilks' Lambda | F | df | Aad | ARM | GRM |
| A: Presence | .49 | 19.11** | 6 | 13.44** | 36.60** | 23.48** |
| B: Immersion | .48 | 49.29** | 3 | 58.80** | 85.67** | 14.63** |
| AxB | .68 | 9.77** | 6 | 5.32* | 11.87 | 14.25** |

Note : * $p < .05$, ** $p < .01$

The difference between independent and dependent variables through post hoc ANOVA analysis is as follows. By examining the results of the main effects and interaction effects for each variable, the hypotheses were tested as follows.

Hypothesis 1 predicted that although attitudes toward VR advertisement content will all be positive regardless of the presence type, it will be more positive when the immersion level is high and less positive when the immersion level is low. As a result of the study, the attitude of advertisement was in the order of emotional presence ($M=4.04$, $SD=1.24$), media presence ($M=3.56$, $SD=1.08$), and cognitive presence ($M=2.85$, $SD=1.32$) media). In addition, the attitude toward advertisement according to the immersion level was found to be more positive where for high immersion, $M=4.32$, $SD=0.98$, and for low immersion, $M=2.82$, $SD=1.04$). This shows a statistically significant difference at 99%, hence, the first hypothesis is accepted.

Hypothesis 2 predicted that regarding cognitive presence in VR advertising, ARM will increase if the immersion level is high; however, GRM will increase if the immersion level is low. Results show that in cognitive presence ARM increases when the immersion level is high, where the mean score is $M=3.87$ and a Standard Deviation value of $SD=1.04$, while GRM increases when it is low, where $M=3.59$ and $SD=1.01$. Here, the second hypothesis is also accepted.

Hypothesis 3 predicted that regarding emotional presence in VR advertising, GRM will increase if the immersion level is high; however, ARM will increase if the immersion level is low. Results show that in terms of the emotional presence showed, GRM ($M=4.57$, $SD=0.94$) increased when the immersion level was high and ARM ($M=3.84$, $SD=1.26$) increased when it was low. Therefore, the third hypothesis is supported.

For the fourth hypothesis, it predicted that in terms of media presence in VR advertising, GRM will be recollected more than ARM, regardless of the immersion level. Results show that regardless of the immersion level, both ARM and GRM had

a low memory effect with mean values of 2.23 and 2.28. Therefore, the fourth hypothesis is rejected.

As a result of this study, Hypotheses 1 to 3 were supported, but Hypothesis 4 was rejected.

Figures 1 to 3 show the interaction effect between the independent and dependent variables.

