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I dedicate this dissertation to my loving parents, Kamrun Nahar and Ahmed Musa. I have been blessed to have you as my parents. You are the most special people in my life. It is impossible to thank you enough for everything you have done for me.

I love you very much.

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Table of Contents

Acknowledgements iv

List of Tables xii

List of Figures xvii

Abstract xxi

Chapter 1: Introduction 1

Chapter 2: Review of the Literature 7

Defining Virtual Reality (VR) 7

Immersion: A Functional Attribute of Interface 9

Immersive VR system 10

Presence: A Perceptual Attribute 12

Presence vs. immersion 13

Dimensions of presence measurement 15

Virtual Product Experience 16

Theoretical Framework of Presence 19

Interactivity 22

Earlier conceptualization of interactivity 22

Theory of interactive media effect (TIME) 25

Conceptualization of interactivity under TIME 28

Vividness 31

Media richness theory (MRT) 32

Indicators of Immersive VR Ad Effectiveness 35

Cognitive responses 35

Affective responses 36
Conative responses 36
Perception of presence: A dependent and mediating variable 37
Perceived Media Novelty 37
The Role of Brand Familiarity 40
Chapter 3: The Research Problem of Study 1 42
Impact on Presence 42
Impact on Cognitive Responses: Brand Recall and Product Knowledge 43
Impact on Attitude and Intention 44
Mediating Role of Presence 46
Chapter 4: Method of Study 1 48
Research Design 48
Independent Variables 48
Immersive VR system 48
Non-VR 2-D System 49
Sample 49
Sample size 49
Sampling Procedure 50
Stimuli 51
Product and brand selection 51
Stimuli description and editing 53
Dependent Variables and Measurement 54
Presence 54

Brand recall 55
Perceived product knowledge 55
Attitude 55
Purchase intention 55
Control Variable 56
Statistical Procedures for Data Analysis 57
Chapter 5: Results of Study 1 60
Descriptive Statistics 60
Hypothesis 1a-d: Effect of Interface Type on Presence 61
Hypothesis 2a-c: Effect of Interface Type on Recall and Product Knowledge 62
Hypothesis 3a-d: Effect of Interface Type on Attitudes and Intentions 64
Hypothesis 4a-d: Mediating Effect of Presence 65
Mediating effect of engagement (H4b) 69
Mediating effect of naturalness (H4c) 75
Mediating effect of negative effects (H4d) 78
Chapter 6: Discussion of Study 1 80
Role of Interface Type on Presence 80
Effect of Interface Type on Brand Recall and Perceived Product Knowledge 81
Effect of Interface Type on Attitude and Intentions 82
Chapter 7: The Research Problem of Study 2 85
Effects of Modality Interactivity and Sensory Breadth on Presence 85
Main Effect of Immersive VR Type 89

Interactions among Immersive VR Type, Modality Interactivity and Sensory Breadth 90
Moderating Effect of Perceived Media Novelty 91
Mediating Effect of Presence 94
Chapter 8: Method of Study 2 96
Research Design 96
Independent Variables 96
Level of immersion 96
Modality interactivity 97
Sensory breadth 98
Moderating variable 99
Sample 99
General Study Procedure and Dependent Variables 100
Stimuli 102
Statistical Procedures for Data Analysis 103
Chapter 9: Results of Study 2 106
Descriptive Statistics 106
Hypotheses 5-6: Main Effects of Modality Interactivity and Sensory Breadth on Presence 107
RQ1: Interaction Effect of Modality Interactivity and Sensory Breadth on Presence 108
Hypothesis 7a-d: Effect of Immersive VR System Type on Presence 110

Hypothesis 8a-c: Effect of Immersive VR System Type on Recall and Product Knowledge 111
Hypothesis 9a-d: Effect of Immersive VR System Type on Attitudes and Intentions 112
RQ2: Interaction of Modality Interactivity and Immersive VR System Type 113
Presence 113
Recall, perceived product knowledge, attitudes and intentions 114
RQ3: Interaction of Sensory Breadth and Immersive VR 115
RQ4: Three-way Interaction 116
Hypotheses 10-11: Effects of Perceived Media Novelty 117
Main effects of perceived media novelty 117
Moderating effects of perceived media novelty 119
RQ 5: Interactions between Modality Interactivity and Sensory Breadth on Presence - Moderated by Perceived Novelty 121
RQ 6: Perceived Novelty - Moderating Two-way interaction effects 127
Hypothesis 12: Mediating Effect of Presence 138
Hypotheses 12a: Mediating effect of spatial presence 138
Hypotheses 12b: Mediating effect of engagement 142
Hypotheses H12c: Mediating effect of naturalness 146
Hypotheses 12d: Mediating effect of negative effects 150
Chapter 10: Discussion of Study 2 157
Role of Modality Interactivity and Sensory Breadth on Presence 157
Moderating effect of perceived novelty on these interactions 158

Role of Immersive VR Type 161
Immersive VR type and presence 161
Immersive VR type and cognition 162
Immersive VR type and attitudes and intentions 164
Role of Interactions among Immersive VR Type, Modality Interactivity and Sensory Breadth 166
Interaction of immersive VR type and modality interactivity on presence 166
Interaction of immersive VR type and modality interactivity on cognitive responses 168
Three-way interaction of immersive VR type, modality interactivity and sensory breadth 169
Chapter 11: Conclusion 171
Summary of Findings 171
Theoretical Implications – Immersive Media Effect and Virtual Experience 173
Theoretical Implication – Mediating Role of Presence 174
Theoretical Implication – Empirical Support for Presence Framework 174
Managerial Implications 175
Limitations and Future Research 178
Conclusion 182
References 183
Appendix A: Descriptive Statistics for All Dependent Variables 198
Appendix B: Major IRB Documents 220
Appendix C: Screenshots of Stimuli 223

List of Tables

Table 1. *Major VR Systems* 8

Table 2. *Scale Measurement Items and Reliability* 56

Table 3. *Pearson's r Correlations Matrix of Key Variables* 57

Table 4. *ANCOVA Summary Table for Spatial Presence* 61

Table 5. *ANCOVA Summary Table for Engagement* 62

Table 6. *ANCOVA Summary Table for Naturalness* 62

Table 7. *ANCOVA Summary Table for Negative Effects* 62

Table 8. *ANCOVA Summary Table for Unaided Recall* 63

Table 9. *ANCOVA Summary Table for Aided Recall* 63

Table 10. *ANCOVA Summary Table for Product Knowledge* 63

Table 11. *ANCOVA Summary Table for Ad Attitude* 64

Table 12. *ANCOVA Summary Table for Brand Attitude* 65

Table 13. *ANCOVA Summary Table for Purchase Intention* 65

Table 14. *ANCOVA Summary Table for Sharing Intention* 65

Table 15. *Direct and Indirect Relationship between Interface Type and Unaided Recall* 66

Table 16. *Direct and Indirect Relationship between Interface type and Product Knowledge* 67

Table 17. *Direct and Indirect Relationship between interface type and ad attitude* 68

Table 18. *Direct and Indirect Relationship between Interface Type and Brand Attitude* 69

Table 19. *Direct and Indirect Relationship between Interface Type and Unaided Recall* 70

Table 20. *Direct and Indirect Relationship between Interface Type and Product Knowledge* 71

Table 21. *Direct and Indirect Relationship between Interface Type and Ad Attitude* ... 72

Table 22. *Direct and Indirect Relationship between Interface Type and Brand Attitude* 73

Table 23. *Direct and Indirect Relationship between Interface Type and Purchase Intention* 74

Table 24. *Direct and Indirect Relationship between Interface Type and Sharing Intention* 75

Table 25. *Direct and Indirect Relationship between Interface Type and Product Knowledge* 76

Table 26. *Direct and Indirect Relationship between Interface Type and Ad Attitude* ... 77

Table 27. *Direct and Indirect Relationship between Interface Type and Brand Attitude* 78

Table 28. *Summary Table for Hypotheses in Study 1* 78

Table 29. *Scale Measurement Items and Reliability* 100

Table 30. *Pearson's r Correlations Matrix of Key Variables* 102

Table 31. *ANCOVA Summary Table for Spatial Presence* 129

Table 32. *ANCOVA Summary Table for Engagement* 130

Table 33. *ANCOVA Summary Table for Naturalness* 131

Table 34. *ANCOVA Summary Table for Unaided Recall* 132

Table 35. *ANCOVA Summary Table for Aided Recall* 132

Table 36. *ANCOVA Summary Table for Product Knowledge* 133

Table 37. *ANCOVA Summary Table for Ad Attitude* 134

Table 38. *ANCOVA Summary Table for Brand Attitude* 135

Table 39. *ANCOVA Summary Table for Purchase Intention* 136

Table 40. *ANCOVA Summary Table for Sharing Intention* 137

Table 41. *Direct and Indirect Relationship Between Interface Type and Ad Attitude* . 139

Table 42. *Direct and Indirect Relationship between Interface Type and Brand Attitude* 140

Table 43. *Direct and Indirect Relationship Between Interface Type and* Purchase Intention 141

Table 44. *Direct and Indirect Relationship Between Interface Type and Sharing Intention* 142

Table 45. *Direct and Indirect Relationship Between Interface Type and Ad Attitude* . 143

Table 46. *Direct and Indirect Relationship between Interface Type and Brand Attitude* 144

Table 47. *Direct and Indirect Relationship Between Interface Type and* Purchase Intention 145

Table 48. *Direct and Indirect Relationship Between Interface Type and Sharing Intention* 146

Table 49. *Direct and Indirect Relationship Between Interface Type and Ad Attitude* . 147

Table 50. *Direct and Indirect Relationship Between Interface Type and Brand Attitude* 148

Table 51. *Direct and Indirect Relationship Between Interface Type and* Purchase Intention 149

Table 52. *Direct and Indirect Relationship Between Interface Type and Sharing Intention* 150

Table 53. *Direct and Indirect Relationship Between Interface Type and Ad Attitude* . 151

Table 54. *Direct and Indirect Relationship Between Interface Type and Purchase Intention* 152

Table 55 . *Summary Table for Hypotheses and Research Questions in Study 2* 152

Table 56. *Descriptive statistics (Means, Standard Deviations, Skewness and Kurtosis) for All Dependent Variables in Study 1* 198

Table 57. *Means and Standard Deviations for All Dependent Variables in All Conditions of Study 1* 198

Table 58. *Descriptive statistics (Means, Standard Deviations, Skewness and Kurtosis) for All Dependent Variables in Study 2.* 198

Table 59. *Means and Standard Deviations for Spatial Presence in All Conditions of Study 2* 199

Table 60. *Means and Standard Deviations for Engagement in all Conditions of Study 2* 201

Table 61. *Means and Standard Deviations for Naturalness in All Conditions of Study 2* 202

Table 62. *Means and Standard Deviations for Negative Effects in All Conditions of Study 2* 204

Table 63. *Means and Standard Deviations for Unaided Recall in All Conditions of Study 2* 206

Table 64. *Means and Standard Deviations for Aided Recall in All Conditions of Study 2* 208

Table 65. *Means and Standard Deviations for Perceived Product Knowledge in All Conditions of Study 2*..... 210

Table 66. *Means and Standard Deviations for Ad Attitude in in All Conditions of Study 2* 212

Table 67. *Means and Standard Deviations for Brand Attitude in in All Conditions of Study 2* 214

Table 68. *Means and Standard Deviations for Purchase Intention in in All Conditions of Study 2* 216

Table 69. *Means and Standard Deviations for Sharing Intention in in All Conditions of Study 2* 218

List of Figures

Figure 1. Technological variables affecting telepresence. 20

Figure 2. Theory of Interactive Media Effect (TIME). 27

Figure 3. Conceptual diagram of model 4. 58

Figure 4. Statistical diagram of model 4. Indirect effect of *X* on *Y* through *Mi = ai bi.*

Direct effect of *X* on *Y = c′* 59

Figure 5. Direct and indirect relationship between interface type and unaided recall ... 66

Figure 6. Direct and indirect effects of interface type on product knowledge. 67

Figure 7. Direct and indirect effects of interface type on ad attitude. 68

Figure 8. Direct and indirect effects of interface type on brand attitude. 69

Figure 9. Direct and Indirect Relationship between interface type and unaided recall . 70

Figure 10. Direct and indirect effects of interface type on product knowledge. 71

Figure 11. Direct and indirect effects of interface type on ad attitude. 72

Figure 12. Direct and indirect effects of interface type on brand attitude. 73

Figure 13. Direct and indirect effects of interface type on purchase intention. 74

Figure 14. Direct and indirect effects of interface type on sharing intention. 75

Figure 15. Direct and indirect effects of interface type on product knowledge. 76

Figure 16. Direct and indirect effects of interface type on ad attitude. 77

Figure 17. Direct and indirect effects of interface type on brand attitude. 78

Figure 18. Conceptual diagram of model 5. 104

Figure 19. Statistical diagram of model 5. Indirect effect of *X* on *Y* through *Mi = ai bi.*

Conditional direct effect of X on Y = c. 105

Figure 20. Interaction effect of modality interactivity and sensory breadth on spatial presence. 109

Figure 21. Interaction effect of modality interactivity and sensory breadth on engagement. 110

Figure 22. Interaction of modality interactivity and immersive VR on spatial presence 113

Figure 23. Interaction effect of modality interactivity and immersive VR system on negative effect. 114

Figure 24. Interaction effect of modality interactivity and immersive VR system on aided recall..... 115

Figure 25. Interaction effect of modality interactivity and sensory breadth on aided recall under low immersive VR system..... 116

Figure 26. Interaction effect of modality interactivity and sensory breadth on aided recall. under high immersive VR system. 117

Figure 27. Moderating effect of perceived novelty on the relationship between immersive VR type and ad attitude. 120

Figure 28. Moderating effect of perceived novelty on the relationship between immersive VR type and sharing intention. 121

Figure 29. Interaction among perceived novelty, modality interactivity and sensory breadth on spatial presence under low perceived novelty condition. 122

Figure 30. Interaction among perceived novelty, modality interactivity and sensory breadth on spatial presence under high perceived novelty condition. 123

Figure 31. Interaction among perceived novelty, modality interactivity and sensory breadth on engagement under low perceived novelty condition. 124

Figure 32. Interaction among perceived novelty, modality interactivity and sensory breadth on engagement under high perceived novelty condition. 125

Figure 33. Interaction among perceived novelty, modality interactivity and sensory breadth on negative effects under high perceived novelty condition. 126

Figure 34. Interaction among perceived novelty, modality interactivity and sensory breadth on negative effects under high perceived novelty condition. 127

Figure 35. Interaction between interface type and sensory breadth on brand attitude under low perceived novelty. 128

Figure 36. Interaction between interface type and sensory breadth on brand attitude under high perceived novelty. 129

Figure 37. Direct and indirect effects of interface type on ad attitude..... 139

Figure 38. Direct and indirect effects of interface type on brand attitude. 140

Figure 39. Direct and indirect effects of interface type on purchase intention. 141

Figure 40. Direct and indirect effects of interface type on sharing intention. 142

Figure 41. Direct and indirect effects of interface type on ad attitude..... 143

Figure 42. Direct and indirect effects of interface type on brand attitude. 144

Figure 43. Direct and indirect effects of interface type on purchase intention. 145

Figure 44. Direct and indirect effects of interface type on sharing intention. 146

Figure 45. Direct and indirect effects of interface type on ad attitude..... 147

Figure 46. Direct and indirect effects of interface type on brand attitude 148

Figure 47. Direct and indirect effects of interface type on purchase intention. 149

Figure 48. Direct and indirect effects of interface type on sharing intention. 150

Figure 49. Direct and indirect effects of interface type on ad attitude..... 151

Figure 50. Direct and indirect effects of interface type on purchase intention. 152

Abstract

The main goal of the present study was to test the advertisement effectiveness of immersive virtual reality (VR) systems. Two experimental studies were conducted to address the goal. The first experiment was done to compare the effects of an immersive VR interface and a traditional non-VR 2-D interface on consumers' perceived presence, brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention, and sharing intention. The second study was conducted to identify and compare the effects of a high immersive VR system and a low immersive VR system. In addition, study 2 focused on examining the effects of modality interactivity (a type of interactivity) and sensory breadth (a type of vividness) on both platforms. In doing so, the study also tested how the perceived media novelty moderated the effects of immersive VR system type on consumers' responses. Finally, the mediating role of presence was examined in both studies.

Results of study 1 revealed that an immersive VR ad is more effective in creating users' sense of presence, ad attitude, purchase intentions and sharing intentions than a 2-D ad. The mediation analysis also confirmed an indirect effect of interface type on such variables via different dimensions of presence (e.g., spatial presence, engagement, and naturalness). Interestingly, although significant direct effects of interface type were not found on participants' brand recall, perceived product knowledge, and brand attitude, the mediation analysis identified indirect effects of interface type on such variables via different dimensions of presence.

Results of study 2 revealed that a high immersive VR system is more effective in creating sense of presence and sharing intentions than a low immersive VR system.

Although most of the direct effects of the immersive VR type were absent, the mediation analysis confirmed indirect effects of the immersive VR type on all variables (i.e., brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention and sharing intention) via different dimensions of presence.

Study 2 also revealed that the combination of modality interactivity and sensory breadth significantly increased the sense of presence, while their individual main effects on presence were missing. The immersive VR type was found to interact with different levels of modality interactivity only on presence such that a high immersive VR system was more effective in increasing the dimensions of presence than a low immersive VR system. However, perceived media novelty of the users moderated several relationships in study 2. In the case of presence, perceived media novelty moderated the interaction of modality interactivity and sensory breadth such that when perceived media novelty is high, then any combination of modality interactivity and sensory breadth became more effective. But, the combination of modality interactivity and high sensory breadth did not contribute more effectively than other situations in the case of high perceived novelty. Perceived media novelty of the users also moderated the effectiveness of the high immersive VR on ad attitude and sharing intention. The study found that when perceived novelty was high, an immersive VR system was more effective than low immersive VR in creating favorable ad attitude and sharing intention. But, when perceived novelty was low, the difference between high and low immersive VR became very low or almost similar. Further, the study found that perceived media novelty also moderated the interaction of immersive VR type and sensory breadth on brand attitude. When the perceived novelty was low, a high immersive VR system with high sensory

breadth was not more effective than low immersive VR. But, when the perceived novelty was high, a high immersive VR system with high sensory breadth became more effective than low immersive VR.

Both studies have important theoretical and practical implications. The first primary theoretical contribution of this dissertation comes from its overall test to find out the effects of an ad presented via different interfaces that varied in terms of immersive features or modalities: non-immersive interface/non-VR interface (e.g., 2-D), low immersive VR interface (e.g., monoscopic VR), and high immersive VR (stereoscopic VR). The results contribute to the body of research on immersive VR media and VR environments done earlier. Another key contribution made by the dissertation was its conceptualization of perceived media novelty as a moderator of the relationships between immersive VR systems and the measure of ad effectiveness. The dissertation showed how high perceived media novelty can exaggerate the real effect of high immersive VR, making it almost equally effective to low immersive VR. Effects of perceived media novelty can provide important insight into the theoretical framework development of immersive VR and virtual product experience to evaluate the effectiveness of emerging immersive VR media more accurately. This dissertation's next theoretical contribution comes from its mediation analysis done on the relationship between interface type and ad effectiveness measures via the sense of presence. Such relationships are theoretically important for several reasons. First, it established the important role of presence to evaluate VR ad effectiveness. The study found that although the direct effects of interface type on several variables were absent, indirect effects were still active in VR ad via different dimensions of presence. Second, the

mediating role of presence is rarely tested in case of monoscopic or stereoscopic VR ads. So, the current study extended the theoretical validity of the mediating role of presence on such platforms. Next, the study focused on determining different dimensions of presence (e.g., spatial presence, engagement, naturalness, and negative effects), rather than determining presence as one single construct. Finally, the dissertation empirically tested Steuer's (1992) presence framework. The dissertation indicates that Steuer's presence framework worked only when users consider the combined role of interactivity and vividness. The findings of the two studies of this dissertation are also important to marketers and have immediate implications. The results indicate that marketers can implement technological modalities of VR to enhance persuasive outcomes. Next, the dissertation upholds the importance of improving "presence" strategy in VR ad campaign and including presence measurement in ad copy pre-testing. Moreover, the dissertation also suggested several insights on the strategy of elevating presence via different combinations of modality interactivity (i.e., using/not using a hotspot) and sensory breadth (i.e., using only text/using text plus visual information). Finally, the dissertation also suggested how marketers should consider the role of perceived media novelty with caution while evaluating the immersive VR ad effectiveness.

Chapter 1: Introduction

Virtual reality or VR, once considered hyped, is now the new reality of communication. Although a VR system was used as a bulky device to play video games in the 1980s, it has rapidly emerged as a sophisticated way of communication (Fox, Arena, & Bailenson, 2009). VR is an interface/system/medium which has the capability to submerge the perceptual system of a user in a computer-generated virtual environment (Biocca & Delaney, 1995) and enhance the perception of being there in that environment (Steuer, 1995). Considering the potential of a VR system, it is of no surprise that the projected revenue of the VR product industry was $4.6 billion for 2017, and there will be more than 171 million active VR users in the United States by 2018 (Statista, 2017). The projected worth of the industry is $35 billion for 2025 (Goldman Sachs Research, 2016). A recent industry research on VR awareness in the USA showed that 92 percent of respondents were aware of the term VR (Statista). The main factor that accelerated the growth of the VR industry was the diffusion of VR devices and headsets, ranging from high-end/high-cost VR technology systems (e.g., Samsung Gear VR, Oculus Rift) to low-end/low-cost systems (e.g., Google Cardboard, onn, ShineVR). Amazon.com, for example, currently offers more than 190 different VR headsets (Phaisan, 2017).

Marketers have already realized that the technological affordances or features of VR systems are too influential to disregard (Van Kerrebroeck, Brengman, & Willems, 2017). VR systems can provide consumers with a vivid, involving, and interactive virtual experience of the product and brand. According to Li, Daugherty and Biocca (2001) such virtual experiences can be closer to or even richer than a direct

product/brand experience. Immersive storytelling, product demonstration and content marketing are a few of many innovative ways to reach consumers via a VR system (WebpageFX Data, n.d.). In addition, people's increasing interest in the system has fortified marketers to use VR systems as an advertising tool (Yim, Cicchirillo, & Drumwright, 2012). Many popular brands such as Marriott International, Thomas Cook, The North Face, Volvo, Jaguar, Adidas, Nike, and IKEA have incorporated the VR in their marketing strategies and observed positive outcomes. For instance, Marriott's VR room service with VR postcards increased consumers' willingness to stay in the hotel (WebpageFX Data). Destination British Columbia also offered a VR experience for Canada's Great Bear Rainforest and achieved a five percent increase in tourism for that location (WebpageFX Data). Thomas Cook's VR initiative to provide users a virtual travel experience over the Manhattan skyline achieved a 190 percent increase in local trips (WebpageFX Data). Therefore, VR has a good potential to serve as an effective marketing communication tool (Biocca & Delaney, 1995; Van Kerrebroeck et al., 2017; Yim et al., 2012). Many scholars and marketers have even considered VR the future of advertising (Van Kerrebroeck et al.).

The main goal of the present study is to test advertisement effectiveness on such emerging VR systems. To be specific, the type of VR system mentioned earlier was defined as an "immersive VR system" by researchers (Biocca & Delaney, 1995). The concept of immersion is a medium attribute of VR systems and defined as the extent to which a VR interface has the capability to submerge the perceptual system of the user in computer-generated stimuli (Biocca & Delaney). The distinctive affordances or features of an immersive VR system may include several features, such as stereoscopic view

(i.e., provides a lens for each eye), 360°/180° contents, spatialized audio, built-in headphone, head-controlled point of view, and natural mapping of head/body movement (Ahn, 2011; Biocca & Delaney). However, research on immersive VR is still in its infancy (Bailey, Bailenson, & Casasanto, 2016). Several fundamental questions about the effectiveness of immersive VR ads have not been answered yet. How are the effects of immersive VR interfaces different from non-VR 2-D interfaces? How are the effects of high immersive VR interfaces different from low immersive VR interfaces? What are the conditions under which immersive VR ads work (or do not work)? To be specific, the empirical question of which factor/factors of immersive VR systems contribute to ad effectiveness has gone completely unexamined. Therefore, the purpose of the study is to answer these important questions.

The study utilized the framework of presence to explicate above mentioned relationships. The notion of presence or illusion of "being there" (Steuer, 1995) has been considered a fundamental aspect in understanding and explaining the psychological effects of immersive VR systems (Barfield, Zeltzer, Sheridan, & Slater, 1995; Lombard & Ditton, 1997; Steuer). According to the telepresence framework of Steuer, presence is mainly an outcome of two medium attributes of immersive VR systems: vividness and interactivity. Vividness refers to a medium's ability to present messages with high quality (e.g., good resolution) and across the senses (e.g., visual, audio, touch, etc.) (Steuer). Interactivity, on the other hand, is defined as the technological affordance of any medium/interface/system that allows users to interact with the form and the content of a mediated environment in real time (Steuer; Sundar, Jia, Waddell, & Huang, 2015). Researchers have strongly argued that although presence

can be a product of any medium, immersive VR system affordances are likely to generate more captivating illusion of presence than any other media (Ahn, 2011; Biocca, 1997; Yim et al., 2012). Further, a sense of presence is considered to mediate the effect of media on consumer responses (Li, et al., 2001). Earlier researchers attempted to explicate the mediating role empirically on a few new media contexts, such as commercial Websites (e.g., Klein, 2003), and three-dimensional product visualization (e.g., Li, Daugherty, & Biocca, 2003). Nevertheless, the mediating role of presence has not been fully tested yet by empirical studies in the context of immersive VR systems. The current study attempted to fill this research gap.

In order to address the above-mentioned questions and fill the research gap, the current dissertation consisted of two experimental studies. The first experiment was done to compare the effects of an immersive VR system and a traditional non-VR 2-D system on consumers' psychological responses (e.g., presence, attitude, cognition and behavioral intentions). The second study was conducted to identify exactly which factor(s) of an immersive VR system contributed to VR ad effectiveness. Two immersive VR affordances that contribute to presence were selected for this purpose: interactivity and vividness. In order to make the propositions more specific, study 2 further divided the immersive VR system into "high immersive VR system" and "low immersive VR system" and then hypothesized the effects of interactivity and vividness on both platforms. In doing so, the study also considered a moderating factor that is likely to be associated with the impact of immersive VR advertisements – perceived media novelty. Perceived media novelty is the degree to which an individual believes a medium or presentation modality to be new or significantly different from any other

media that the individual has encountered before (A Lang, 2006; Berlyne et al., 1963; Forster, Lieberman, & Shapira, 2011; Rosenkrans, 2009; Tokunaga, 2013). As immersive VR platforms and technologies are still emerging and novel to many people, it was assumed that the effect of immersive VR platforms would be conditioned by the extent to which users think the media to be novel. Finally, the mediating role of presence was tested for both studies. The current study is one of the very first studies to address specifically "when immersive VR works better" considering the predictors of presence and to explain how presence actually mediates the relationship between immersive VR type and ad responses under varying degrees of interactivity and vividness (while considering the moderating effect of perceived media novelty).

Both studies have important theoretical and practical implications. The first primary theoretical contribution of this dissertation comes from its overall test to find out the effects of an ad presented via different interfaces that varied in terms of immersive features or modalities: non-immersive interface/non-VR interface (e.g., 2-D), low immersive VR interface (e.g., monoscopic VR), and high immersive VR (stereoscopic VR). The results contribute to the body of research on immersive VR media and VR environments done earlier. Another key contribution made by the dissertation was its conceptualization of perceived media novelty as a moderator of the relationships between immersive VR systems and the measure of ad effectiveness. Effects of perceived media novelty can provide important insight into the theoretical framework development of immersive VR and virtual product experience to evaluate the effectiveness of emerging immersive VR media more accurately. This dissertation's next theoretical contribution comes from its mediation analysis done on the relationship

between interface type and ad effectiveness measures via the sense of presence. Such relationships are theoretically important for several reasons. First, it established the important role of presence to evaluate VR ad effectiveness. Second, the mediating role of presence is rarely tested in case of monoscopic or stereoscopic VR ads. So, the current study extended the theoretical validity of the mediating role of presence on such platforms. Next, the study focused on determining different dimensions of presence, rather than determining presence as one single construct. Finally, the dissertation empirically tested Steuer's (1992) presence framework. The findings of the two studies of this dissertation are also important to marketers and have immediate implications. The results indicate that marketers can implement technological modalities of VR to enhance persuasive outcomes. Next, the dissertation upholds the importance of improving "presence" strategy in VR ad campaign and including presence measurement in ad copy pre-testing. Moreover, the dissertation also suggested several insights on the strategy of elevating presence via different combinations of interactivity and vividness. Finally, the dissertation also suggested how marketers should consider the role of perceived media novelty with caution while evaluating the immersive VR ad effectiveness.

Chapter 2: Review of the Literature

The major purpose of this dissertation is to understand the effectiveness of immersive VR systems in creating positive psychological responses toward advertisements. In order to explicate this relationship, it is important to understand the concepts of virtual reality, immersion, and presence. The current study used the framework of telepresence as its foundation. This chapter, first, focuses on explaining two important concepts, immersion and presence, to define VR, while presenting the relationship between them. Next, a theoretical backdrop of Steuer's (1995) framework of telepresence or presence is presented. This chapter provides a comprehensive discussion on the two major determinants of presence: interactivity and vividness. Next, the impacts of immersive VR system on users' psychological responses (perception of presence, product knowledge, recall, attitude, behavioral intention) are described. Finally, this chapter explicates the role of presence (as a mediating variable), perceived media novelty (as a moderating variable) and brand familiarity (as a controlling variable) in detail.

Defining Virtual Reality (VR)

From the technological perspective, virtual reality (VR) is nothing but an interface / system / medium with "a display and control technology that can envelop a person in an interactive computer-generated or computer-mediated virtual environment" (McGreevy, 1993, p. 163). There exists no one paradigmatic type of VR system (Biocca & Delaney, 1995). VR technology comes in many forms with a certain collection of technological hardware and/or software, including computers, VR applications, head-mounted display (HMD), headphones, haptic devices, motion-sensing gloves, etc.

(Greenbaum, 1992; Krueger, 1991). Based on a classification used by Louis Brill (1993), Bicocca and Delaney stated that VR systems can be divided into, but not limited to, seven categories (see Table 1).

Table 1. *Major VR Systems*

VR systems	Description
Window system	A computer screen provides a window or portal onto an interactive, 3-D virtual world. Desktop computers are often used and users sometimes wear 3-D glasses for stereoscopic effects.
Mirror system	The users look at a projection screen and see an image of themselves moving in a virtual world. Video equipment is used to record the user's body. A computer superimposes a cut-out image on a computer graphic background. The cut-out images of themselves on the screen mirrors their movements, hence the name *mirror systems.*
Vehicle system	The users enter what appears to be vehicle (e.g., tank, plane, car, space ship, etc.) and operate controls that simulate movement in the virtual world. The world is most often projected on screens. The vehicles may include motion platforms to simulate physical movement.
Cave System	Users enter a room or enclosure where they are surrounded by large screens that project a nearly continuous virtual scene. 3-D glasses are sometimes used to enhance the sense of space.
Immersive virtual reality systems	Users wear displays that fully immerse a number of the senses in computer generated stimuli. The stereoscopic head-mounted displays (HMD) are a distinctive feature of such systems.
Augmented reality systems	Users wear a visual display (e.g., transmissive HMD) that superimposes 3-D virtual objects on real-world scenes.

Adapted from “Immersive virtual reality technology” by Biocca, F., and Delaney, B. 1995. In Frank Biocca & Mark R. Levy, (Eds.), *Communication in the age of virtual reality* (pp. 57-124). Copyright 1995 by the Lawrence Erlbaum Associates.

Unfortunately, a device-oriented definition of VR is not adequate, specifically for social science researchers (Steuer, 1995). According to Steuer, the definition involves three significant problems: (a) arbitrary classification of a system as VR (or not-VR) based on the presence (or absence) of the necessary hardware, (b) vague conceptual unit of analysis for VR, and (c) absence of theoretical dimensions through which VR can be contrasted with other systems. Therefore, as stated by Steuer, "it is difficult to perform social science research that addresses the similarities and differences among various virtual reality systems, or that examines VR in relation to other media" (p. 4). In order to address this conceptual deficiency, researcher began to use two concepts, i.e., "immersion" and "presence," to explain that VR can be defined beyond its technological corpus, allowing room for more precise conceptual unit of analysis and theoretical dimensions for VR. Based on immersion, Wexelblat (1993) defined VR as a computer mediated interactive environment in which people can get immersed. Steuer defined VR as a real or simulated environment in which users perceive presence. Concepts of immersion and presence are discussed in detail the following paragraphs.

Immersion: A Functional Attribute of Interface

Although the notion of immersion lacks a canonical definition, it has frequently been used to explain VR (Ahn, 2011). In general, the term immersion means deep mental involvement with something. In the case of virtual reality, Biocca and Delaney (1995) defined the term immersion as "the degree to which a virtual environment submerges the perceptual system of the user in computer-generated stimuli. The more the system has the capability to captivate the senses and blocks out stimuli from the

physical world, the more the system is considered immersive" (p. 57). Slater and Wilbur (1997) referred immersion as the extent to which novel affordances of digital media can increase the reality of the mediated environment by delivering a comprehensive, wide-ranging, and vivid illusion of reality to the senses. Similarly, Riva (2006) defined it as the degree to which a virtual environment "submerges the perceptual system of the user" (p. 52). It should be noted that all these definitions depicted the concept of immersion mainly as a functional affordance of VR system (Anh). In other words, immersion is an attribute or affordance of a medium.

Immersion level depends on the layers of sensory information (e.g., visual, aural, motion, tactile) created by technology (Loomis, Blascovich, & Beall, 1999) and the extent to which the technology can block out stimuli from the physical world to provide the sense of non-mediation (Biocca & Delaney, 1995). The more an interface can offer such technological features, the more the interface will be termed as immersive (Biocca, 1997). Based on this perspective, an interface that provides a 360° view of the environment within a message is more immersive than the interface system that provides traditional two-dimensional view. Here, "360° view" in any video or picture means that the content is presented in a spherical view, in which every viewpoint of the environment is recorded or captured at the same time and can be accessible via the display system (Etherington, 2015).

Immersive VR system

Earlier researchers, including Biocca and Delaney (1995), and Biocca (1997), used the term "immersive VR" to indicate a VR system that provides very higher level of immersive affordances. Biocca and Delaney indicated that immersive VR includes a

system in which “users wear displays that fully immerse a number of the senses in computer generated stimuli” (p. 59). Biocca and Levy (1995) noted that -

> …in the most compelling virtual reality experiences, the senses are immersed in the virtual world; the body is entrusted to a reality engine. The eyes are covered by a head-mounted display; the real world is invisible. The ears are covered by headphones; ambient sound is muffled. The hands are covered by gloves or props: ‘touch only the virtual bodies.’ Virtual reality may share common elements with reading a book in a quiet corner, but this book has stretched in all directions and wrapped itself around the senses of the reader – the reader is swallowed by the story. (p. 135)

However, a monocopic system on a flat computer screen and a stereoscopic head-mounted display (HMD) system are examples of immersive VR. Anh (2011) stated that a monoscopic flat-desktop display contains the criteria of low immersive VR, as the system involves monoscopic vision of the 360° video, non-spatialized audio via external headphone, mouse-controlled point of view, and no mapping of head movement (Ahn). A stereoscopic head-mounted display (HMD) system, on the other hand, is an example of high immersive VR system. Anh defined stereoscopic HMD as “a headpiece with a lens for each eye which provides stereoscopic views of the computer-generated environment, and various devices that track simple head and body movements as well as the position of the body in three-dimensional space” (p. 13). Stereoscopic HMD has built-in headphones to hear the spatial sound. It may also come with other sensory interactive devices, such as devices to create a sense of touch or taste, motion-sensing gloves, etc. Stereoscopic display in the HMD uses the stereo parallax principle, which enables a user to see different images with each eye and HMD’s built-in glasses are used to adjust the images (Dodgson, 2005; Rupkalvis, 2001). The aural experience in such a system differs from the aural experience on a

standard set of headphones regarding the element of “user motion” (Biocca & Delaney, 1995). Biocca and Delaney explained this as following.

> When a user listens to a standard stereo recording, the user’s movement does not change the properties of the sound. The properties of the audio space are fixed and determined at the time of the recording and mixing. But in a head-centered virtual audio space, the sound is dynamic and interactive; it changes as the user's head swivels away or toward the virtual sound source. Move your head closer to the virtual drum and the sound changes. (p. 82)

To sum up, an immersive VR system actually indicates the extent to which a VR platform offers immersive technological affordances and, based on the level, immersive VR systems can further be divided into high immersive VR (e.g., stereoscopic VR) and low immersive VR (e.g., monoscopic VR).

Presence: A Perceptual Attribute

A perceptual or subjective approach of defining VR considers the concepts of presence. Presence is generally defined as the subjective perception of “being there” in an environment represented by a medium (Barfield et al., 1995; Biocca, 1997; Heeter, 1992). Lombard and Ditton (1997) added that presence creates a perceptual illusion of non-mediation or non-existence of technology. Lee (2004) explained that illusion of presence can make people forget about “the para-authenticity of mediated objects” or “the artificiality of simulated objects” (p. 36). Chertoff, Schatz, McDaniel, and Bowers, (2008) also stated that presence is highly realized “when a person cannot distinguish between sensory input from a hardware-mediated environment and sensory input from reality, and thus responds to the hardware-mediated input as though it came from the real world” (p. 405).

One thing should be noted that many scholars earlier used another term called “telepresence.” Initially telepresence and presence were treated as different terms.

Whereas presence involved the natural/real perception of an environment, telepresence involves the mediated perception of an environment (Steuer, 1995). Later, Biocca (1997) refined the notion of presence as the illusion of "being there" in an environment, irrespective of its being physical/real, mediated, or fictional and used the terms "telepresence" and "presence" interchangeably.

Presence is not dichotomous in nature, as the sense of presence is developed by a user's subjective internal processing (Loomis, 1992). "A user's sense of presence often shifts among the virtual, physical, and imagined environments or between the concepts of "being there" and "not being there" in virtual environments" (Yim et al., 2013, p. 114). Therefore, the sense of presence can be a product of any medium (e.g., book, television, radio, video game, etc.) (Reeves & Nass, 1996). A person can experience same level of presence either by reading a book or by watching a movie on TV. But, the level of presence can vary depending on degree of a user's perception.

However, although presence can be generated via any medium, the illusion of presence is suddenly relaunched with the emergence of immersive VR interfaces offering the most captivating sense of presence (Biocca, 1997; Biocca & Levy, 1995; Lombard & Ditton, 1997; Steuer, 1995). VR is indeed defined as a natural, mediated, or fictional environment in which users can experience presence (Biocca). VR researchers (e.g., Barfield et al., 1995; Lombard & Ditton; Sheridan, 1992; Steuer) have agreed on the stance that the concept of presence is fundamental in hypothesizing about VR.

Presence vs. immersion

Presence and immersion have conceptual similarities and have often been used interchangeably in earlier research (Anh, 2011). In their review of earlier literatures on

presence, Lombard and Ditton (1997) identified six different categories of presence, indicating a mix of the concepts of presence and immersion. First, the presence concept, mainly used in communications research, dealt with the extent to which a medium has the necessary capacity to communicate information to users. Second, the concept focused on the extent to which a medium can provide accurate and precise sensory input to create realistic presentation. Third, the concept was utilized to describe a medium as a transport mechanism "by giving a user the sense that they are transported elsewhere (i.e., "you are there"), by bringing a place or objects to the user's location (i.e., "it is here"), or by bringing one user to a "place" with another user (i.e., copresence)" (Mennecke, Triplett, Hassall, & Conde, 2010., p. 2). Fourth, presence was also used to describe how users can get immersed (physically and/or psychologically) within a medium. Fifth, presence addressed how users perceive a character in the medium as a social actor. Finally, presence was also utilized to investigate "the tendency of people to treat inanimate objects that do not resemble human actors in a socially sound manner" (Mennecke et al., 2010, p. 3).

However, Anh's (2011) approach treats presence and immersion as separate concepts. Whereas immersion is an objective or technological unit of evaluation, presence is a subjective unit of evaluating the realism of the mediated experience (Ahn). Anh explained the reason in detail.

> That is, even when users are exposed to the same mediated environment (i.e., immersion), individuals may have different subjective assessments of how realistic it is (i.e., presence). Immersion will be operationalized by manipulating the components and layers of sensory inputs provided by digital technology while presence will be measured as various forms of individual assessments of the virtual environment's realism. (p. 22)

The present study considered Ahn's approach to treat immersion and presence separately, as the approach clearly distinguished between the functional and perceptual approach of evaluating media effect (Ahn, 2011).

Dimensions of presence measurement

It is important provide a brief explanation on how presence is measured. Earlier studies have used a wide variety of dimensions to measure presence (e.g., Barfield & Weghorst, 1993; Cho et al., 2003; Dinh et al., 1999; Kim & Biocca, 1997, etc.). Those measurements were very different from each other and mainly depend on presence's conceptualization and context of application. However, Lessiter, Freeman, Keogh, and Davidoff (2000) treated presence as a multidimensional construct and developed The Independent Television Commission- Sense of Presence Inventory (ITC-SOPI). ITC-SOPI has widely been used to measure presence across various forms of media and specifically focused on participants' media experience within the mediated environment (Li et al., 2002, 2003). Unlike many measurements of presence, ITC-SOPI use multidimensional construct, directly ask participants about how present they feel, or refer to specific media system and content properties (Lessiter et al., 2000).

The ITC-SOPI involves four distinct dimensions of presence: spatial/physical, engagement, ecological validity/naturalness, and negative effects. The physical dimension of presence focuses on a sense of physical space, "corresponds with the traditional definition of "being there" in the mediated environment" (Li et al., 2002, p. 47). The engagement dimension of presence "provides a measure of a user's involvement and interest in the content of the displayed environment, and their general enjoyment of the media experience" (Lessiter et al., p. 193). The naturalness dimension

focuses on the ecological validity of the content and the environment within the media (Lessiter, et al.). According to Lessiter, et al. the concept of ecological validity is related to "the believability and realism of the content and the naturalness and solidity of the environment" (p. 193). Lessiter, et al. stated that naturalness is likely to be influenced by the quantity, degree, and consistency of sensory stimulation generated by media. Finally, the negative effects dimension focuses on measuring some negative physiological responses that may co-occur while sensing presence (dizziness, cyber-sickness, nausea, etc.).

Virtual Product Experience

In immersive VR interfaces, users can use visual, auditory and/or even tactile simulation with a "sensorimotor coordination of the moving head with visual displays" (Biocca, 1997, p. 14). As a result, such systems are likely to generate the illusion of "being there" or "presence" more than any other media low in immersive technologies (Ahn, 2011; Biocca; Meyer, Applewhite, & Biocca, 1992; Yim et al., 2012). According to Biocca, the psychological effects of immersive VR environment can be expressed via presence. Biocca stated that a sense of presence can be generated via three different ways in an immersive system. First, users can have an illusion of self-presence (i.e., via using an Avatar) and feel that the actual self's experience in VR worlds resembles to the experience of the virtual self (Biocca). Next, users can have a sense of social presence or "being there" with another body. It is sometimes called co-presence. Finally, users can have a sense of physical presence or spatial presence. It means to have an illusion of just "being there." In other words, physical presence indicates the extent to which the user "feels that the mediated environment and the objects within the environment that

surrounds him or her is real to the extent that the environment responds realistically to user inputs" (Ahn, p. 25). According to Biocca,

> When we experience our everyday sense of presence in the physical world, we automatically generate a mental model of an external space from patterns of energy on the sensory organs. In virtual environments, patterns of energy that stimulate the structure to those experienced in the physical environment are used to activate the same automatic perceptual processes that generate our stable perception of the physical world. (p. 53)

For marketers, the above-mentioned link between an immersive VR system and presence is important to understand, as this link is likely to impact the effectiveness of their marketing messages via advertisement. Unlike traditional media with low immersive technologies (e.g., television, radio, book), which can offer only indirect product experience to their passive audience (Reeves & Nass, 1996), immersive VR interfaces can offer immersive virtual experiences of product to their active users (Biocca, 1997). Generally, consumers can have two types of product experiences: direct and indirect (Li et al., 2002; 2003). In direct product experience, consumers can directly interact with the product by using their full sensory capacity (i.e., visual, aural, taste and smell, haptic, and orienting) in an unmediated environment (Gibson, 1966). Indirect experience, on the other hand, is a mediated experience that can be realized via indirect sources such as advertisements, words of mouth or consumer reports, etc. (Li et al., 2002). Here, consumers typically can use limited sensory items and have limited interactions with the product (Li et al., 2002). Virtual experience of product is just another form of indirect mediated experience, although richer and more interactive than any traditional indirect forms of experience (print or TV ads) (Li et al., 2002; 2003). Virtual experience is defined as "a vivid, involving, active, and affective psychological state occurring in an individual interacting with three-dimensional computer

simulations" (p. 9). For instance, 3-D or 360° product visualization on a flat screen provides a richer and more interactive virtual experience than 2-D visualization. Similarly, virtual experience of product in stereoscopic VR interfaces is even richer and more interactive, and thus, closer to reality (Steuer, 1995) than virtual experience in flat desktop screen (Li et al., 2002). This dissertation used the term immersive virtual experience to indicate consumer's product experience in ad via immersive VR system.

Like many areas that use virtual experiences (e.g., virtual simulation in military, medical training, education, employee training, etc.), marketing and consumer studies have acknowledged perceived presence as the psychological foundation of virtual experiences (Barfield et al., 1995; Biocca, 1997; Büscher, O'Brien, Rodden, & Trevor, 2001; Held & Durlach, 1992; Ijsselsteijn, Ridder, Freeman, Avons, & Bouwhuis, 2001; Lombard & Dittion, 1997; Loomis, 1992; Stanney, Mourant, & Kennedy, 1998; Steuer, 1995). The main significance of such immersive virtual experience, enhanced via heightened sense of presence, in marketing communication may be embedded in the notion that such mediated experience resembles non-mediated direct experiences of the physical world (Clark, 2001; Gallagher & Gallagher, 2005). According to Biocca (1997),

> When we experience our everyday sense of presence in the physical world, we automatically generate a mental model of an external space from patterns of energy on the sensory organs. In virtual environments, patterns of energy that stimulate the structure to those experienced in the physical environment are used to activate the same automatic perceptual processes that generate our stable perception of the physical world. (p. 53)

Therefore, when experiencing products via immersive VR, users may feel as if they are communicating directly with the product within the environment. Consumers are likely to gain a unique virtual experience (i.e., immersive virtual experience) with a

heightened sense of presence in the virtual environment. Studies on consumer psychology depicted that direct experience of a product has a more significant impact than an indirect experience (e.g., TV/ banner advertising), particularly for high involvement purchases, such as car, DSLR camera, laptop, etc. (Li et al., 2003). As virtual experience resembles direct experience, it is more likely to bring the similar kind of effects that are expected from direct experience. In addition, Klein (1998) argued that virtual experience of a product can impact consumer's psychological responses by converting the experience attributes of products into search attributes. For instance, in addition to providing a product's specific attributes, virtual experience can alter the weights consumers assign to each attribute by using different styles or formats of information presentation (Klein). Such experiences are very important in the situation when experience attributes are not present (Klein). In this way, virtual product experience can even reduce the perceived risk prior to purchase (Li et al., 2001). Li et al. added that virtual experience can be "even richer than direct experience for consumer learning because unlike direct experience, virtual experience can be framed and annotated through dynamic presentation, product use contextualization, and mythological and fantastic product environments" (p. 10). Therefore, virtual experience can play a significant role in creating ad effectiveness.

Theoretical Framework of Presence

Before explicating the relationship between immersive VR system and presence to generate consumers' psychological responses, it is also important to understand which factors of immersive VR system contribute to presence. Steuer's (1995) framework of telepresence, presented in a paper titled *Defining virtual reality:*

Dimensions determining telepresence, has widely been used to focus on above-mentioned aspects. Although presence can be affected by several factors, such as features of the technology used (Ijsselsteijn et al., 2001), elements within the virtual environmental (Ivory & Kalyanaraman, 2007), and individual differences (Sacau, Laarni, & Hartmann, 2008), Steuer treated presence as a function of technological aspects (interactivity and vividness) and variation across individuals. According to Steuer, communication technologies vary mainly by two key dimensions: interactivity and vividness. Steuer's major focus was to propose these two technological dimensions as the predictors of telepresence and posit that higher interactivity and vividness will increase the sense of telepresence (see Figure 1). He discussed very little about the role of variation across individuals, led by immediate situational factors and ongoing personal concerns, in determining the extent of telepresence. In the next few paragraphs, Steuer's telepresence framework is discussed.

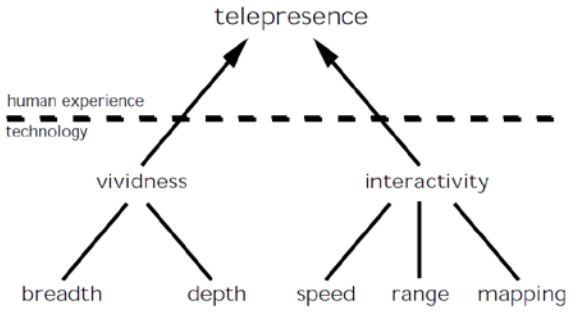

Figure 1. Technological variables affecting telepresence.

Adapted from "Defining virtual reality: Dimensions determining telepresence," by Steuer J., 1995, In Frank Biocca & Mark R. Levy, (Eds.), *Communication in the age of virtual reality* (pp. 33–56). Copyright 1995 by the Lawrence Erlbaum Associates.

Vividness refers to "the ability of a technology to produce a sensorially rich mediated environment" (Steuer, 1995, p. 10). According to Steuer, vividness is indicated by two factors: sensory breadth (i.e., a medium's ability to present

information across the senses) and sensory depth (i.e., a medium's ability to present quality information). As argued by Steuer, both higher sensory breadth and sensory depth are likely to cause a higher level of presence. Previous studies have supported such propositions (e.g., Coyle & Thorson, 2001; Fennis et al. 2012; Hendrix & Barfield, 1996; Van Kerrebroeck et al., 2017; Klein, 2003; Slater, Usoh & Steed, 1994; Yim et al., 2012). The proposition regarding vividness, as stated by Steuer, indicates that communication media rich in sensory depth and/or breadth are more likely to generate presence perception in users than media poor in those factors.

Steuer (1995) considered interactivity as technology-driven concept and defined it as "the extent to which users can participate in modifying the form and content of a mediated environment in real time" (p. 14). As Steuer mainly focused on the technological aspects of telepresence and thereby considered interactivity as a property of the mediated environment, his definition differed from many earlier interactivity researchers, who focused on the perceptual form of interactivity. Steuer stated that there are three major factors that contribute to interactivity: speed, range and mapping. Speed is referred as "the rate at which input can be assimilated into the mediated environment" (p. 15). In other word, speed simply indicates the response time or level of immediacy of response. Interaction via tactile devices in stereoscopic VR also seem highly interactive, as haptic devices can map a user's every action in the VR virtual environment in real time (although many haptic devices still allow a little delay). Range is referred as "the number of possibilities for action at any given time" (p. 15). For instance, a three-dimensional presentation of a product on a flat screen can provide the users with options to change the color or size of the product. Finally, mapping is

referred as “the ability of a system to map its controls to changes in the mediated environment in a natural and predictable manner” (p. 15). For example, turning the steering wheel in the physical world can move the virtual car in a video game, providing the mapping capability of the system. The proposition regarding interactivity, as stated by Steuer, indicates that communication media with interactivity are more likely to generate presence perception in users than media poor in interactivity. A detail discussion on both interactivity and vividness is presented below.

Interactivity

According to Steuer’s (1995) telepresence framework interactivity is a direct predictor of presence. Steuer only indicated the factors that can enhance the quality of interactivity and thus, contribute to generate presence (e.g., speed, range, and mapping). These factors can ensure high interactivity. But the conceptualization of interactivity itself was not specific in Steuer’s framework. Therefore, this study focused on the theory of interactive media effect (TIME) to conceptualize interactivity and examine its effect. A detail discussion on interactivity and TIME is in order.

Earlier conceptualization of interactivity

Interactivity is one of the most crucial defining features of computer-mediated media technologies, making the concept of “medium” more dynamic. Users no longer consider media mere channels of transmitting information between senders and receivers, but rather as tools via which users can form interactions with the media themselves and/or with others. Interactivity may range from simple tasks of clicking on Web pages or chatting in Facebook Messenger to more complicated tasks of rotating a virtual product with haptic devices or managing Avatars in virtual games. Such

activities, as stated by Sundar et al. (2015), can impact "the locus, nature, and effects of our communications - whom we communicate with, what information we exchange and how we are affected by it" (p. 49). So, interactivity has become a fundamental characteristic of digital media. Therefore, media and communication scholars have widely focused on interactivity to understand the effects of modern media technologies on users' responses.

The notion of interactivity has received diverse conceptualizations over the last two decades (Javornik, 2016; Kiousis, 2002; Kweon, Cho, & Kim, 2008; McMillan & Hwang, 2002). Whereas some scholars investigated interactivity in human to human communication (e.g., Rafaeli, 1988; Rice & Williams, 1984), others focused in human to computer interaction (e.g., Oh & Sundar, 2015; Sicilia, Ruiz, & Munuera, 2005; Sundar, Kalyanaraman, & Brown, 2003). Many studies focused on examining the defining characteristics of interactivity, such as the ability of the users to create, change and/or control the content of media (e.g., Newman, 1991; Steuer, 1995), real time two-way communication (e.g., Rice & Williams, 1984), synchronization of communication (e.g., Liu & Shrum, 2002), media responsiveness towards user (Rafaeli, 1988), and information acting as interactivity itself (Kalyanaraman, Ito, Malik, & Ferris, 2009).

However, overall, the notion of interactivity was conceptualized and operationalized in two diverse ways: feature-based interactivity and perceived interactivity (Javornik, 2016). Feature-based interactivity refers to the inherent functionality or attribute of a specific communication interface, which may affect user experience unalterably (Steuer, 1995; Sundar et al., 2015). Regarding feature-based interactivity, Sundar et al. stated that, "we may think of this as the media-ecological

approach, pioneered by McLuhan (1964), wherein interactivity is seen as a game-changer, fundamentally redefining communication and social psychological processes surrounding it" (p. 49). However, such media-ecological approach is criticized for being quite object-centered or mechanical, ignoring the experience part of interactivity (Sundar et al.).

Perceived interactivity, on the other hand, remains in the eye of the beholder, i.e., how the users perceive functional attributes of technology during communication (Leiner & Quiring, 2008; Liu & Shrum, 2002). Based on a user's using pattern, a system can be perceived as highly interactive or less interactive. This perception-based classification of interactivity may fall within the paradigm of the uses-and gratifications, as the concept "privileges user motivations and allows users to determine the amount of interactivity in a given interaction" (Sundar et al., 2015, p. 49). However, perceived interactivity has often been criticized as it cannot be checked with valid manipulations, making it difficult to identify the exact features that contribute more (or less) interactivity (Liu & Shrum). Moreover, there remains a good chance to mix the perceptual measures of interactivity with users' perceptions of system attributes unrelated to interactivity, such as perceived usability of the media (Sundar, 2004).

However, none of the aforementioned approaches explored the nature and operation of interactivity. Therefore, important questions, such as "what is it about interactivity that changes the process and outcomes of communication?" or "What exactly is the salient aspect of interactivity that impacts users' psychology and thereby affects their perception and attitudes toward content?" remained unanswered (Sundar et al. 2015, p. 50).

Sundar (2009) and Sundar et al. (2015) argued that the media-effects approach to investigating media communication technology can provide a feasible solution to here. They emphasized on disaggregating the media itself into specific technological attributes (e.g., interactivity) in a way that the attributes can be measured and manipulated in a causal experimental study (Van Noort et al., 2012). Theory of interactive media effect (TIME), developed by Sundar et al., is one of the few attempts, probably the most significant attempt, to incorporate such aspects to investigate the effect of interactivity. In the next section the TIME is briefly discussed.

Theory of interactive media effect (TIME)

In order to understand the TIME, one first needs to understand the concept of "affordance," which simply refers to "an interface feature attributable to the technology of the medium rather than the source or content of communication" (Sundar et al. 2015, p. 50). Similar to the classic conceptualizations of affordance (see Gibson, 1977; Norman, 1988), the TIME argued that affordance occurs at the intersection of both the medium and the user (Sundar et al.). Further, affordance impacts user's psychological responses in two different ways: (a) by offering symbolic representational or visual cues on the interface and/or (b) by making users to take some action by using the interface attributes (see figure 2) (Sundar et al.).

The sheer existence of symbolic representational or visual cues on the interface can trigger the perception of affordances among users, even though users do not take any action by actually using the cues (Sundar et al., 2015). Visual cues can take many forms, such as presence of features (options for writing comments on a post), tools (clickable hotspot) and/or auto-generated metrics (e.g., the number of likes on a

Facebook page) (Sundar et al.). Such cues help the user perceive the affordances an interface can offer and induce psychological reactions. Presence of multiple buttons on a screen, for example, may increase the users' perception of having a choice. Number of likes on a social media post may increase the likelihood to perceive the post as a positive one. A well-designed visual cue is most likely to match the system functionality with the action expectations and accurately signal the underlying affordances (Gaver, 1991). However, it would be the users who decide or perceive the extent to which the affordances are facilitating (or limiting) users' interactions. It can be seen from figure 2, such psychological realizations act as mediators between affordances and subsequent psychological responses, such as cognitions, affection and behavior. This path from affordances to psychological responses is the cue route of TIME.

Next, affordance, represented by the underlying technological attributes of a medium, can motivate users to take actions on the interface. Sundar et al. (2015) further explained that,

> The actions afforded by an interface feature may be ontological (e.g., provision of choice to users, or allowing the user to broadcast, i.e., serve as source of communication), but the key requirement for TIME is that they have psychological correlates (choice = perceived control, self as source = sense of agency). (p. 51)

The TIME next argued that such psychological correlates work as mediators between affordances (actions motivated by the Interface) and user-engagement with the content. Finally, user-engagement moderates the effects of media content on users' knowledge, attitudes, and behaviors. This path from affordances to psychological responses is the action route of TIME. In TIME media affordances prompt psychological correlates in

the consumer and then translate such correlates into affective, cognitive and behavioral responses.

Although this dissertation did not test how TIME works on immersive VR systems, it would provide an important knowledge of how the action on interactivity, as a technological affordance of a system, actually contributes to outcomes. The use of interactive features (i.e., action) in immersive VR systems can generate different effects on users' recall, product knowledge, attitudes and intentions.

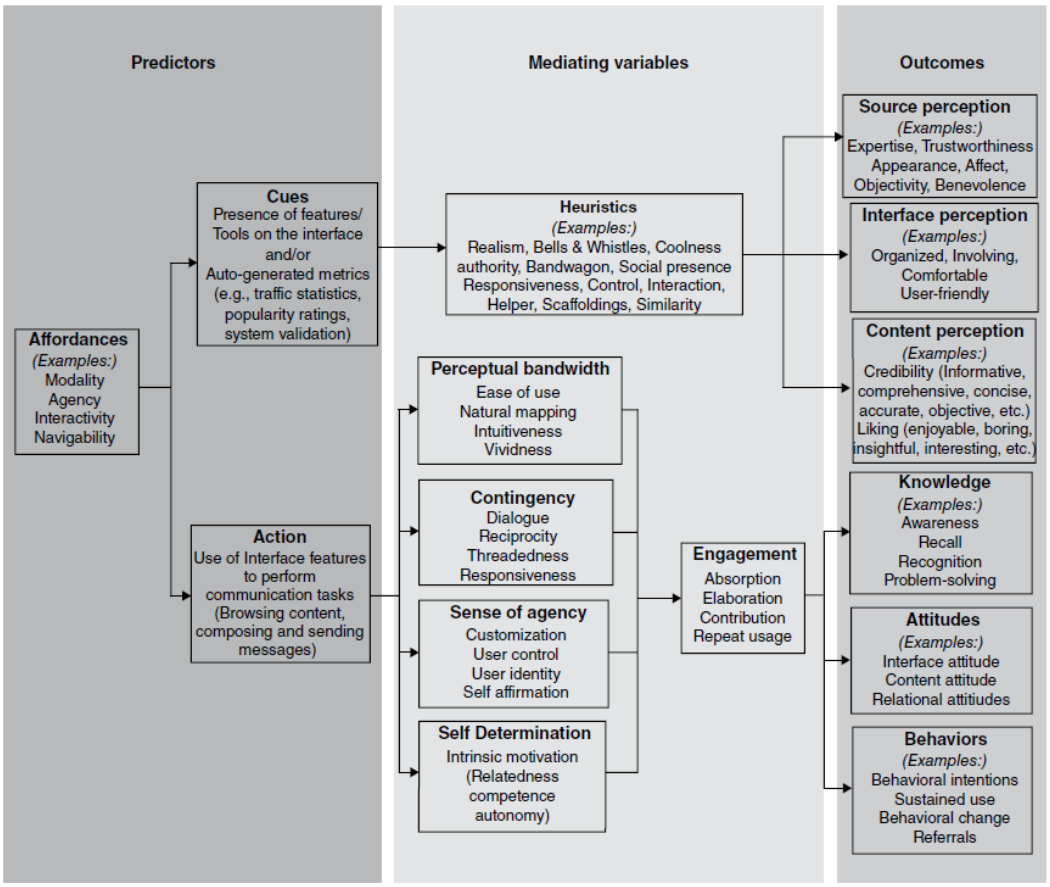

Figure 2. Theory of Interactive Media Effect (TIME).

Note. Adapted from "Toward a theory of interactive media effects (TIME)" by Sundar, S. S., Jia, H., Waddell, T. F., and Huang, Y. 2015. In S. S. Sundar (Ed.), *The handbook of the psychology of communication technology* (pp. 47–86). Copyright 2015 by the John Wiley & Sons, Inc.

Conceptualization of interactivity under TIME

It should be noted that the theoretical formulation of TIME is based on four earlier models of interactivity: the interactivity effects model (see Sundar, 2007), the agency model of customization (Sundar, 2008a), the motivational technology (Sundar et al., 2012) and the agency-interactivity-navigability model Sundar (2008b). The conceptualization of "interactivity" as affordance derived from the propositions of interactivity effects model (IEM) (Sundar, 2007). According to IEM, interactivity can occur in three forms: medium (modality) interactivity, message interactivity, and source interactivity (Sundar).

First, medium (or modality) interactivity refers to "various methods of interaction offered by the interface, such as clicking, scrolling, dragging, and hovering" (Sundar et al., 2015, p. 54). Different options provide different opportunity for interaction, allowing the users to handle the information in a specific way (Sundar, Xu, & Bellur, 2010). For example, reading information by clicking a "hotspot," a navigational tool, is totally different from reading it from the interface screen. Likewise rotating a three-dimensional object on flat computer screens is different compared to rotating it in immersive VR platform with haptic devices. Also, relevant information can pop out when users hover over mouse in certain places. This interactivity is completely different from clicking on the options to see the information. Therefore, modality interactivity is mainly about functional features available on the interface to access information (Sundar et al.). Such interactivity is also known as a functional view of interactivity (Javornik, 2016). Based on the IEM, the TIME proposed that modality interactivity leads to better user engagement (absorption) with media, as it increases a

user's perceptual bandwidth. This, in turn, enhances knowledge, attitude and behavior (Sundar et al.).

Message interactivity, on the other hand, refers to "the nature of exchanges between the user and the system (or other users)" (Sundar et al., 2015, p. 56). Such interactivity is realized in the form of various information organization styles, mainly via navigation tools. For example, when users use such tools, they make navigational decisions (e.g., which information to read and which to overlook) in an order that make more sense to them. According to Sundar et al., this kind of interaction is contingent upon prior response. In other words, users need to perceive that the interface is responding to them contingently. Based on the degree of perception user may feel more or less engaged with the content and thus elicit psychological responses (Sundar, Bellur, Oh, Jia, & Kim, 2016). This category is also known as contingency view of interactivity. Based on the IEM, the TIME proposed that message interactivity "leads to greater user engagement (elaboration) with media by enhancing the contingency or interdependency in message exchanges" (Sundar et al., p. 52). Ultimately, such interactivity also impacts knowledge, attitude and behavior (Sundar et al.).

Finally, source interactivity refers to "the degree to which the interface lets the user serve as the source of communication" (Sundar et al., 2015, p. 56). This category treats source or the sender as the initial point of interactions. According to Javornik (2016), source interactivity "investigates to which degree the technology establishes the user as the source of communication and the one in control, either through selection of content or its creation and customization" (p. 993). Customization is the critical theoretical mechanism of such interactivity (Sundar, 2007). Using blogging tools to

create own contents or using YouTube to subscribe own work are examples of source interactivity. Based on the IEM, the TIME proposed that source interactivity "leads to greater user engagement (contribution) with media by enhancing users' ability to customize, curate, and create content" (Sundar et al., p. 52). Then such interactivity can influence knowledge, attitude and behavior (Sundar et al.).

Earlier studies on interactivity have mainly focused on Web-based contexts (Javornik, 2016). Although interactivity remained one of the major predictors of presence, the effect of interactivity on immersive VR has not been examined yet. This dissertation focused on modality interactivity. As message interactivity indicates the exchange of message among users and the capability of the medium to assist in the communication thread, message interactivity seems less suitable and/or technologically affordable for immersive VR advertising context (Sundar et al., 2015). Ads on immersive VR system currently do not provide the functionality of two-way communication (such as chat, email, discussion board), which may become viable in the future. Source interactivity, on the other hand, provides the users with the opportunity to be the source of the communication and be in control of content creation and customization (Sundar et al., 2015). Although some brands (such as IKEA, Honda, Volvo, Chevron) provide several options for source interactivity (e.g., changing the size or color of product) in their VR applications, these facilities are limited specifically for actual advertisements in which the brands may show the product and its experience virtually along important information. In the case of actual product advertisement, to the best of researcher's knowledge, use of source interactivity is still not utilized. Therefore, this dissertation did not consider source interactivity. To sum up, the study

will manipulate the level of modality interactivity to see how interactivity affect users' psychological responses on high immersive VR system.

Vividness

As discussed earlier, vividness indicates the representational richness of a mediated environment as defined by its formal features, that is, the way in which an environment presents information to the senses. Therefore, media vividness is also termed as media richness. Although many factors can contribute to vividness, two most significant variables are "sensory breadth" and "sensory depth" (Steuer, 1995). Sensory breadth is the ability of media to present the information via multiple sensory items (Steuer). People have five distinct perceptual systems: orienting (for a continuing body equilibrium), auditory, haptic/touch, taste/smell, and visual (Gibson, 1966). Higher the number of sensory systems, higher the breadth of medium. For example, television (involves audio and visual system) has higher breadth than radio (audio only) or print media (visual only). Immersive VR technology has shown the capacity to increase sensory breadth (Steuer). Stereoscopic head-mounted displays, for example, can provide perceptual/sensory system of touching via haptic devices, the sense of spatial audio and image of the visual environment that moves with the head movement of the viewer. A recent VR application of IKEA provided users an experience of cooking in a kitchen with a frying pan by using HMD with haptic devices. The brand also has another application for providing VR shopping experience, in which they can walk in the virtual floor of IKEA, examine products with multiple senses and add products in the cart.

Sensory depth, on the other hand indicates the quality or resolution of information within these perceptual channels (Steuer, 1995). For example, good quality

of auditory information will provide more depth than less quality of auditory information in both radio and television media. Technically, depth depends on two factors: (a) the amount of encoded data and (b) the data bandwidth of the communication channel. Immersive VR technology has shown the capacity to increase sensory depth. Stereoscopic head-mounted displays, for example, provide a sense of depth as the visual environment that moves with the head movement of the viewer. Like 3-D images on a flat screen, stereoscopic VR can transmit more detailed 3D images embedded in the environment (Klein, 2003). However, the assumption behind vividness or media richness is that messages appealing to multiple sensory systems and messages with good quality are more effective than message appealing to single or fewer perceptual systems (Li et al., 2004).

When does vividness work more effectively in the case of marketing communication? The possible way to answer this question is to use media richness theory (MRT). As stated by Steuer (1995), concept of vividness is also synonymous of the term “media richness” (also see Li et al., 2002, 2003). MRT is briefly discussed in the following section.

Media richness theory (MRT)

MRT was originated by Daft and Lengel (1984, 1986) to facilitate organizational decisions with regard to media choice. The original MRT stated that there are four dimensions to classify richness (or leanness) of a medium: (1) the ability to communicate multiple cues (e.g. verbal, symbolic, nonverbal) simultaneously; (2) the ability to provide feedback; (3) the ability to establish a sense of personal presence; and

(4) language variety (Schmitz & Fulk, 1991). If a medium has multiple dimensions (as oppose to one/few), it will be called as a richer medium.

The fundamental argument of MRT is that information acquisition from media is influenced by an appropriate match between the medium's richness capabilities and the content (Daft & Lengel, 1986). Rich media are likely to be more effective in communicating ambiguous, complex, or personal information than less rich media or lean media. The assumption is that if users communicate a simple message via a highly rich medium, message will probably to be misinterpreted (Daft & Lengel; Pinsonneault & Ouyang, 2002; Trevino, Daft, & Lengel, 1990). Media richness, for example, may provide excess information and cues (sometimes conflicting cues), which can distract the users' attention toward the message and make the decision process unnecessarily complex and long (Daft & Lengel, 1984, 1986).

Based on media richness criteria, face-to-face communication is the richest of all media. However, online media have changed the meaning of richness to a greater extent. Online media are different from traditional media for countless reasons. One of the major differentiation comes from technological aspects, e.g., multiple addressability, external recording, computer-processing memories (Markus, 1994), use of multiple sensory items, interactivity (Biocca, 1997; Li et al., 2002; Steuer, 1995). Allen, Mahto, and Otondo (2007) considered some Websites rich, as they provided multiple sensory items and cues such as visual images, symbols, sounds and navigating functions. In addition, a "lean Website" was described as a platform presenting only text or text/pictures (Cho, Phillips, Hageman, & Patten, 2009; Jiang & Benbasat, 2007; Simon & Peppas, 2004). Jiang and Benbasat argued that information presentation via a rich

medium may bring the consumer experience of the product/brand closer to reality and create positive attitudes and intentions (Saat & Selamat, 2014).

According to Steuer (1995), vividness, as indicated by sensory breadth, can be manipulated by varying the number of sensory channels that are used. Previous studies have manipulated sensory breadth of vividness in various ways, e.g., messages containing pictures and text versus messages containing video and audio (Klein, 2003), messages with audio and animations versus without such elements (Coyle & Thorson, 2001). Fennis, Das, and Fransen, (2012) even generated different level of vividness, breadth in particular, by varying text presentation style and text language: vivid texts (e.g., with bright color and abstract adjectives to describe the product) versus pallid text (e.g., with black and white text and actual tangible attributes to describe the product). In the case of immersive VR, vividness is rarely examined as an independent variable and manipulated directly for the same medium. Different medium interface was rather tested, assuming that they vary based on the level of media richness or vividness along with interactivity. Li et al. (2002, 2003), for example, compared the effect of 3-D vs. 2-D ad and contributed the favorable effects of 3-D to the interactivity and vividness, assuming that 3-D presentation system generates higher interactivity and vividness than 2-D system. Similarly, Van Kerrebroeck et al. (2017) attempted to study the vividness effect of in the case of transformational marketing by using a video presented via either 2-D interface (on a mobile phone) or via immersive VR interface (by using a Google Cardboard-type HMD). But, no direct manipulation of vividness was done.

Indicators of Immersive VR Ad Effectiveness

The impact of immersive VR ads can be realized by various psychological responses of users, e.g., presence, brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intentions. While presence is a primarily associated with the any VR platforms, other psychological responses, based on cognitive, affective, and conative aspects (Lutz, 1975; Wright, 1980) are the most fundamental and traditional way to measure ad effectiveness. These concepts are discussed below.

Cognitive responses

The term cognition basically indicates the thought-process, which can be developed naturally or artificially, consciously or unconsciously (Fodor & Pylyshyn, 1988). “Cognitive measures are used to determine the ability of an advertisement, physical product, or other marketing stimulus to attract attention and ultimately generate product knowledge” (Li et al., 2002, p. 45). Product knowledge, as an indicator of cognitive response, plays a significant role shaping consumer’s amount of knowledge about the product (Bettman & Park, 1980). Product knowledge can be measured by two ways, subjective knowledge (i.e., consumers’ belief about their own knowledge about a product) (Park & Lessig, 1981), and objective knowledge (i.e., actual knowledge about the product stored in memories) (Brucks, 1985). Advertisements can contribute to increase both types of knowledge. As subjective product knowledge or self-confidence about product information can minimize perceived uncertainty and risk in purchases, many studies measured subjective or perceived product knowledge (Smith & Park, 1992). Contrary to this self-reported perceived response, recall provides an important memory-based cognitive measure of ad effectiveness (Sheinin, Varki, & Ashley, 2011).

Although both ad recall and brand recall are important, brand recall becomes more important for unfamiliar brands developing highly creative, novel ads, as consumers may reminisce information about the ad but not the brand (Lange & Dahlén, 2003). Both aided and unaided recalls were frequently used by previous studies (Lange & Dahlén).

Affective responses

Affective measures mainly focus on consumer's attitude, i.e., subjective evaluations of an object (Lutz, 1975). Attitude can be identified by either established (existing) or newly developed attitude from message exposure (Li et al., 2003). Consumers' attitudes toward the ad and toward the brand are two widely used affective variables (MacKenzie & Lutz, 1989; MacKenzie, Lutz, & Belch, 1986). Whereas ad attitudes are referred as "recipients' affective reactions (e.g., liking, disliking) to the ad itself," brand attitudes are referred as "recipients' affective reactions toward the advertised brand (or, where desirable, attitude toward purchasing the brand)" (Lutz, MacKenzie, & Belch, 1983, p. 533). The rationale for using affective measures is based on the stance that a pleasing and/or informative message can develop a positive affect from favorable ad attitude and/or brand attitude an such attitudes can ultimately generate positive behavioral intentions or actual behavior (Mehta, 2000).

Conative responses

Lastly, conative measures indicate consumer's actual behavior or behavioral intention after ad exposure (MacKenzie & Lutz, 1989). Consumers' intentions to purchase is one of the most frequently used conative measures. Purchase intention is referred as "recipients' assessments of the likelihood that they will purchase the brand

in the future" (Lutz et al., 1983, p. 533). Another important intention in the age of the Internet is the intention to share a content. Any interesting or novel content enhances the possibility of video sharing among peers (Huang, Su, Zhou, & Liu, 2013).

Perception of presence: A dependent and mediating variable

Presence has already been conceptualized in earlier sections. In addition to understanding how immersive VR systems impact presence (as a dependent variable), it is also important to understand how presence mediates (as a mediating variable) the effect of immersive VR system on consumer's psychological responses. A mediating variable plays as an intervening role between an independent variable and dependent variable and is likely to impact a dependent variable (Iacobucci, Saldanha, & Deng, 2007). A mediation analysis is necessary to find out the degree to which an independent variable affects the dependent variable directly and indirectly (via the mediating variable) (Iacobucci et al., 2007). Explicating the mediating role of presence can contribute to the knowledge addressing how immersive VR works.

Perceived Media Novelty

Many studies focused on the concept of consumers' perceived novelty while evaluating ad effectiveness (e.g., Hewitt, 1972; Cox & Locander, 1987; Sheinin, Varki, & Ashley, 2011). Earlier research mainly considered the novel content of the ad. But, with the emergence of novel digital ad platforms one after another (e.g., banner advertisements, outside the frame (OTF) advertising, 3-D product presentations, augmented reality, virtual reality) researchers felt the urgency to focus on novel presentation modality or novel platform or novel medium as well (see Edwards & Gangadharbatla, 2001; Hopp & Gangadharbatla, 2016; Yim et al., 2012). Thus,

explicating the role of media novelty is helpful to understand the ad effectiveness on emerging digital ad platforms (Nysveen & Breivik, 2005; Yim et al.).

In the case of advertisements, novelty can be defined as the extent to which an individual perceives a stimulus to be new, uncommon, unfamiliar, or noticeably different from any earlier content or design (Berlyne et al., 1963; Forster, Lieberman, & Shapira, 2011; A Lang, 2004; Rosenkrans, 2009; Tokunaga, 2013). Novelty can be elicited by within stimulus factors that bring uniqueness in physical attributes of the stimulus itself, how the stimulus is physically placed and how the stimulus is presented (Constantin & Grigorovici, 2004). However, perceived media novelty can be defined as the extent to which an individual perceives a medium or presentation modality to be new, uncommon, unfamiliar, or significantly different from other previously exposed media. It should be noted that novelty is a subjective matter and depends on the evaluator. That means, the level of perceived novelty can be similar for 2-D and VR or for monoscopic VR and stereoscopic VR, if the viewer considers all the media new, unique and unfamiliar.

Earlier studies have found evidence on how novelty influenced consumers' sense of cognitive, attitudinal and behavioral intentions. First, in the case of novel stimuli, people do not have cognitive shortcuts or schemas to make a meaning out of the message and thus, they start a mental evaluation to classify the stimulus (Reisenzein, Meyer, & Schutzwohl, 1996) based on what they have in the surrounding environment (e.g., Carver & Scheier, 1981; Kovar & James, 1993; Edwards & Gangadharbatla, 2001). Previous research found perceived stimuli novelty to elicit deliberation, (e.g.,

Ajzen 2002; Burke & James, 2008) capture consumer attention and enhance information processing (Lang, 2000; Thorson & Lang, 1992).

However, such rationale can be applicable to media novelty, which may lead people to provide more attention to the media aspects and less on product or brand information. Here, it is important to understand the explanation of how cognitive resource are utilized. Human being has a limited number of cognitive resources (Basil, 1994; Schneider, Dumais, & Shiffrin, 1984; Shiffrin & Schneider, 1977; Sweller, 1988). People disburse this fixed pool of limited resources on the tasks of "perceiving, encoding, understanding, and remembering the world they live in" (A Lang, 2006, p. 59). In the theoretical framework of limited capacity model of motivated mediated message processing (LC4MP), A Lang stated that there are three sub-processes of mental tasks along which users distribute their cognitive resources: encoding, storage and retrieval. When exposed to a message, users encode information into working memory and then store into long-term memory (A Lang). Retrieval of already stored information in long-term memory is done to store the new information in long-term memory more effectively by linking new and old information (A Lang). A Lang stated that our limited cognitive resources are utilized by transferring, in varying amount, from one sub-process to another, according to the needs and motivation of processing information (e.g., related to individual goals, the content of the message, and the structure of the message). When a sub-process of mental task needs more cognitive resources than available, "cognitive overload" occurs and cognition related to that task deteriorates (A Lang). For example, poor storing can take place, if less resources are available than required for storing information and this eventually, may hamper the

retrieval of information. Therefore, it is assumed that when users experience higher cognitive load, less learning occurs (e.g. Badger et al., 2014; Chandler & Sweller, 1996; Kisrchner, Ayres, & Chandler 2011; Sweller, 1988). In high media novelty case, there will be a demand for encoding information needed to navigate through the media. Few resources are likely to be left for processing brand and product information embedded. Therefore, such novelty perception about the platform may lead to lower brand recall and perceived product knowledge.

In addition, several researches on digital media identified that novel ad platforms were likely to elicit favorable attitudinal and behavioral outcomes (e.g., Edwards & Gangadharbatla, 2001; Brown, 2002; Yim et al., 2012). According to Hopp & Gangadharbatla (2016) initial arousal, generated from the novelty issue, may contribute to form positive attitudes and intentions among people.

As VR advertisement is still a new form of marketing communication and at the early stage of adoption, this dissertation focused on finding out the moderating role of perceived media novelty on VR ad effectiveness.

The Role of Brand Familiarity

Brand familiarity is defined as consumer's previous interactions, experiences, and learning with the brand (Hoyer & Brown, 1990). Consumers utilize the notion of brand familiarity as a heuristic to evaluate a product (e.g., Dodds, Monroe, & Grewal, 1991), form attitudes (e.g., Delgado-Ballester, Navarro, & Sicilia, 2012) and have behavioral intentions, such as purchase intentions (e.g., Phelps & Hoy, 1996; Shoenberger & Thorson, 2014). Unfamiliar brand, on the other hand, may form neutral or inverse type of consumer reactions (Delgado-Ballester et al.). Therefore, in order to

capture the real effects a brand and product has on consumer's mind, the effect of brand familiarity needs to be controlled.

Chapter 3: The Research Problem of Study 1

The purpose of study 1 is to test the effect of immersive VR interface in comparison to non-VR 2-D interface. Based on earlier research, the effects of interface type are discussed and then, hypotheses are developed in the following sections.

Impact on Presence

Presence is a subjective or perceptual experience of "being there" and this illusion can be a product of any medium (Reeves & Nass, 1996). The same medium can stimulate different levels of presence over time due to the emergence of new media technology (Ahn, 2012). Motion picture, which produced higher sense of presence among audience in 1985, is no longer considered immersive (Campbell, 2000). Same is true for radio when compared to television. Therefore, digital media technology and system, providing richer sensory experiences, are considered more immersive in nature and thus, able to create a greater sense of presence. Recently, VR systems are considered the most compatible technology to generate the sense of presence among users, due to VR system's advanced technological features (e.g., interactivity, vividness) (Steuer, 1995; Biocca, 1997). When compared to traditional media, Green, Brock, and Kaufman (2004) found that virtual reality simulation resulted in high presence. In case of Web-based advertising, Li et al., (2002) found that virtual 3-D product visualization on a flat screen is capable of enhancing a greater sense of presence than 2-D on the same screen. Similarly, Van Kerrebroeck et al. (2017) concluded that non/low immersive 360° VR video ad on flat screens generated higher perceptions of presence than a regular 2-D video for transformational ads. Earlier studies have also detected higher sense of presence among participants when exposed to immersive

stereoscopic VR ads as oppose to flat 3-D ads. Yim et al. (2012), for example, found that non-glass type and glass type of stereoscopic 3-D advertising in comparison to flat-display of 3-D advertising produced higher sense of presence. Ahn (2011) also found similar results for stereoscopic VR stimuli in comparison to flat monoscopic VR stimuli. Similarly, Lau and Lee, (2016) found that stereoscopic fashion show using virtual mirrors (in comparison to 3-D turn-around features) was more effective in creating presence. So, immersive VR system is likely to produce a greater sense of presence (Biocca). In terms of presence dimensions, the current study predicted that immersive VR system is likely to produce a greater sense of spatial presence, engagement with the media, naturalness, and negative effects generated by media.

H1: An ad presented via the immersive VR system results in a higher sense of presence – (a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects – than an ad presented via the 2-D system.

Impact on Cognitive Responses: Brand Recall and Product Knowledge

As discussed earlier, although virtual experience of a product in an immersive VR environment is an indirect mediated experience, it is richer and interactive than any traditional indirect forms of experience (print or TV ads) (Li et al., 2002; 2003). The functional modalities of immersive VR system can provide a near-direct experience of the product (Li et al.). Consumers, for example, are able to see and/or experience the details of a product with realistic shape, functionality, and texture. Thus, virtual experience in immersive VR can enhance consumer's confidence about their product evaluation (Ha, 2005; Kim & Biocca, 1997; Wu & Shaffer, 1987) and reduce the perceived risk prior to purchase (Li et al., 2001). Li et al., for example, found 3-D ads to

produce more active cognitive activities than 2-D ads and attributed such effects to the interface property of 3-D advertising. Therefore, based on previous studies, the current study predicted that virtual experience in immersive VR interface would more likely to enhance both actual and perceived knowledge regarding the advertised product and brand (Li et al.; Smith & Park, 1992).

H2: An ad presented via the immersive VR system results in higher (a) unaided recall, (b) aided recall, and (c) perceived product knowledge than ad presented via the 2-D system.

Impact on Attitude and Intention

The attitudinal and intentional effects of VR systems are often attributed to the immersive properties of VR system modalities. Such technological affordances have the capability to meet users' goals (e.g., hedonic versus informational) in a convenient or favorable way (see Mehta, 2000). The effect created can be transferred to users' further attitudinal and intentional responses (MacKenzie et al., 1986).

Attitudinal and intentional effects have frequently been tested in earlier VR based advertising and marketing studies. Greater attention was given on comparing 3-D ad versus 2-D display in the context of informational ads. Through a series of studies, Li et al. (2002) examined the effect of 3-D product visualization versus 2-D product visualization and television ad for three types of product categories: geometric product (consumer do not feel the urge to touch the product to acquire further information, e.g., candy bars), material product (whose features require touching the product, e.g., clothes), and mechanical products (consumers need to touch the attributes and further information is also needed in addition to merely touching the product, e.g., camera).

Their study found that 3-D product visualization (with interactive features of zooming, rotating and moving) impacted brand attitude and purchase intention for geometric product and mechanical products. They did not find any significant effect of 3-D visualization for material product. The latter result makes sense as only product visualization either via 2-D or 3-D were not technologically capable of providing the facility of touching. In another study, Li et al. (2003) also found that 3-D advertising can ultimately influence brand attitude, and purchase intention. Similar results were found in Choi and Taylor's (2014) study. They found that in the case of geometric products, 3-D product representations (with interactive features of zooming, rotating and moving) generated higher brand attitude and purchase intentions in comparison to static 2-D picture. Suh and Lee (2005), also examined the similar problem for two kinds of product: virtually high experiential (VHE) and virtually low experiential (VLE) products (categorized in terms of the sensory modalities that are used and required for product inspection). The study found that VR interfaces increased both product attitude and purchase intention and such results were more significant for VHE products than VLE products. The study found that VR interfaces increased overall consumer learning (product knowledge, product attitude and purchase intention) and that such learning was more significant for VHE products than VLE products. Van Kerrebroeck et al. (2017) investigated the effect of an immersive VR system (implemented via Google Cardboard-type head-mounted display) in comparison to 2-D mobile display in the context of transformational ad. The study found that VR generated more favorable ad attitude, brand attitude and purchase intentions. Based on the above discussion, the

study expected that similar effects would also be found in case of immersive VR and therefore, hypothesized the following proposition.

H3: An ad presented via the immersive VR system results in (a) more favorable ad attitude, (b) more favorable brand attitude, (c) higher purchase intention, and (d) higher sharing intention than ad presented via the 2-D system.

Mediating Role of Presence

Next, the study focused on examining the mediating role of presence. Several researchers have strongly argued for the existence and significance of such a role (Hoffman & Novak, 1996; Kim & Biocca, 1997; Li et al., 2001), implying that the sense of presence actually explains the underlying mechanism of immersive VR system. Earlier studies have found more active cognitive, affective and behavioral responses in immersive interfaces. These studies contributed such activities not only to the interface properties but also to the illusion of presence created by the immersive interface. For example, in case of 3-D messages, the study of Li et al. (2002) studies identified presence to be associated with greater product knowledge in comparison to 2-D messages. Several studies have found that a higher degree of presence, generated via more immersive interface (3-D vs. 2-D product visualization), positively impacted consumer responses regarding ad attitudes, brand attitudes, and purchase intention (e.g., Anderson & Bushman, 2001; Dillon, Keogh, Freeman, & Davidoff, 2000; Hopkins, Raymond, & Mitra, 2004; Li et al., 2001; 2002; 2003; Meehan, 2000; Pugnetti, Meehan, & Mendozzi, 2001). Therefore, earlier studies implied that the perception of presence is more likely to be the underlying mechanism of influencing the ad effectiveness

presented via immersive VR. Therefore, the study hypothesized that presence would mediate the relationship between interface type and cognition, attitude and intentions.