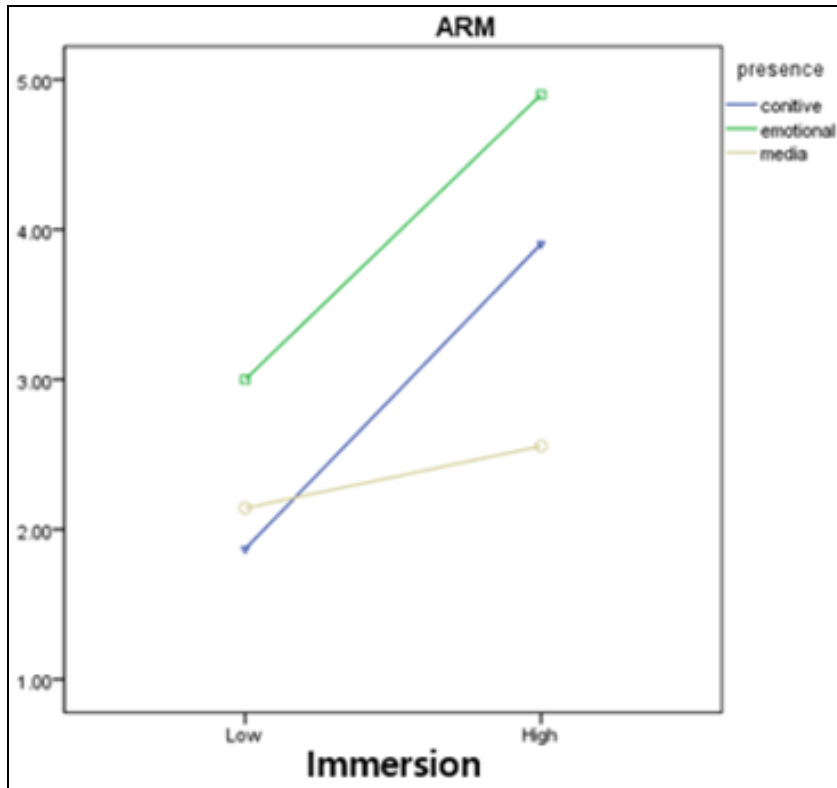


Fig. 1: Effects of Interaction between independent and dependent on ARM

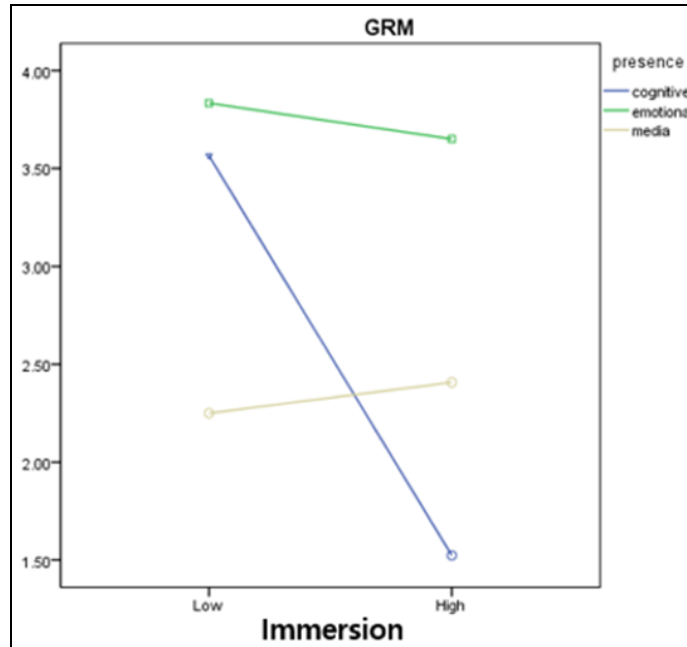


Fig. 2: Effects of Interaction between independent and dependent on GRM

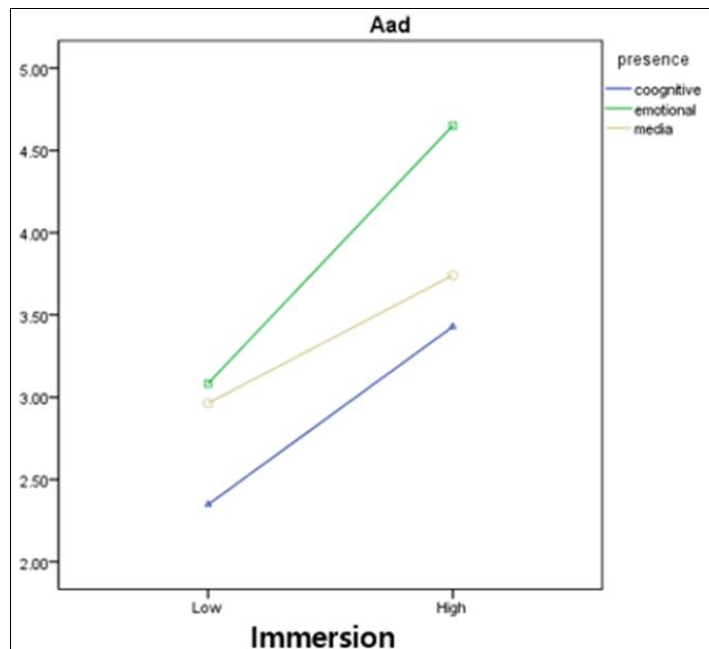


Fig. 3: Effects of Interaction between Independent and Dependent on Aad

5. Conclusions

To present a strategic direction for VR advertising, through an experiment, this study empirically examined the differences generated in relation to ARM and GRM which affect attitude towards advertisements, depending on the three types of presence (cognitive, emotional, and media) and immersion levels (high and low).