H4a(i-vii): Spatial presence mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.

H4b(i-vii): Engagement mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.

H4c(i-vii): Naturalness mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.

H4d(i-vii): Negative effect mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.

Chapter 4: Method of Study 1

This chapter describes the research design that was used to test the hypotheses developed in Chapter 3. The aim of study 1 was to test the effectiveness of an immersive VR ad on users' psychological responses in comparison to a 2-D ad. This chapter explained research design, variables (independent, dependent, mediating and control variables), sampling procedure, study procedure, stimuli development procedure, and statistical procedures for data analysis.

Research Design

An experimental study was conducted to test the effect of an immersive VR system versus a non-VR 2-D system. The study was conducted in a laboratory setting in which each participant saw an ad either via 2-D flat desktop computer screen or via immersive VR system. The ad in the VR condition was a 360° ad, which has a spherical view to see every possible angle of the ad (Etherington, 2015). The same ad was used in the 2-D condition without a 360° or spherical view on flat desktop computer screen.

Independent Variables

Immersive VR system

The stereoscopic head-mounted display (HMD) contains the distinguishing technological features of a highly immersive VR system. A stereoscopic HMD involves stereoscopic vision of the 360° video ad, spatialized audio, in-built headphone, head controlled point of view to see the ad from a particular angle, and natural mapping of head/body movement (Ahn, 2011). For this study "VR Shinecon," a stereoscopic HMD, was used to implement the high immersive VR system. This device can track the body movements and body position in the three-dimensional space and has in-built

headphones to hear spatialized sound (VR Shinecon, n.d.). So, in an immersive VR system condition, participants saw the 360° video ad via VR Shinecon.

Non-VR 2-D System

2-D flat-desktop displays of 21 inch were used to implement this condition. This system contains two-dimensional view of the video, non-spatialized audio via external headphone, no mapping of head movement, and no mouse controlled point of view.

Sample

Sample size

For anticipating the minimum sample size of an analysis of covariance (ANCOVA), a-priori power analysis was conducted by G*Power (Erdfelder, Faul, & Buchner, 1996). The calculation required the anticipated effect size, the desired probability level, statistical power levels, the numerator degrees of freedom and number of covariate (Erdfelder et al., 1996).

Effect size is referred as “a quantitative reflection of the magnitude of some phenomenon that is used for the purpose of addressing a question of interest” (Kelley & Preacher, 2012, p. 140). Effect size can simply quantify the difference between two groups and present the magnitude in several forms, e.g., correlation between variables, the strongest predictor variable or regression coefficient in a regression model, or difference between means. Any value of effect size can be interpreted as small, medium, or large depending on the nature of the study and test. For instance, Cohen’s (1992) conventional values of 0.10, 0.25 and 0.40 are considered small, medium and large respectively. Small effects are difficult to detect and require more information to be collected than large effects (Westland, 2010). In addition, medium effects are

generally used in social science research (Westland). Therefore, study 1 considered a medium effect size of 0.25 for the *F-test in ANCOVA*. Next, the convention of social science research for statistical power, defined as the "probability of rejecting the null hypothesis when it is false; it is the probability of not making a Type II error" (Wolf, Harrington, & Miller, 2013, p. 915), is typically 0.8 (Westland). Next, probability level or the alpha level (i.e., the rate of Type I error), was considered 0.05 by convention (Wolf et al.). Also, the numerator degrees of freedom was 1 (as total number of groups was 2 and each group has only two levels). Finally, there was one covariate. Given the values, the recommended minimum sample size was 128 for study 1.

Sampling Procedure

The study was conducted by using a sample of students from a large mid-western university campus. Young students were methodologically appropriate as sample because of their keenness for computers, the Internet and new technologies (e.g., VR) (Ebbesen & Ahsan, 2017; Li et al., 2003). In addition, they are also more likely to be the early adopters of new technology (e.g., Caruso & Salaway, 2008; Jones, 2002). Therefore, the study predicted that young students would represent a consumer category who are eager to test a VR ad. Faculty instructors were requested via email to allow time in their class to announce the recruitment. Instructors were free to provide extra credit to participating students. In that case, non-participating students had an opportunity to get the same amount of credit by completing an alternative task.

Students interested to participate in the study were allowed to schedule a date/time from a list of alternatives. Participation date and time slots were randomly assigned to each condition (Hopp & Gangadharbatla, 2016). Each participant was

requested to report to one of three computer labs situated in the campus. A total of 60 students was recruited for this study. They were randomly assigned to two groups. VR condition had 32 participants while 2-D condition had 28. Among them, 26 participants were male (43.3%) and 34 were female (57.7%). Participants' age was ranged between 18.00 to 25.00 years (M = 20.87, SD = 1.59). Also, almost 42 percent of the students were sophomores, followed by juniors (30 percent) and then seniors (20 percent).

Study Procedure

As a part of recruitment procedure, participants were told that the goal of the study is to evaluate an ad presented via a desktop computer (2-D condition) or an emerging medium (immersive VR condition) (Hopp & Gangadharbatla, 2016). They were also instructed that they have to report their judgments and thoughts after the study is completed (Kempf & Smith, 1998; Li et al., 2002). After their arrival, participants were given quick guidelines on (a) 2-D/360° video functionality, and (b) how to use the equipment to view the ad. After they gave their consents in online consent form, they started the survey, which began with several instructions regarding how to see the video, followed by a 1.57 minute video ad. Once the ad is finished, participants filled out the questionnaire to provide information on nine topics: brand familiarity, presence, unaided brand recall, aided brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention and sharing intention.

Stimuli

Product and brand selection

The study followed the procedure of Li et al. (2002) to select the test product for the study. In their study to examine the relative effect of 3-D virtual product

visualization (a. k. a., virtual experience) and 2-D product visualization (a. k. a., indirect product experience), Li et al. argued that the test product must meet three requirements. First, in both conditions the test product needs to be well-represented in order to "minimize the differences between the stimulus materials to isolate the type of experience properly as the influencing variable" (Li et al., 2002, p. 46). Next, the test product should make participants to engage in active information processing for evaluating the product. Based on the approach of Kempf and Smith (1998), Li et al., rationalized that in consumer behavior research such an engagement is generally created by letting the participants know that they will be required to report their judgments and thoughts after the study is completed. Finally, the brand of the product needs to be of moderate interest to reduce the confounding effect of preconceived response (Li et al.). Based on these requirements, Li et al. selected a digital video camera of an existing brand (identified as neutral via a pretest).

Based on Li et al.'s (2002) procedure, this study judged a car as an appropriate test product. A car is a high-involvement purchase item (Li et al.). It has both experience attributes (e.g., interior styling, driving experience, size, etc.) and search attributes (e.g., price, horsepower, transmission, fuel consumption, safety facilities, etc.). Further, industrial research data showed that more than 60 percent consumers across eight countries was interested to use VR presentations when searching for information about vehicles (MarketingCharts, 2017). A foreign car brand "Peugeot," unavailable in US market, was used for the study. A less familiar or non-familiar brand can minimize confounding effect of existing brand-related variables and can help create

control in an experimental study (Belch, 1981; MacKenzie et al., 1986; Seitz & Aldebasi, 2016).

An existing 2-minute 360° VR ad of Peugeot brand was used for the study. While participants in immersive VR system condition saw the 360° video via stereoscopic HMD, participants in 2-D condition saw the same video without touching the mouse or keyboard via a flat desktop screen.

Stimuli description and editing

The ad depicted an experience of Peugeot car journey. The car started the journey from an open place where there were several other same types of Peugeot car in different colors. Then the car went via different roads and reached a destination. During the journey, the video showed both exterior and interior of the car. When the video showed the inside view of the car, participants were able to see a person driving it. As the position of the video recording camera was on the right front side, participants were likely to feel that they were sitting just beside the driver. In both conditions, three salient attributes of the car were presented (all together) to the audience at the mid-point of the total time of the ad (i.e., at around 58 second) and the information stayed for 12 seconds. Such attributes were not in-built in the original ad, rather they were added by using Adobe Illustrator. Thus, the ad as identified as a mix of informational (e.g., salient attributes) and experiential (e.g., car journey) approach, fulfilling both search and experiential needs of consumers. In order to identify the salient product attributes, a free elicitation technique of Fishbein and Ajzen (1975) was used. A pretest asked 30 students to write down the most important car features that they would consider when purchasing a car. Finally, three top features were selected for using in study: safety,

exterior and interior. In order to provide a specific feature of the attributes, Peugeot's original Website was analyzed. The final message, with three salient attributes was "The new Peugeot 308 is better than ever! Offers more safety with its improved active blind spot detection system! Comes in 7 vibrant colors! The Peugeot i-cockpit® features a compact steering wheel, head-up instrument panel and large touchscreen!" This message appeared in a box within the video. See Appendix C.

Dependent Variables and Measurement

Presence

The Independent Television Commission- Sense of Presence Inventory (ITC-SOPI) was used to measure presence (Lessiter et al., 2000). The ITC-SOPI involves 44 self-reported Likert scale (strongly disagree/strongly agree) items, relating to respondents' experiences before and during the mediated environment (Lessiter et al.). The ITC-SOPI measures four distinct dimensions of presence: spatial/physical, engagement, ecological validity/naturalness, and negative effects. Physical dimension of presence is measured by 14 items (Cronbach $\alpha = 0.908$). The study excluded 5 items, as they included the aspects of social interaction and/or olfactory sensory experiences, which were not presented in the stimuli. The engagement dimension of presence was measured by using 13 items (Cronbach $\alpha = 0.910$). The naturalness dimension was measured by using 5 items (Cronbach $\alpha = 0.789$). Finally, the presence dimension of negative effects was measured via 6 items (Cronbach $\alpha = 0.908$). All responses were measures by a 7-point scales (i.e., 1 = strongly disagree though to 7 = strongly agree). Each presence dimensions of ITC-SOPI was analyzed separately, as different determinants of presence may have different effects on each of them (Lessiter et al.)

Brand recall

Unaided brand recall was measured by asking an open-ended question – "what is the name of the brand?" The answers were coded to three levels: no recall, partial recall, and perfect recall (Yoon et al., 2017). Aided brand recall was measured by asking a question – "what is the name of the brand?" with three choices (Yoon et al.).

Perceived product knowledge

Product knowledge was measured by using Smith and Park's, (1992) self-reported items. Participants were asked to indicate their level of agreement (strongly disagree/strongly agree) with three statements (utilizing 7-point scales) about: (a) how knowledgeable they felt about the product, (b) the amount of additional information they need to make a purchase decision, and (c) the amount of additional information they need to make a quality judgment of the product (Cronbach $\alpha = 0.833$).

Attitude

Measurements of both ad and brand attitudes utilized 7-point semantic differential scales and three items (bad/good, unpleasant/pleasant, unfavorable/ favorable) regarding the ad and brand respectively (MacKenzie et al., 1986) (Cronbach α for ad attitude = 0.937; Cronbach α for brand attitude = 0.938).

Purchase intention

Purchase intention and sharing intention were estimated 7-point semantic differential scales and three items (improbable/highly probable, unlikely/very likely, highly impossible/highly possible (MacKenzie et al., 1986) (Cronbach α for purchase intention = 0.919; Cronbach α for sharing intention = 0.922).

Control Variable

The study collected information regarding participants' familiarity with brand, as a control variable, via a three-item scale ("Regarding the brand, I am": 1= Unfamiliar vs. 7= Familiar, 1= Inexperienced vs. 7= Experienced, 1= Not knowledgeable vs. 7= Knowledgeable) with a 7-point Likert-type scale (Kent & Allen, 1994) (Cronbach α = 0.95).

See Table 2 for all the scale measurement, reliability score, mean and standard deviation of all variables and table 3 for correlation matrix.

Table 2. *Scale Measurement Items and Reliability*

Scale	Items	Cronbach α	*M*	*SD*
Brand familiarity (BF)	"Regarding the brand, I am": 1= Unfamiliar vs. 7= Familiar, 1= Inexperienced vs. 7= Experienced, 1= Not knowledgeable vs. 7= Knowledgeable (Kent & Allen, 1994).	.950	2.30	.16
Perceived product knowledge (PK)	"Indicate the amount of additional information you need to make a purchase decision (1= very much vs. 7 = not at all); Indicate the amount of additional information you need to make a quality judgment of the product (1= very much vs. 7 = not at all)" (Smith & Park, 1992)	.833	2.06	.32
Presence: Spatial presence (Spre)	"I felt I could interact with the displayed environment," "I felt I was visiting the places in the displayed environment," etc. (1= strongly disagree vs. 7 = strongly agree).	.917	4.30	.68
Engagement (Eng)	"I felt sad that my experience was over," "I had a sense that I had returned from a journey," etc. (1= strongly disagree vs. 7 = strongly agree)"	.924	4.36	.78
Naturalness (Nat)	"The displayed environment seemed natural," "The content seemed believable to me," etc. (1= strongly disagree vs. 7 = strongly agree).	.731	5.06	.56

Negative Effects (NE)	"I felt disorientated," "I felt tired," etc. (1= strongly disagree vs. 7 = strongly agree). Lessiter et al. (2000)	.940	3.11	.19
Attitude toward the Ad (Aad)	"Overall, how do you feel about the video" (unfavorable/ favorable, bad/good, and negative/positive) (MacKenzie et al., 1986)	0.937	4.96	.15
Attitude toward the brand (Ab)	"Please indicate your feelings about the brand" (unfavorable/ favorable, bad/good, and negative/positive) (MacKenzie et al., 1986)	0.938	4.48	.08
Purchase intention (PI)	"How likely are you intend to purchase the product in future" (likely/ unlikely, probable/ improbable, and possible/ impossible) (MacKenzie et al., 1986)	0.919	2.82	.57
Intention to share the ad (SI)	"How likely are you intend to share the ad?" (likely/ unlikely, probable/ improbable, possible/ impossible, and certain/ uncertain) (MacKenzie et al., 1986)	0.922	3.24	.28

Table 3. *Pearson's r Correlations Matrix of Key Variables*

	1	2	3	4	5	6	7	8	9	10	11
1. Unaided recall	1										
2. Aided recall	-.071	1									
3. Product knowledge	.079	-.036	1								
4. Spatial presence	.301*	-.099	.345**	1							
5. Engagement	.265*	.027	.314*	.751**	1						
6. Naturalness	.176	-.218	.318*	.676**	.561**	1					
7. Negative effects	-.168	-.070	-.002	-.097	-.288*	-.192	1				
8. Ad attitude	.253	-.159	.390**	.708**	.830**	.642**	-.351**	1			
9. Brand attitude	.154	.008	.357**	.348**	.435**	.352**	-.190	.568**	1		
10. Purchase intention	-.034	.113	.266*	.338**	.341**	.349**	-.150	.444**	.377**	1	
11. Sharing intention	.095	.162	.317*	.499**	.492**	.328*	-.113	.486**	.323*	.548**	1

* p <.05, ** p <.01, *** p<.001

Statistical Procedures for Data Analysis

Qualtrics portal was used for conducting the online survey. After finishing the data collection, the data file was imported into SPSS 25 software. To test the hypotheses, the study used ANCOVA to compare the mean differences between the VR

and 2-D conditions for each of the dependent variables when controlling the effect of brand familiarity.

To determine whether and how presence mediates the relationship between two types of immersive VR system and recall, product knowledge, ad attitude, brand attitude, and purchase intention, a mediation analysis was conducted. PROCESS macro 2.16.3 for SPSS was utilized to conduct the mediation by using 10000 bootstrap samples and bias-corrected confidence intervals (CIs) (Hayes, 2013). For study 1, mediation model 4 was found appropriate. Model 4 indicates a direct effect of *X* on *Y* and an indirect effect of *X* on *Y* via M_j. The study hypothesized that interface type (*X*) will affect dependent variables (*Y*) via four dimensions of presence (M_j).

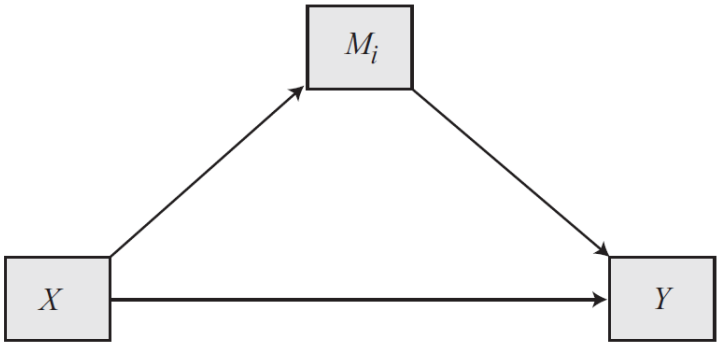

Figure 3. Conceptual diagram of model 4.

Adapted from "Introduction to mediation, moderation, and conditional process analysis: A regression-based approach," by Hayes A. F., 2013. Copyright 2013 by The Guilford Press.

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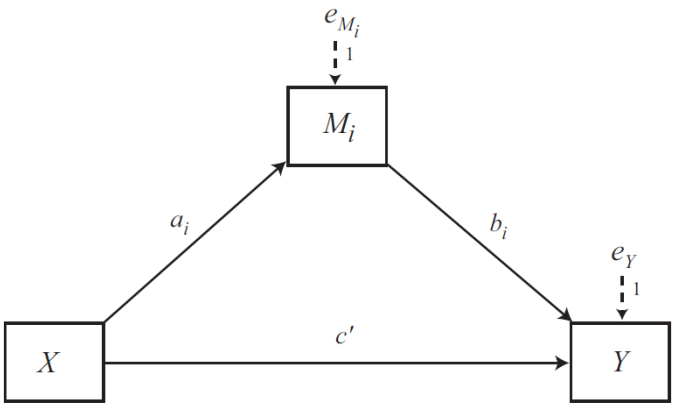

Figure 4. Statistical diagram of model 4. Indirect effect of *X* on *Y* through *Mi = ai bi.* Direct effect of *X* on *Y = c'*

Adapted from "Introduction to mediation, moderation, and conditional process analysis: A regression-based approach," by Hayes A. F., 2013. Copyright 2013 by The Guilford Press.

Chapter 5: Results of Study 1

The goal of study 1 was to examine the effect of two interfaces: 2-D and VR. Analysis of covariance (ANCOVA) was used to test the hypotheses. Participants' brand familiarity was used as a covariate. Results of study 1 are presented below. First, descriptive statistics (mean, standard deviation, skewness and kurtosis) for all variables are presented. Next, results regarding the hypotheses testing are analyzed.

Descriptive Statistics

Descriptive statistics of study 1 show the mean and standard deviation scores of all dependent variables: spatial presence (M = 4.30, SD = 1.13), engagement (M = 4.36, SD = 1.09), naturalness (M = 5.063, SD = .92), negative effect (M = 3.114, SD = 1.635), unaided brand recall (M = 1.47, SD = .65), aided brand recall (M = 2.90, SD =.44), perceived product knowledge (M = 2.05, SD = .84), ad attitude (M =4.96, SD = 1.19), brand attitude (M = 4.48, SD = 1.0), purchase intention (M = 2.82, SD = 1.44), and sharing intention (M = 3.24, SD = 1.77). Spatial presence had skewness of -.10 (SE = .31) and kurtosis of -.38 (SE = .61). Engagement had skewness of -.19 (SE = .31) and kurtosis of -.39 (SE = .61). Naturalness had skewness of -.11 (SE = .31) and kurtosis of .13 (SE = .61). Negative effects had skewness of .58 (SE = .31) and kurtosis of -.86 (SE = .61). Unaided brand recall had skewness of 1.09 (SE = .309) and kurtosis of .08 (SE = .608). Aided recall had skewness of -4.24 (SE = .31) and kurtosis of 16.49 (SE = .61). Perceived product knowledge had skewness of 1.35 (SE = .31) and kurtosis of 3.21 (SE = .61). Ad attitude had skewness of -.364 (SE = .31) and kurtosis of -.02 (SE = .61). Brand attitude had skewness of -.476 (SE = .31) and kurtosis of 1.78 (SE = .61). Purchase intention had skewness of .48 (SE = .31) and kurtosis of -.91 (SE = .61).

Sharing intention had skewness of .31 (*SE* = .31) and kurtosis of -1.03 (*SE* = .61). Results are summarized in Appendix A.

Hypothesis 1a-d: Effect of Interface Type on Presence

Hypothesis 1a-d predicted that an ad presented via immersive VR system results in a higher sense of presence than an ad presented via 2-D system when controlling for brand familiarity. ANCOVA found significant main effects of interface type on the first three indicators of presence.

First, the main effect of interface type on spatial presence was significant, $F(1, 57) = 40.60$, $p < .01$, $\eta^2_{part} = .416$. Results further revealed that the VR system generated higher spatial presence ($M = 4.97$, $SD = .81$) than the 2-D system ($M = 3.53$, $SD = .94$). Next, the main effect of interface type on engagement was significant, $F(1, 57) = 15.08$, $p < .01$, $\eta^2_{part} = .2097$. Results further revealed that the VR system generated higher engagement ($M = 4.82$, $SD = .84$) than the 2-D system ($M = 3.83$, $SD = 1.12$). The main effect of interface type on ecological validity/naturalness was also significant, $F(1, 57) = 19.89$, $p < .001$, $\eta^2_{part} = .259$. Results further revealed that the VR system generated higher ecological validity/naturalness ($M = 5.51$, $SD = .79$) than the 2-D system ($M = 4.56$, $SD = .80$). Finally, the main effect of interface type on negative effects was not significant, $F(1, 57) = .035$, $p = .85$, $\eta^2_{part} = .001$. Results also revealed the scores of 2-D system ($M = 3.13$, $SD = 1.50$) and the VR system ($M = 3.10$, $SD = 1.77$). Therefore, H1a-c were supported, while H1d was not supported. Results are summarized in Tables 4-7.

Table 4. *ANCOVA Summary Table for Spatial Presence*

Source	*df*	*MS*	*F*	*P*	η^2_{part}
Brand Familiarity	1	.531	.688	.410	.012
Interface type	1	31.328	40.600	.000	.416

Error	57	.772			
Total	60				
Corrected Total	59				

Note. R^2 = .417 ($R^2_{Adjusted}$ = .396).
$^{*}p < .001$

Table 5. *ANCOVA Summary Table for Engagement*

Source	*df*	*MS*	*F*	*P*	η^2_{part}
Brand Familiarity	1	.122	.125	.725	.002
Interface type	1	14.644	15.076	.000	.209
Error	57	.971			
Total	60				
Corrected Total	59				

Note. R^2 = .210 ($R^2_{Adjusted}$ = .183).
$^{*}p < .001$

Table 6. *ANCOVA Summary Table for Naturalness*

Source	*df*	*MS*	*F*	*P*	η^2_{part}
Brand Familiarity	1	.026	.040	.843	.001
Interface type	1	12.819	19.898	.000	.259
Error	57	.644			
Total	60				
Corrected Total	59				

Note. R^2 = .268 ($R^2_{Adjusted}$ = .243).
$^{*}p < .001$

Table 7. *ANCOVA Summary Table for Negative Effects*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	4.716	1.758	.190	.030
Interface type	1	.095	.035	.852	.001
Error	57	2.683			
Total	60				
Corrected Total	59				

Note. R^2 = .030 ($R^2_{Adjusted}$ = -.004).

Hypothesis 2a-c: Effect of Interface Type on Recall and Product Knowledge

Hypothesis 2 predicted that an ad presented in a VR system results in higher unaided recall (H2a), aided recall (H2b) and perceived product knowledge (H2c) than an ad presented via a 2-D system when controlling for brand familiarity. ANCOVA found no significant main effects of interface type on unaided recall ($F(1, 57) = 1.38$, p

= .25, η^2_{part} = .024) and aided recall (F(1, 57) = .145, p = .71, η^2_{part} = .003, observed power = .066). For unaided recall, results revealed the scores of the VR system (M = 3.56, SD = .72) and the 2-D system (M = 1.36, SD =.56). For aided recall, results revealed the scores of the VR system (M = 2.87, SD = .49) and the 2-D system (M = 2.93, SD = .38). However, there was a main effect (with approached statistical significance) of interface type on perceived product knowledge, F(1, 57) = 3.76, p = .057, η^2_{part} = .062. Results further revealed that the VR system generated higher perceived product knowledge (M = 2.27, SD = .98) than the 2-D system (M = 1.81, SD = .58). Therefore, H2a-c were not supported. Results are summarized in Table 8-10.

Table 8. *ANCOVA Summary Table for Unaided Recall*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.006	.014	.906	.000
Interface type	1	.588	1.380	.245	.024
Error	57	.426			
Total	60				
Corrected Total	59				

Note. R^2 = .026 ($R^2_{Adjusted}$ = -.009).

Table 9. *ANCOVA Summary Table for Aided Recall*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.037	.185	.669	.003
Interface type	1	.029	.145	.705	.003
Error	57	.199			
Total	60				
Corrected Total	59				

Note. R^2 = .007 ($R^2_{Adjusted}$ = -.028).

Table 10. *ANCOVA Summary Table for Product Knowledge*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.961	1.451	.233	.025
Interface type	1	2.494	3.764	.057	.062
Error	57	.663			
Total	60				
Corrected Total	59				

Note. R^2 = .099 ($R^2_{Adjusted}$ = .067).

Hypothesis 3a-d: Effect of Interface Type on Attitudes and Intentions

Hypothesis 3 predicted that an ad presented via a VR system results in higher ad attitude (H3a), brand attitude (H3b), purchase intention (H3c), and sharing intention (H3d) than an ad presented via a 2-D system.

ANCOVA found a significant main effect of interface type on ad attitude, $F(1, 57) = 16.91$, $p < .001$, $\eta^2_{part} = .23$. Results further revealed that the VR system generated more favorable ad attitude ($M = 5.5$, $SD = .98$) than the 2-D system ($M = 4.33$, $SD = 1.12$). But, no significant main effect of interface type on brand attitude was found, $F(1, 57) = 1.99$, $p = .16$, $\eta^2_{part} = .034$. Results also revealed the scores of the VR system ($M = 4.70$, $SD = .98$) and the 2-D system ($M = 4.22$, $SD = 1.00$).

Next, ANCOVA found a significant main effect of interface type on purchase intention, $F(1, 57) = 4.44$, $p < .05$, $\eta^2_{part} = .072$. Results further revealed that the VR system generated higher purchase intention ($M = 3.22$, $SD = 1.46$) than the 2-D system ($M = 2.36$, $SD = 1.30$). Finally, a significant main effect of interface type on sharing intention was found, $F(1, 57) = 15.25$, $p < .001$, $\eta^2_{part} = .211$. Results further revealed that the VR system generated higher sharing intention ($M = 3.99$, $SD = 1.80$) than 2-D system ($M = 2.39$, $SD = 1.29$). Therefore, H3a, H3c, and H3d were supported, while H3b was not. Results are summarized in Table 11-14.

Table 11. *ANCOVA Summary Table for Ad Attitude*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.292	.262	.611	.005
Interface type	1	18.835	16.911	.000	.229
Error	57	1.114			
Total	60				
Corrected Total	59				

Note. $R^2 = .245$ ($R^2_{Adjusted} = .219$).
$^{*}p < .001$

Table 12. *ANCOVA Summary Table for Brand Attitude*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	7.159	8.228	.006	.126
Interface type	1	1.734	1.992	.164	.034
Error	57	.870			
Total	60				
Corrected Total	59				

Note. R^2 = .174 ($R^2_{Adjusted}$ = .146).

Table 13. *ANCOVA Summary Table for Purchase Intention*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	4.791	2.555	.115	.043
Interface type	1	8.329	4.442	.039	.072
Error	57	1.875			
Total	60				
Corrected Total	59				

Note. R^2 = .129 ($R^2_{Adjusted}$ = .099).
$^{*}p < .05$

Table 14. *ANCOVA Summary Table for Sharing Intention*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.572	.223	.638	.004
Interface type	1	39.065	15.259	.000	.211
Error	57	2.560			
Total	60				
Corrected Total	59				

Note. R^2 = .212 ($R^2_{Adjusted}$ = .184).
$^{*}p < .001$

Hypothesis 4a-d: Mediating Effect of Presence

Hypothesis 4 predicted that presence - spatial presence (H4a), engagement (H4b), ecological validity/naturalness (H4c), and negative effects (H4d) would mediate the influence of interface type on participants' brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention, and sharing intention when controlling for brand familiarity. A mediating analysis was done via PROCESS macro 2.16.3 for SPSS using 10000 bootstrap samples and bias-corrected confidence intervals (CIs) (Hayes, 2013). For study 1, mediation model 4 was found appropriate.

Mediating effect of spatial presence (H4a)

The study first tested how spatial presence mediated the effect of interface type on unaided recall. A significant positive effect of interface type on spatial presence was found (b = 1.47, SE = .2310, $p < .001$). In turn, spatial presence positively influenced unaided recall (b = .1973, SE = .0958, $p < .05$). Although the direct effect of interface type on unaided recall was not found (b = -.0886, SE = .2185, 95% CI = [-.5265, .3492]), a significant positive indirect effect was found (b = .2904, SE = .1494, 95% CI = [.0187, .6181]). These relationships indicate that the VR system generated more spatial presence, and in turn led to higher unaided recall than the 2-D system. Therefore, H4a-i was supported. See Figure 5 and Table 15.

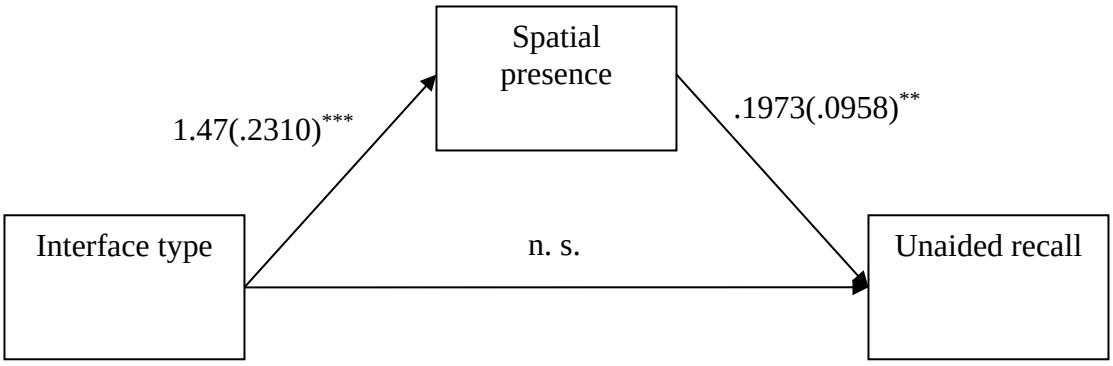

Figure 5. Direct and indirect relationship between interface type and unaided recall
$^{***}p < .001$, $^{**}p < .05$

Table 15. *Direct and Indirect Relationship between Interface Type and Unaided Recall*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → URe	-.0886	.2185	-.5265	.3492
Interface type → Spre → URe	.2904	.1494	.0187	.6181

Note. URe = Unaided recall; Spre = Spatial presence.

Next, the study tested how spatial presence mediated the effect of interface type on aided recall. No significant mediating effect of spatial presence was found on aided

recall. Therefore, H4a-ii was not supported. Further, the study tested how spatial presence mediated the effect of interface type on perceived product knowledge. A significant positive effect of interface type on spatial presence was found (b = 1.47, SE = .2310, p < .001). In turn, spatial presence positively influenced (with approached significance) product knowledge (b = .2322, SE = .1199, p = .058). Although the direct effect of interface type on product knowledge was not found (b = .0735, SE = .2736, 95% CI = [-.4746, .6216]), a significant positive indirect effect was found (b = .3418, SE = .1551, 95% CI = [.0609, .6666]). These relationships indicate that the VR system generated more spatial presence, and in turn led to higher product knowledge than the 2-D system. H4a-iii was supported. See Figure 6 and Table 16.

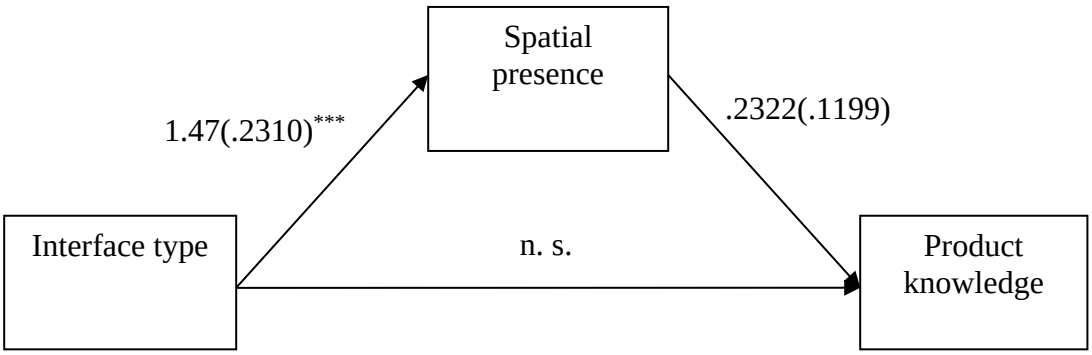

Figure 6. Direct and indirect effects of interface type on product knowledge.
***p < .001

Table 16. *Direct and Indirect Relationship between Interface type and Product Knowledge*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → PK	.0735	.2736	.4746	.6216
Interface type → Spre → PK	.3418	.1551	.0609	.6666

Note. PK = Product knowledge; Spre = Spatial presence.

Next, the study tested how spatial presence mediated the effect of interface type on ad attitude. A significant positive effect of interface type on spatial presence was

found (*b* = 3.389, *SE* = .199, *p* < .001). In turn, spatial presence positively influenced ad attitude (*b* = .7448, *SE* = .1498, *p* < .001). Although the direct effect of interface type on ad attitude was not found (*b* = .2725, *SE* = .2914, 95% *CI* = [-.311, .856]), a significant positive indirect effect was found (*b* = .869, *SE* = .237, 95% *CI* = [.4746, 1.420]). These relationships indicate that the VR system generated more spatial presence, and in turn led to more favorable ad attitude than the 2-D system. Therefore, H4a-iv was supported. See Figure 7 and Table 17.

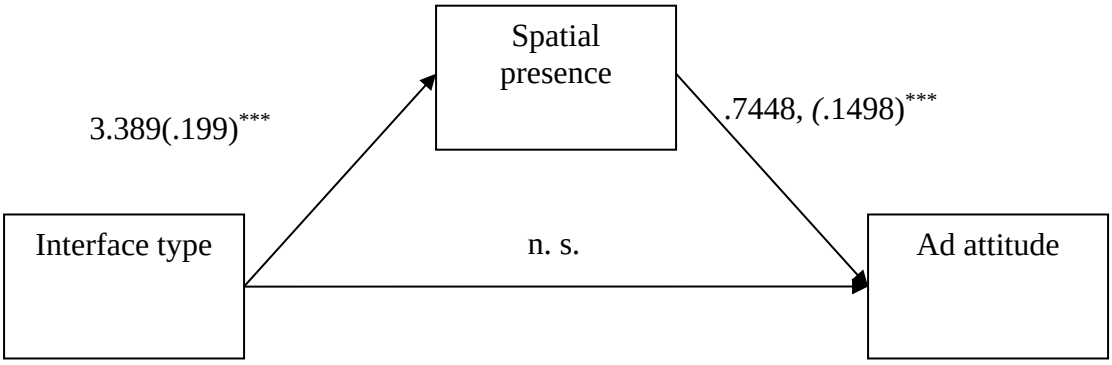

Figure 7. Direct and indirect effects of interface type on ad attitude.
***$p < .001$

Table 17. *Direct and Indirect Relationship between interface type and ad attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → Aad	.2725	.2914	-.3110	.8560
Interface type → Spre → Aad	.869	.237	.4746	1.420

Note. Aad = Ad attitude; Spre = Spatial presence.

Next, the study tested how spatial presence mediated the effect of interface type on brand attitude. A significant positive effect of interface type on spatial presence was found (*b* = 1.167, *SE* = .2062, *p* < .001). In turn, spatial presence positively influenced brand attitude (*b* = .3906, *SE* = .1502, *p* < .05). Although the direct effect of interface type on brand attitude was not found (*b* = -.109, *SE* = .2921, 95% *CI* = [-.6945, .4759]),

a significant positive indirect effect was found (b = .4556, SE = .1782, 95% CI = [.1497, .8584]). These relationships indicate that the VR system generated more spatial presence, and in turn led to more favorable brand attitude than the 2-D system. Therefore, H4a-v was supported. See Figure 8 and Table 18.

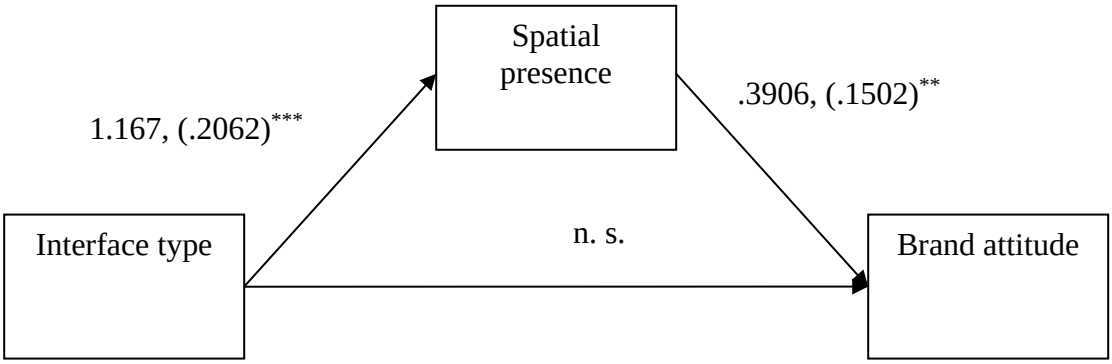

Figure 8. Direct and indirect effects of interface type on brand attitude.
***p < .001, **p < .05

Table 18. *Direct and Indirect Relationship between Interface Type and Brand Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → Ab	-.109	.2921	-.6945	.4759
Interface type → Spre → Ab	.4556	.1782	.1497	.8584

Note. Ab = Brand attitude; Spre = Spatial presence.

No significant mediating effect of spatial presence was found on either purchase intention or sharing intention. Therefore, H4a-vi and H4a-vii were not supported.

Mediating effect of engagement (H4b)

The study tested how engagement mediated the effect of interface type on unaided recall. A significant positive effect of interface type on spatial presence was found (b = 1, SE = .2592, p < .001). In turn, spatial presence positively influenced (with approached significance) unaided recall (b = .1454, SE = .0864, p = .098). Although the direct effect of interface type on unaided recall was not found (b = .0553, SE = .1900,

95% *CI* = [-.3254, .4360]), a significant positive indirect effect was found (*b* = .1464, *SE* = .0801, 95% *CI* = [.0115, .3316]). These relationships indicate that the VR system generated more spatial presence, and in turn led to higher unaided recall than the 2-D system. H4b-i was supported. See Figure See Figure 9 and Table 19.

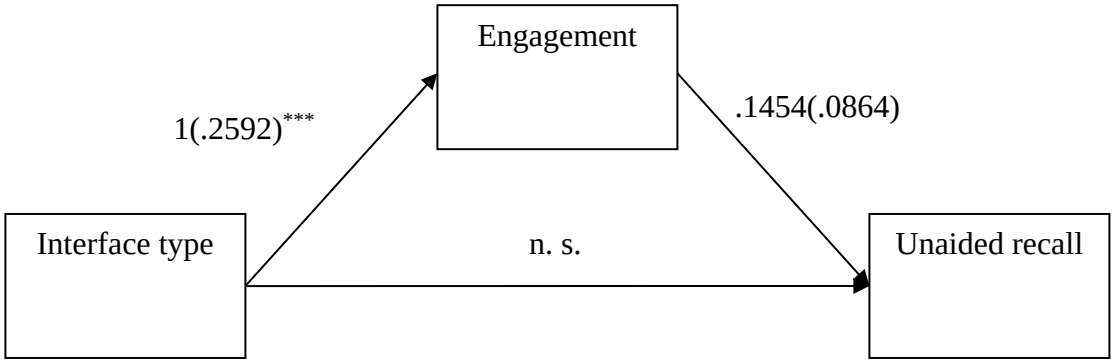

Figure 9. Direct and Indirect Relationship between interface type and unaided recall
***$p < .001$

Table 19. *Direct and Indirect Relationship between Interface Type and Unaided Recall*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → URe	.0553	.1900	-.3254	.4360
Interface type → Eng → URe	.1464	.0801	.0115	.3316

Note. URe = Unaided recall; Eng = Engagement.

No significant mediating effect of engagement was found on aided recall. Therefore, H4b-ii was not supported. Next, the study tested how engagement mediated the effect of interface type on perceived product knowledge. A significant positive effect of interface type on engagement was found (*b* = 1, *SE* = .2592, *p* < .001). In turn, engagement positively influenced (with approached significance) product knowledge (*b* = .1904, *SE* = .1074, p = .082). Although the direct effect of interface type on product knowledge was not found (*b* = .2237, *SE* = .2363, 95% *CI* = [-.2497, .6972]), a significant positive indirect effect was found (*b* = .1916, *SE* = .1135, 95% *CI* = [.0104,

.4678]). These relationships indicate that the VR system generated more engagement, and in turn engagement led to higher product knowledge than the 2-D system. Therefore, H4b-iii was supported. See Figure 10 and Table 20.

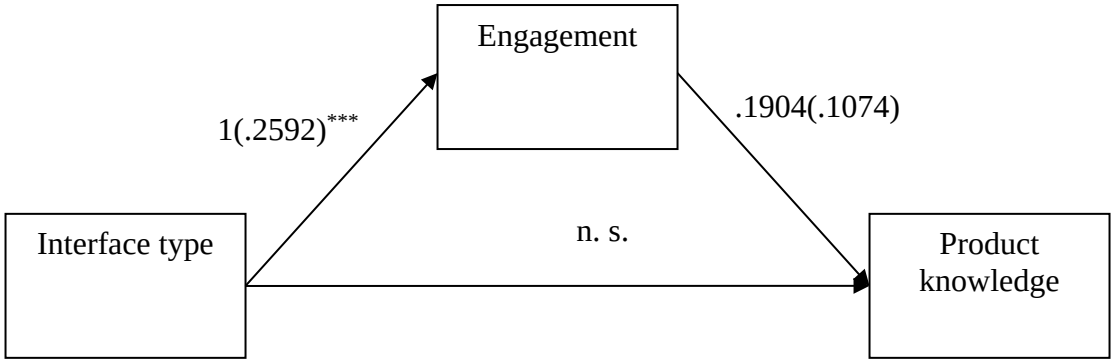

Figure 10. Direct and indirect effects of interface type on product knowledge.
***$p < .001$

Table 20. *Direct and Indirect Relationship between Interface Type and Product Knowledge*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → PK	.2237	.2363	-.2497	.6972
Interface type → Eng → PK	.1916	.1135	.0104	.4678

Note. PK = Product knowledge; Eng = Engagement.

Next, the study tested how engagement mediated the effect of interface type on ad attitude. A significant positive effect of interface type on engagement was found (b = 1, SE = .2592, $p < .001$). In turn, engagement positively influenced ad attitude (b = .8437, SE = .0881, $p < .0001$). Although the direct effect of interface type on ad attitude was not found (b = .2923, SE = .1939, 95% CI = [-.0962, .6807]), a significant positive indirect effect was found (b = .8491, SE = .2340, 95% CI = [.4375, 1.561). These relationships indicate that VR system generated more engagement, and in turn engagement led to more favorable ad attitude than 2-D system. Therefore, H4b-iv was supported. See Figure 11 and Table 21.

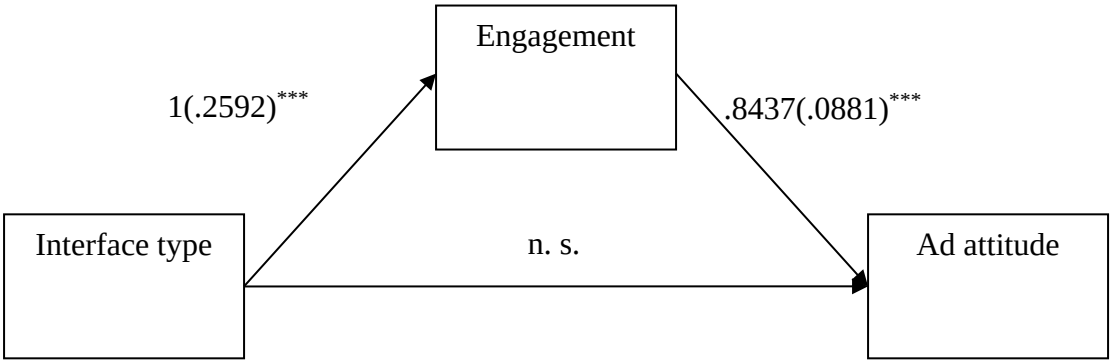

Figure 11. Direct and indirect effects of interface type on ad attitude.

***$p < .001$

Table 21. *Direct and Indirect Relationship between Interface Type and Ad Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → Aad	.2923	.1939	-.1150	6523
Interface type → Eng → Aad	8727	.2440	.4342	1.398

Note. Aad = Ad attitude; Eng = Engagement.

Next, the study tested how engagement mediated the effect of interface type on brand attitude. A significant positive effect of interface type on engagement was found ($b = 1$, $SE = .2592$, $p < .001$). In turn, engagement positively influenced brand attitude ($b = .4013$, $SE = .1145$, $p < .0001$). Although the direct effect of interface type on brand attitude was not found ($b = -.0576$, $SE = .2521$, 95% $CI = [-.5625, .4474]$), a significant positive indirect effect was found ($b = .4038$, $SE = .1176$, 95% $CI = [.1357, .8501]$). These relationships indicate that the VR system generated more engagement, and in turn engagement led to more favorable brand attitude than the 2-D system. Therefore, H4b-v was supported. See Figure 12 and Table 22.

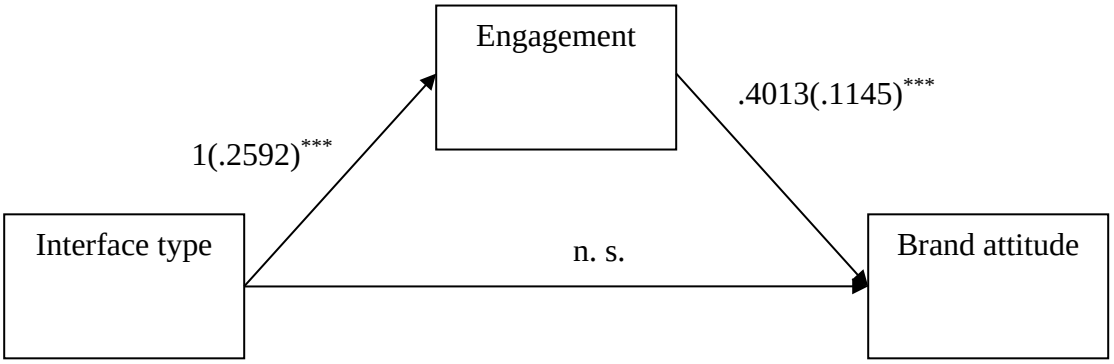

Figure 12. Direct and indirect effects of interface type on brand attitude.
$^{***}p < .001$, $^{**}p < .05$

Table 22. *Direct and Indirect Relationship between Interface Type and Brand Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → Ab	-.0576	.2521	-.5625	.4474
Interface type → Eng → Ab	.4038	.1176	.1357	.8501

Note. Ab = Brand attitude; Eng = Engagement.

Next, the study tested how engagement mediated the effect of interface type on purchase intention. A significant positive effect of interface type on engagement was found ($b = 1$, $SE = .2592$, $p < .001$). In turn, engagement positively (with marginal significance) influenced purchase intention ($b = .3545$, $SE = .1795$, $p = .053$). Although the direct effect of interface type on purchase intention was not found ($b = .4023$, $SE = .3950$, 95% $CI = [-.3891, 1.1936]$), a significant positive indirect effect was found ($b = .3567$, $SE = .1880$, 95% $CI = [.0710, .8387]$). These relationships indicate that the VR system generated more engagement, and in turn engagement led to higher purchase intention than the 2-D system. Therefore, H4b-vi was supported. See Figure 13 and Table 23.

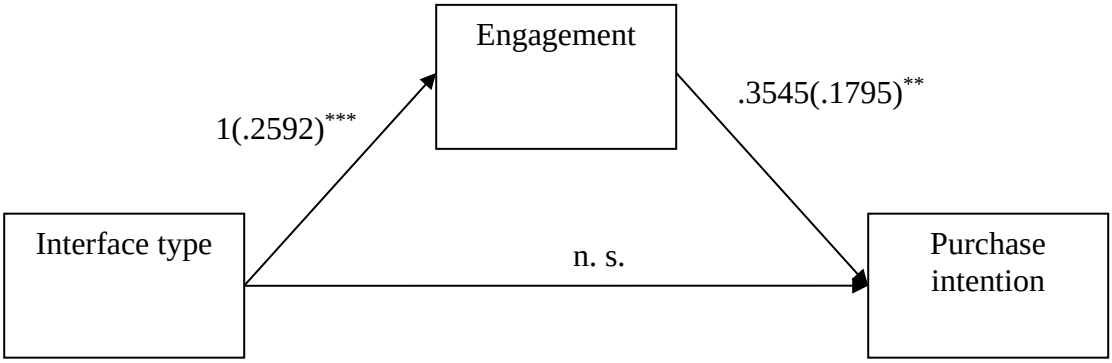

Figure 13. Direct and indirect effects of interface type on purchase intention.
$^{***}p < .001$, $^{**}p < .05$

Table 23. *Direct and Indirect Relationship between Interface Type and Purchase Intention*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → PI	.4023	.3950	-.3891	1.1936
Interface type → Eng → PI	.3567	.1880	.0710	.8387

Note. PI = Purchase intention; Eng = Engagement.

Next, the study tested how engagement mediated the effect of interface type on sharing intention. A significant positive effect of interface type on engagement was found ($b = 1$, $SE = .2592$, $p < .001$). In turn, engagement positively influenced sharing intention ($b = .5780$, $SE = .2027$, $p < .001$). A direct effect of interface type on sharing intention was found ($b = 1.062$, $SE = .4461$, 95% $CI = [.1684, 1.9557]$). Also, a significant positive indirect effect was found ($b = .5817$, $SE = .2583$, 95% $CI = [.1866, 1.2432]$). These relationships indicate that the VR system generated more engagement, and in turn engagement led to higher sharing intention than the 2-D system. Therefore, H4b-vii was supported. See Figure 14 and Table 24.

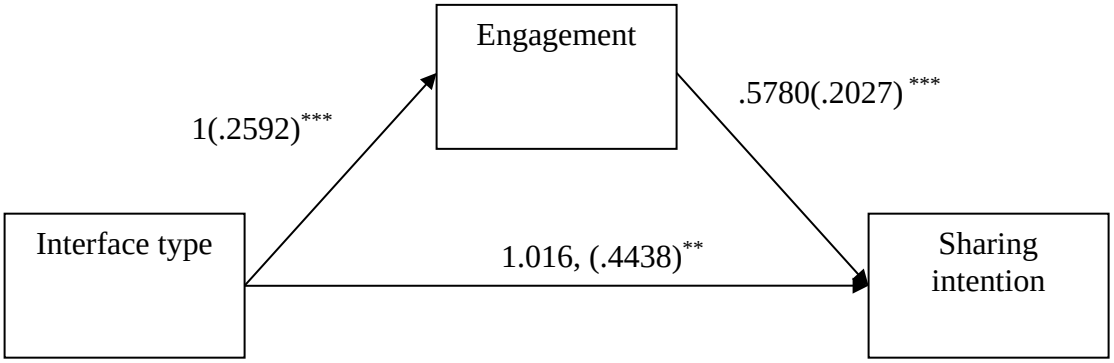

Figure 14. Direct and indirect effects of interface type on sharing intention.

***$p < .001$

Table 24. *Direct and Indirect Relationship between Interface Type and Sharing Intention*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → SI	1.062	.4461	.1684	1.9557
Interface type → Eng → SI	.5817	.2583	.1866	1.2432

Note. SI = Sharing intention; Eng = Engagement.

Mediating effect of naturalness (H4c)

No significant mediating effect of naturalness was found on unaided recall, aided recall, purchase intention and sharing intention. Therefore, H4c-i H4c-ii, H4c-vi and H4c-vii were not supported.

The study tested how naturalness mediated the effect of interface type on perceived product knowledge. A significant positive effect of interface type on naturalness was found (b = .9416, SE = .2111, $p < .001$). In turn, naturalness positively influenced product knowledge (b = .2150, SE = .1325, $p > .05$), although the influence was not significant. Further, the direct effect of interface type on product knowledge was not found (b =.2129, SE = .2452, 95% CI = [-.2782, .7041]), a significant positive indirect effect was found (b =.2024, SE = .1104, 95% CI = [.0031, .4407]). These relationships indicate that the VR system generated more naturalness, and in turn

naturalness led to more favorable product knowledge than the 2-D system. Therefore, H4c-iii was supported. See Figure 15 and Table 25.

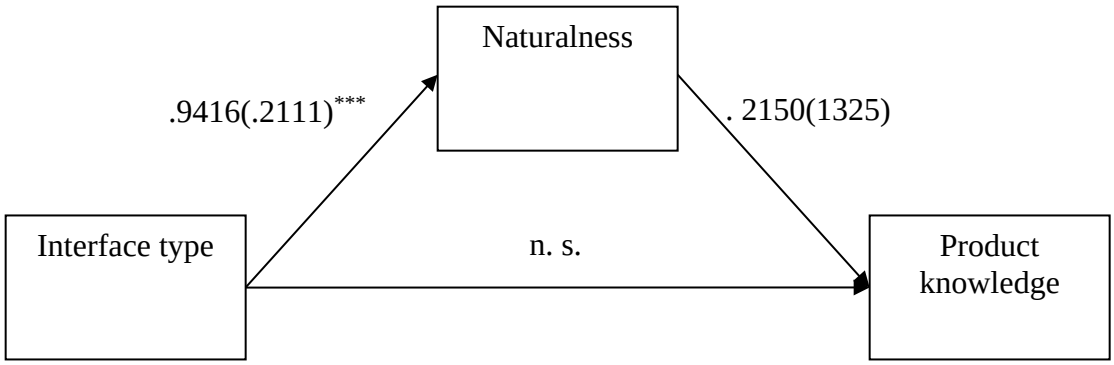

Figure 15. Direct and indirect effects of interface type on product knowledge

***$p < .001$

Table 25. *Direct and Indirect Relationship between Interface Type and Product Knowledge*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → PK	.2129	.2452	-.2782	.7041
Interface type → Nat → PK	.2024	.1104	.0031	.4407

Note. PK= Product knowledge; Nat = Naturalness.

The study also tested how naturalness mediated the effect of interface type on ad attitude. A significant positive effect of interface type on naturalness was found (b = .9416, SE = .2111, $p < .001$). In turn, naturalness positively influenced ad attitude (b = .6830, SE = .1501, $p < .001$). Although the direct effect of interface type on ad attitude was not found (b = .4983, SE = .2779, 95% CI = [-.0585, 1.055]), a significant positive indirect effect was found (b = .6431, SE = .1807, 95% CI = [.3465, 1.073]). These relationships indicate that the VR system generated more naturalness, and in turn naturalness led to more favorable ad attitude than the 2-D system. Therefore, H4c-vi was supported. See Figure 16 and Table 26.

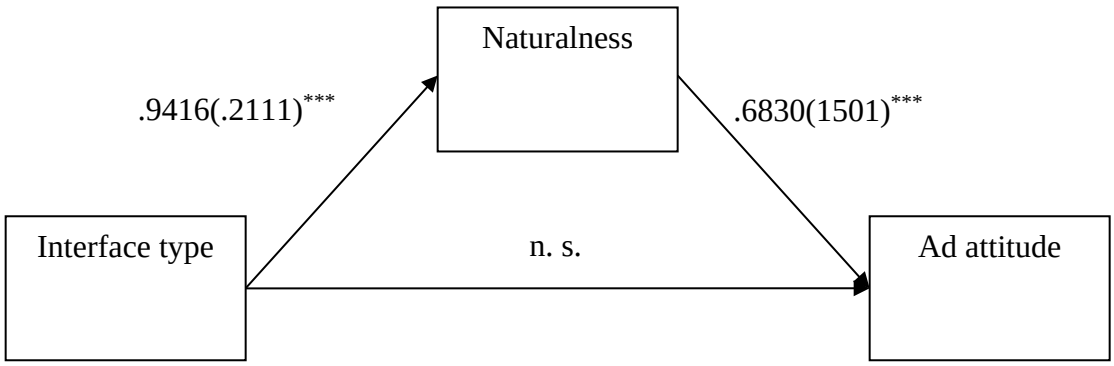

Figure 16. Direct and indirect effects of interface type on ad attitude.

***$p < .001$

Table 26. *Direct and Indirect Relationship between Interface Type and Ad Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → Aad	.4983	.2779	-.0585	1.055
Interface type → Nat → Aad	.6431	.1807	.3465	1.073

Note. Aad = Ad attitude; Nat = Naturalness.

The study also tested how naturalness mediated the effect of interface type on brand attitude. A significant positive effect of interface type on naturalness was found (b = .9416, SE = .2111, $p < .001$). In turn, naturalness positively influenced brand attitude (b = .3323, SE = .1488, $p < .05$). Although the direct effect of interface type on brand attitude was not found (b =.0334, SE = .2755, 95% CI = [-.5185, .5852]), a significant positive indirect effect was found (b =.3129, SE = .1521, 95% CI = [.0760, .6879]). These relationships indicate that the VR system generated more naturalness, and in turn naturalness led to more favorable brand attitude than the 2-D system. Therefore, H4c-v was supported. See Figure 17 and Table 27.

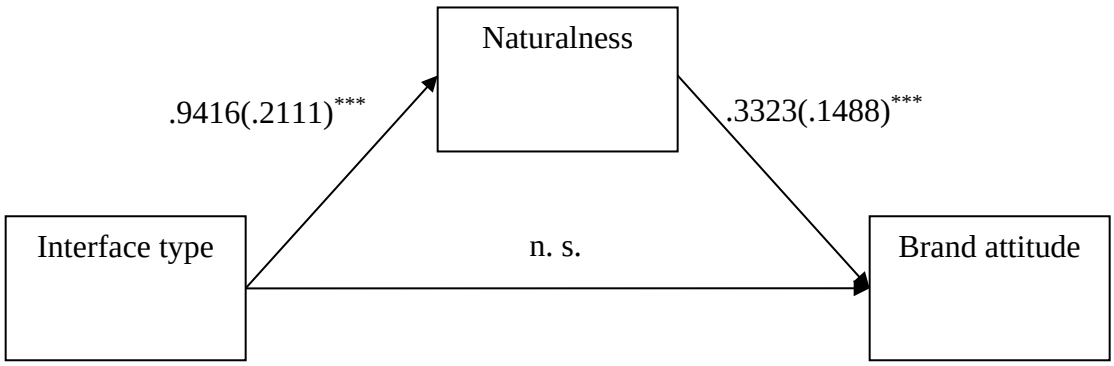

Figure 17. Direct and indirect effects of interface type on brand attitude.

***$p < .001$

Table 27. *Direct and Indirect Relationship between Interface Type and Brand Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
Interface type → Ab	.0334	.2755	-.5185	.5852
Interface type → Nat → Ab	.3129	.1521	0760	.6879

Note. Ab = Brand attitude; Nat = Naturalness.

Mediating effect of negative effects (H4d)

No significant mediating effect of negative effects was found on any dependent variables. Therefore, H4d was not supported.

Table 28. *Summary Table for Hypotheses in Study 1*

	Hypotheses	**Outcome**
H1a-d	An ad presented via the immersive VR system results in a higher sense of presence - (a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects - than an ad presented via the 2-D system.	H1a-c supported.
H2a-c	An ad presented via the immersive VR system results in higher (a) unaided recall, (b) aided recall, and (c) perceived product knowledge than ad presented via the 2-D system.	H2a, H2b and H2c (with an approached statistical significance) not supported.

H3a-d	An ad presented via the immersive VR system results in (a) more favorable ad attitude, (b) more favorable brand attitude, (c) higher purchase intention, and (d) higher sharing intention than ad presented via the 2-D system.	H3a, H3c, H3d supported.
H4a	Spatial presence mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.	H4a-i, H4a-iii, H4a-iv, and H4a-v supported
H4b	Engagement mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.	H4b-i, H4b-iii, H4b-iv, Hb-4v, H4b-vi and H4b-vii supported
H4c	Naturalness mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.	H4c-iii, H4c-iv, and Hc-4v supported
H4d	Negative effect mediates the influence of interface type on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.	Not supported

Chapter 6: Discussion of Study 1

The objective of study 1 was to compare the effectiveness of two interfaces, 2-D and immersive VR, in the case of presenting an advertisement. This study hypothesized that an immersive VR system would lead to higher perception of presence, cognitions, favorable attitude and behavioral intentions than a 2-D interface. Results of this study yield important insights into the independent role of interface type and the mediating role presence in the process of immersive VR experiences.

Role of Interface Type on Presence

Results of this study support the proposition that participants experiencing an immersive VR advertisement are more likely to have a higher sense of presence than participants experiencing a 2-D advertisement. This relationship became apparent for the first three dimensions of presence: spatial presence, engagement, and naturalness. That means, participants who saw an immersive VR advertisement (rather than a 2-D advertisement) were more likely to perceive that they were physically present in the virtual environment. They also thought that they were more involved with and interested in the medium and content of the displayed environment. Finally, they felt that the displayed environment in VR was closer to reality. These responses show how an ad presented via immersive VR interface were more effective in producing overall higher perception of presence among consumers than an ad presented via 2-D interface. The results confirmed the finding of previous studies attributing immersive interface properties of VR system for gaining elevated sense of presence, particularly via spatial presence, engagement, and naturalness dimensions of presence (e.g., de Boer, Verleur,

Heuvelman, & Heynderickx, 2010; Kim & Biocca, 1997; Klein, 1998; Li et al., 2001, 2002, 2003).

Effect of Interface Type on Brand Recall and Perceived Product Knowledge

First, the current study did not find any significant difference between 2-D and VR interfaces on aided brand recall. In both cases, most of the participants recognized the brand name correctly from a list of choices. Mediation analysis, on the other hand, also showed that the dimensions of presence were not able to create an indirect effect between interface type and aided recall. But such results for aided recall are contradictory to the predictions that state immersive VR affordances would help users remember (directly or indirectly via presence) the name better than 2-D. Therefore, alternative explanations are needed. It can be speculated that the foreign French brand name "Peugeot" itself has a novelty effect (especially when put alongside other fictitious brand names in English), which in turn, might have generated orienting responses or automatic attention among participants to the name (A Lang, 2006). Therefore, participants' scores in aided brand recall did not differ significantly due to the level of technological affordances of interfaces or due to the level of presence they felt.

Next, the current study also did not find any significant difference between 2-D and VR interfaces on unaided brand recall. The study found that in both cases participants were successful in stating the name more or less correctly (fully or partially). However, significant effects were identified only when mediation analysis was done. An indirect effect of interface type was recognized on unaided recall via two dimensions of presence (spatial presence and engagement). That means participants'

sense of physically being there in the environment and involvement with the media made them focus better on the brand.

Finally, the study found an effect of interface type on participants' product knowledge such that the VR system generated the higher score. That means, a near-real virtual product experience due to the technological benefits of the immersive VR (as opposed to the 2-D) was more effective in creating perceived product knowledge. But this direct effect was identified with approached significance. However, an indirect effect of interface type was recognized on product knowledge via three dimensions of presence (spatial presence, engagement, and naturalness). That means, when participants felt that they were physically present in the environment, or they were involved with the media or the VR experience was closer to reality, they had higher subjective product knowledge and self-confidence about the product. Earlier studies argued that the illusion of presence helps create a richer virtual product experience and, in turn, such experience enhance positive cognitive responses of the consumers (Li et al., 2001; 2002; 2003). The current study also found similar results. Therefore, the above discussion argues for the important mediating role of presence (i.e., spatial presence, engagement, and naturalness) in evaluating immersive VR ad's effectiveness in terms of cognition, as predicted by earlier studies (e.g., Li et al.).

Effect of Interface Type on Attitude and Intentions

The study found a significant effect of interface type on ad attitude such that participants who saw an immersive VR ad (rather than a 2-D ad) were more likely to like the ad, resulting in higher ad attitude. On the other hand, no significant effect of interface type was found on brand attitude, although the rating of brand attitude was

higher in the case of the VR ad. However, mediation analysis found an indirect effect of interface type on both ad and brand attitude via presence. To be specific, indirect effects of spatial presence, engagement and naturalness were found on ad and brand attitude. That means when participants thought that they were physically present in the VR environment, or they were highly engaged within the media environment or the VR experience felt natural, they expressed emotional responses (Biocca, 1997). As the ad content was nothing unpleasant, the elevated sense of presence actually led to positive emotional responses, e.g., positive ad and brand attitude. Therefore, elevated perception of presence, in general, played a significant role to form favorable affective responses among consumers, confirming the results of previous studies (e.g., Kim & Biocca, 1997; Klein, 1998; Li et al., 2001; 2002; 2003).

Furthermore, interface type had a significant direct influence on intentions. Participants showed higher positive intention to purchase the product in future and share the ad with others in the case of the VR ad (as opposed to the 2-D ad). In other words, the VR ad was more effective in increasing intentions than the 2-D ad. An indirect effect of interface type was also found via the naturalness dimension of presence. In other words, participants' believability and realism of the virtual product/object/environment within VR interface was higher and in turn such elevated feeling of naturalness helped participants to generate purchase and sharing intentions. This mediated causal relationship also confirmed the results of previous studies (e.g., Kim & Biocca, 1997; Klein, 1998; Li et al., 2001, 2002, 2003).

Overall, the above-mentioned findings established a critical relationship among the interface type, sense of presence, and ad effectiveness measures confirming the

claims of several earlier researches on immersion and presence (e.g., Kim & Biocca, 1997; Klein, 1998; Li et al., 2001; 2002; 2003). The present study showed that the immersive VR ad is more effective than the 2-D ad.

Chapter 7: The Research Problem of Study 2

Although study 1 hypothesized to test the impact of immersive VR (in comparison to non-VR), it did not indicate exactly which factor(s) of the immersive VR system would contribute to ad effectiveness. The main goal of study 2 is to approach this unanswered question. Study 2 first went beyond comparing a VR versus non-VR system and focuses on the aspects of immersion on the VR system. This study focused on examining the effect of two significant variables, i.e., modality interactivity (one type of interactivity) and sensory breadth (one type of vividness), on users' psychological responses in high immersive VR system in comparison to low immersive VR system. So, the research problem of study 2 simply addressed the effect of immersive VR system type, modality interactivity and sensory breadth on presence, cognition, attitude and intention. Next, the study also focused on predicting the mediating role of presence. Finally, the study hypothesized about how the relationships between or among the concepts mentioned above are moderated by perceived media novelty. The hypotheses and research questions are discussed below.

Effects of Modality Interactivity and Sensory Breadth on Presence

Earlier studies on 3-D or immersive VR ads have mainly focused on finding out the effect of different media platforms in enhancing ad effectiveness (e.g., Ha, 2005; Kim & Biocca, 1997; Lau & Lee, 2016; Li et al., 2001, 2002, 2003; Suh & Lee, 2005). They contributed the effectiveness of an immersive ad or medium inherently to the technological features of the medium, i.e., interactivity and/or vividness, or to the sense of presence, which is mostly elevated by interactivity and/or vividness. Steuer's (1995) presence framework stated that both interactivity and vividness are important predictors

of presence. But, rarely any study was done to test the separate effects of interactivity and vividness on presence. Sundar et al. (2015) argued that media modalities should better be examined independently to find out their specific effect. Therefore, the study hypothesized about how different level of modality interactivity and sensory breadth would affect the sense of presence. Such a prediction will be helpful to understand how Steuer's framework works on immersive VR systems in general.

First, Steuer (1995), in his telepresence framework, referred to interactivity as an important predictor of presence. As discussed earlier, Steuer argued that three factors contribute to enhance interactivity and thus, sense of presence: speed, range, and mapping. Sundar et al. (2015) proposed that modality interactivity has the capability to enhance these three factors and thus, enhance one's mental representation of the information on the interface. Heeter (1992), and Welch, Blackmon, Liu, Mellers, and Stark (1996) found that interactivity (created by allowing participants to drive a simulated situation in stereoscopic VR) increased the sense of presence. Although their researches were done on source interactivity, they argued that modality interactivity as an environmental factor of the system can also affect presence. However, empirical study on the effect of modality interactivity on presence is rarely done. Therefore, based on the previous studies on interactivity in general and source interactivity, the study expected to have a similar kind effect on three dimensions of presence (i.e., spatial presence, engagement, and naturalness) in the case of modality interactivity.

H5: An ad presented with modality interactivity results in higher sense of presence – (a) spatial presence, (b) engagement, and (c) naturalness – than an ad presented no modality interactivity.

It should be noted that the negative effect dimension of presence is not considered for the above relationships as modality interactivity is less likely to generate negative effects of presence dimensions. Negative effects of presence dimension originate from the medium itself (e.g., dizziness or cybersickness) and were particularly appropriate for media or platform comparison (interface type).

Next, Steuer (1995) referred to vividness as another important predictor of presence. Sensory breadth, as one of the indicators of vividness, has the ability to create the sense of presence (Shih, 1998; Steuer, 1995). The relationship between presence and sensory breadth has been tested empirically by earlier studies (e.g., Coyle & Thorson, 2001; Fennis et al., 2012; Hendrix & Barfield, 1996; Klein, 2003; Slater, Usoh & Steed, 1994). Schmitz and Fulk (1991) found that vividness or media richness (i.e., the ability of media to transmit both video and audio) convey a greater sense of presence than less rich media. In the case of VR, Van Kerrebroeck et al. (2017) found that higher perceptions of overall vividness (did not differentiate between depth and breadth) in immersive virtual reality led higher perception of presence than a regular 2-D video. Yim et al. (2012), on the other hand, compared the effect of ad presented via stereoscopic 3-D technology versus flat 3-D display on desktop and found that vividness created by stereoscopic 3‑D produced higher presence than flat 3-D. Study 1 argued that if multiple sensory breadth items (in comparison to a few or none) are

applied while presenting information in the ad, it will create higher sense of presence in all kinds of immersive VR systems. Therefore, this study hypothesized the following:

> **H6:** An ad presented with higher sensory breadth results in higher sense of presence – (a) spatial presence, (b) engagement, and (c) naturalness – than an ad presented with lower sensory breadth.

Again, it should be noted that the negative effect dimension of presence is also not considered for the above relationships, as sensory breadth is less likely to generate negative effects of presence dimensions. Negative effects, generated from media, more suitable to consider for media comparison (e.g., interface type).

However, Steuer's (1992) presence framework or earlier research did not indicate the nature and direction of relationship between different levels of modality interactivity and sensory breadth on presence. As immersive VR systems utilize both interactivity and vividness, it is important to find out how these two factors will work together. It will also provide a more elaborative explanation of Steuer's (1992) presence framework. This study focused on finding out a two-way interaction of modality interactivity and sensory breadth.

But, there exist almost no research that has investigated such a relationship. Only a few studies indicated the possibility of a two-way interaction of vividness and interactivity (e.g., Choi & Taylor, 2014; Li et al., 2002). Li et al.'s study was conducted to investigate the impact of product visualization in Website advertisements. They compared two different types of ads for both geometric and material products: 2-D product visualization (static picture only) and 3-D product visualization (with the option for interactivity (e.g., moving, zooming and rotating of the product). They found that 3-

D visualization to be more effective in case of generating product knowledge, brand attitude, and purchase intention (only for the geometric product). Similarly, Choi and Taylor examined the effect of two types of advertisements: 2-D non-interactive picture versus 3-D interactive picture (options to zoom, rotate, and move the product) for geometric and material products. Their study found that 3-D product presentation in Website led to a more favorable site attitude and higher intention to revisit the Website. These effects were higher for the geometric product. More favorable brand attitudes and higher purchase intentions were found only in the case of geometric product. But these studies did not explicitly consider vividness and/or interactivity independent variables. The concepts of vividness and interactivity were rather assumed as one of many technological aspects of virtual product visualization in an interface. Also, when considering the specific aspects of both vividness and interactivity, such as sensory breadth of vividness and modality interactivity, previous research did not provide any direction of interaction. Therefore, this study posed a research question to find out whether and how the interaction takes place.

> **RQ1:** Will there be an interaction effect between modality interactivity and sensory breadth on presence – (a) spatial presence, (b) engagement, and (c) naturalness? What will be the nature of interaction?

Main Effect of Immersive VR Type

Study 1 hypothesized that interface type (immersive VR vs. 2-D) influences presence, cognition, attitude and intentions. Ad presented via immersive VR interface was predicted to be more effective in creating positive responses than ad presented via 2-D interface. Study 2 aimed to examine the similar predictions, but only on different

types of immersive VR platforms: high immersive VR and low immersive VR. Similar to study 1, study 2 hypothesized that level of immersive features of a VR system will affect the responses and ad presented via high immersive VR will be more effective in creating those responses than ad presented via low immersive VR system.

H7a-d: An ad presented via the high immersive VR system results in higher sense of presence – (a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects – than an ad presented via low immersive VR system

H8a-c: An ad presented via the high immersive VR system results in higher (a) unaided recall, (b) aided recall, and (c) perceived product knowledge than an ad presented via the low immersive VR system.

H9a-d: An ad presented via the high immersive VR system results in higher (a) ad attitude, (b) brand attitude, (c) purchase intention, and (d) sharing intention than an ad presented via the low immersive VR system.

Interactions among Immersive VR Type, Modality Interactivity and Sensory Breadth

Previous studies on 3-D or immersive VR ads contributed the effectiveness of an immersive ad or medium fundamentally to interactivity and/or vividness, or to the sense of presence, which is mainly elevated by interactivity and/or vividness. (e.g., Ha, 2005; Kim & Biocca, 1997; Lau & Lee, 2016; Li et al., 2001, 2002, 2003; Suh & Lee, 2005). As mentioned earlier, such research did not focus on testing the effects of interactivity and vividness independently. Further, it is still not known how interactivity and vividness will work on different types of immersive VR platforms. In order to have a clear understanding of the effectiveness of immersive VR ads, it is important to

explicate the relationship among immersive VR type, interactivity and vividness. As no studies have addressed such factors simultaneously, this study addressed the following research questions:

RQ2: Will there be an immersive VR type X modality interactivity interaction on (a) presence, (b) unaided recall, (c) aided recall, (d) product knowledge, (e) ad attitude, (f) brand attitude, (g) purchase intention, and (h) sharing intention? If yes, then what will be the nature of the interaction?

RQ3: Will there be an immersive VR type X sensory breadth interaction on (a) presence, (b) unaided recall, (c) aided recall, (d) product knowledge, (e) ad attitude, (f) brand attitude, (g) purchase intention, and (h) sharing intention? If yes, then what will be the nature of the interaction?

RQ4: Will there be an immersive VR type X modality interactivity X sensory breadth interaction on (a) presence, (b) unaided recall, (c) aided recall, (d) product knowledge, (e) ad attitude, (f) brand attitude, (g) purchase intention, and (h) sharing intention? If yes, then what will be the nature of the interaction?

Moderating Effect of Perceived Media Novelty

The study hypothesized regarding the role of perceived media novelty in moderating the effects of different immersive VR systems. While discussing about the main effects of immersive VR types, the study posed that high immersive VR will generate higher brand recall, perceived product knowledge, attitudes and intentions. The study has also discussed about how high perceived novelty can create lower cognition, more favorable attitudes and intentions. Based on the earlier discussion, the study assumed that the effects of high immersive VR will be realized differently when

viewers perceive a low level of perceived media novelty rather than a high level of media novelty.

First, viewers' cognitive responses will be affected differently by different immersive VR based on the perceived novelty. In the case of low perceived media novelty, high immersive VR (rather than low immersive VR) is more likely to create higher recall and perceived product knowledge due to the medium properties (e.g., creating near-real product exposure) of high immersive VR. But, in the case of high perceived media novelty, viewers' attention will be largely occupied by the media, they may not be able to focus on the product/brand information in the content. Thus, lower brand recall and perceived product knowledge are expected to occur in case of high perceived media novelty situation. As both of the media will be perceived as novel to the viewers, the technological benefits of high immersive VR are more likely to be overlooked by the viewers (Yim et al., 2012). Therefore, high immersive VR will not more likely to produce high cognitive responses than low immersive VR.

Next, viewers' attitude and intentions will also be affected differently by different immersive VR based on the perceived novelty. In the case of low perceived media novelty, high immersive VR (rather than low immersive VR) is more likely to produce favorable ad attitude and sharing intention. But, in the case of high perceived media novelty, high immersive VR can become as effective as high immersive VR. Positive effects of high immersive VR on attitude and intentions may also become disappear in the case of high perceived media novelty (Yim et al., 2012), but the effect may be better realized in case of low perceived media novelty. Therefore, the study posed the following hypotheses.

H10a-c: The effect of immersive VR advertising in creating cognition – (a) unaided brand recall, (b) aided brand recall, and (c) product knowledge – will be moderated by the perceived media novelty when controlling for brand familiarity.

H10a-c(i): When viewers perceive low level of media novelty, a high immersive VR ad will be more effective in creating cognition than a low immersive VR ad.

H10a-c(ii): When viewers perceive high level of media novelty, a high immersive VR ad will not be more effective in creating cognitive responses than low immersive VR ad.

H11a-d: The effect of immersive VR advertising in creating attitudes and intentions – (a) ad attitude, (b) brand attitude, (c) purchase intentions, and (d) sharing intention – will be moderated by the perceived media novelty when controlling for brand familiarity.

H11a-d(i): When viewers perceive low level of media novelty, a high immersive VR advertising will be more effective in creating attitudes and intentions than a low immersive VR ad.

H11a-d(ii): When viewers perceive high level of media novelty, a high immersive VR ad will not be more effective in creating attitudes and intentions than a low immersive VR ad.

Next, the study also posed several research questions to see the nature of interaction among immersive VR type, interactivity and vividness on dependent variables, if moderated by perceived novelty.

RQ5: Will participants' perceived novelty moderate the interactions between modality interactivity and sensory breadth on presence [(a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects]? What will be the nature of the interactions?

RQ6: Will participants' perceived novelty moderate the interaction effect of (i) interface and modality interactivity, and (ii) interface and sensory breadth on cognitions, attitude and intentions? What will be the nature of the interactions?

Mediating Effect of Presence

Similar to study 1, study 2 also focused on examining how presence mediates the relationship between interface type and cognition, attitude and intentions and hypothesized the followings.

H12a(i-vii): Spatial presence mediates the influence of level of immersion on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.

H12b(i-vii): Engagement mediates the influence of level of immersion on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.

H12c(i-vii): Naturalness mediates the influence of level of immersion on participants' (i) brand recall, (ii) product knowledge, (iii) ad attitude, (iv) brand attitude, (v) purchase intention, and (vi) sharing intention when controlling for brand familiarity.

H12d(i-vii): Negative effect mediates the influence of level of immersion on participants' (i) brand recall, (ii) product knowledge, (iii) ad attitude, (iv) brand attitude, (v) purchase intention, and (vi) sharing intention when controlling for brand familiarity.

Chapter 8: Method of Study 2

This chapter describes the research design used to test the hypotheses developed in Chapter 7. The aim of study 2 was to test how immersive VR system type, modality interactivity, and sensory breadth affect perceived presence, brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention and sharing intention. Next, this study also focused on the mediating role of presence and the moderating role of perceived media novelty. This chapter explains research design, variables (independent, dependent, mediating and control variables), sampling procedure, study procedure, stimuli development procedure, and statistical procedures for data analysis.

Research Design

A 2 (immersive VR system: high immersive/low immersive) X 2 (modality interactivity: with modality interactivity /no modality interactivity) X 2 (sensory breadth: high/low) between-subject experimental design was implemented to achieve the goal of study 2. Like study 1, this study was also conducted in a laboratory setting. Eight different conditions were tested.

Independent Variables

Level of immersion

Level of immersion (high versus low) in VR system was the first independent variable of study 2. Level of immersion was divided into two levels: high and low. As stated earlier, there is no standard way to quantify a VR system as either "high immersive" or "low immersive" (Ahn, 2011). According to Ahn, the level of immersion can be divided based on the number and the array of sensory inputs a user can have in the virtual environment. Based on Ahn's rationale, this study operationalized that a

monoscopic flat-desktop computer display indicated a low immersive VR system, whereas a stereoscopic head-mounted display (HMD) indicated a high immersive VR system (also see Biocca, 1997).

The operationalization of immersive VR in study 1 was used for operationalizing high immersive VR system, implemented by a stereoscopic head-mounted display (HMD). In a high immersive VR system condition, participants saw a 360° video ad via an HMD called VR Shinecon. A monoscopic flat-desktop display of 21 inches was used to implement the low immersive VR system condition. This system contains monoscopic vision of the 360° video, non-spatialized audio via external headphone, mouse controlled point of view to see the ad from a particular angle, and no natural mapping of head/body movement. Participants also saw the same 360° video via this system.

Modality interactivity

The study used "hotspot," one of the most frequently used medium feature, as a type of modality interactivity (Sundar et al., 2015). Two levels of modality interactivity were created: an ad with a hotspot versus an ad without a hotspot. For the "with hotspot" condition, users were able to see three salient product attributes in a pop-up box, by clicking on the hotspot (see Appendix C). For the high immersive VR condition with modality, participants executed the clicking option by looking at the icon. When they looked at the icon for a few seconds they saw a gray ring around the icon. When the ring turned from gray to red, the hotspot opened. The total time to open the hotspot took 5 seconds. For the low immersive VR condition with modality, participants executed the clicking option by a mouse. They also had the option to close the box

anytime they want. For “without hotspot” condition, information about three salient product attributes were presented automatically at the mid-point of total duration of the video.

To assess whether participants correctly recognized the conditions, they were asked to rate the degree of modality interactivity. The manipulation of interactivity was checked by asking “On a scale of 1–7 (1 being did not allow and 7 being fully allowed), to what extent do you think that the ad allowed you to see and click on the hotspot on the screen?” An independent sample t-test was conducted to check the manipulation. The difference between the groups was significant, t = -12.10, p <.001. Participants under the modality interactivity condition reported higher agreement (M = 6.41, SD = 1.05) than the participants under the without modality interactivity condition (M = 4.09, SD = 1.95).

Sensory breadth

Sensory breadth contained two levels: high and low. High breadth was operationalized by multiple items, i.e., text and visual image (Klein, 2003). Low sensory breadth was operationalized by only one sensory item, i.e., text (Klein).

To assess whether participants correctly recognized the conditions, they were asked to rate the degree of sensory breadth. The manipulation was checked by asking “On a scale of 1–7 (1 being no sensory items (only text) and 7 being multiple sensory items (both text and picture), to what extent do you think that the information about the car in the video (shown in a box) was presented via sensory items?” An independent sample t-test was conducted to check the manipulation. The difference between the groups were significant, t = -5.8, p <.001. Participants under the high sensory breadth

condition reported higher agreement (M = 5.61, SD = 1.40) than the participants under the low sensory breadth condition (M = 4.940, SD = 2.00).

Moderating variable

Participants' perceived media novelty was measured as a moderating variable. A four-item scale was used to indicate how much they agree or disagree with the statements asking whether that the ad presentation modality was new/unique / different/ unusual. The scale was adapted from Kent and Allen (1994) and the scale was measure on a 7-point Likert-type scale (Cronbach $\alpha = 0.863$). A median split was done to create two groups: participants with high perceived novelty (with a median value of 5.5 and higher) and participants with low perceived novelty (with a median value lower than 5.5).

Sample

An analysis of covariance (ANCOVA) test was conducted for study 2. Minimum sample size was calculated via a-priori power analysis on G*Power calculator (Erdfelder et al., 1996). The calculation required the anticipated effect size, the desired probability level, statistical power levels, numerator degrees of freedom, number of groups and number of covariates (Erdfelder et al.). For *F-test*, Cohen's (1992) conventional values of 0.10, 0.25 and 0.40 are considered small, medium and large respectively. Similar to study 1, study 2 considered a medium effect size, which is 0.25 in this case. Statistical power and probability level was considered 0.8 and 0.05 respectively (Wolf et al., 2013). Also, numerator degrees of freedom were 1 (as each group has only two levels and total the number of groups was 8). There was one covariate. According to G*Power, the minimum sample size was 171 for study 2.

However, the study obtained a total of 271 participants. They were randomly assigned to eight groups in the following quantities: 1) high immersive-modality interactivity-high sensory breadth, *N* = 36; 2) high immersive-modality interactivity-low sensory breadth, *N* = 32; 3) high immersive- no modality interactivity-high sensory breadth, *N* = 34; 4) high immersive- no modality interactivity-low sensory breadth, *N* = 36; 5) low immersive-modality interactivity-high sensory breadth, *N* = 32; 6) low immersive-modality interactivity-low sensory breadth, *N* = 34; 7) low immersive- no modality interactivity-high sensory breadth, *N* = 33; 8) low immersive-no modality interactivity-low sensory breadth, *N* = 34. Among them, 94 participants were male and 176 were female. Participants' average age was 21.00 (*SD* = 1.59). Also, almost 49 percent of the students were sophomores, followed by juniors (27 percent) and then seniors (19 percent).

General Study Procedure and Dependent Variables

General procedure of study 1, as described in chapter 6, was followed here. Also, study 2 adopted the same dependent variables and measurements of study 1. In addition, perceived media novelty was measured in study 2. Each variable had a satisfactory scale-reliability score. See Table 29. A correlation matrix, by using the key variables, is presented in Table 30.