The results revealed that positive attitudes were formed towards the advertisement used in the experiment when the level of emotional presence was the highest. In addition, higher immersion levels established positive attitudes towards the advertisement. Since emotional presence is a subjective and emotional state such as excitement and interest formed while experiencing AR, positive attitude towards the advertisement was formed if the immersion level is high and if emotional presence is achieved. In general, positive attitudes towards an advertisement positively impact attitudes towards a product in terms of the effect of advertising communication, and they trigger purchasing behavior. Thus, affecting the formation of attitudes towards advertisements is a key strategy. As a strategic measure, VR advertising content must stimulate emotional presence and high immersion levels. In general, positive advertising attitudes in advertising communication effects positively affect product attitudes and induce purchasing behavior, so forming advertising attitudes is a very important strategy. Therefore, in order to produce virtual reality advertising content, strategic measures are required to induce emotional presence and increase the level of immersion. Furthermore, regarding cognitive presence's effects on memory, ARM such as product-attribute information was found to increase when the immersion level is high; however, GRM such as overall product evaluation was found to increase when the immersion level is low.

This is because cognitive presence is acquiring information, knowledge, and meaning about a product in AR advertising experiences. Product-attribute information was remembered first, due to systematic cognitive-information processing when the immersion level was high; however, a tendency to recall evaluative information by peripheral factors took over when the immersion level was low. Cognitive Presence learns information, knowledge, and meaning about a product while experiencing virtual reality advertisements. If the impression level is high, product attribute information is first remembered due to systematic cognitive information processing. Therefore, if the characteristics of products or services are superior to competitors, strategic measures are needed to strengthen cognitive presence and increase impressions to immerse themselves in virtual reality advertising. Accordingly, when characteristics of a product or service are superior to those of a competitor, an effective strategic plan would strengthen cognitive presence and enable immersive VR advertisements with high immersion levels. Moreover, regarding emotional presence, GRM was found to increase when the immersion level was high; however, ARM was found to increase when the

immersion level was low. This is because when users experience immersive VR advertisements and feel interested and excited, they evaluate the advertisement itself and store information in memory based on the positive attitude; however, when the immersion level is low, they rather explore specific attribute information. Thus, to help form a positive attitude, VR advertisements must have surrounding elements such as models, content, and background music rather than product-attribute information. Furthermore, to increase the gear effect, a plan is needed to increase the level of immersion/immersion through emotional presence.

Finally, media presence's effect on memory was found to be very low regardless of the immersion level. If a product has unique characteristics, rather than increasing immersion, a more effective communication strategy would be to produce advertising content that conveys the new knowledge system by enabling users to acquire information and knowledge about a product through the VR content.

The limitation of this study is that, first, the experiment is conducted with an existing brand, and the existing attitude of the subjects is likely to be transferred to the research results. In future studies, there is a need to manipulate virtual brands when manipulating experiments. Second, in order to accurately measure recall, it is reasonable to conduct a survey in a short period of time after the experiment is completed. the experiment is completed. However, in this study, the memory effect will most likely appear immediately as the subjects may measure recall the moment the experiment is completed.

Therefore, in future studies, it is recommended to measure the memory effect after a certain period of time after the end of the experiment. This study has significance in that it categorized VR advertising by three types of presence: cognitive, emotional, and media presences; and empirically analyzed the effects on attitudes toward advertisements depending on the kinds of information recalled (memory information, attitudinal memory information, and evaluative memory information) and immersion levels. However, previously formed attitudes towards the brand used for the AR advertisement in this experiment may have influenced the results and acted as an extraneous variable. Therefore, future research must conduct the experiment using a hypothetical brand.

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