Table 29. *Scale Measurement Items and Reliability*

Scale	Items	Cronbach α	*M*	*SD*
Brand Familiarity (BF)	"Regarding the brand, I am": 1= Unfamiliar vs. 7= Familiar, 1= Inexperienced vs. 7= Experienced, 1= Not knowledgeable vs. 7= Knowledgeable (Kent & Allen, 1994).	.924	2.54	.61
Perceived Media	"New/ unique / different/ unusual (1= strongly disagree vs. 7 = strongly agree)."	.863	5.18	.41

novelty (PN)				
Perceived product knowledge (PK)	"Indicate the amount of additional information you need to make a purchase decision (1= very much vs. 7 = not at all); Indicate the amount of additional information you need to make a quality judgment of the product (1= very much vs. 7 = not at all);	.829	2.29	.24
Presence:				
Spatial presence (Spre)	"I felt I could interact with the displayed environment," "I felt I was visiting the places in the displayed environment," etc. (1= strongly disagree vs. 7 = strongly agree).	.908	4.51	.57
Engagement (Eng)	"I felt sad that my experience was over," "I had a sense that I had returned from a journey," etc. (1= strongly disagree vs. 7 = strongly agree)"	.910	4.46	.73
Naturalness (N)	"The displayed environment seemed natural," "The content seemed believable to me," etc. (1= strongly disagree vs. 7 = strongly agree).	.789	4.97	.48
Negative Effects (NE)	"I felt disorientated," "I felt tired," etc. (1= strongly disagree vs. 7 = strongly agree). Lessiter et al. (2000)	.908	3.19	.36
Attitude toward the Ad (Aad)	"Overall, how do you feel about the video" (unfavorable/ favorable, bad/good, and negative/positive) (Karson & Fisher, 2005)	0.907	5.15	.08
Attitude toward the brand (Ab)	"Please indicate your feelings about the brand" (unfavorable/ favorable, bad/good, and negative/positive) (Karson & Fisher, 2005)	0.934	4.54	.08
Purchase intention (PI)	"How likely are you intend to purchase the product in future" (likely/ unlikely, probable/ improbable, and possible/ impossible) (MacKenzie et al., 1986)	0.882	2.95	.60
Intention to share the ad (SI)	"How likely are you intend to share the ad?" (likely/ unlikely, probable/ improbable, possible/ impossible, and certain/ uncertain) (MacKenzie et al., 1986)	0.932	3.62	.36

Table 30. *Pearson's r Correlations Matrix of Key Variables*

	1	2	3	4	5	6	7	8	9	10	11
1. Unaided recall	1										
2. Aided recall	.303**	1									
3. Product knowledge	.024	-.107	1								
4. Spatial presence	-.064	-.093	.017	1							
5. Engagement	.004	.002	.034	.759**	1						
6. Naturalness	.069	-.016	.067	.656**	.625**	1					
7. Negative effects	-.114	-.015	.026	.101	-.077	-.054	1				
8. Ad attitude	.155*	.032	.086	.565**	.702**	.516**	-.271**	1			
9. Brand attitude	.159**	.055	.082	.312**	.422**	.364**	-.076	.512**	1		
10. Purchase intention	.015	-.071	.125*	.293**	.396**	.231**	-.098	.317**	.390**	1	
11. Sharing intention	-.023	.002	.013	.461**	.573**	.298**	-.044	.435**	.302**	.424**	1

* p <.05, **p <.01, ***p<.001

Stimuli

Study 2 used the same stimuli of study 1. The justification of the selection of product and brand have discussed earlier. However, study 2 manipulated modality interactivity and breadth of stimuli. Texts and pictures (e.g., sensory breadth) were inserted in the 360° video by Abode illustrator (version CC 2018). Hotspots (e.g., modality interactivity) were added in the 360° video by using a free online facility provided by VIAR Inc. (VIAR Inc., n.d.). The Website of this organization allows users to use virtual reality tools to create interactive immersive VR stories (VIAR Inc.). For interactive condition, in order to provide the participants with an opportunity to engage in active information processing for evaluating the product, it was necessary that participants click the hotspot and see the information (either in text or text and audio-visual) inside the pop-up box. Therefore, all participants were instructed earlier about how to open the hotspot. They were also told that they would be required to report their

judgments and thoughts after the study based on the everything they saw in the ad including pop-up information and were requested to open the hotspot at least once in the entire video. Once participants finished viewing the video, a follow up question was asked regarding whether they have clicked the hotspot.

As described in chapter 5, the ad showed a Peugeot car journey and information about the car. In all conditions, participants saw the exterior, interior of the car, and surrounding environment by either moving their heads around (in the high immersive condition) or scrolling the mouse (in the low immersive condition). In the no interactivity conditions, three attributes of the car were automatically presented at the half time of the ad either via text (in the low breadth condition) or text and picture (in the high breadth condition). In interactivity conditions, one hotspot was inserted at the central view of the video. Participants were able to open the hotspots via by looking at the hotspot for around 5 seconds and then car's information (with high or low breadth) popped up.

Statistical Procedures for Data Analysis

ANCOVA was conducted via *F-test* compare to test the hypotheses. Similar to study 1, study 2 conducted a mediation analysis by following the same procedure.

Mediation analysis was conducted by using PROCESS macro 2.16.3 for SPSS with 10000 bootstrap samples and bias-corrected confidence intervals (CIs) (Hayes, 2013). For study 2, mediation model 5 was found appropriate, as it shows the hypothesized relationship among immersive VR type, presence, perceived media novelty, and all dependent variables. Model 5 indicates a direct effect of *X* on *Y* and an indirect effect of *X* on *Y* via M_j. The direct effect was mediated by *W*. The study hypothesized that interface type (*X*) will affect dependent variables (*Y*) via four dimensions of presence (M_j). Perceived media novelty (*W*) will moderate the direct relationship.

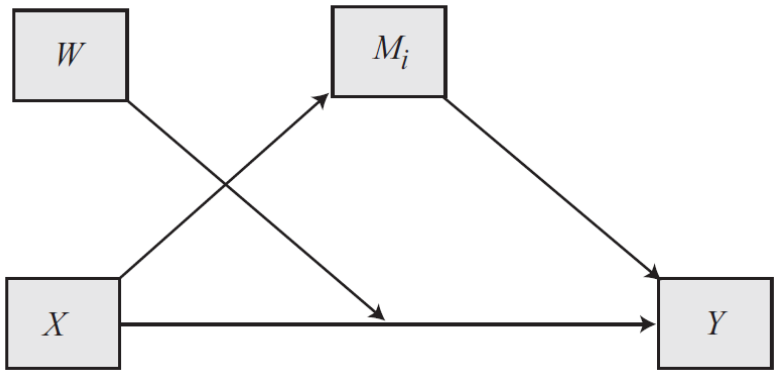

Figure 18. Conceptual diagram of model 5.

Adapted from "Introduction to mediation, moderation, and conditional process analysis: A regression-based approach," by Hayes A. F., 2013. Copyright 2013 by The Guilford Press.

.

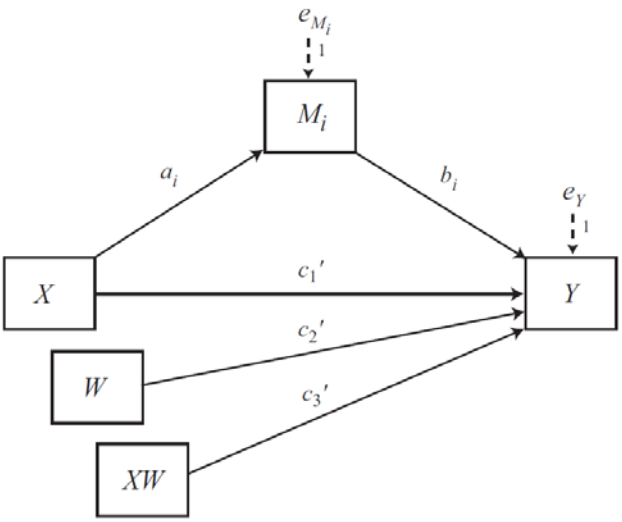

Figure 19. Statistical diagram of model 5. Indirect effect of *X* on *Y* through *Mi = ai bi.* Conditional direct effect of X on Y = c.

Adapted from "Introduction to mediation, moderation, and conditional process analysis: A regression-based approach," by Hayes A. F., 2013. Copyright 2013 by The Guilford Press.

Chapter 9: Results of Study 2

The aim of study 2 was to test how immersive VR system type, modality interactivity, and sensory breadth affect perceived presence, brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention and sharing intention. Next, this study was also focused on the mediating role of presence. Moreover, participant's perceived novelty was used as a moderating variable while analyzing the relationships. Participants' brand familiarity was used as covariate.

Descriptive Statistics

Descriptive statistics of study 2 show the mean and standard deviation scores of all dependent variables: spatial presence (M = 4.51, SD = 1.08), engagement (M = 4.46, SD = 1.06), naturalness (M = 4.97, SD = 1.06), negative effect (M = 3.19, SD = 1.52), unaided brand recall (M = 1.42, SD = .70), aided brand recall (M = .80, SD =.40), perceived product knowledge (M = 2.29, SD = 1.38), ad attitude (M =5.15, SD = 1.16), brand attitude (M = 4.54, SD = .99), purchase intention (M = 2.95, SD = 1.34), and sharing intention (M = 3.62, SD = 1.79). Spatial presence had skewness of -.29 (SE = .15) and kurtosis of -.17 (SE = .30). Engagement had skewness of -.34 (SE = .15) and kurtosis of -.23 (SE = .30). Naturalness had skewness of .56 (SE = .15) and kurtosis of .42 (SE = .30). Negative effects had skewness of .65 (SE = .15) and kurtosis of -.53 (SE = .30). Unaided brand recall had skewness of 1.35 (SE = .15) and kurtosis of .36 (SE = .30). Aided recall had skewness of -1.52 (SE = .15) and kurtosis of .30 (SE = .30). Perceived product knowledge had skewness of 1.52 (SE = .15) and kurtosis of 2.21 (SE = .30). Ad attitude had skewness of -.60 (SE = .15) and kurtosis of .29 (SE = .30). Brand attitude had skewness of .26 (SE = .15) and kurtosis of .84 (SE = .30). Purchase

intention had skewness of .43 (*SE* = .15) and kurtosis of -.38 (*SE* = .30). Sharing intention had skewness of .04 (*SE* = .15) and kurtosis of -1.26 (*SE* = .30). Results are summarized in Appendix A.

Hypotheses 5-6: Main Effects of Modality Interactivity and Sensory Breadth on Presence

Hypothesis 5 predicted that an ad presented with modality interactivity would result in higher perceived presence than an ad presented without modality interactivity when controlling for brand familiarity. No significant main effects were found.

First, the main effect of modality interactivity on spatial presence was not significant, $F(1, 270) = .01$, $p = .92$, $\eta^2_{part} = .001$. Results also revealed the scores of modality interactivity condition ($M = 4.51$, $SD = 1.10$) and the no modality interactivity condition ($M = 4.51$, $SD = 1.10$). Next the main effect of the modality interactivity on engagement was also not significant, $F(1, 270) = .28$, $p = .60$, $\eta^2_{part} = .001$. Results also revealed the scores of the modality interactivity condition ($M = 4.46$, $SD = 1.00$) and the no modality interactivity condition ($M = 4.80$, $SD = 1.07$). The main effect of the modality interactivity on naturalness was not significant, $F(1, 270) = .129$, $p = .79$, $\eta^2_{part} = .001$. Results also revealed the scores of the modality interactivity condition ($M = 4.97$, $SD = 1.00$) and the no modality interactivity condition ($M = 4.97$, $SD = 1.11$). The main effect of the modality interactivity on negative effects dimension was also not significant, $F(1, 270) = .006$, $p = .94$, $\eta^2_{part} = .000$. Results also revealed the scores of the modality interactivity condition ($M = 3.19$, $SD = 1.54$) and the no modality interactivity condition ($M = 3.18$, $SD = 1.51$). Therefore, H5a-d not were supported. Results are summarized in Tables 31-35.

Next, hypotheses 6 predicted that an ad presented with higher sensory breadth would result in higher perceived presence than an ad presented with lower sensory breadth when controlling for brand familiarity. No significant main effects were found. First, the main effect of sensory breadth on spatial presence was not significant, $F(1, 270) = .003$, $p = .96$, $\eta^2_{part} = .000$. Results also revealed the scores of the high sensory breadth condition ($M = 4.52$, $SD = 1.06$) and the low sensory breadth condition ($M = 4.50$, $SD = 1.11$). Next the main effect of sensory breadth on engagement was also not significant, $F(1, 270) = .318$, $p = .57$, $\eta^2_{part} = .001$. Results also revealed the scores of the high sensory breadth condition ($M = 4.50$, $SD = 1.04$) and the low sensory breadth condition ($M = 4.42$, $SD = 1.10$). The main effect of sensory breadth on naturalness was not significant, $F(1, 270) = .239$, $p = .63$, $\eta^2_{part} = .001$. Results also revealed the scores of the low sensory breadth condition ($M = 4.99$, $SD = 1.09$) and the high sensory breadth condition ($M = 4.95$, $SD = 1.02$). The main effect of sensory breadth on negative effects dimension was also not significant, $F(1, 270) = .045$, $p = .83$, $\eta^2_{part} = .000$. Results also revealed the scores of high sensory breadth condition ($M = 3.19$, $SD = 1.51$) and the low sensory breadth condition ($M = 3.18$, $SD = 1.55$). Therefore, H6a-d were not supported. Results are summarized in Tables 31-35.

RQ1: Interaction Effect of Modality Interactivity and Sensory Breadth on Presence

Research question 1 was posed to find out whether and how modality interactivity and sensory breadth have an interaction effect on presence. ANCOVA found a significant interaction effect on spatial presence, $F(1, 270) = 3.38$, $p < .05$, $\eta^2_{part} = .013$. Results further revealed that in the low sensory breadth with modality

interactivity condition generated higher spatial presence (*M* = 4.62, *SD* = 1.12) than the high sensory breadth with modality interactivity condition (*M* = 4.42, *SD* = 1.09). Also, in the high sensory breadth without modality interactivity condition generated higher spatial presence (*M* = 4.62, *SD* = 1.03) than the low sensory breadth without modality interactivity condition (*M* = 4.40, *SD* = 1.10). See Table 31 and Figure 20.

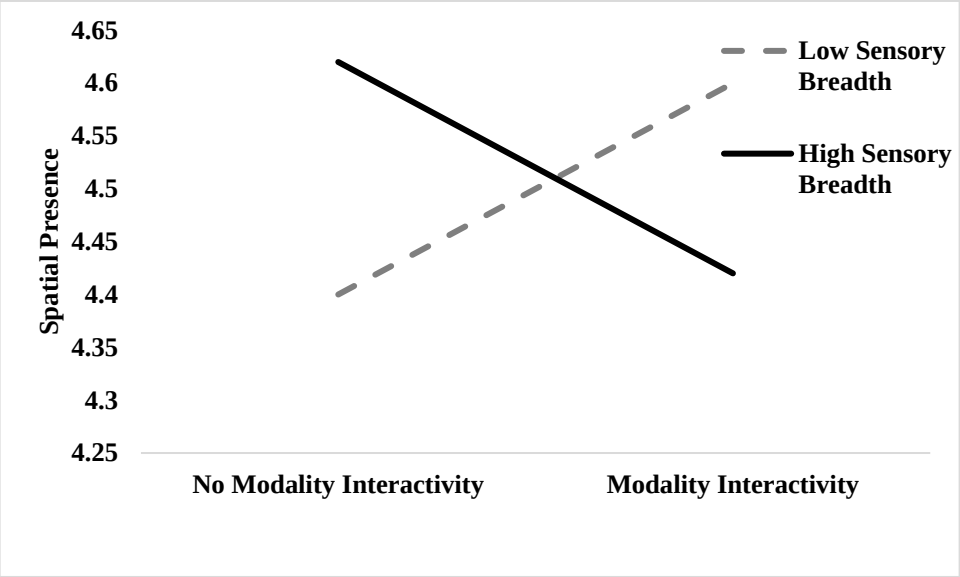

Figure 20. Interaction effect of modality interactivity and sensory breadth on spatial presence.

However, ANCOVA found a significant interaction on engagement, $F(1, 270) = 8.21$, $p < .01$, $\eta^2_{part} = .031$. Results further revealed that in the low sensory breadth with modality interactivity condition generated higher engagement (*M* = 4.58, *SD* = .99) than the high sensory breadth with modality interactivity condition (*M* = 4.37, *SD* = 1). Also, in the high sensory breadth without modality interactivity condition generated higher engagement (*M* = 4.65, *SD* = 1.05) than the low sensory breadth without modality interactivity condition (*M* = 4.28, *SD* = 1.16). Results are summarized in Table 32. See Figure 21.

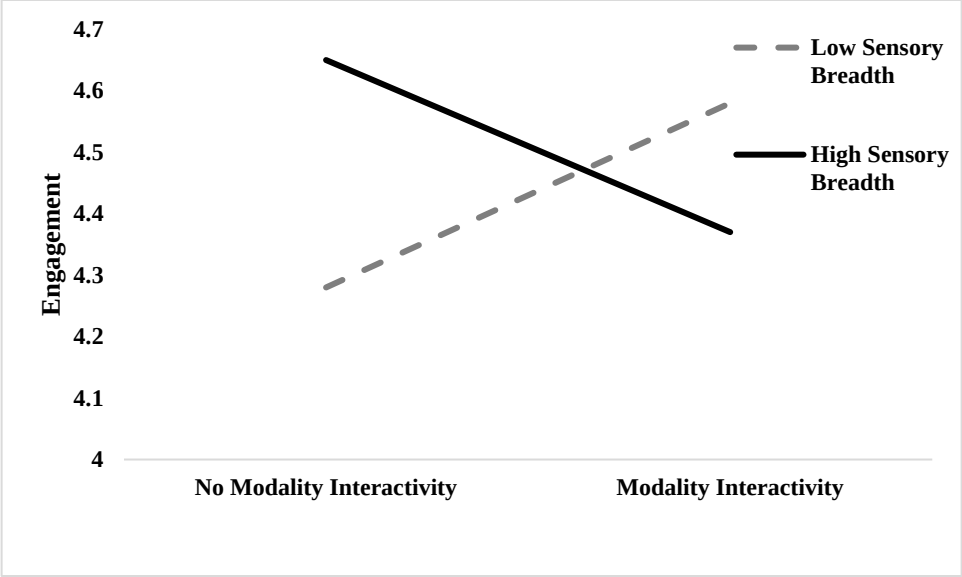

Figure 21. Interaction effect of modality interactivity and sensory breadth on engagement.

Hypothesis 7a-d: Effect of Immersive VR System Type on Presence

Hypothesis 7 predicted that an ad presented via the high immersive VR system results in a higher sense of presence than an ad presented via the low immersive VR system when controlling for brand familiarity. ANCOVA found significant main effects of interface type on all indicators of presence: spatial presence, engagement, ecological validity/naturalness, and negative effect.

First, the main effect of immersive VR system type on spatial presence was significant, $F(1, 270) = 19.03$, $p < .001$, $\eta^2_{part} = .07$. Results further revealed that the high immersive VR system generated higher spatial presence ($M = 4.80$, $SD = .95$) than the low immersive VR system ($M = 4.21$, $SD = 1.13$). Next, the main effect of immersive VR system type on engagement was significant, $F(1, 270) = 16.72$, $p < .001$, $\eta^2_{part} = .062$. Results further revealed that the high immersive VR system led to higher engagement ($M = 4.74$, $SD = .91$) than the low immersive VR system ($M = 4.17$, $SD = 1.13$). The main effect of interface type on ecological validity/naturalness was not

significant. Finally, the main effect of interface type on negative effects was significant, $F(1, 270) = 12.08$, $p < .01$, $\eta^2_{part} = .045$. Results further revealed that the high immersive VR system generated higher negative effects ($M = 3.49$, $SD = 1.59$) than the low immersive VR system ($M = 2.88$, $SD = 1.39$). Therefore, H7a, H7b, and H7d were supported, while H7c was not. Results are summarized in Tables 31-35.

Hypothesis 8a-c: Effect of Immersive VR System Type on Recall and Product Knowledge

Hypothesis 8 predicted that an ad presented via high immersive VR system results in higher unaided recall (H8a), aided recall (H8b), and higher perceived product knowledge (H8c) than an ad presented via low immersive VR system when controlling for brand familiarity. No significant main effects were found.

First, the main effect of immersive VR system type on unaided recall was not significant, $F(1, 270) = .293$, $p = .59$, $\eta^2_{part} = .001$. Results also revealed the scores of the high immersive VR system ($M = 1.42$, $SD = .66$) and the low immersive VR system ($M = 1.43$, $SD = .74$). Next, the main effect of immersive VR system type on aided recall was not significant, $F(1, 270) = .04$, $p = .84$, $\eta^2_{part} = .000$. Results also revealed the scores of the high immersive VR system ($M = .79$, $SD = .41$) and the low immersive VR system ($M = .81$, $SD = .39$). Next, the main effect of immersive VR system type on perceived product knowledge was not significant, $F(1, 270) = .542$, $p = .46$, $\eta^2_{part} = .002$. Results also revealed the scores of the high immersive VR system ($M = 2.30$, $SD = 1.33$) and the low immersive VR system ($M = 2.32$, $SD = 1.43$). Therefore, H8a-c were not supported. Results are summarized in Tables 36-38.

Hypothesis 9a-d: Effect of Immersive VR System Type on Attitudes and Intentions

Hypothesis 9 predicted that an ad presented via the high immersive VR system results in more favorable ad attitude (H9a), more favorable brand attitude (H9b), higher purchase intention (H9c), and higher sharing intention (H9d) than an ad presented via low immersive VR system.

ANCOVA found a main effect (with approached statistical significance) of system type on ad attitude, $F(1, 270) = 3.04$, $p = .083$, $\eta^2_{part} = .012$. Results further revealed that the high immersive VR system generated more favorable ad attitude ($M = 5.32$, $SD = 1.04$) than the low immersive VR system ($M = 4.97$, $SD = 1.26$). But, no significant main effect of system type on brand attitude was found, $F(1, 270) = .345$, $p > .05$, $\eta^2_{part} = .001$. Results also revealed the scores of the VR system ($M = 4.62$, $SD = 1.0$) and low immersive VR system ($M = 4.46$, $SD = .99$).

Next, ANCOVA found a main effect (with approached statistical significance) of interface type on purchase intention, $F(1, 270) = 2.91$, $p = .089$, $\eta^2_{part} = .011$. Results further revealed that the high immersive VR system generated higher purchase intention ($M = 3.14$, $SD = 1.32$) than the low immersive VR system ($M = 2.75$, $SD = 1.33$). Finally, a significant main effect of interface type on sharing intention was found, $F(1, 270) = 7.78$, $p < .01$, $\eta^2_{part} = .03$. Results further revealed that the high immersive VR system generated higher sharing intention ($M = 3.97$, $SD = 1.73$) than the low immersive system ($M = 3.27$, $SD = 1.79$). Therefore, only H9d was supported. Results are summarized in Tables 39-42.

RQ2: Interaction of Modality Interactivity and Immersive VR System Type

Presence

ANCOVA found an interaction effect (with approached statistical significance) of modality interactivity and immersive VR system on spatial presence, $F(1, 270) = 3.34$, $p = .069$, $\eta^2_{part} = .013$. Results further revealed that participants in the high immersive VR system with modality interactivity condition perceived higher spatial presence ($M = 4.91$, $SD = .94$) than the participants in the high immersive VR system without modality interactivity condition ($M = 4.70$, $SD = .96$). On the other hand, participants in the low immersive VR system without modality interactivity condition perceived higher spatial presence ($M = 4.30$, $SD = 1.15$) than the participants in the low immersive VR system with modality interactivity condition ($M = 4.12$, $SD = 1.11$). Results are summarized in Table 31. See Figure 22.

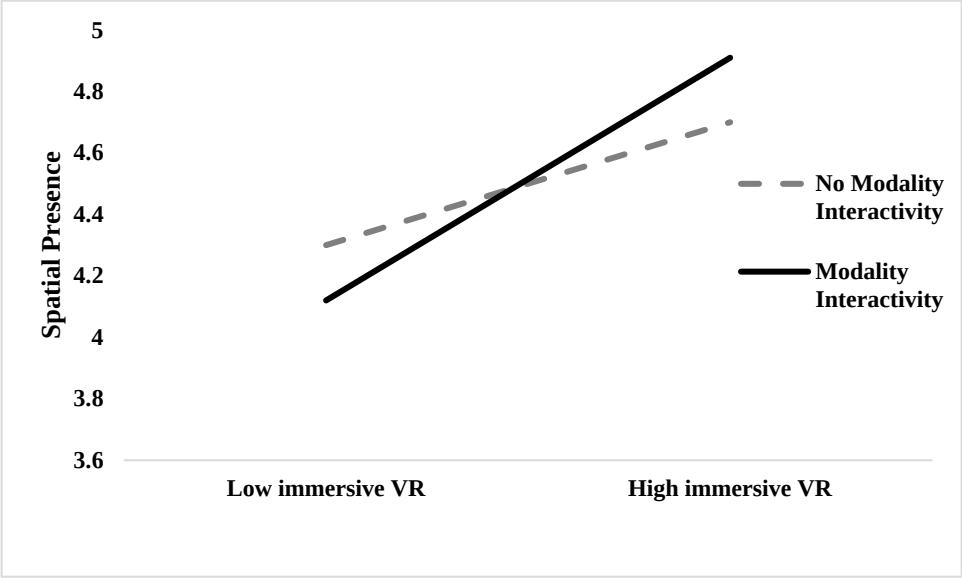

Figure 22. Interaction of modality interactivity and immersive VR on spatial presence

ANCOVA also found a significant interaction effect of modality interactivity and immersive VR system type on negative effect, $F(1, 270) = 7.01$, $p < .01$, $\eta^2_{part} = .027$. Results further revealed that participants in the high immersive VR system with modality interactivity condition perceived higher spatial presence ($M = 3.77$, $SD = 1.64$) than the participants in the high immersive VR system the no modality interactivity condition ($M = 3.22$, $SD = 1.51$). On the other hand, participants in the low immersive VR system without modality interactivity condition perceived higher spatial presence ($M = 3.14$, $SD = 1.53$) than the participants in the low immersive VR system with modality interactivity condition ($M = 2.66$, $SD = 1.18$). See Figure 23. Results are summarized in Table 35.

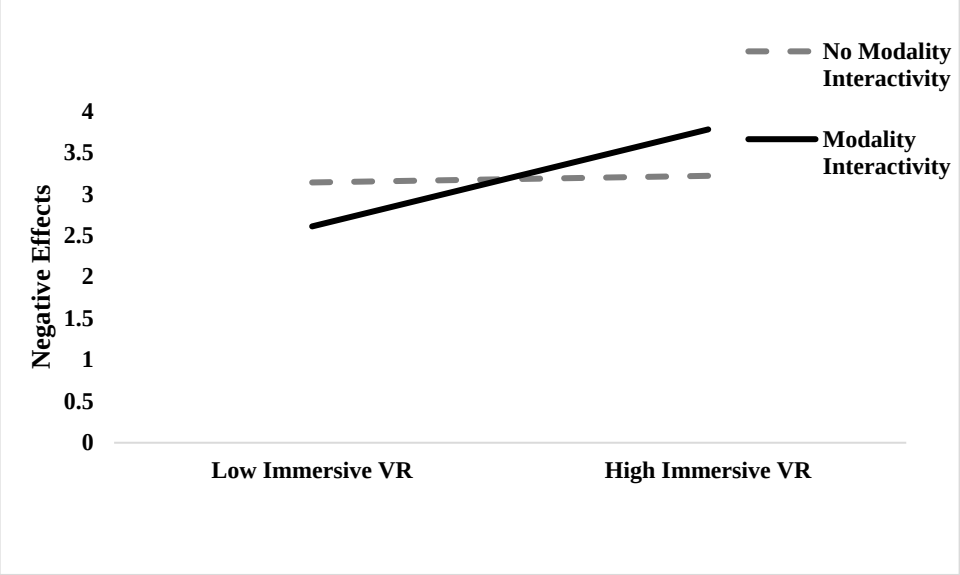

Figure 23. Interaction effect of modality interactivity and immersive VR system on negative effect.

Recall, perceived product knowledge, attitudes and intentions

ANCOVA found no significant interaction of modality interactivity and immersive VR system on recall, product knowledge, attitudes, and intentions. However, there was an interaction of modality interactivity and immersive VR system (with

approached statistical significance) on aided recall, $F(1, 270) = 2.93$, $p = .088$, $\eta^2_{part} = .01$. Results further revealed that participants in the high immersive VR system without modality interactivity condition had higher aided recall ($M = 0.82$, $SD = .39$) than the participants in the high immersive VR system with modality interactivity condition ($M = .76$, $SD = .432$). On the other hand, participants in the low immersive VR system with modality interactivity condition had higher aided recall ($M = .85$, $SD = .36$) than the participants in the low immersive VR system without modality interactivity condition ($M = .78$, $SD = .42$). See Figure 24. Results are summarized in Table 36-40.

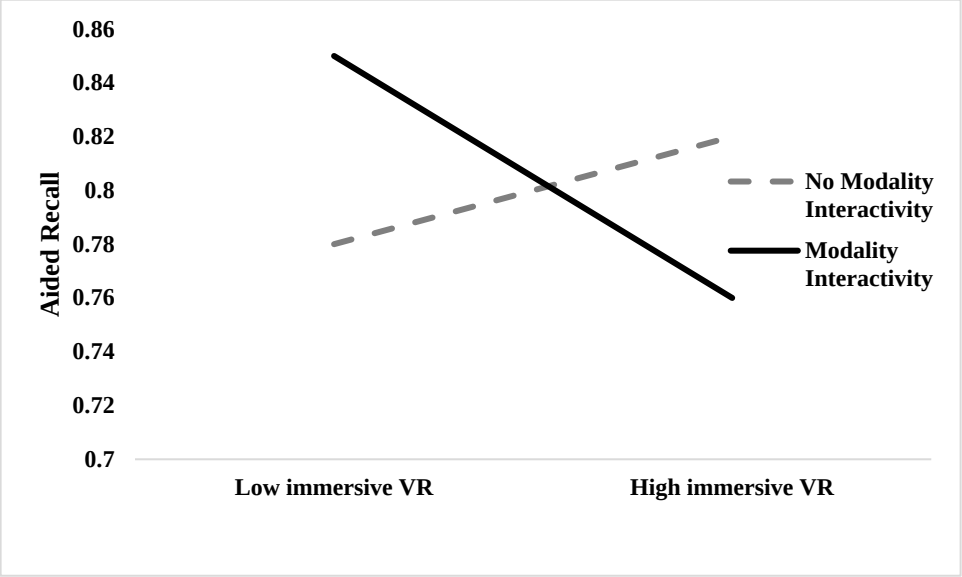

*Figure 24***.** Interaction effect of modality interactivity and immersive VR system on aided recall.

RQ3: Interaction of Sensory Breadth and Immersive VR

ANCOVA found no significant interaction effect of sensory breadth and immersive VR system on presence, recall, product knowledge, attitudes, and intentions. Therefore, H13 and H14 were not supported.

RQ4: Three-way Interaction

A research question was posed to find out whether there was a three-way (immersive VR type X modality interactivity X sensory breadth) interaction on (a) presence, (b) brand recall, (c) product knowledge, (d) ad attitude, (e) brand attitude, (f) purchase intention, and (g) sharing intention. ANCOVA found a significant three-way interaction only on recall, $F(1, 270) = 4.03$, $p < .05$, $\eta^2_{part} = .016$. Results further revealed that in the case of low immersive VR, low sensory breadth (with modality interactivity) created higher recall ($M = .88$, $SD = .34$) than high sensory breadth condition ($M = .81$, $SD = .39$). Also, in the case of low immersive VR, high sensory breadth (with no modality interactivity) created higher recall than was there ($M = .79$, $SD = .42$) than low sensory breadth ($M = .76$, $SD = .43$). See Figure 25.

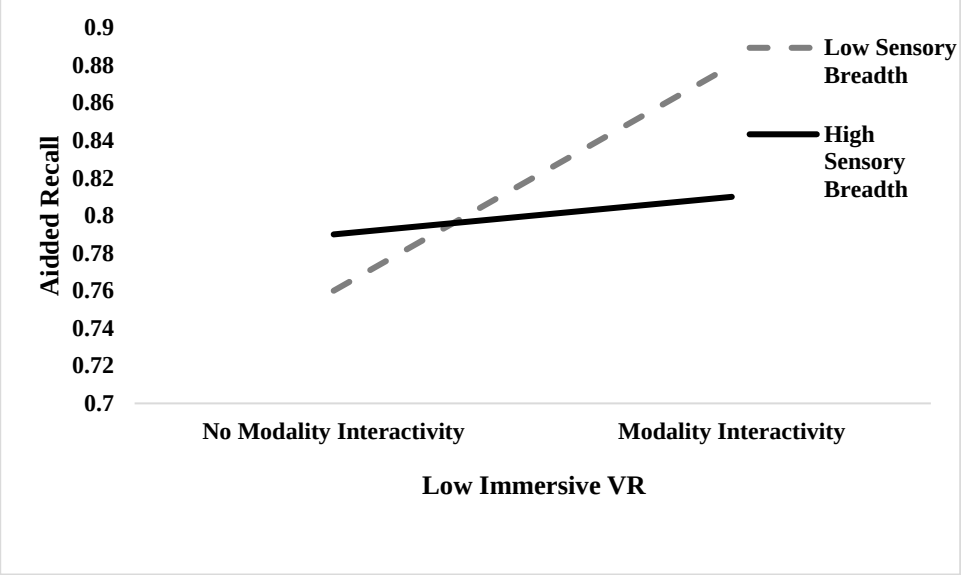

Figure 25. Interaction effect of modality interactivity and sensory breadth on aided recall under low immersive VR system.

On the other hand, results further revealed that in the case of high immersive VR, high sensory breadth (with modality interactivity) created higher recall ($M = .83$, $SD = .38$) than low sensory breadth condition ($M = .67$, $SD = .48$). Also, in the case of

high immersive VR, low sensory breadth (with no modality interactivity) created higher recall than was there (M = .87, SD = .34) than high sensory breadth (M = .76, SD = .43). See Figure 26. Results are summarized in Table 38.

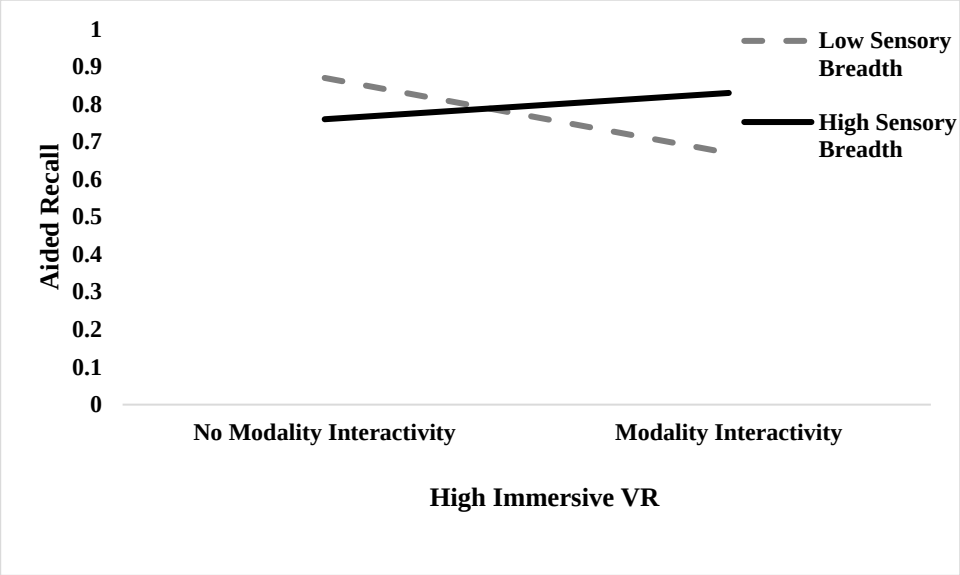

Figure 26. Interaction effect of modality interactivity and sensory breadth on aided recall. under high immersive VR system.

Hypotheses 10-11: Effects of Perceived Media Novelty

Main effects of perceived media novelty

Although the main effects of perceived novelty were not hypothesized, the study found that perceived novelty positively affected presence – (a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects. All the main effects were significant, except for negative effects. ANCOVA found significant main effect of novelty on spatial presence ($F(1, 270) = 30.45$, $p < .001$, $\eta^2_{part} = .107$), engagement ($F(1, 270) = 57.04$, $p < .001$, $\eta^2_{part} = .183$), and naturalness ($F(1, 270) = 15.92$, $p < .001$, $\eta^2_{part} = .059$). Results further revealed that participants who perceived high novelty felt higher spatial presence (M = 4.87, SD = .92), engagement (M = 4.9, SD = .87), and naturalness (M = 5.22, SD = .88) than the participants who perceived low novelty

(respectively (M = 4.13, SD = 1.11), (M = 3.4, SD = 1.1), and (M = 4.7, SD = 1.2). However, ANCOVA found no significant main effect of novelty on the negative effects dimensions of presence, $F(1, 270) = .247$, $p > .05$, $\eta^2_{part} = .001$). Results also revealed the scores of the high perceived media novelty condition (M = 3.17, SD =1.50) and the low perceived media novelty condition (M = 3.20, SD = 1.55).

Next, ANCOVA found no significant main effect of novelty on cognitive responses: unaided recall ($F(1, 270) = .48$, $p = .49$, $\eta^2_{part} = .002$), aided recall ($F(1, 270) = .70$, $p = .42$, $\eta^2_{part} = .003$) and perceived product knowledge ($F(1, 270) = .002$, $p = .97$, $\eta^2_{part} = .000$). Results also revealed the scores of the high perceived media novelty condition for unaided recall (M = 1.46, SD = .71), aided recall (M = .82, SD = .39), and perceived product knowledge (M = 2.28, SD = 1.35). Results also revealed the scores of the low perceived media novelty condition for unaided recall (M = 1.39, SD = .70), aided recall (M = .78, SD = .42), and perceived product knowledge (M = 2.30, SD = 1.41).

The study also found significant main effect of perceived novelty on attitudes and intention. ANCOVA found significant main effect of novelty on ad attitude ($F(1, 270) = 30.43$, $p < .001$, $\eta^2_{part} = .107$), brand attitude ($F(1, 270) = 14.26$, $p < .001$, $\eta^2_{part} = .053$), purchase intention ($F(1, 270) = 8.08$, $p < .01$, $\eta^2_{part} = .031$), and sharing intentions ($F(1, 270) = 27.79$, $p < .001$, $\eta^2_{part} = .099$). Results further revealed that participants who perceived high novelty had more favorable ad attitude (M = 5.5, SD = 1), brand attitude (M = 4.77, SD = 1.02), purchase intention (M = 3.18, SD = 1.4), and sharing intentions (M = 4.19, SD = 1.7) than the participants who perceived low novelty

(respectively (M = 4.7, SD = 1.2), (M = 4.31, SD = .90), (M = 2.69, SD = 1.23), and (M = 3.02, SD = 1.7). Results are summarized in Tables 31-40.

Moderating effects of perceived media novelty

However, the study mainly focused on how perceived novelty moderated the effects of immersive VR system types on participants' responses. Hypotheses 10a-c focused on finding out how participants' perceived novelty moderates the effect of interface type on unaided recall, aided recall, and perceived product knowledge when controlling for brand familiarity. ANCOVA found no such significant moderating effect on cognitive responses.

Hypotheses 11a-d focused on finding out how participants' perceived novelty moderates the effect of interface type on ad attitude, brand attitude, purchase intention and sharing intention when controlling for brand familiarity. A significant interaction of perceived novelty and interface was found on ad attitude (H11a), $F(1, 270) = 7.85$, $p < .01$, $\eta^2_{part} = .03$. Results further revealed that when participants perceived high novelty, both high (M = 5.52, SD = .10) and low immersive VR system (M = 5.53, SD = .10) generated almost similar score in ad attitude. But, when participants perceived low novelty, high immersive VR system generated more favorable ad attitude (M = 5.08, SD = 1.0) than low immersive VR system (M = 4.50, SD = 1.2). So, H11a-i and H11a-ii were supported. See Figure 27. Results are summarized in Table 36.

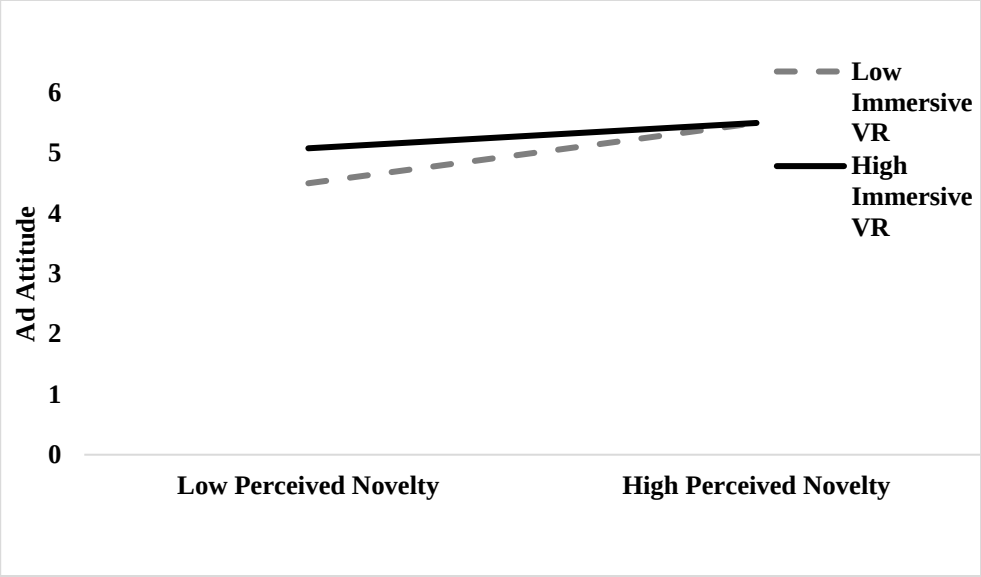

Figure 27. Moderating effect of perceived novelty on the relationship between immersive VR type and ad attitude.

Another significant interaction of perceived novelty and interface was found on sharing intention, $F(1, 270) = 4.74$, $p < .05$, $\eta^2_{part} = .018$. Results further revealed that when participants perceived high novelty, both high ($M = 4.28$, $SD = 1.69$) and low immersive VR system ($M = 4.1$, $SD = 1.72$) generated almost similar score for sharing intention. But, when participants perceived low novelty, high immersive VR system generated more favorable ad attitude ($M = 3.55$, $SD = 1.70$) than low immersive VR system ($M = 2.58$, $SD = 1.55$). So, H11d-i was supported See Figure 28. Results are summarized in Table 40.

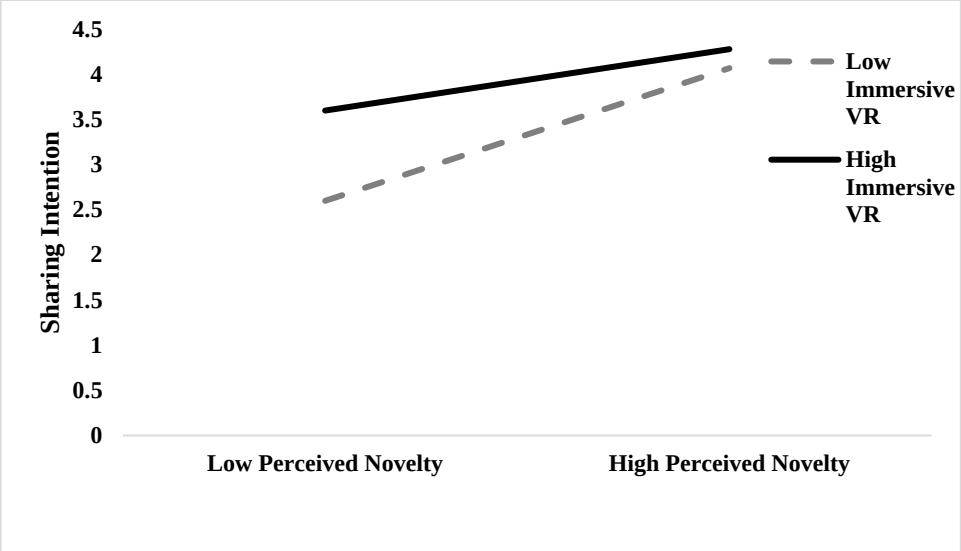

Figure 28. Moderating effect of perceived novelty on the relationship between immersive VR type and sharing intention.

RQ 5: Interactions between Modality Interactivity and Sensory Breadth on Presence - Moderated by Perceived Novelty

Research question 5 was posed to find out whether and how participants' perceived novelty moderated the interactions between modality interactivity and sensory breadth on presence when controlling for brand familiarity. ANCOVA found two significant interactions. A significant three-way interaction was found among perceived novelty, modality interactivity and sensory breadth on spatial presence, $F(1, 270) = 5.81$, $p < .05$, $\eta^2_{part} = .022$. Results further revealed that when participants perceived low novelty in a condition with modality interactivity and low sensory breadth, they perceived higher spatial presence ($M = 4.26$, $SD = 1.1$) than in a condition with modality interactivity and high sensory breadth ($M = 4.01$, $SD = 1.1$). Also, when participants perceived low novelty in a condition without modality interactivity and high sensory breadth, they perceived higher spatial presence ($M = 4.49$, $SD = .94$) than

in a condition without modality interactivity and low sensory breadth (*M* = 3.77, *SD* = .98). See Figure 29. Results are summarized in Table 31.

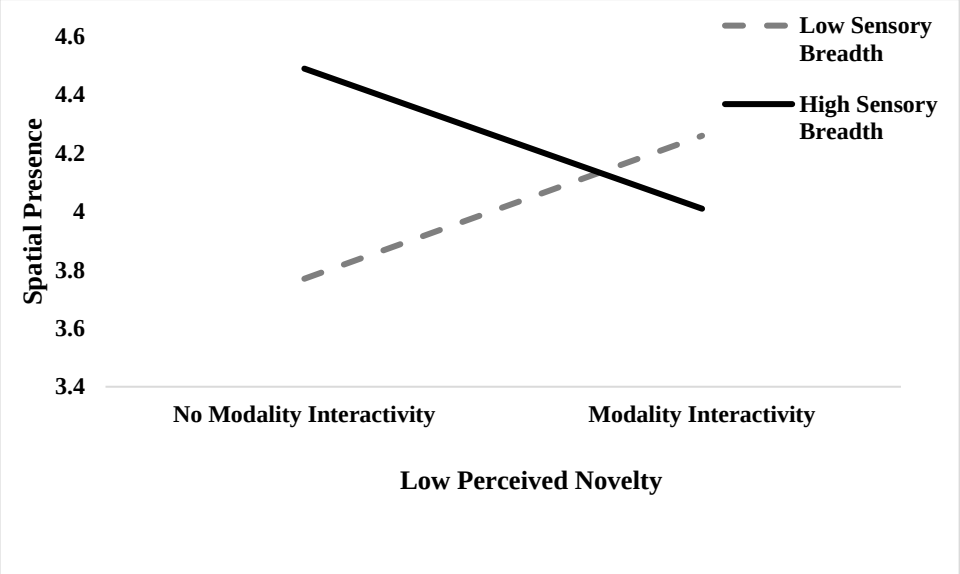

Figure 29. Interaction among perceived novelty, modality interactivity and sensory breadth on spatial presence under low perceived novelty condition.

On the other hand, results further revealed that when participants perceived high novelty in a condition with modality interactivity and low sensory breadth, they perceived higher spatial presence (*M* = 4.9, *SD* = 1.1) than in a condition with modality interactivity and high sensory breadth (*M* = 4.76, *SD* = 1.1). Also, when participants perceived high novelty in a condition without modality interactivity and low sensory breadth, they perceived lower spatial presence (*M* = 5.04, *SD* = .83) than in a condition without modality interactivity and low sensory breadth (*M* = 4.79, *SD* = .67). See Figure 30. Results are summarized in Table 31.

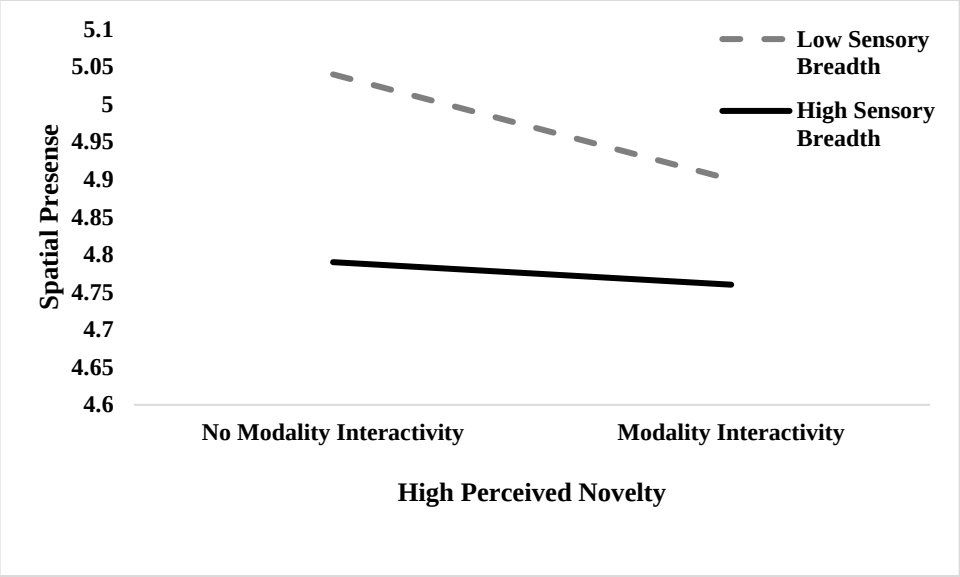

Figure 30. Interaction among perceived novelty, modality interactivity and sensory breadth on spatial presence under high perceived novelty condition.

In response to research question 5, ANCOVA found another significant three-way interaction among perceived novelty, modality interactivity and sensory breadth on engagement, $F(1, 270) = 4.30$, $p < .05$, $\eta^2_{part} = .017$. Results further revealed that in the case of modality interactivity and low sensory breadth condition, participants who perceived high novelty perceived higher engagement ($M = 4.11$, $SD = .91$) than the participants who perceived high novelty in the case of modality interactivity and high sensory breadth condition participants ($M = 3.83$, $SD = .88$). Also, in the case of without modality interactivity and high sensory breadth condition, participants who perceived low novelty had higher engagement ($M = 4.4$, $SD = 1$) than the participants who perceived low novelty in the case of modality interactivity and high sensory breadth condition participants ($M = 3.63$, $SD = 1$). Results are summarized in Table 32. See figure 31.

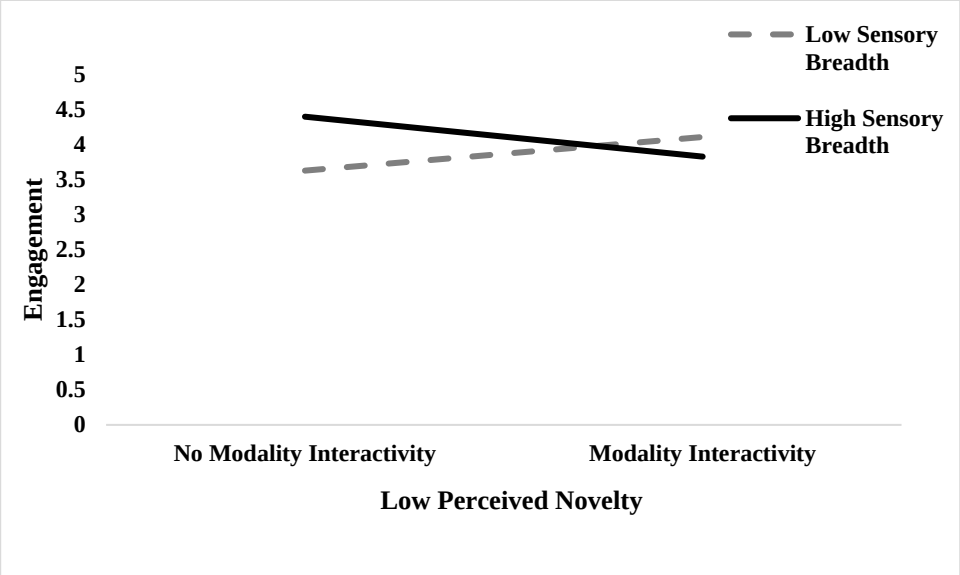

Figure 31. Interaction among perceived novelty, modality interactivity and sensory breadth on engagement under low perceived novelty condition.

On the other hand, in the case of no modality interactivity and low sensory breadth condition, participants who perceived high novelty perceived higher engagement (M = 4.92, SD = .86) than the participants who perceived high novelty in the case of without modality interactivity and high sensory breadth condition participants (M = 4.96, SD = .87). Also, in the case of without modality interactivity and high sensory breadth condition, participants who perceived high novelty felt higher engagement (M = 4.94, SD = .91) than the participants who perceived high novelty in the case of without modality interactivity and low vividness condition participants (M = 4.8, SD = .89). Results are summarized in Table 32. See figure 32.

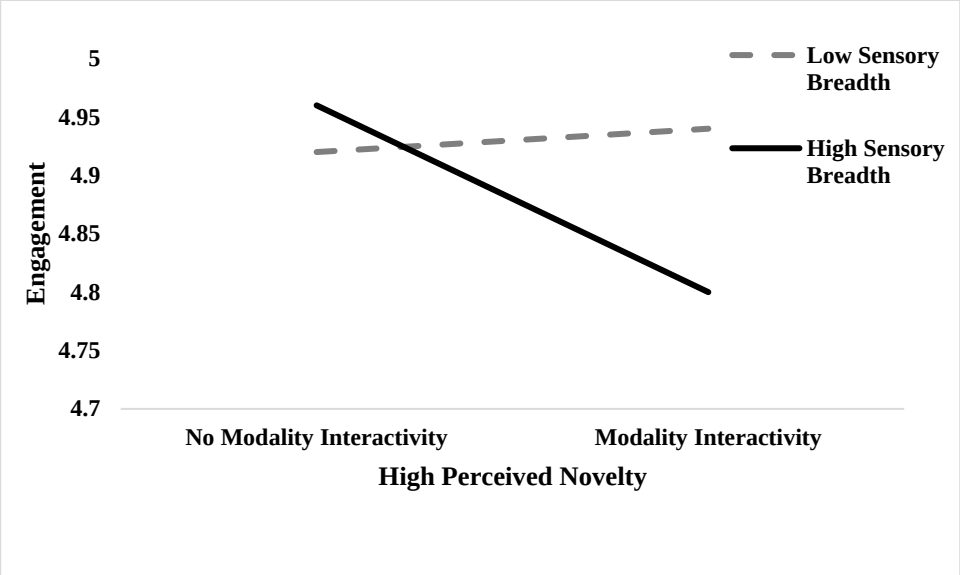

Figure 32. Interaction among perceived novelty, modality interactivity and sensory breadth on engagement under high perceived novelty condition.

ANCOVA found another three-way interaction among perceived novelty, modality interactivity and sensory breadth on negative effects, $F(1, 270) = 3.47$, $p = .064$, $\eta^2_{part} = .013$. But the result achieved only approached significance. Results further revealed that in the case of low perceived novelty, modality interactivity condition was more effective in creating negative effects when the sensory breadth was higher ($M = 3.33$, $SD = 1.43$) than lower ($M = 2.72$, $SD = 1.25$). Also, in the case of low perceived novelty, without modality interactivity condition was more effective in creating negative effects when the sensory breadth was lower ($M = 3.35$, $SD = 1.86$) than higher ($M = 3.16$, $SD = 1.5$). Results are summarized in Table 34. See figure 33.

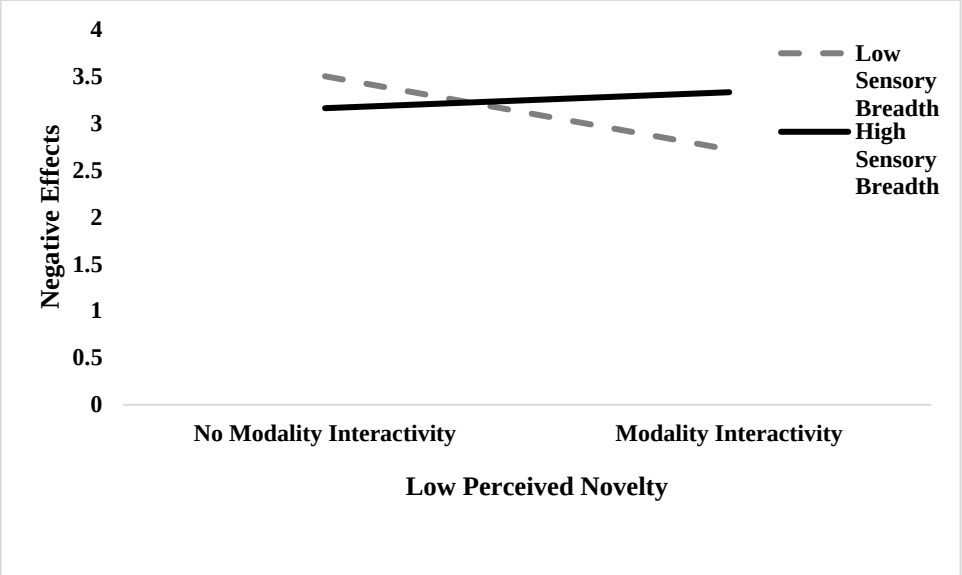

Figure 33. Interaction among perceived novelty, modality interactivity and sensory breadth on negative effects under high perceived novelty condition.

Results also revealed that in the case of high perceived novelty, modality interactivity condition was more effective in creating negative effects when the sensory breadth was lower (M = 3.44, SD = 1.61) than higher (M = 3.18, SD = 1.73). Also, in the case of high perceived novelty, no modality interactivity condition was more effective in creating negative effects when the sensory breadth was higher (M = 3.09, SD = 1.36) than lower (M = 2.96, SD = 1.25). See figure 34.

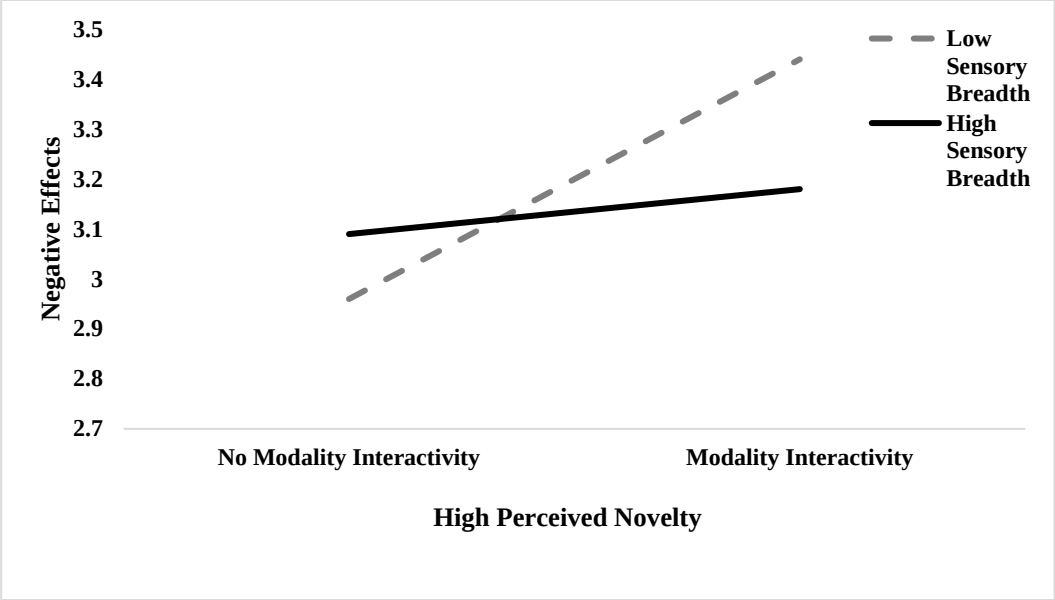

Figure 34. Interaction among perceived novelty, modality interactivity and sensory breadth on negative effects under high perceived novelty condition.

RQ 6: Perceived Novelty - Moderating Two-way interaction effects

Research question 6 was posed to find out whether and how participants' perceived novelty moderates the interaction effect of (i) interface and modality interactivity, and (ii) interface and sensory breadth on cognitions, attitude and intentions ANCOVA found that perceived novelty significantly moderated the interaction between interface type and sensory breadth on brand attitude, $F(1, 270) = 8.11$, $p < .0\ 1$, $\eta^2_{part} = .031$. Results further revealed that participants who perceived high novelty in the low immersive VR system with low sensory breadth had more favorable brand attitude ($M = 4.86$, $SD = 1.2$) than participants who perceived high novelty in the low immersive VR system with high sensory breadth ($M = 4.44$, $SD = .78$). Also, who perceived low novelty in the low immersive VR system with high sensory breadth had more favorable brand attitude ($M = 4.67$, $SD = .85$) than participants who perceived low novelty in the

low immersive VR system with low sensory breadth (*M* = 4.13, *SD* = .97). See Figure 35. Results are summarized in Table 37.

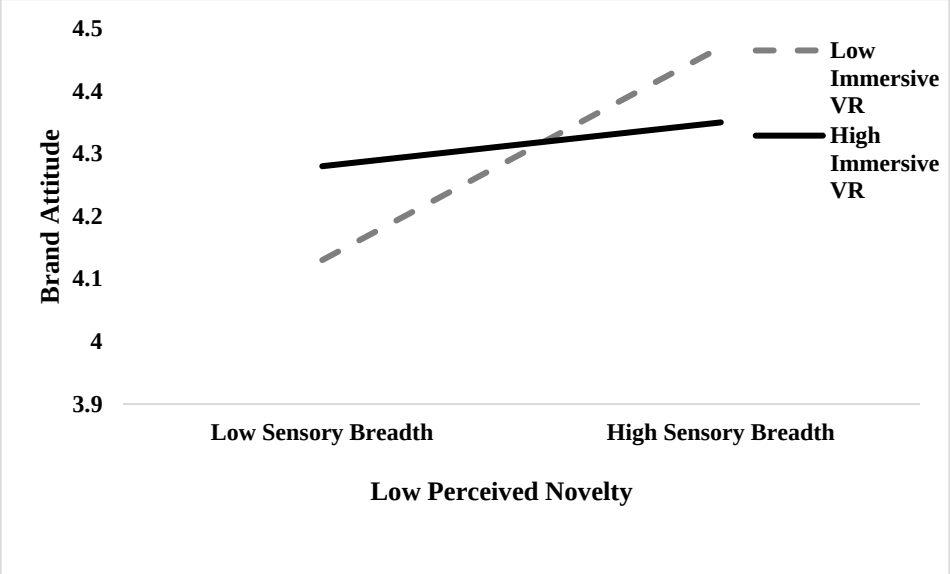

Figure 35. Interaction between interface type and sensory breadth on brand attitude under low perceived novelty.

On the other hand, participants who perceived high novelty in the high immersive VR system with high sensory breadth had more favorable brand attitude (*M* = 5.1, *SD* = .97) than participants who perceived high novelty in the high immersive VR system with low sensory breadth (*M* = 4.85, *SD* = 1.02). Also, who perceived low novelty in the high immersive VR system with high sensory breadth had more favorable brand attitude (*M* = 4.35, *SD* = .74) than participants who perceived low novelty in the high immersive VR system with low sensory breadth (*M* = 4.28, *SD* = 1.04). See Figure 36. Results are summarized in Table 37.

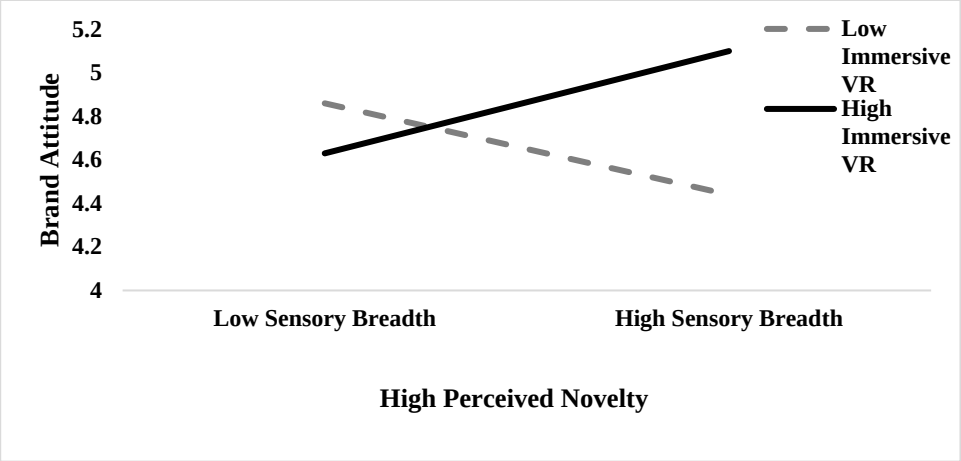

Figure 36. Interaction between interface type and sensory breadth on brand attitude under high perceived novelty.

Table 31. *ANCOVA Summary Table for Spatial Presence*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.149	.155	.694	.001
Immersive VR type	1	18.275	19.034	.000	.070
Modality Interactivity	1	.010	.010	.921	.000
Sensory Breadth	1	.003	.003	.956	.000
Perceived Novelty	1	29.239	30.452	.000	.107
Interface * Modality Interactivity	1	3.207	3.340	.069	.013
Interface * Sensory Breadth	1	1.190	1.240	.267	.005
Interface * Perceived Novelty	1	1.110	1.156	.283	.005
Modality Interactivity * Sensory Breadth	1	3.839	3.998	.047	.015
Modality Interactivity * Perceived Novelty	1	.546	.569	.451	.002
Sensory Breadth * Perceived Novelty	1	1.789	1.863	.173	.007
Interface * Modality Interactivity * Sensory Breadth	1	.033	.034	.853	.000
Interface * Modality Interactivity * Perceived Novelty	1	.024	.025	.874	.000
Interface * Sensory Breadth * Perceived Novelty	1	.629	.655	.419	.003

Modality Interactivity * Sensory Breadth * Perceived Novelty	1	5.578	5.810	.017	.022
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.009	.009	.923	.000
Error	254	.960			
Total	271				
Corrected Total	270				

Note. R^2 = .232 ($R^2_{Adjusted}$ = .183).
$^{*}p < .05$

Table 32. *ANCOVA Summary Table for Engagement*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.681	.799	.372	.003
Immersive VR type	1	14.265	16.722	.000	.062
Modality Interactivity	1	.236	.277	.599	.001
Sensory Breadth	1	.271	.318	.573	.001
Perceived Novelty	1	48.662	57.043	.000	.183
Interface * Modality Interactivity	1	.040	.046	.830	.000
Interface * Sensory Breadth	1	.563	.660	.417	.003
Interface * Perceived Novelty	1	2.335	2.737	.099	.011
Modality Interactivity * Sensory Breadth	1	7.007	8.214	.005	.031
Modality Interactivity * Perceived Novelty	1	.032	.037	.847	.000
Sensory Breadth * Perceived Novelty	1	1.071	1.255	.264	.005
Interface * Modality Interactivity * Sensory Breadth	1	.003	.003	.954	.000
Interface * Modality Interactivity * Perceived Novelty	1	.120	.140	.708	.001
Interface * Sensory Breadth * Perceived Novelty	1	.698	.818	.366	.003
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	3.665	4.297	.039	.017
Interface * Modality Interactivity * Sensory	1	.409	.480	.489	.002

Breadth * Perceived Novelty					
Error	254	.853			
Total	271				
Corrected Total	270				

Note. R^2 = .290 ($R^2_{Adjusted}$ = .246).
$^{*}p < .05$

Table 33. *ANCOVA Summary Table for Naturalness*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	.819	.769	.381	.003
Immersive VR type	1	2.751	2.584	.109	.010
Modality Interactivity	1	.137	.129	.720	.001
Sensory Breadth	1	.255	.239	.625	.001
Perceived Novelty	1	16.948	15.918	.000	.059
Interface * Modality Interactivity	1	.035	.033	.856	.000
Interface * Sensory Breadth	1	1.238	1.163	.282	.005
Interface * Perceived Novelty	1	2.197	2.063	.152	.008
Modality Interactivity * Sensory Breadth	1	1.231	1.156	.283	.005
Modality Interactivity * Perceived Novelty	1	.502	.472	.493	.002
Sensory Breadth * Perceived Novelty	1	.031	.029	.864	.000
Interface * Modality Interactivity * Sensory Breadth	1	.641	.602	.439	.002
Interface * Modality Interactivity * Perceived Novelty	1	.342	.321	.571	.001
Interface * Sensory Breadth * Perceived Novelty	1	.244	.229	.633	.001
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	1.428	1.341	.248	.005
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.568	.534	.466	.002
Error	254	1.065			
Total	271				
Corrected Total	270				

Note. R^2 = .102 ($R^2_{Adjusted}$ = .045).
$^{*}p < .05$

Table 34. *ANCOVA Summary Table for Unaided Recall*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	1.344	2.792	.096	.011
Immersive VR type	1	.141	.293	.589	.001
Modality Interactivity	1	1.719	3.571	.060	.014
Sensory Breadth	1	.002	.004	.948	.000
Perceived Novelty	1	.229	.476	.491	.002
Interface * Modality Interactivity	1	.012	.026	.873	.000
Interface * Sensory Breadth	1	.303	.629	.428	.002
Interface * Perceived Novelty	1	.175	.363	.547	.001
Modality Interactivity * Sensory Breadth	1	2.191	4.552	.034	.018
Modality Interactivity * Perceived Novelty	1	.291	.605	.437	.002
Sensory Breadth * Perceived Novelty	1	.317	.659	.418	.003
Interface * Modality Interactivity * Sensory Breadth	1	.144	.300	.585	.001
Interface * Modality Interactivity * Perceived Novelty	1	.196	.407	.524	.002
Interface * Sensory Breadth * Perceived Novelty	1	.535	1.112	.293	.004
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.047	.098	.755	.000
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	1.224	2.543	.112	.010
Error	254	.481			
Total	271				
Corrected Total	270				

Note. R^2 = .075 ($R^2_{Adjusted}$ = .017).
$^{*}p < .05$

Table 35. *ANCOVA Summary Table for Aided Recall*

Source	*df*	*MS*	*F*	*p*	η^2_{part}

Brand Familiarity	1	.932	5.873	.016	.023
Immersive VR type	1	.006	.040	.842	.000
Modality Interactivity	1	.017	.106	.745	.000
Sensory Breadth	1	.022	.137	.712	.001
Perceived Novelty	1	.111	.697	.405	.003
Interface * Modality Interactivity	1	.465	2.931	.088	.011
Interface * Sensory Breadth	1	.074	.466	.495	.002
Interface * Perceived Novelty	1	.179	1.128	.289	.004
Modality Interactivity * Sensory Breadth	1	.106	.669	.414	.003
Modality Interactivity * Perceived Novelty	1	.003	.021	.886	.000
Sensory Breadth * Perceived Novelty	1	.207	1.308	.254	.005
Interface * Modality Interactivity * Sensory Breadth	1	.639	4.030	.046	.016
Interface * Modality Interactivity * Perceived Novelty	1	.067	.420	.518	.002
Interface * Sensory Breadth * Perceived Novelty	1	.002	.014	.904	.000
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.501	3.157	.077	.012
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.012	.078	.780	.000
Error	254	.159			
Total	271				
Corrected Total	270				

Note. R^2 = .068 ($R^2_{Adjusted}$ = .009).
$^{*}p < .05$

Table 36. *ANCOVA Summary Table for Product Knowledge*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	9.885	5.140	.024	.020
Immersive VR type	1	1.042	.542	.462	.002
Modality Interactivity	1	.463	.241	.624	.001
Sensory Breadth	1	6.648	3.456	.064	.013
Perceived Novelty	1	.004	.002	.965	.000

Interface * Modality Interactivity	1	.091	.047	.828	.000
Interface * Sensory Breadth	1	.946	.492	.484	.002
Interface * Perceived Novelty	1	.648	.337	.562	.001
Modality Interactivity * Sensory Breadth	1	.834	.434	.511	.002
Modality Interactivity * Perceived Novelty	1	.524	.272	.602	.001
Sensory Breadth * Perceived Novelty	1	1.289	.670	.414	.003
Interface * Modality Interactivity * Sensory Breadth	1	.066	.034	.853	.000
Interface * Modality Interactivity * Perceived Novelty	1	.697	.362	.548	.001
Interface * Sensory Breadth * Perceived Novelty	1	.355	.185	.668	.001
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.106	.055	.814	.000
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.069	.036	.850	.000
Error	254	1.923			
Total	271				
Corrected Total	270				

Note. R^2 = .047 ($R^2_{Adjusted}$ = .013).
$^{*}p < .05$

Table 37. *ANCOVA Summary Table for Ad Attitude*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	10.066	8.845	.003	.034
Immersive VR type	1	3.456	3.037	.083	.012
Modality Interactivity	1	.714	.627	.429	.002
Sensory Breadth	1	.299	.263	.609	.001
Perceived Novelty	1	34.630	30.429	.000	.107
Interface * Modality Interactivity	1	.707	.621	.431	.002
Interface * Sensory Breadth	1	.409	.359	.549	.001

Interface * Perceived Novelty	1	8.928	7.845	.005	.030
Modality Interactivity * Sensory Breadth	1	.739	.649	.421	.003
Modality Interactivity * Perceived Novelty	1	.994	.873	.351	.003
Sensory Breadth * Perceived Novelty	1	.782	.688	.408	.003
Interface * Modality Interactivity * Sensory Breadth	1	.426	.374	.541	.001
Interface * Modality Interactivity * Perceived Novelty	1	.286	.251	.617	.001
Interface * Sensory Breadth * Perceived Novelty	1	1.348	1.184	.278	.005
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	8.613	7.568	.006	.029
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.578	.508	.477	.002
Error	254	1.138			
Total	271				
Corrected Total	270				

Note. R^2 = .245 ($R^2_{Adjusted}$ = .219).
$^{*}p < .05$

Table 38. *ANCOVA Summary Table for Brand Attitude*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	7.975	8.877	.003	.034
Immersive VR type	1	.310	.345	.558	.001
Modality Interactivity	1	1.416	1.576	.210	.006
Sensory Breadth	1	.376	.419	.518	.002
Perceived Novelty	1	12.808	14.256	.000	.053
Interface * Modality Interactivity	1	.019	.022	.883	.000
Interface * Sensory Breadth	1	.812	.904	.343	.004
Interface * Perceived Novelty	1	.058	.065	.799	.000
Modality Interactivity * Sensory Breadth	1	.586	.652	.420	.003

Modality Interactivity * Perceived Novelty	1	.505	.562	.454	.002
Sensory Breadth * Perceived Novelty	1	.564	.628	.429	.002
Interface * Modality Interactivity * Sensory Breadth	1	.664	.739	.391	.003
Interface * Modality Interactivity * Perceived Novelty	1	.003	.003	.954	.000
Interface * Sensory Breadth * Perceived Novelty	1	7.287	8.110	.005	.031
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	1.106	1.231	.268	.005
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.469	.523	.470	.002
Error	254	.898			
Total	271				
Corrected Total	270				

Note. R^2 = .144 ($R^2_{Adjusted}$ = .090).
$^{*}p < .05$

Table 39. *ANCOVA Summary Table for Purchase Intention*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	17.981	10.660	.001	.040
Immersive VR type	1	4.902	2.906	.089	.011
Modality Interactivity	1	1.334	.791	.375	.003
Sensory Breadth	1	1.292	.766	.382	.003
Perceived Novelty	1	13.622	8.076	.005	.031
Interface * Modality Interactivity	1	.502	.297	.586	.001
Interface * Sensory Breadth	1	.015	.009	.924	.000
Interface * Perceived Novelty	1	.671	.398	.529	.002
Modality Interactivity * Sensory Breadth	1	1.455	.862	.354	.003
Modality Interactivity * Perceived Novelty	1	.012	.007	.933	.000
Sensory Breadth * Perceived Novelty	1	1.077	.639	.425	.003

Interface * Modality Interactivity * Sensory Breadth	1	.102	.060	.806	.000
Interface * Modality Interactivity * Perceived Novelty	1	3.485	2.066	.152	.008
Interface * Sensory Breadth * Perceived Novelty	1	2.460	1.458	.228	.006
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	1.044	.619	.432	.002
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	.070	.042	.839	.000
Error	254	1.687			
Total	271				
Corrected Total	270				

Note. R^2 = .115 ($R^2_{Adjusted}$ = .059).
$^{*}p < .05$

Table 40. *ANCOVA Summary Table for Sharing Intention*

Source	*df*	*MS*	*F*	*p*	η^2_{part}
Brand Familiarity	1	2.446	.889	.347	.003
Immersive VR type	1	21.961	7.979	.005	.030
Modality Interactivity	1	.487	.177	.674	.001
Sensory Breadth	1	.243	.088	.767	.000
Perceived Novelty	1	76.498	27.794	.000	.099
Interface * Modality Interactivity	1	.205	.075	.785	.000
Interface * Sensory Breadth	1	1.223E-5	.000	.998	.000
Interface * Perceived Novelty	1	13.057	4.744	.030	.018
Modality Interactivity * Sensory Breadth	1	13.748	4.995	.026	.019
Modality Interactivity * Perceived Novelty	1	.001	.001	.982	.000
Sensory Breadth * Perceived Novelty	1	3.215	1.168	.281	.005
Interface * Modality Interactivity * Sensory Breadth	1	.192	.070	.792	.000

Interface * Modality Interactivity * Perceived Novelty	1	.152	.055	.814	.000
Interface * Sensory Breadth * Perceived Novelty	1	2.394	.870	.352	.003
Modality Interactivity * Sensory Breadth * Perceived Novelty	1	9.520	3.459	.064	.013
Interface * Modality Interactivity * Sensory Breadth * Perceived Novelty	1	11.675	4.242	.040	.016
Error	254	2.752			
Total	271				
Corrected Total	270				

Note. R^2 = .115 ($R^2_{Adjusted}$ = .059).
$^{*}p < .05$

Hypothesis 12: Mediating Effect of Presence

Hypothesis 12 predicted that indicators of presence – (a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects – mediate the influence of interface type on participants' cognition, attitudes and intentions when controlling for brand familiarity and considering perceived novelty as moderating variable. For study 2, mediation model 5 was found appropriate and used for analysis.

Hypotheses 12a: Mediating effect of spatial presence

No significant mediating effect of spatial presence was found on recall, and product knowledge. Therefore, H12a-(i-iii) were not supported.

Next, the study tested how spatial presence mediated the effect of interface type on ad attitude. A significant positive effect of interface type on spatial presence was found (b = .6133, SE = .1288, $p < .0001$). In turn, spatial presence positively influenced ad attitude (b = .5529, SE = .0569, p < .0001). Next, a conditional direct effect of interface type on ad attitude was found in the case of high perceived novelty group (b =

-.3834, *SE* = .1630, 95% *CI* = [-.7042, -.0625]), but no significant direct conditional effect was found in the low novelty case. A significant positive indirect effect was found (*b* = .3391, *SE* = .0801, 95% *CI* = [.1953, .5126]). These relationships indicate that the high immersive VR system generated more spatial presence, and in turn led to more favorable ad attitude than the low immersive VR system. Therefore, H12a-iv was supported. See Figure 37. Results are summarized in Table 41.

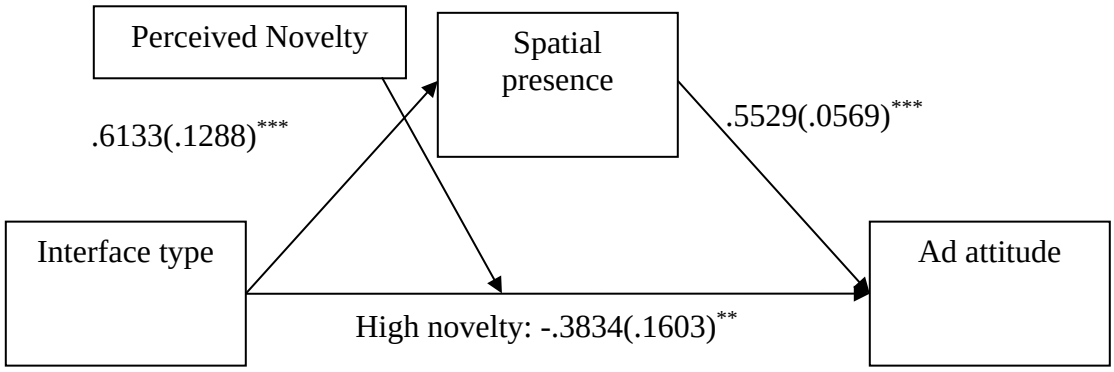

Figure 37. Direct and indirect effects of interface type on ad attitude.
***$p < .001$, **$p < .05$

Table 41. *Direct and Indirect Relationship Between Interface Type and Ad Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Aad	-.3834	.1630	-.7042	-.0625
Low N: Interface type → Aad	.2194	.1647	-.1050	.5437
Interface type → Spre → Aad	.3391	.0801	.1953	.5126

Note. Aad = Ad attitude; Spre = Spatial presence, N = Novelty

Next, the study tested how spatial presence mediated the effect of interface type on brand attitude. A significant positive effect of interface type on spatial presence was found (*b* = .6133, *SE* = .1288, *p* < .0001). In turn, spatial presence positively influenced brand attitude (*b* = .2536, *SE* = .0570, *p* < .0001). Although the direct effect of interface type on brand attitude was not found, a significant positive indirect effect was found (*b* = .1556, *SE* = .0503, 95% *CI* = [.0753, .2735]). These relationships indicate that the

high immersive VR system generated more spatial presence, and in turn led to more favorable brand attitude than the low the high immersive VR. Therefore, H12a-v was supported. See Figure 38. Results are summarized in Table 42.

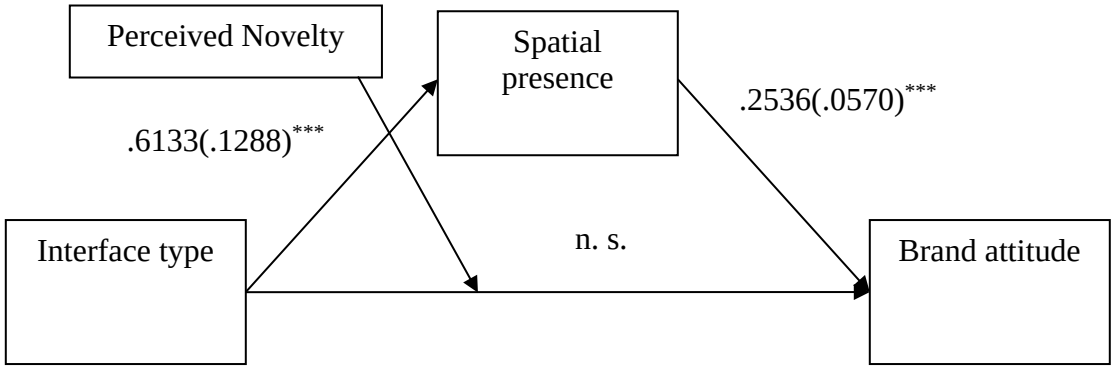

Figure 38. Direct and indirect effects of interface type on brand attitude.
***$p < .001$, **$p < .05$

Table 42. *Direct and Indirect Relationship between Interface Type and Brand Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Ab	-.0322	.1633	-.3538	.2893
Low N: Interface type → Ab	-.1434	.1651	-.4684	.1816
Interface type → Spre → Ab	.1556	.0503	.0753	.2735

Note. Ab = Brand attitude; Spre = Spatial presence, N = Novelty

Next, the study also found significant mediating effect in the case of purchase intention. A significant positive effect of interface type on spatial presence was found ($b = .6133$, $SE = .1288$, $p < .0001$). Next, spatial presence also positively influenced purchase intention ($b = .3120$, $SE = .0774$, $p < .001$). Although the direct effect of interface type, mediated by novelty, on purchase intention was not found, a significant positive indirect effect was found ($b = .1913$, $SE = .0597$, 95% CI = [.0962, .3362]). These relationships indicate that the high immersive VR system generated more spatial presence, and in turn spatial presence led to higher purchase intention than the low

immersive VR system. Therefore, H12a-vi was supported. See Figure 39. Results are summarized in Table 43.

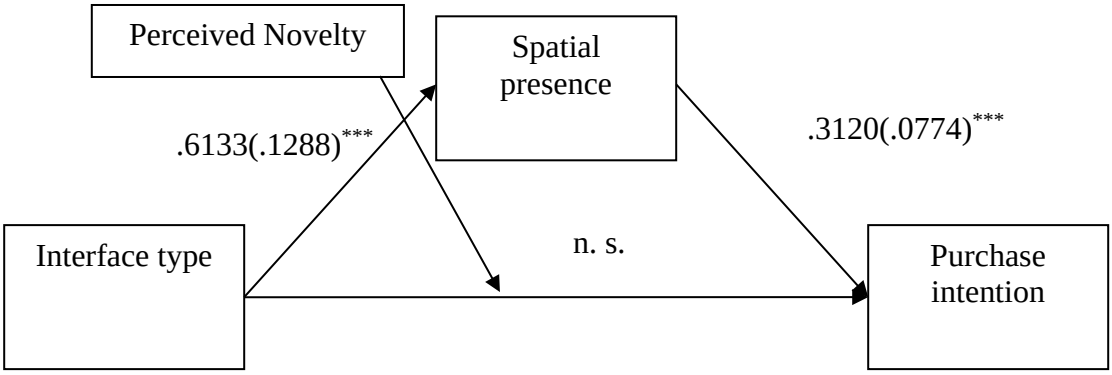

Figure 39. Direct and indirect effects of interface type on purchase intention.

$^{***}p < .001$, $^{**}p < .05$

Table 43. *Direct and Indirect Relationship Between Interface Type and* Purchase Intention

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → PI	.0112	.2217	-.4252	.4477
Low N: Interface type → PI	.1388	.2241	-.3024	.5800
Interface type → Spre → PI	.1913	.0597	.0962	.3362

Note. PI = Purchase intention; Spre = spatial presence, N = Novelty

Next, the study also found significant mediating effect in the case of sharing intention. A significant positive effect of interface type on spatial presence was found (b = .6133, SE = .1288, $p < .0001$). Spatial presence also positively influenced sharing intention (b = .6176, SE = .0960, $p < .0001$). A direct conditional effect (moderated by novelty) of interface type on sharing intention was found in the case of low novelty condition (b = .5751 SE = .2777, 95% CI = [.0284, 1.121]). Next a significant positive indirect effect was found (b = .3787, SE = .0928, 95% CI = [.2167, .5877]). These relationships indicate that the high immersive VR system generated more spatial

presence, and in turn spatial presence led to higher sharing intention than the low high immersive VR system. Therefore, H12a-vii was supported. See Figure 40. Results are summarized in Table 44.

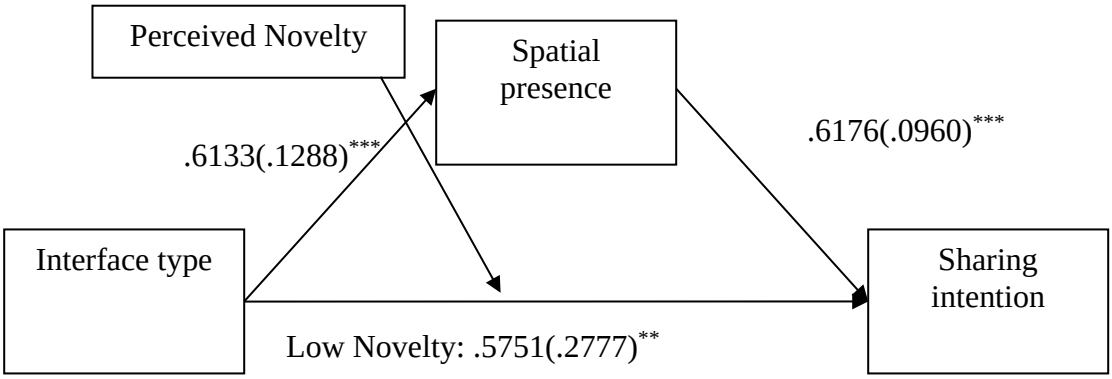

Figure 40. Direct and indirect effects of interface type on sharing intention.
***$p < .001$, **$p < .05$

Table 44. *Direct and Indirect Relationship Between Interface Type and Sharing Intention*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → SI	-.1393	.2748	-.6803	.4018
Low N: Interface type → SI	.5751	.2777	.0284	1.121
Interface type → Spre → SI	.3787	.0928	.2167	.5877

Note. SI = Sharing intention; Spre = spatial presence, N = Novelty

Hypotheses 12b: Mediating effect of engagement

No significant mediating effect of engagement was found on recall and product knowledge. Therefore, H12b-(i-iii) were not supported.

However, the study found significant mediating effect in the case of ad attitude. Here, a significant positive effect of interface type on engagement was found (b = .5714, SE = .1267, $p < .0001$). Engagement positively influenced ad attitude (b = .7460, SE = .0533, $p < .0001$). Although a direct conditional effect (negative) of interface type on ad attitude was found in the case of high perceived novelty condition (b = -.3549, SE

= .1430, 95% *CI* = [-.6365, -.0733]), no such direct conditional effect was found in the case of low perceived novelty condition. A significant positive indirect effect was found (*b* = .4263, *SE* = .0987, 95% *CI* = [.2424, .6269]). These relationships indicate that the high immersive VR system generated more engagement, and in turn engagement led to more favorable ad attitude than the low immersive VR system. Therefore, H12b-iv was supported. See Figure 41. Results are summarized in Table 45.

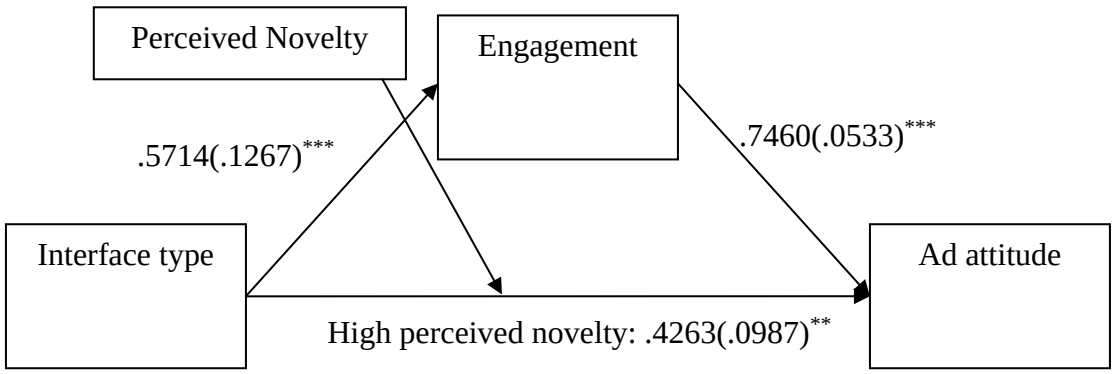

Figure 41. Direct and indirect effects of interface type on ad attitude.
***p < .001, **p < .05

Table 45. *Direct and Indirect Relationship Between Interface Type and Ad Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Aad	-.3549	.1430	-.6365	-.0733
Low N: Interface type → Aad	.0769	.1462	-.2111	.3648
Interface type → Eng → Aad	.4263	.0987	.2424	.6269

Note. Aad = Ad attitude; Eng = Engagement, N = Novelty

Next, the study found significant mediating effect in the case of brand attitude. Here, a significant positive effect of interface type on engagement was found (*b* = .5714, *SE* = .1267, *p* < .0001). Engagement positively influenced brand attitude (*b* = .3786, *SE* = .0582, *p* < .0001). Although no direct conditional effects of interface type on brand attitude was found, a significant positive indirect effect was found (*b* = .2163,

SE = .0633, 95% *CI* = [.1099, .3618]). These relationships indicate that the high immersive VR system generated more engagement, and in turn engagement led to more favorable brand attitude than the low immersive VR system. Therefore, H12b-v was supported. See Figure 42. Results are summarized in Table 46.

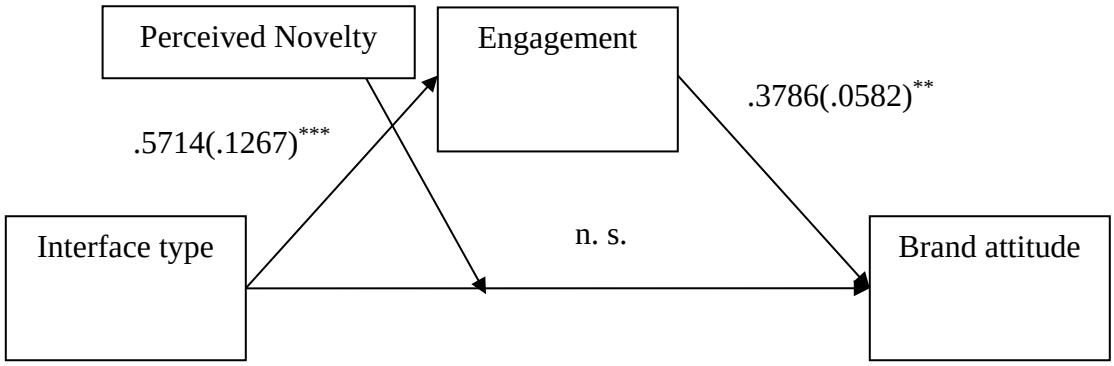

Figure 42. Direct and indirect effects of interface type on brand attitude.
$^{***}p < .001$, $^{**}p < .05$

Table 46. *Direct and Indirect Relationship between Interface Type and Brand Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Ab	-.0297	.1562	-.3373	.2780
Low N: Interface type → Ab	-.2326	.1598	-.5472	.0819
Interface type → Eng → Ab	.2163	.0633	.1099	.3618

Note. Ab = Brand attitude; Eng = Engagement, N = Novelty

Next, the study found significant mediating effect in the case of purchase intention. Here, a significant positive effect of interface type on engagement was found (*b* = .5714, *SE* = .1267, *p* < .0001). Engagement also positively influenced purchase intention (*b* = .4676, *SE* = .0796, *p* < .0001). Although the direct effect of interface type on purchase intention was not found, a significant positive indirect effect was found (*b* = .2672, *SE* = .0764 95% *CI* = [.1401, .4416]). These relationships indicate that the high immersive VR system generated more engagement, and in turn engagement led to

higher purchase intention than the low immersive VR system. Therefore, H12b-vi was supported. See Figure 43. Results are summarized in Table 47.

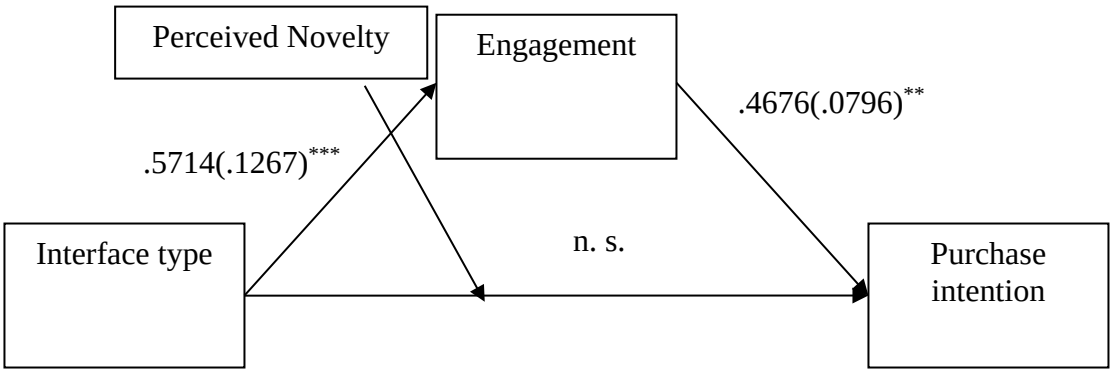

Figure 43. Direct and indirect effects of interface type on purchase intention. $^{***}p < .001$, $^{**}p < .05$

Table 47. *Direct and Indirect Relationship Between Interface Type and* Purchase Intention

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → PI	.0138	.2135	-.4065	.4341
Low N: Interface type → PI	.0278	.2183	-.4020	.4576
Interface type → Eng → PI	.2672	.0764	.1401	.4416

Note. PI = Purchase intention; Eng = Engagement, N = Novelty

Next, the study found significant mediating effect in the case of sharing intention. Here, a significant positive effect of interface type on engagement was found ($b = .5714$, $SE = .1267$, $p < .0001$). Engagement positively influenced sharing intention ($b = .8561$, $SE = .0959$, $p < .0001$). No direct effect of interface type on sharing intention was found. A significant positive indirect effect was found ($b = .4892$, $SE = .1147$, 95% $CI = [.2813, .7345]$). These relationships indicate that the high immersive VR system generated more engagement, and in turn engagement led to higher sharing intention than the low immersive VR system. Therefore, H12b-vii was supported. See Figure 44. Results are summarized in Table 48.

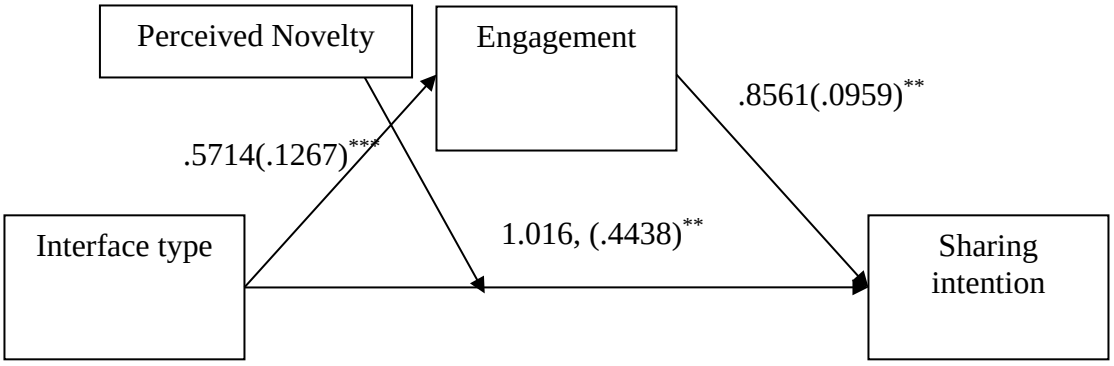

Figure 44. Direct and indirect effects of interface type on sharing intention.
***$p < .001$, **$p < .05$

Table 48. *Direct and Indirect Relationship Between Interface Type and Sharing Intention*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → SI	-.1065	.2574	-.6133	.4004
Low N: Interface type → SI	.4009	.2632	-.1174	.9192
Interface type → Eng → SI	.4892	.1147	.2813	.7345

Note. SI = Sharing intention; Eng = Engagement, N = Novelty

Hypotheses H12c: Mediating effect of naturalness

No significant mediating effect of naturalness was found on aided recall, unaided recall and product knowledge. Therefore, H12c(i-iii) were not supported.

However, the study found significant mediating effect in the case of ad attitude. Here, a significant positive effect of interface type on naturalness was found ($b = .2662$, $SE = .1296$, $p < .05$. Naturalness positively influenced ad attitude ($b = .4851$, $SE = .0570$, $p < .0001$). Although a direct conditional (positive) effect of interface type on ad attitude was found in the case of low perceived novelty condition ($b = .3813$, $SE = .1674$, 95% $CI = [.0518, .7109]$), no such direct conditional effect was found in the case of high perceived novelty condition. A significant positive indirect effect was found ($b = .1292$, $SE = .0665$, 95% $CI = [.0064, .2711]$). These relationships indicate that the

high immersive VR system generated more naturalness, and in turn naturalness led to more favorable ad attitude than the low immersive VR system. Therefore, H12b-iv was supported. See Figure 45. Results are summarized in Table 49.

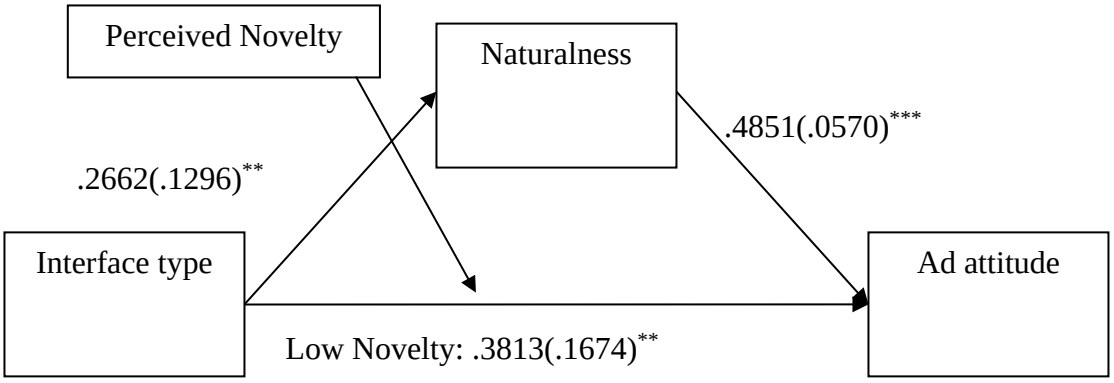

Figure 45. Direct and indirect effects of interface type on ad attitude.
***$p < .001$, **$p < .05$

Table 49. *Direct and Indirect Relationship Between Interface Type and Ad Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Aad	-.1557	.1662	-.4829	.1715
Low N: Interface type → Aad	.3813	.1674	.0518	.7109
Interface type → Nat → Aad	.1292	.0665	.0064	.2711

Note. Aad = Ad attitude; Nat = Naturalness, N = Novelty

The study found significant mediating effect in the case of brand attitude. Here, a significant positive effect of interface type on naturalness was found ($b = .2662$, $SE = .1296$, $p < .05$. Naturalness positively influenced brand attitude ($b = .3035$, $SE = .5043$, $p < .0001$). Although no direct conditional effects of interface type on brand attitude was found, a significant positive indirect effect was found ($b = .0808$, $SE = .0445$, 95% $CI = [.0048, .1819]$). These relationships indicate that the high immersive VR system generated more naturalness, and in turn naturalness led to more favorable brand attitude than the low immersive VR system. Therefore, H12b-v was supported. See Figure 46. Results are summarized in Table 50.

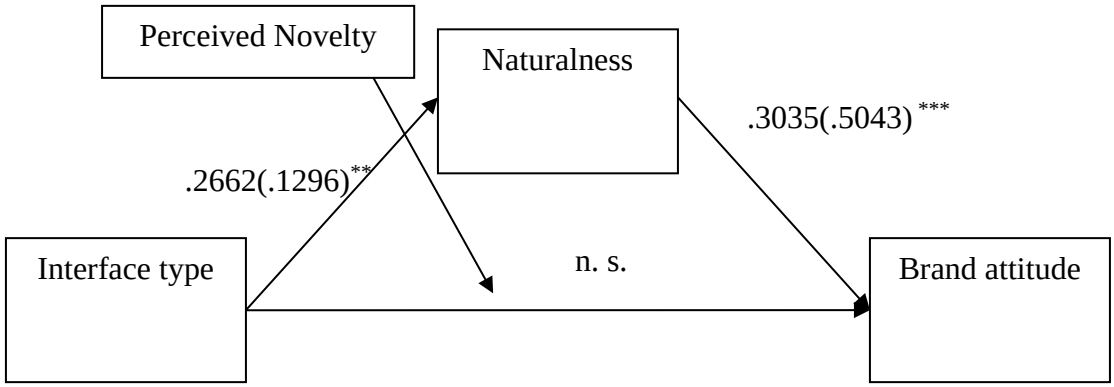

Figure 46. Direct and indirect effects of interface type on brand attitude
$^{***}p < .001$, $^{**}p < .05$

Table 50. *Direct and Indirect Relationship Between Interface Type and Brand Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Ab	.0694	.1582	-.2421	.3809
Low N: Interface type → Ab	-.1000	.1593	-.4137	.2138
Interface type → Nat → Ab	.0808	.0445	.0048	.1819

Note. Ab = Brand attitude; Nat = naturalness, N = Novelty

The study found significant mediating effect in the case of purchase intention. Here, a significant positive effect of interface type on naturalness was found (b = .2662, SE = .1296, $p < .05$. Naturalness also positively influenced purchase intention (b = .2262, SE = .0762, $p < .0001$). Although the direct effect of interface type on purchase intention was not found, a significant positive indirect effect was found (b = .0620, SE = .0364 95% CI = [.00963, .1566]). These relationships indicate that the high immersive VR system generated more naturalness, and in turn naturalness led to higher purchase intention than the low immersive VR system. Therefore, H12-vi was supported. See Figure 47. Results are summarized in Table 51.

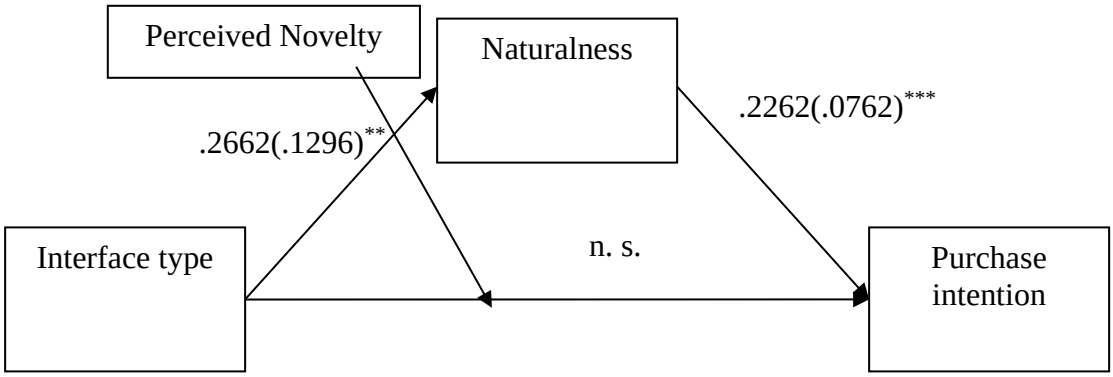

Figure 47. Direct and indirect effects of interface type on purchase intention. $^{***}p < .001$, $^{**}p < .05$

Table 51. *Direct and Indirect Relationship Between Interface Type and* Purchase Intention

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → PI	.1413	.2220	-.2957	.5784
Low N: Interface type → PI	.2483	.2236	-.1919	.6885
Interface type → Nat → PI	.0620	.0364	.0096	.1566

Note. PI = Purchase intention; Nat = naturalness, N = Novelty

The study found significant mediating effect in the case of sharing intention. Here, a significant positive effect of interface type on naturalness was found ($b = .2662$, $SE = .1296$, $p < .05$. Naturalness positively influenced sharing intention ($b = .3487$, $SE = .0978$, $p < .001$). Although a direct conditional effect (positive) of interface type on sharing intention was found in the case of low perceived novelty condition ($b = .8296$, $SE = .2872$, 95% $CI = [.2642, 1.395]$), no such direct conditional effect was found in the case of high perceived novelty condition. No direct effect of interface type on sharing intention was found. A significant positive indirect effect was found ($b = .0928$, $SE = .0539$, 95% $CI = [.0095, .2258]$). These relationships indicate that the high immersive VR system generated more naturalness, and in turn naturalness led to higher sharing

intention than the low immersive VR system. Therefore, H12b-vii was supported. See Figure 48. Results are summarized in Table 52.

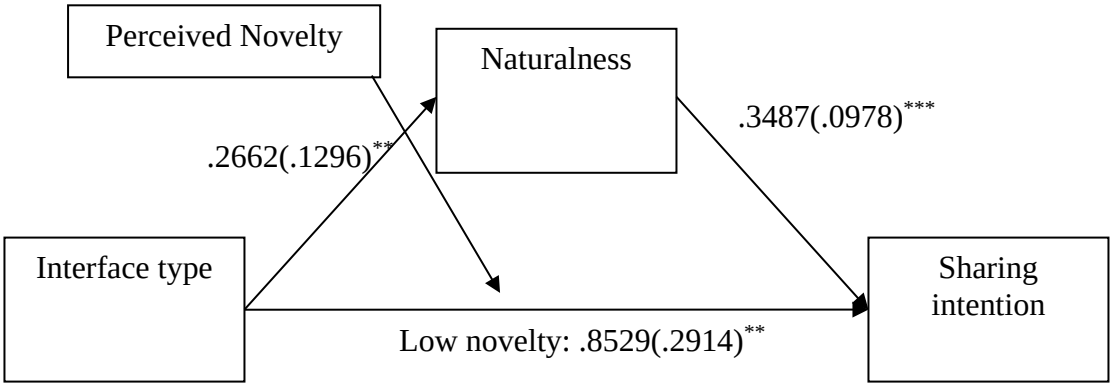

Figure 48. Direct and indirect effects of interface type on sharing intention.

***$p < .001$, **$p < .05$

Table 52. *Direct and Indirect Relationship Between Interface Type and Sharing Intention*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → SI	.1293	.2851	-.4321	.6906
Low N: Interface type → SI	.8296	.2872	.2642	1.395
Interface type → Nat → SI	.0928	.0539	.0095	.2258

Note. SI = Sharing intention; Nat = naturalness, N = Novelty

Hypotheses 12d: Mediating effect of negative effects

No significant mediating effect of negative effects was found on any dependent variables, except for ad attitude and purchase intention. Therefore, H12d-i, H12d-ii. H12d-iii, H12d-v, and H12d-vii were not supported.

Interface type positively influenced negative effects ($b = .6628$, $SE = .134$, $p < .0001$). Also, negative effects inversely influenced ad attitude ($b = -.2232$, $SE = .0418$, $p < .0001$). Although a direct conditional (positive) effect of interface type on ad attitude was found in the case of low perceived novelty condition ($b = .7259$, $SE = .1804$, 95% $CI = [.3707, 1.0812]$), no such direct conditional effect was found in the case of high

perceived novelty condition. A significant inverse indirect effect was found (b = -.1491, SE = .0523, 95% CI = [-.2712, -.0641]). These relationships indicate that the high immersive VR system generated more negative effects, and in turn negative effects led to less favorable ad attitude than the low immersive VR system. Therefore, H12d-iv was supported. See Figure 49. Results are summarized in Table 53.

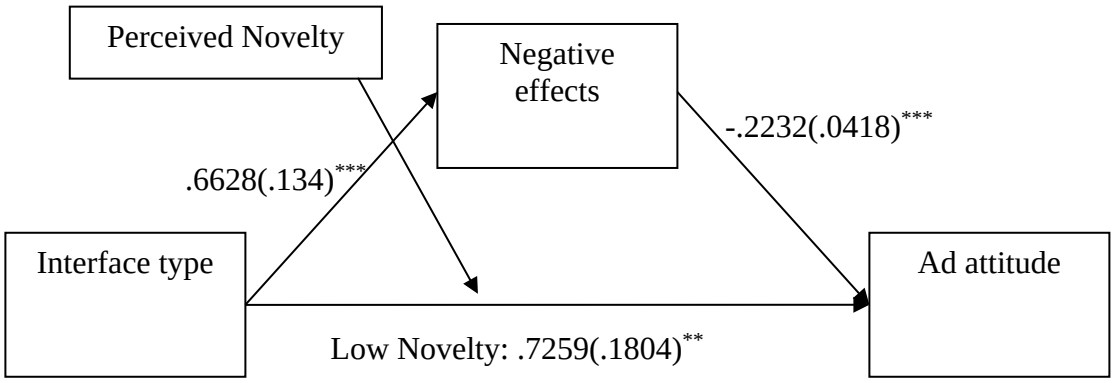

Figure 49. Direct and indirect effects of interface type on ad attitude.
***p < .001, **p < .05

Table 53. *Direct and Indirect Relationship Between Interface Type and Ad Attitude*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → Aad	.0052	.1802	-.3496	.3600
Low N: Interface type → Aad	.7259	.1804	.3707	1.081
Interface type → NE → Aad	-.1491	.0523	-.2712	-.0641

Note. Aad = Ad attitude; NE = Negative effects, N = Novelty

However, results also showed that negative effects also inversely (with approached significance) influenced purchase intention (b = -.0916, SE = .0527, p = .0830). Although the direct effect of interface type on purchase intention was not found, a significant inverse indirect effect was found (b = -.0612, SE = .0387, 95% 10000 Bootstrap CI = [-.1566, -.0001]). These relationships indicate that the high immersive VR system generated more negative effects, and in turn negative effects led to lower

purchase intention than the low immersive VR system. Therefore, only H12d-vi was supported. See Figure 50. Results are summarized in Table 54.

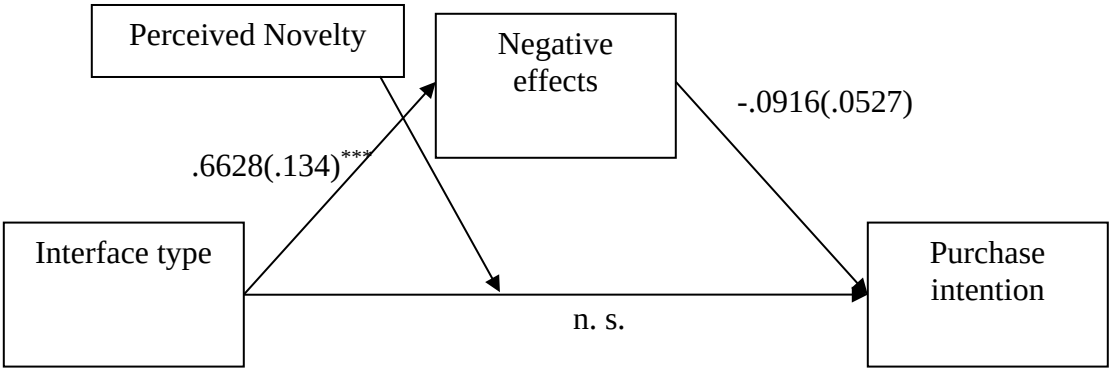

Figure 50. Direct and indirect effects of interface type on purchase intention.

$^{***}p < .001$

Table 54. *Direct and Indirect Relationship Between Interface Type and Purchase Intention*

Specific Effect	Point Estimate	*Boot SE*	95% Bootstrap CI	
			LL	UL
High N: Interface type → PI	.0283	.2269	-.2385	.6551
Low N: Interface type → PI	.4001	.2272	-.0473	.8474
Interface type → NE → PI	-.0612	.0387	-.1566	-.0001

Note. PI = Purchase intention; NE = Negative effects, N = Novelty

Table 55 . *Summary Table for Hypotheses and Research Questions in Study 2*

	Hypotheses and Research Questions	**Outcome**
H5	An ad presented with modality interactivity results in higher sense of presence - (a) spatial presence, (b) engagement, and (c) naturalness - than an ad presented no modality interactivity.	Not supported.
H6	An ad presented with higher sensory breadth results in higher sense of presence - (a) spatial presence, (b) engagement, and (c) naturalness - than an ad presented with lower sensory breadth.	Not supported.

RQ1	Will there be an interaction effect between modality interactivity and sensory breadth on presence - (a) spatial presence, (b) engagement, and (c) naturalness? What will be the nature of interaction?	On Spatial presence and engagement.
H7a-d	An ad presented via the high immersive VR system results in higher sense of presence - (a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects -than an ad presented via low immersive VR system.	H7a, H7b & H7b supported
H8a-c	An ad presented via the high immersive VR system results in higherer (a) unaided recall, (b) aided recall, and (c) perceived product knowledge than ad presented via the low immersive VR system.	Not supported.
H9a-d	Ad presented via the high immersive VR system results in higher (a) ad attitude, (b) brand attitude, (c) purchase intention, and (d) sharing intention than ad presented via the low immersive VR system.	H9a (with approached significance), H9b, & H9c (with approached significance) not supported; H9d supported.
RQ2	Will there be an immersive VR type X modality interactivity interaction on (a) presence, (b) unaided recall, (c) aided recall, (d) product knowledge, (e) ad attitude, (f) brand attitude, (g) purchase intention, and (h) sharing intention? If yes, then what will be the nature of the interaction?	On spatial presence (with approached significance), negative effects, and aided recall (with

		approached significance).
RQ3	Will there be an immersive VR type X sensory breadth interaction on (a) presence, (b) unaided recall, (c) aided recall, (d) product knowledge, (e) ad attitude, (f) brand attitude, (g) purchase intention, and (h) sharing intention? If yes, then what will be the nature of the interaction?	No effect was found
RQ4:	Will there be an immersive VR type X modality interactivity X sensory breadth interaction on (a) presence, (b) unaided recall, (c) aided recall, (d) product knowledge, (e) ad attitude, (f) brand attitude, (g) purchase intention, and (h) sharing intention? If yes, then what will be the nature of the interaction?	On aided recall
H10a-c	The effect of immersive VR advertising in creating cognition - (a) unaided brand recall, (b) aided brand recall, and (c) product knowledge – will be moderated by the perceived media novelty when controlling for brand familiarity.	
H10a-c(i)	When viewers perceive low level of media novelty, a high immersive VR ad will be more effective in creating cognition than a low immersive VR ad.	Not supported
H10a-c(ii)	When viewers perceive high level of media novelty, a high immersive VR advertising will not be more effective in creating cognitive responses than a low immersive VR ad.	Not supported
H11a-d	The effect of immersive VR advertising in creating attitudes and intentions - (a) ad attitude, (b) brand attitude, (c) purchase intentions, and (d) sharing intention – will be moderated by the perceived	

	media novelty when controlling for brand familiarity.	
H11a-d(i)	When viewers perceive low level of media novelty, a high immersive VR ad will be more effective in creating attitudes and intentions than a low immersive VR ad.	Supported
H11a-d(ii)	When viewers perceive high level of media novelty, a high immersive VR ad will not be more effective in creating attitudes and intentions than a low immersive VR ad.	Not supported
RQ5	Will participants' perceived novelty moderate the interactions between modality interactivity and sensory breadth on presence [(a) spatial presence, (b) engagement, (c) naturalness, and (d) negative effects]? What will be the nature of the interactions?	On spatial presence, engagement & negative effects (with approached significance)
RQ6	Will participants' perceived novelty moderate the interaction effect of (i) interface and modality interactivity, and (ii) interface and sensory breadth on cognitions, attitude and intentions? What will be the nature of the interactions?	On brand attitude
H12a(i-vii)	Spatial presence mediates the influence of level of immersion on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.	H12a(iv-vii) supported
H12b(i-vii)	Engagement mediates the influence of level of immersion on participants' (i) unaided recall, (ii) aided recall (iii) product knowledge, (iv) ad	H12a(iv-vii) supported

	attitude, (v) brand attitude, (vi) purchase intention, and (vii) sharing intention when controlling for brand familiarity.	
H12c(i-vii)	Naturalness mediates the influence of level of immersion on participants' (i) brand recall, (ii) product knowledge, (iii) ad attitude, (iv) brand attitude, (v) purchase intention, and (vi) sharing intention when controlling for brand familiarity.	H12a(iv-vii) supported
H12d(i-vii)	Negative effect mediates the influence of level of immersion on participants' (i) brand recall, (ii) product knowledge, (iii) ad attitude, (iv) brand attitude, (v) purchase intention, and (vi) sharing intention when controlling for brand familiarity.	H12a-iv & H12a-vii supported.

Chapter 10: Discussion of Study 2

Study 2 was conducted to test the psychological effect of various levels of modality interactivity, sensory breadth and their interactions on two types of immersive VR systems considering the moderating effect of perceived media novelty. Overall, the results of this study provided several important insights related to the effectiveness of VR ad. They are discussed below.

Role of Modality Interactivity and Sensory Breadth on Presence

First, hypotheses 5-6 and research question 2 were posed to confirm Steuer's (1992) propositions regarding how interactivity and vividness actually affect presence on VR systems, regardless of the level of immersion. In other words, main and interaction effects of modality interactivity and sensory breadth on presence were the concerns. Interestingly, contrary to Steuer's (1992) propositions, the current study found no such main effects of either modality interactivity or sensory breadth on any dimensions of presence. However, the importance of these two concepts to create presence were realized only when they were put together. As the directions of interaction were not explained by Steuer's (1992) framework or other scholars, this study can add an important theoretical insight to the presence framework.

Significant interaction effects of modality interactivity and sensory breadth were identified on two major dimensions of presence: spatial presence and engagement. First, participants perceived spatial presence (i.e., the sense of being there physically in VR environment) the most when VR systems had low sensory breadth but no modality interactivity. That means, in VR systems with hotspot, the use of only textual information worked better to create spatial presence. On the other hand, when VR

systems had no option for modality interactivity, the use of high sensory breadth elevated the sense of being there physically among participants. In other words, in the absence of a hotspot in VR systems, the use of both textual and visual information produced higher sense of spatial presence. In fact, high sensory breadth in the absence of modality interactivity generated the highest score in spatial presence. The same pattern of relationship was identified in the case of engagement dimension of presence. Participants had the highest sense of involvement and enjoyment in the VR environment when VR systems had low sensory breadth (i.e., textual information) and modality interactivity (i.e., hotspot). Also, in the case of VR system with no modality interactivity, the use of both textual and visual information worked better.

These interactions of modality interactivity and sensory breadth on presence dimensions make sense. As the participants could see and use the interface features, i.e., hotspot, to perform communication tasks, they felt that they were physically present there and involved with the VR environment even though only one sensory item was there. Thus, high sensory breadth was not effective in creating the sense of presence when participants saw and utilized modality interactivity. The effect of high sensory breadth on presence was only realized in the absence of modality interactivity.

Moderating effect of perceived novelty on these interactions

Interesting results were revealed when the study added the concept of perceived novelty to moderate the interaction effects of modality interactivity and sensory breadth on presence (the interaction between modality interactivity and sensory breadth has already been discussed in the earlier section). First, in the case of low perceived novelty, the nature of interaction remained same among modality interactivity and

sensory breadth in creating spatial presence (as discussed under the previous heading). But, in the case of high perceived novelty, the nature of interaction totally changed. First of all, each condition under high novelty generated higher spatial presence than any conditions under low perceived novelty. Interestingly, low sensory breadth was more effective than high sensory breadth in creating spatial presence in all levels of modality interactivity. Unlike low perceived novelty condition, high perceived novelty eliminated the effect of high sensory breadth, as it remained same for all conditions of modality interactivity. It can be speculated that when participants thought the medium to be novel, they provide greater attention to the medium itself and this, in turn, contributed to higher spatial presence (Yim et al., 2012). Adding a hotspot or pictures to the VR environment did little to elevate the sense of physical presence, when either the monoscopic or stereoscopic VR system was perceived as novel. Therefore, based on such results, it can be said that using multiple sensory items and a hotspot in any kind of immersive VR will not contribute much to create spatial presence, if viewers think the medium to be novel.

Again, interesting results were found when the study added the concept of perceived novelty to moderate the interaction effects of modality interactivity and sensory breadth on engagement (the interaction between modality interactivity and sensory breadth has already been discussed in the earlier section). The nature of interaction between modality interactivity and sensory breadth in creating engagement remained same for both high and low perceived novelty. But, each condition of high novelty led to higher spatial presence than any conditions of low perceived novelty. For low perceived novelty situation, in the presence of modality interactivity high sensory

breadth was less effective, while in the absence of modality interactivity low sensory breadth was more effective. Unlike low perceived novelty condition, high perceived novelty condition showed that the magnitude of the difference between low sensory breadth and high sensory breadth was higher when modality interactivity was present. Therefore, based on such results, it can be said that adding textual plus visual product information and hotspot to the VR environment did little to create the sense of engagement, when either the monoscopic or stereoscopic VR system was perceived as novel.

Although the study found no significant interaction of modality interactivity and sensory breadth on the negative effects dimension of presence, the interaction was realized when the moderating effect of perceived media novelty was considered. The moderating effect was realized with only approached significance. In the case of low perceived novelty, the presence of a hotspot and textual plus visual product information boosted the negative effects generated from the media usage (dizziness, nausea, headache, etc.). According to Lessiter et al. (2002), when there is no variation in the content that all the participants saw and there occurs higher than average negative effects, then the content itself may be held responsible, regardless of which medium is used. Similarly, adding multiple picture and text in the content when a hotspot present have intensified the negative effects of media exposure (Lessiter et al.). However, when participants perceived high media novelty, the nature of interaction between modality interactivity and sensory breadth changed. When a hotspot was there in the content, the use multi-sensory items (as opposed to a single item) actually did not contribute much to higher negative effects. Perceived novelty also reduced the score of negative effects

for modality interactivity and sensory breadth condition. It can be speculated that when viewers remained busy in dealing with the novel media, they underestimated or overlooked the adverse consequences of the media. Therefore, based on such results, it can be said that when viewers will get used to the medium and consider it no longer a new one, the combination of using textual plus visual information and a hotspot may increase the negative effects generated form the media.

To sum up, it can be stated that the effects of modality interactivity and sensory breadth on presence should better be evaluated in different combinations rather than separately on different dimensions of presence (i.e., spatial presence, engagement, and negative effects). Adding the concept of perceived media novelty provided much deeper insights on the relationships.

Role of Immersive VR Type

Similar to study 1, the aim of the study 2 was to find out the nature of impact immersive VR type had on presence, cognition, attitude and intentions. The current study hypothesized that high immersive VR system would lead to higher perception of presence, higher cognitions, favorable attitude and higher behavioral intentions than high immersive VR system. Discussion on the results regarding such responses are presented below.

Immersive VR type and presence

The results of this study found that participants experiencing high immersive VR advertisement were more likely to have a higher sense of spatial presence, engagement, and negative effects than participants experiencing low immersive VR

advertisement. These relationships support the previous research claims on immersion, as a functional media feature, to impact presence (e.g., Ahn, 2011; Biocca, 1997).

Immersive VR type and cognition

Similar to study 1, study 2 did not find expected results regarding the direct effect of immersive VR type on any cognitive responses. As discussed earlier for study 1, the current study might have failed to find any significant difference between high and low immersive VR type on aided brand recall due to the novelty effect of the foreign French brand "Peugeot." The name might have gained automatic orienting responses among participants, regardless of the group (high vs. low immersion) (A Lang, 2006). In addition, mediating role of presence was absent in this case.

Next, the study 2 found no significant difference between high and low immersive VR type on unaided recall. But, mediation analysis found an indirect effect of immersive VR type on unaided recall via engagement dimension of presence. That means an ad presented via the high immersive VR system was more likely to elevate the sense of involvement, interest and enjoyment within the media experience among participants and such interest, in turn, helped participants provide more attention to the brand name and recall (unaided) the name better than an ad presented via the low immersive VR system. This result confirms the predicted mediating role of presence between VR system type and unaided recall. The results also imply the idea that the high immersive VR ad (rather than the low immersive VR ad) is more effective in generating actual brand recall by creating a sense of involvement and enjoyment among consumers.

Finally, no significant difference between high and low immersive VR type on perceive product knowledge was found. The dimensions of presence were not able to create an indirect effect as well. These results were also contradictory to the prediction of the study stating that the high immersive VR would generate higher perceived product knowledge than the low immersive VR. However, the absence of any effect (both direct and indirect) of immersive VR interface type on perceived product knowledge requires alternative explanation. One possible explanation for this situation may come from one of the design issues, i.e., quantity or category of product information provided in the ad. It should be noted that the mean scores of perceived product knowledge were way below the average score, implying that participants were less confident about their product evaluation and needed more information to make a purchase decision and/or a quality judgment of the product. Such impact might have reduced or vanished the compelling effect of the high immersive VR technology and the near-real virtual product experience in the high immersive VR environment (Smith & Park, 1992).

Moderating role of perceived media novelty. The study also predicted that participants' perceived media novelty would moderate the effect of immersive VR type on cognitive responses. The study hypothesized that when viewers perceive a low level of media novelty, a high immersive VR ad would be more effective in creating cognition than low immersive VR ad. When viewers perceive a high level of media novelty, a high immersive VR ad would not be more effective. However, the study found no such conditional effects. That means, the effectiveness of high immersive VR on cognitive responses were not conditional upon perceived media novelty. In the case

of brand recall, it can be speculated that the orienting response from the brand name might have captured some attention away from the media and/or from media's technological affordances (created due high perceived media novelty). Therefore, the effectiveness of high immersive VR may remain close to the same, regardless of perceived media novelty. Also, in the case of perceived product knowledge, one possible alternative explanation may come from the issue of how the product and brand information is presented in the ad. Product information in the ad was presented in a distinctive box in the ad, which might have gained users' attention to the product and then to the virtual product experience. Here, the richness and quality of high immersive VR might have taken a lead to create higher perceived product knowledge irrespective of perceived media novelty. That's why the level of perceived novelty did not affect the relationship between interface type and cognitive responses.

Immersive VR type and attitudes and intentions

The current study results identified that the high immersive VR ad led to more favorable affective and behavioral (intentions) responses than the low immersive VR ad mainly via the mediating role of presence. Mediation analysis of study 2 found indirect effects of immersive VR type on (a) ad attitude via all dimensions of presence, i.e., spatial presence, engagement, naturalness and negative effects; and (a) brand attitude via three dimensions of presence, i.e., spatial presence, engagement, and naturalness. Also, in the case of intentions, mediation analysis found indirect effects of immersive VR type on (a) purchase intention via all dimensions of presence, i.e., spatial presence, engagement, naturalness and negative effects; and (b) sharing intention via three dimensions of presence, i.e., spatial presence, engagement, and naturalness. These

indirect effects confirmed the important role of presence in the relationship between immersive VR type, participants' attitudes and intentions while evaluating ad effectiveness, as claimed by earlier studies (e.g., Kim & Biocca, 1997; Klein, 1998; Li et al., 2001, 2002, 2003).

Moderating effect of perceived novelty. The study also predicted that participants' perceived media novelty would moderate the effect of immersive VR type on attitude and intentions. However, the study identified that perceived media novelty only moderated the effect of immersive VR system on ad attitude and sharing intention.

The study hypothesized the high immersive VR to be more effective in creating more favorable ad attitude and sharing intention than the low immersive VR system due to the high immersive features of stereoscopic VR system. But, when participants perceived high media novelty, the study hypothesized that the high immersive VR would not generate more favorable ad attitude or sharing intention than low immersive media. The results of the study found such relationships as well.

As predicted by the study, when participants perceived the medium to be not novel, the high immersive VR ad was more effective than the low immersive VR ad in creating both ad attitude and sharing intention due to the high immersive features of stereoscopic VR system. Based on the previous discussion, it can be said that positive affects created by such media affordances can lead to favorable ad attitude and sharing intentions (see MacKenzie et al., 1986). But, when participants perceived the immersive VR system (regardless of high or low) as new, unique and unfamiliar, the score of both ad attitude and sharing intentions were uplifted for both media. In case of ad attitude, the effect of high immersive VR was similar to low immersive VR. Here the

technological benefits of high immersive VR over low VR might have gone, because participants perceived the both types of VR as novel (Yim et al., 2012). However, in case of sharing intention, the effect of high immersive VR was a little higher than low immersive VR. But the magnitude of the difference between the two media in creating sharing intention was very low in the high perceived novelty situation (as oppose to the low perceived media novelty situation). Therefore, based on such results, it can be said that perceived novelty played a significant moderating role in elevating participants' ad attitude and sharing intentions.

Role of Interactions among Immersive VR Type, Modality Interactivity and Sensory Breadth

One of the major objectives of study 2 was to find out whether and how the interactions among immersive VR type, modality interactivity and sensory breadth affect the sense of presence, brand recall, perceived product knowledge, ad attitude, brand attitude, purchase intention and sharing intention. The study found a few interactions, which are discussed below.

Interaction of immersive VR type and modality interactivity on presence

The study found that the modality interactivity at various levels of immersive VR system were able to influence perceived spatial presence. Although this result was realized via approached significance, it shows that the high immersive VR was more effective than the low immersive VR in creating spatial presence in all conditions, i.e., with modality interactivity and without modality interactivity. But, the high immersive VR was more effective only when there was modality interactivity. That means, using a hotspot in a stereoscopic VR ad led to the highest sense of being there in the

environment. These results provide an important insight on the collaborative effect of high immersive VR and modality interactivity to produce spatial or physical presence. As discussed earlier, the VR system with high immersive features, 360° video, spatialized audio via in-built headphone, head-controlled point of view, and natural mapping of head movement, are likely to make viewers feel that they are physically present in the VR environment (Ahn, 2011; Biocca, 1997). Interactivity itself also has an effect in creating presence (Steuer, 1995; Heeter, 1992; Welch et al., 1996). The study showed that a combination of high immersive VR and modality interactivity had higher effect on spatial presence. In other words, when viewers got the opportunity to see a hotspot and moreover, open and control it with a head/eye controlled function (a. k. a. VR interface features), their sense of physical presence in there elevated.

A significant interaction was identified in the case of negative effect dimension of presence. The high immersive VR system led to more negative effects than the low immersive VR system in all conditions, i.e., with modality interactivity and without modality interactivity. But, this effect of high immersive VR was intensified when modality interactivity was there in the content. That means, using a hotspot in a stereoscopic VR ad created the most negative effects. This result also make sense. Due to stereoscopic VR properties, it is highly possible that viewers might have experienced adverse physiological effect. In addition, in order to experience the hotspot in the stereoscopic VR, the viewers had to look at the hotspot for several seconds and then, a new information box popped up in front of them. So, the mechanism of dealing with the hotspot itself might have come strong on viewers, creating an additive negative effect due to the combination of immersive VR features and interactive hotspot.

Interaction of immersive VR type and modality interactivity on cognitive responses

The study identified only one interaction effect of immersive VR type and modality interactivity on aided recall. But this result was realized with only with approached significance. The results found that, high immersive VR was more effective in creating the higher recall only when there was no modality interactivity. On the other hand, the low immersive VR generated the highest recall score only when modality interactivity was there in the content. This result is interesting, as both high immersive VR and modality interactivity were assumed to create higher recall separately. Previous studies (e.g., Sundar, Bellur, Oh, & Jia, 2011; Sundar, Bellur, Oh, Xu, & Jia, 2014; Xu & Sundar, 2011) have shown that the modality interactivity can create favorable effects on cognitions. According to Sundar et al. (2015), modality interactivity provides a "spotlighting function" within the medium, as such interactivity is likely to divert user attention from non-interactive parts of an interface and allocate cognitive resources mainly to the message activated by modality interactivity function. Such interactivity expands "the scope of user exploration of the interface while simultaneously freeing up cognitive resources that would otherwise be allocated for operating the interface" (Sundar et al., 2015, p. 55). Therefore, when exposed to the new window participants were not supposed to be affected by any changes and/or intensity of the message within immersive VR environment (e.g., message content, presentation style, presentation medium) (A Lang, 2000) and were better able to focus more on the information.

However, when modality interactivity was used, high immersive VR became less effective in gaining higher recall. Two possible explanation can be speculated. One possible explanation of this situation may involve explicating the opening or closing

mechanism of the hotspot in high immersive VR. Viewer had to pay more deliberate attention to open and close the hotspot in stereoscopic VR (as they had to look at it for several seconds) and this, in turn, might have occupied view's cognitive resources, resulting in less focus on brand information. Also, the popping up of an information box via hotspot during the middle of the ad may act as a distraction (Sundar et al., 2015). It might have caused viewers not to spend enough time in reading brand information inside and close the information box. Therefore, higher recall was noticed in the high immersive only when there was no hotspot.

Three-way interaction of immersive VR type, modality interactivity and sensory breadth

Interestingly, a significant three-way interaction of immersive VR type, modality interactivity and sensory breadth was found. That means, when sensory breadth was added to the relationship mentioned in the previous paragraph, effectiveness of high immersive VR with modality interactivity improved a lot. In the case of the high immersive VR, high sensory breadth created higher recall in the presence of modality interactivity (as opposed to low sensory breadth). That means, when participants used the hotspot and saw both textual plus visual information about the product in a stereoscopic VR ad, they recalled the brand name more correctly (as opposed to when they saw only text). This result implies the important combined role of modality interactivity and sensory breadth to gain higher aided recall. It can be speculated that after opening the hotspot, the popped-up visuals along with texts caught their orienting attention and they shifted their cognitive resources towards the textual-visual information, resulting in higher recall (A Lang, 2014). The distracting effect of interactivity, as found in the previous interaction, might have reduced by the use of

multiple visuals along with text. Furthermore, seeing product and brand information in vivid visuals in a new window (created by the hotspot), allowing other distractions to hide for a little, might have helped them employ their cognitive resources for attending the information (Sundar et al., 2011; Xu & Sundar, 2011) in a more elaborative way (Bryce & Yalch, 1993; Daft & Lengel, 1986; Edell & Keller, 1989).

On the other hand, the study found that in the case of low immersive VR system, modality interactivity condition was more effective in creating higher aided recall than without modality interactivity condition. But, the effect of modality interactivity was intensified when low sensory breadth was used, instead of high sensory breadth. Although the study found that recall score was highest in the case of low immersive (with modality interactivity and high sensory breadth), the study revealed an important insight for high immersive VR. Use of both modality interactivity and multiple sensory items in immersive VR system would provide higher ad effectiveness in terms of aided recall.

Chapter 11: Conclusion

Summary of Findings

Study 1 revealed that an immersive VR ad is more effective in creating users' sense of presence, favorable ad attitude, purchase intentions and sharing intentions than a 2-D ad. The mediation analysis also confirmed an indirect effect of ad type on such variables via different dimensions of presence. Interestingly, although significant direct effect of ad type was not found on unaided brand recall, perceived product knowledge, and brand attitude, the mediation analysis identified indirect effects of ad type on such variables via different dimensions of presence.

Study 2 revealed that the high immersive VR ad is more effective in creating sense of presence and sharing intentions than the low immersive VR ad. Although most of the direct effects of the immersive VR system were absent, the mediation analysis confirmed an indirect effect of immersive VR type on unaided recall, perceived product knowledge, ad attitude, brand attitude, purchase intention and sharing intention via different dimensions of presence.

Study 2 also revealed that the combination of modality interactivity and sensory breadth significantly increased the sense of presence, while their individual main effects on presence were missing. Immersive VR type was found to interact with modality interactivity only on presence such that the high immersive VR was more effective in increasing the dimensions of presence than the low immersive VR. However, perceived media novelty of the users moderated several relationships in study 2. In case of presence, perceived media novelty moderated the interaction effect of modality interactivity and sensory breadth such that when perceived media novelty is high, any

combination of modality interactivity and sensory breadth became more effective. But, the combination of modality interactivity and high sensory breadth did not contribute more effectively than other situations in the case of low perceived novelty. Perceived media novelty of the users also moderated the effectiveness of high immersive VR on ad attitude and sharing intention. The study found that when perceived novelty was high, the immersive VR was more effective than the low immersive VR in creating favorable ad attitude and sharing intention. But, when perceived novelty was high, the difference between the high immersive VR and the low immersive VR became very low or almost similar. Further, the study found that perceived media novelty also moderated the interaction of immersive VR type and sensory breadth on brand attitude. When the perceived novelty was low, the high immersive VR with high sensory breadth was not more effective than the low immersive VR. But, when the perceived novelty was high, the high immersive VR with high sensory breadth became more effective than the low immersive VR.

To sum up, both studies revealed the strength of immersive modalities or VR system in increasing VR ad effectiveness, specially via the sense of presence. Both studies established the significant role of presence to mediate the relationship between interface type and ad effectiveness outcomes. However, study 2 additionally revealed how high immersive VR can generate different levels of effectiveness when the concepts of modality interactivity and sensory breadth were considered. Also, adding the concept of perceived media novelty provided important insights.

Theoretical Implications – Immersive Media Effect and Virtual Experience

The first primary theoretical contribution of this dissertation comes from its overall test to find out the effects of an ad presented via different interfaces that varied in terms of immersive features or modalities: non-immersive interface/non-VR interface (e.g., 2-D), low immersive VR interface (e.g., monoscopic VR), and high immersive VR (stereoscopic VR). In terms of ad effectiveness, both studies revealed that the immersive VR interface outperformed the non-immersive interface, while high immersive VR outperformed low immersive VR. These results, thus, established that immersion, as a functional property of VR platforms, can enhance ad effectiveness. The results contribute to the body of research on immersive VR media and VR environments done earlier.

Another important insight can be added to the literature of virtual experience. Although immersive VR provides an indirect experience, product exposure in immersive VR is more realistic and users have better control over the review of a product in the ad. Such compelling virtual experience was found to enhance confidence in buyers, boost their emotional responses and finally, enable them to make better consumer decisions.

Finally, another key contribution made by the current study was its conceptualization of perceived media novelty as a moderator of the relationships between immersive VR systems and the measure of ad effectiveness. The study showed how high perceived media novelty can exaggerate the real effect of high immersive VR, making it almost equally effective to low immersive VR. Effects of perceived media novelty would provide important insight into the theoretical framework development of

immersive VR and virtual product experience to evaluate the effectiveness of emerging immersive VR media more accurately.

Theoretical Implication – Mediating Role of Presence

This study's second theoretical contribution comes from its mediation analysis done on the relationship between interface type and ad effectiveness measures via the sense of presence. Such relationships are theoretically important for several reasons. First, it established the important role of presence to evaluate VR ad effectiveness. The study found that although the direct effects of interface type on several variables were absent, indirect effects were still active in VR ad via different dimensions of presence. Second, the mediating role of presence is rarely tested in case of monoscopic or stereoscopic VR ads. So, the current study extended the theoretical validity of the mediating role of presence on such platforms. Next, the study focused on determining different dimensions of presence (e.g., spatial presence, engagement, naturalness, and negative effects), rather than determining presence as one single construct. To the best of the researcher's knowledge, almost no studies have yet considered and scrutinized such dimensions of presence on immersive VR interfaces to conduct the mediation analysis.

Theoretical Implication – Empirical Support for Presence Framework

The current study offers important implications for Steuer's (1992) presence framework, which stated that interactivity and vividness are important predictors of presence. The implications are three-fold. First, the current study actually tested Steuer's presence framework by using sub-components of interactivity and vividness, e.g., modality interactivity and sensory breadth, respectively. But, no main effects of

modality interactivity and sensory breadth were identified. Interestingly, the study found significant interaction effects of modality interactivity and sensory breadth on different dimensions of presence and showed how these two factors worked together in increasing the sense of presence. Interaction effects of such variables (as opposed to separate main effects) provided a more detailed understanding of Steuer's presence framework. Therefore, the study indicates that Steuer's presence framework worked only when users consider the combined role of interactivity and vividness. However, in previous studies the concepts of vividness and interactivity were not manipulated as an independent variable, but rather assumed to be there in an interface as one of many technological affordances. Moreover, the interaction effects of these two variables were never explicated on an immersive VR interface. Therefore, to the researcher's best knowledge, the current study is the first to utilize interactivity and vividness as independent variables and demonstrate how different levels of modality interactivity and sensory breadth affected different dimensions of presence. Second, as discussed earlier, the study utilized different dimensions of presence to test Steuer's presence framework, providing a detailed explanation of how and when the framework worked. Finally, adding the moderating role of novelty on such a relationship also provided more specific insights to the presence framework.

Managerial Implications

The findings of the two studies are important to marketers and have immediate implications. The results indicate that marketers can implement technological modalities of VR to enhance persuasive outcomes. Like previous studies, the current studies identified that high immersive VR platforms, e.g., stereoscopic VR, increased ad

effectiveness, suggesting the importance of including VR interfaces as a part of advertising campaigns. Developing a captivating and engaging virtual product exposure potentially can improve users' overall virtual experience. Moreover, the studies suggested that the concept of presence acted as a mediating variable to enhance VR ad effectiveness. This study specifically upholds the roles of physical presence, engagement and enjoyment, ecological validity/naturalness and negative effects of presence dimension. Therefore, advertisers need to improve their "presence strategy" in ads to make users feel that (a) users are physically present in the displayed VR environment, (b) they are involved and interested in the content of the displayed VR environment, while enjoying the media experience, and (c) the content and environment are real and natural, while considering minimizing or off-setting the negative effects associated with the media usage. The study identified that a compelling virtual experience via presence can potentially enhance users' confidence about the product evaluation, positive feeling about the ad, willingness to buy the product in future and desire to share the ad with others. Also, including measures of such presence dimensions in ad copy pre-testing would be beneficial to the selection of effective media.

Moreover, the study also suggested several insights on the strategy of elevating presence via different combinations of modality interactivity (i.e., using/not using a hotspot) and sensory breadth (i.e., using only text/using text plus visual information). The study found that when there was a hotspot, using only textual product information (as opposed to textual plus visual information) was more effective in creating the sense of physical presence and naturalness. On the other hand, when there was no hotspot,

using text plus visual information (as opposed to only textual product information) was more effective in creating the sense of physical presence and naturalness. These specific combinations indicate how marketers can potentially enhance VR ad effectiveness by elevating the sense of presence.

Further, the study indicated when high immersive VR ads can be the most effective system in the presence of different combinations of modality interactivity (i.e., using/not using a hotspot) and/or sensory breadth (i.e., using only text/using text plus visual information). High immersive VR was realized as the most effective one in creating presence when a hotspot and textual plus visual information were used together. Also, in the case of high immersive VR ad, when there was a hotspot, using textual plus visual information (as opposed to only text) worked better to gain aided brand recall. And, in the same case, when there was no hotspot, using only textual information (as opposed to text plus visual) worked better to gain aided brand recall. In order to enhance aided brand recall, markets can utilize such specific combinations.

Finally, the study suggested that marketers should evaluate the effectiveness of VR ads with caution, as the media effectiveness was found to be equal or almost equal for the high immersive VR and the low immersive VR when users perceived high media novelty (as opposed to the low perceived medium novelty condition). That means the high immersive VR, i.e., stereoscopic VR, is not more effective than the low immersive VR, i.e., monoscopic VR, when users perceived both media as novel. The study found that perceived media novelty moderated (a) the effect of immersive VR type on ad attitude and sharing intentions, (b) the interaction effect of modality interactivity and sensory breadth on presence, and (c) the interaction effect of immersive VR type, and

sensory breadth on brand attitude. All the combinations in high perceived novelty condition generated higher scores. Such results provided interesting guidance for marketers. Stereoscopic VR platforms are still new to many people and marketers should not be disappointed if high immersive VR seems less effective than monoscopic VR platforms. It might just be a novelty issue. Once users get used to and experienced with such kind of immersive technology of both stereoscopic and monoscopic VR systems, the scores of effectiveness may change in favor of stereoscopic VR platforms. Initially, marketers will benefit from both type of platforms. But if immersive VR is deeply embedded in marketers' future media plans, marketers have the responsibility of both developing creative contents to entice viewers' attention and familiarizing VR headsets among users. Before any major ad campaign that includes stereoscopic VR, marketers should analyze the target market to find out their familiarity with VR and take necessary steps to make the high immersive VR familiar.

Limitations and Future Research

This study does not offer precise conclusive answers or directions regarding the predicted issues as it has several limitations. The current study identified several concerns to address in further research. Limitations and recommendations for future study are discussed below.

First, while this study reveals implications for advertising, marketing and communication researchers and practitioners, its generalizability is limited to only one type of product and ad. The external validity of causal relationship established in the study 1 and 2 should be tested on different types of products and ads. Earlier studies have recognized that consumers' psychological responses were affected differently by

different types of products, e.g., high/low involvement products (Klatzky, Lederman, Matula 1991; Norman 1998) and different types of ads, e.g., informational/transformational ads (Puto & Wells, 1984). Further experimental studies should be conducted on with different products and ads to extent the external validity of the current studies.

Next, only technological predictors of presence, e.g., interactivity and vividness, were used to test the presence framework. According to Steuer (1992), variation across individuals due to both immediate situational factors and ongoing personal concerns play a crucial role in influencing the sense of presence. Ahn (2011), for example, found that individual difference in presence perception determined the extend of presence. Variation across individuals can also interact with the vividness and interactivity. However, the current study did not consider such factors in order to keep the research design less complex. This opens an avenue for future research to consider indicators of individual differences to determine presence, along with interactivity and vividness.

ICT-SOPI was used to measure perception of presence to gain detailed insight regarding the dimensions of presence. However, the measurements used a self-reported questionnaire, which has its own methodological limitations, especially for the concepts that involve greater emotionally loaded experience, e.g., sense of presence (Ahn, 2011; Yim et al., 2012). Many researchers (e.g., Biocca 1997; Heeter 1992; Lee 2004) have already addressed this issue. According the them, users may often remain unaware about their perception of presence and/or the level of presence while they experience it. Therefore, users' responses to questions that involve reporting on "their cognitively stored experiences" regarding presence, may be problematic (Yim et al., p. 123).

Physiological measures, e.g., heart rate, skin conductance, appeared as more objective alternatives of measuring presence than self-reported questionnaire (Ahn; Meehan, Razzaque, Whitton, & Brooks, 2003). However, physiological measures should be evaluated with caution, as they do not directly measure presence, but rather, associate the changes in physiological responses with perception of presence (Ahn). In order to navigate the shortcomings of each measures, many scholars have suggested future research to consider physiological measures along with self-reporting measures (Bailenson et al., 2004).

Next, the concepts of interactivity and vividness were not explicated fully in these studies. In case of interactivity, only a specific type of modality interactivity, e.g., hotspot, was considered. Future research has multiple opportunity to test (a) other types of interactivity, e.g., source interactivity or message interactivity (Sundar et al., 2015), (b) other types of modality interactivity, e.g., zoom in/out option, parallel scrolling, etc. (Sundar et al.), or (c) different factors that may affect the degree of interactivity, e.g., natural mapping, speed, and range (Steuer, 1992). Also, the study operationalized interactivity with a non-embodied functionality. “Embodiment” or “being embodied” means being an active participant, bounded by the human body, in the world (Zahorik & Jenison, 1998). Human beings have five distinct sensory or perceptual systems: orienting (for a continuing body equilibrium), auditory, haptic/touch, taste/smell, and visual (Gibson, 1966). Embodied experiences are realized when such systems are used either separately or combined. In the current study, the option of embodiment to interact was limited, as no tactile option (i.e., using hands) was there to click the hotspot. But, VR ads will potentially offer high embodied experiences more frequently. So, adding

embodied experience in the VR ad to exercise interactivity may generate interesting results for future researchers.

Moreover, the study only considered sensory breadth category of vividness and manipulated it with either only textual information and textual plus visual information. Other sensory items, e.g., aural, tactile, were not used. Also, the study did not consider sensory depth category of vividness. These had limited the scope of the study results. However, future research is needed to address such issues and test how each dimension and category of vividness may affect the perception of presence and then, influence ad effectiveness.

Next, the study did not control for the information exposure frequency and time for modality interactivity condition. Participants were not given any instructions on what to do once they open the hotspot, how many times they could open/close it, or how much time they could spend to read the product information in order to simulate a natural use of the hotspot. In non-modality condition the exposure time was limited and participants could see the information only once. So, the variance in the duration and frequency of product information exposure might have a confounding effect on the results.

Last but not the least, the sample size of study 1 was lower than what was suggested by the power calculator due to time and resource restriction. This might have created an issue of low power, increasing the probability of missing the true effects of practical importance. However, replication of the present study with larger sample size will be helpful to evaluate the results in detail.

Conclusion

Immersive VR system is gradually becoming the new reality of marketing communication, as this system can provide a compelling virtual experience to the users. The main goal of the current dissertation was to examine the immersive VR ad effectiveness via two experimental studies. This dissertation identified that technological modalities of immersive VR helped users elevate the sense of presence (particularly physical presence, engagement, and naturalness). Such dimensions of presence ultimately helped immersive VR outperform 2-D interface in terms of enhancing unaided brand recall, ad attitude, brand attitude, purchase intention, and sharing intention. Also, such dimensions of presence helped high immersive VR outperform low immersive VR in terms of enhancing attitudes and intentions. The combined role of modality interactivity and sensory breadth was identified to enhance physical presence, engagement and naturalness. Moreover, the study found how these two elements, e.g., modality interactivity and sensory breadth, influence aided brand recall on different level of immersion. Finally, the dissertation identified how perceived media novelty moderated the relationships between immersive VR systems and the measure of ad effectiveness. The results from both studies significantly add value and meaningful insights to the current literatures on VR, virtual experience and presence framework, while providing immediate marketing implications regarding effective immersive VR ad development and media planning.

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Appendix A: Descriptive Statistics for All Dependent Variables

Table 56. *Descriptive statistics (Means, Standard Deviations, Skewness and Kurtosis) for All Dependent Variables in Study 1*

	Spre	Eng	Nat	NE	URe	ARe	PK	Aad	Ab	PI	SI
M	4.300	4.358	5.063	3.114	1.47	2.90	2.056	4.956	4.478	2.817	3.242
SD	1.130	1.090	.922	1.635	.650	.440	.8429	1.194	1.009	1.442	1.771
Skewness	-.101	-.188	-.112	.579	1.085	-4.236	1.353	-.364	-.476	.483	.314
SE of Skewness	.309	.309	.309	.309	.309	.309	.309	.309	.309	.309	.309
Kurtosis	-.380	-.394	.129	-.862	.083	16.49	3.212	-.023	1.779	-.908	-1.03
SE of Kurtosis	.608	.608	.608	.608	.608	.608	.608	.608	.608	.608	.608

Table 57. *Means and Standard Deviations for All Dependent Variables in All Conditions of Study 1*

Dependent Variables	Interface Type	*Mean*	*SD*
Presence			
Spatial Presence	2-D	3.5332	.94391
	VR	4.9710	.81236
Engagement	2-D	3.8297	1.11518
	VR	4.8197	.84075
Naturalness	2-D	4.5571	.80435
	VR	5.5063	.78860
Negative Effects	2-D	3.1250	1.49321
	VR	3.1042	1.77283
Unaided Recall	2-D	1.36	.559
	VR	1.56	.716
Aided Recall	2-D	2.93	.378
	VR	2.87	.492
Perceived Product Knowledge	2-D	1.8095	.58393
	VR	2.2708	.97599
Ad Attitude	2-D	4.3333	1.12217
	VR	5.5000	.98009
Brand Attitude	2-D	4.2262	1.00228
	VR	4.6979	.97774
Purchase Intention	2-D	2.3571	1.29871
	VR	3.2187	1.46062
Sharing Intention	2-D	2.3839	1.29544
	VR	3.9922	1.80667

Table 58. *Descriptive statistics (Means, Standard Deviations, Skewness and Kurtosis) for All Dependent Variables in Study 2.*

	Spre	Eng	Nat	NE	URe	ARe	PK	Aad	Ab	PI	SI
M	4.512	4.462	4.967	3.187	1.42	.80	2.290	5.154	4.541	2.946	3.6218
SD	1.084	1.063	1.056	1.523	.700	.400	1.378	1.164	.9937	1.339	1.7879
Skewness	-.287	-.343	-.556	.651	1.350	-1.514	1.517	-.591	.264	.429	.038

SE of Skewness	.148	.148	.148	.148	.148	.148	.148	.148	.148	.148	.148
Kurtosis	-.170	-.233	.423	-.525	.361	.295	2.213	.294	.838	-.383	-1.260
SE of Kurtosis	.295	.295	.295	.295	.295	.295	.295	.295	.295	.295	.295

Table 59. *Means and Standard Deviations for Spatial Presence in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	3.5263	1.04171	19
			High	4.8000	1.05158	15
			Total	4.0882	1.21372	34
		High Sensory Breadth	Low	4.2857	1.29363	19
			High	4.8520	.44428	14
			Total	4.5260	1.04991	33
		Total	Low	3.9060	1.22070	38
			High	4.8251	.80328	29
			Total	4.3038	1.14875	67
	Modality Interactivity	Low Sensory Breadth	Low	3.9365	1.13307	18
			High	4.4286	1.20034	16
			Total	4.1681	1.17407	34
		High Sensory Breadth	Low	3.6071	1.05881	16
			High	4.5134	.88303	16
			Total	4.0603	1.06381	32
		Total	Low	3.7815	1.09490	34
			High	4.4710	1.03746	32
			Total	4.1158	1.11468	66
	Total	Low Sensory Breadth	Low	3.7259	1.09181	37
			High	4.6083	1.12786	31
			Total	4.1282	1.18580	68
		High Sensory Breadth	Low	3.9755	1.22400	35
			High	4.6714	.72203	30
			Total	4.2967	1.07442	65
		Total	Low	3.8472	1.15656	72
			High	4.6393	.94288	61
			Total	4.2105	1.13162	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	4.0420	.86199	17
			High	5.2109	.58749	21
			Total	4.6880	.92454	38
		High Sensory Breadth	Low	4.6984	1.17255	18
			High	4.7277	.82694	16
			Total	4.7122	1.00961	34
		Total	Low	4.3796	1.07140	35
			High	5.0019	.73183	37
			Total	4.6994	.95883	72
			Low	4.8357	.67263	10

	Modality Interactivity Sensory Breadth	Low	High	5.2643	.86124	20
			Total	5.1214	.81768	30
		High Sensory Breadth	Low	4.4429	.89874	15
			High	4.9524	1.06026	21
			Total	4.7401	1.01507	36
		Total	Low	4.6000	.82427	25
			High	5.1045	.96918	41
			Total	4.9134	.94325	66
	Total	Low Sensory Breadth	Low	4.3360	.87545	27
			High	5.2369	.72500	41
			Total	4.8792	.89914	68
		High Sensory Breadth	Low	4.5823	1.04904	33
			High	4.8552	.96031	37
			Total	4.7265	1.00516	70
		Total	Low	4.4714	.97462	60
			High	5.0559	.86082	78
			Total	4.8018	.95399	138
Total	No Modality Interactivity Sensory Breadth	Low	Low	3.7698	.98281	36
			High	5.0397	.82569	36
			Total	4.4048	1.10501	72
		High Sensory Breadth	Low	4.4865	1.23682	37
			High	4.7857	.66796	30
			Total	4.6205	1.02611	67
		Total	Low	4.1331	1.16814	73
			High	4.9242	.76315	66
			Total	4.5087	1.06934	139
	Modality Interactivity Sensory Breadth	Low	Low	4.2577	1.07316	28
			High	4.8929	1.09431	36
			Total	4.6150	1.12238	64
		High Sensory Breadth	Low	4.0115	1.05722	31
			High	4.7625	.99902	37
			Total	4.4202	1.08569	68
		Total	Low	4.1283	1.06284	59
			High	4.8268	1.04185	73
			Total	4.5146	1.10374	132
	Total	Low Sensory Breadth	Low	3.9833	1.04388	64
			High	4.9663	.96534	72
			Total	4.5037	1.11407	136
		High Sensory Breadth	Low	4.2700	1.17439	68
			High	4.7729	.86056	67
			Total	4.5196	1.05739	135
		Total	Low	4.1310	1.11809	132
			High	4.8731	.91816	139
			Total	4.5116	1.08422	271

Table 60. *Means and Standard Deviations for Engagement in all Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	3.1579	1.03568	19
			High	4.7897	1.15950	15
			Total	3.8778	1.35346	34
		High Sensory Breadth	Low	4.1822	1.12681	19
			High	4.7473	.78239	14
			Total	4.4219	1.02143	33
		Total	Low	3.6700	1.18697	38
			High	4.7692	.97821	29
			Total	4.1458	1.22347	67
	Modality Interactivity	Low Sensory Breadth	Low	3.8590	.97023	18
			High	4.7308	.88690	16
			Total	4.2692	1.01861	34
		High Sensory Breadth	Low	3.5865	1.01968	16
			High	4.6490	.83369	16
			Total	4.1178	1.06336	32
		Total	Low	3.7308	.98823	34
			High	4.6899	.84773	32
			Total	4.1958	1.03531	66
	Total	Low Sensory Breadth	Low	3.4990	1.05216	37
			High	4.7593	1.01074	31
			Total	4.0735	1.20506	68
		High Sensory Breadth	Low	3.9099	1.10523	35
			High	4.6949	.79774	30
			Total	4.2722	1.04539	65
		Total	Low	3.6987	1.09044	72
			High	4.7276	.90523	61
			Total	4.1706	1.12999	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	4.1674	.85105	17
			High	5.0183	.56312	21
			Total	4.6377	.81759	38
		High Sensory Breadth	Low	4.6453	1.12068	18
			High	5.1442	.93111	16
			Total	4.8801	1.05117	34
		Total	Low	4.4132	1.01367	35
			High	5.0728	.73580	37
			Total	4.7521	.93636	72
	Modality Interactivity	Low Sensory Breadth	Low	4.5615	.59920	10
			High	5.1154	.90931	20
			Total	4.9308	.85069	30
		High Sensory Breadth	Low	4.0923	.66121	15
			High	4.9084	.92871	21
			Total	4.5684	.91337	36
		Total	Low	4.2800	.66687	25

			High	5.0094	.91377	41
			Total	4.7331	.89729	66
	Total	Low	Low	4.3134	.77950	27
		Sensory	High	5.0657	.74412	41
		Breadth	Total	4.7670	.83897	68
		High	Low	4.3939	.96782	33
		Sensory	High	5.0104	.92435	37
		Breadth	Total	4.7198	.98805	70
		Total	Low	4.3577	.88171	60
			High	5.0394	.82939	78
			Total	4.7430	.91459	138
Total	No Modality	Low	Low	3.6346	1.06958	36
	Interactivity	Sensory	High	4.9231	.85559	36
		Breadth	Total	4.2788	1.16004	72
		High	Low	4.4075	1.13269	37
		Sensory	High	4.9590	.87373	30
		Breadth	Total	4.6544	1.05432	67
		Total	Low	4.0263	1.16146	73
			High	4.9394	.85738	66
			Total	4.4599	1.12225	139
	Modality	Low	Low	4.1099	.91099	28
	Interactivity	Sensory	High	4.9444	.90749	36
		Breadth	Total	4.5793	.99364	64
		High	Low	3.8313	.88877	31
		Sensory	High	4.7963	.88642	37
		Breadth	Total	4.3563	1.00514	68
		Total	Low	3.9635	.90255	59
			High	4.8693	.89374	73
			Total	4.4645	1.00203	132
	Total	Low	Low	3.8425	1.02357	64
		Sensory	High	4.9338	.87576	72
		Breadth	Total	4.4202	1.09139	136
		High	Low	4.1448	1.06144	68
		Sensory	High	4.8691	.87788	67
		Breadth	Total	4.5043	1.03684	135
		Total	Low	3.9983	1.05027	132
			High	4.9026	.87420	139
			Total	4.4621	1.06343	271

Table 61. *Means and Standard Deviations for Naturalness in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	4.3579	1.36395	19
			High	5.2800	1.41986	15
			Total	4.7647	1.44430	34
			Low	4.7368	1.22393	19

		High Sensory Breadth	High	5.1286	.62071	14
			Total	4.9030	1.01873	33
		Total	Low	4.5474	1.29254	38
			High	5.2069	1.09216	29
			Total	4.8328	1.24540	67
	Modality Interactivity	Low Sensory Breadth	Low	4.5778	1.23267	18
			High	5.0500	1.07951	16
			Total	4.8000	1.17034	34
		High Sensory Breadth	Low	4.4000	1.05071	16
			High	5.3000	.90037	16
			Total	4.8500	1.06559	32
		Total	Low	4.4941	1.13697	34
			High	5.1750	.98603	32
			Total	4.8242	1.11246	66
	Total	Low Sensory Breadth	Low	4.4649	1.28846	37
			High	5.1613	1.23981	31
			Total	4.7824	1.30475	68
		High Sensory Breadth	Low	4.5829	1.14416	35
			High	5.2200	.77433	30
			Total	4.8769	1.03422	65
		Total	Low	4.5222	1.21333	72
			High	5.1902	1.02919	61
			Total	4.8286	1.17683	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	4.9882	.97332	17
			High	5.1429	.72151	21
			Total	5.0737	.83494	38
		High Sensory Breadth	Low	5.0000	1.40084	18
			High	5.2250	.56980	16
			Total	5.1059	1.08235	34
		Total	Low	4.9943	1.19458	35
			High	5.1784	.65283	37
			Total	5.0889	.95291	72
	Modality Interactivity	Low Sensory Breadth	Low	5.1200	.57504	10
			High	5.4600	.75422	20
			Total	5.3467	.70844	30
		High Sensory Breadth	Low	4.5600	.92335	15
			High	5.1714	.89507	21
			Total	4.9167	.94461	36
		Total	Low	4.7840	.83650	25
			High	5.3122	.83192	41
			Total	5.1121	.86656	66
	Total	Low Sensory Breadth	Low	5.0370	.83765	27
			High	5.2976	.74582	41
			Total	5.1941	.78795	68
			Low	4.8000	1.21037	33

		High Sensory Breadth	High	5.1946	.76229	37
			Total	5.0086	1.01092	70
		Total	Low	4.9067	1.05732	60
			High	5.2487	.75054	78
			Total	5.1000	.90940	138
Total	No Modality Interactivity	Low Sensory Breadth	Low	4.6556	1.22134	36
			High	5.2000	1.05289	36
			Total	4.9278	1.16489	72
		High Sensory Breadth	Low	4.8649	1.30133	37
			High	5.1800	.58569	30
			Total	5.0060	1.04850	67
		Total	Low	4.7616	1.25815	73
			High	5.1909	.86607	66
			Total	4.9655	1.10701	139
	Modality Interactivity	Low Sensory Breadth	Low	4.7714	1.06627	28
			High	5.2778	.92245	36
			Total	5.0562	1.01197	64
		High Sensory Breadth	Low	4.4774	.97799	31
			High	5.2270	.88715	37
			Total	4.8853	.99630	68
		Total	Low	4.6169	1.02270	59
			High	5.2521	.89878	73
			Total	4.9682	1.00376	132
	Total	Low Sensory Breadth	Low	4.7063	1.14862	64
			High	5.2389	.98361	72
			Total	4.9882	1.09349	136
		High Sensory Breadth	Low	4.6882	1.17302	68
			High	5.2060	.76195	67
			Total	4.9452	1.02051	135
		Total	Low	4.6970	1.15685	132
			High	5.2230	.88074	139
			Total	4.9668	1.05603	271

Table 62. *Means and Standard Deviations for Negative Effects in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	2.9825	1.65821	19
			High	2.9556	1.26062	15
			Total	2.9706	1.47451	34
		High Sensory Breadth	Low	3.2632	1.62286	19
			High	3.3810	1.58307	14
			Total	3.3131	1.58210	33
		Total	Low	3.1228	1.62455	38
			High	3.1609	1.41595	29

			Total	3.1393	1.52659	67
	Modality	Low	Low	2.5463	1.22848	18
	Interactivity	Sensory	High	2.5938	1.15945	16
		Breadth	Total	2.5686	1.17860	34
		High	Low	2.6875	1.09861	16
		Sensory	High	2.6250	1.33680	16
		Breadth	Total	2.6562	1.20404	32
		Total	Low	2.6127	1.15377	34
			High	2.6094	1.23103	32
			Total	2.6111	1.18261	66
	Total	Low	Low	2.7703	1.46162	37
		Sensory	High	2.7688	1.20314	31
		Breadth	Total	2.7696	1.34017	68
		High	Low	3.0000	1.41825	35
		Sensory	High	2.9778	1.48152	30
		Breadth	Total	2.9897	1.43641	65
		Total	Low	2.8819	1.43520	72
			High	2.8716	1.34005	61
			Total	2.8772	1.38715	133
High	No Modality	Low	Low	4.0784	1.95000	17
Immersive	Interactivity	Sensory	High	2.9683	1.27869	21
VR		Breadth	Total	3.4649	1.68555	38
		High	Low	3.0556	1.38738	18
		Sensory	High	2.8333	1.13039	16
		Breadth	Total	2.9510	1.25899	34
		Total	Low	3.5524	1.73806	35
			High	2.9099	1.20223	37
			Total	3.2222	1.51130	72
	Modality	Low	Low	3.0333	1.29291	10
	Interactivity	Sensory	High	4.1250	1.60853	20
		Breadth	Total	3.7611	1.57731	30
		High	Low	4.0222	1.44868	15
		Sensory	High	3.6111	1.89175	21
		Breadth	Total	3.7824	1.71076	36
		Total	Low	3.6267	1.44760	25
			High	3.8618	1.75669	41
			Total	3.7727	1.63891	66
	Total	Low	Low	3.6914	1.78413	27
		Sensory	High	3.5325	1.54570	41
		Breadth	Total	3.5956	1.63333	68
		High	Low	3.4949	1.47637	33
		Sensory	High	3.2748	1.63498	37
		Breadth	Total	3.3786	1.55493	70
		Total	Low	3.5833	1.61079	60
			High	3.4103	1.58358	78
			Total	3.4855	1.59194	138

Total	No Modality Interactivity	Low Sensory Breadth	Low	3.5000	1.86019	36
			High	2.9630	1.25300	36
			Total	3.2315	1.59777	72
		High Sensory Breadth	Low	3.1622	1.49561	37
			High	3.0889	1.36439	30
			Total	3.1294	1.42808	67
		Total	Low	3.3288	1.68210	73
			High	3.0202	1.29612	66
			Total	3.1823	1.51374	139
	Modality Interactivity	Low Sensory Breadth	Low	2.7202	1.25056	28
			High	3.4444	1.60505	36
			Total	3.1276	1.49418	64
		High Sensory Breadth	Low	3.3333	1.42919	31
			High	3.1847	1.72571	37
			Total	3.2525	1.58755	68
		Total	Low	3.0424	1.37109	59
			High	3.3128	1.66086	73
			Total	3.1919	1.53838	132
	Total	Low Sensory Breadth	Low	3.1589	1.65670	64
			High	3.2037	1.45006	72
			Total	3.1826	1.54505	136
		High Sensory Breadth	Low	3.2402	1.45735	68
			High	3.1418	1.56354	67
			Total	3.1914	1.50614	135
		Total	Low	3.2008	1.55173	132
			High	3.1739	1.50065	139
			Total	3.1870	1.52297	271

Table 63. *Means and Standard Deviations for Unaided Recall in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	1.47	.841	19
			High	1.33	.724	15
			Total	1.41	.783	34
		High Sensory Breadth	Low	1.21	.535	19
			High	1.29	.611	14
			Total	1.24	.561	33
		Total	Low	1.34	.708	38
			High	1.31	.660	29
			Total	1.33	.683	67
	Modality Interactivity	Low Sensory Breadth	Low	1.33	.686	18
			High	1.44	.814	16
			Total	1.38	.739	34
		High Sensory Breadth	Low	1.75	.856	16
			High	1.63	.806	16

		High Sensory Breadth	Total	1.69	.821	32
		Total	Low	1.53	.788	34
			High	1.53	.803	32
			Total	1.53	.789	66
	Total	Low Sensory Breadth	Low	1.41	.762	37
			High	1.39	.761	31
			Total	1.40	.756	68
		High Sensory Breadth	Low	1.46	.741	35
			High	1.47	.730	30
			Total	1.46	.731	65
		Total	Low	1.43	.747	72
			High	1.43	.741	61
			Total	1.43	.741	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	1.41	.712	17
			High	1.43	.598	21
			Total	1.42	.642	38
		High Sensory Breadth	Low	1.22	.548	18
			High	1.25	.447	16
			Total	1.24	.496	34
		Total	Low	1.31	.631	35
			High	1.35	.538	37
			Total	1.33	.581	72
	Modality Interactivity	Low Sensory Breadth	Low	1.50	.850	10
			High	1.40	.598	20
			Total	1.43	.679	30
		High Sensory Breadth	Low	1.27	.458	15
			High	1.81	.873	21
			Total	1.58	.770	36
		Total	Low	1.36	.638	25
			High	1.61	.771	41
			Total	1.52	.728	66
	Total	Low Sensory Breadth	Low	1.44	.751	27
			High	1.41	.591	41
			Total	1.43	.654	68
		High Sensory Breadth	Low	1.24	.502	33
			High	1.57	.765	37
			Total	1.41	.670	70
		Total	Low	1.33	.629	60
			High	1.49	.679	78
			Total	1.42	.660	138
Total	No Modality Interactivity	Low Sensory Breadth	Low	1.44	.773	36
			High	1.39	.645	36
			Total	1.42	.707	72
			Low	1.22	.534	37

		High	High	1.27	.521	30
		Sensory Breadth	Total	1.24	.525	67
		Total	Low	1.33	.668	73
			High	1.33	.591	66
			Total	1.33	.630	139
	Modality Interactivity	Low Sensory Breadth	Low	1.39	.737	28
			High	1.42	.692	36
			Total	1.41	.706	64
		High Sensory Breadth	Low	1.52	.724	31
			High	1.73	.838	37
			Total	1.63	.790	68
		Total	Low	1.46	.727	59
			High	1.58	.780	73
			Total	1.52	.756	132
	Total	Low Sensory Breadth	Low	1.42	.752	64
			High	1.40	.664	72
			Total	1.41	.704	136
		High Sensory Breadth	Low	1.35	.641	68
			High	1.52	.746	67
			Total	1.44	.698	135
		Total	Low	1.39	.695	132
			High	1.46	.705	139
			Total	1.42	.700	271

Table 64. *Means and Standard Deviations for Aided Recall in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	.84	.375	19
			High	.67	.488	15
			Total	.76	.431	34
		High Sensory Breadth	Low	.74	.452	19
			High	.86	.363	14
			Total	.79	.415	33
		Total	Low	.79	.413	38
			High	.76	.435	29
			Total	.78	.420	67
	Modality Interactivity	Low Sensory Breadth	Low	.83	.383	18
			High	.94	.250	16
			Total	.88	.327	34
		High Sensory Breadth	Low	.81	.403	16
			High	.81	.403	16
			Total	.81	.397	32
		Total	Low	.82	.387	34
			High	.87	.336	32
			Total	.85	.361	66

	Total	Low	Low	.84	.374	37
		Sensory	High	.81	.402	31
		Breadth	Total	.82	.384	68
		High	Low	.77	.426	35
		Sensory	High	.83	.379	30
		Breadth	Total	.80	.403	65
		Total	Low	.81	.399	72
			High	.82	.388	61
			Total	.81	.392	133
High	No Modality	Low	Low	.88	.332	17
Immersive	Interactivity	Sensory	High	.86	.359	21
VR		Breadth	Total	.87	.343	38
		High	Low	.67	.485	18
		Sensory	High	.87	.342	16
		Breadth	Total	.76	.431	34
		Total	Low	.77	.426	35
			High	.86	.347	37
			Total	.82	.387	72
	Modality	Low	Low	.60	.516	10
	Interactivity	Sensory	High	.70	.470	20
		Breadth	Total	.67	.479	30
		High	Low	.80	.414	15
		Sensory	High	.86	.359	21
		Breadth	Total	.83	.378	36
		Total	Low	.72	.458	25
			High	.78	.419	41
			Total	.76	.432	66
	Total	Low	Low	.78	.424	27
		Sensory	High	.78	.419	41
		Breadth	Total	.78	.418	68
		High	Low	.73	.452	33
		Sensory	High	.86	.347	37
		Breadth	Total	.80	.403	70
		Total	Low	.75	.437	60
			High	.82	.386	78
			Total	.79	.409	138
Total	No Modality	Low	Low	.86	.351	36
	Interactivity	Sensory	High	.78	.422	36
		Breadth	Total	.82	.387	72
		High	Low	.70	.463	37
		Sensory	High	.87	.346	30
		Breadth	Total	.78	.420	67
		Total	Low	.78	.417	73
			High	.82	.389	66
			Total	.80	.403	139
			Low	.75	.441	28

	Modality	Low	High	.81	.401	36
	Interactivity	Sensory	Total	.78	.417	64
		Breadth				
		High	Low	.81	.402	31
		Sensory	High	.84	.374	37
		Breadth	Total	.82	.384	68
		Total	Low	.78	.418	59
			High	.82	.385	73
			Total	.80	.399	132
	Total	Low	Low	.81	.393	64
		Sensory	High	.79	.409	72
		Breadth	Total	.80	.400	136
		High	Low	.75	.436	68
		Sensory	High	.85	.359	67
		Breadth	Total	.80	.401	135
		Total	Low	.78	.416	132
			High	.82	.385	139
			Total	.80	.400	271

Table 65. *Means and Standard Deviations for Perceived Product Knowledge in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low	No Modality	Low	Low	2.5789	1.72613	19
Immersive	Interactivity	Sensory	High	2.4333	1.54535	15
VR		Breadth	Total	2.5147	1.62595	34
		High	Low	1.8684	.92559	19
		Sensory	High	2.1071	1.04105	14
		Breadth	Total	1.9697	.96776	33
		Total	Low	2.2237	1.41277	38
			High	2.2759	1.31330	29
			Total	2.2463	1.36063	67
	Modality	Low	Low	2.7222	1.91144	18
	Interactivity	Sensory	High	2.4063	1.49687	16
		Breadth	Total	2.5735	1.71063	34
		High	Low	2.0313	1.07189	16
		Sensory	High	2.3750	1.42009	16
		Breadth	Total	2.2031	1.24990	32
		Total	Low	2.3971	1.58964	34
			High	2.3906	1.43535	32
			Total	2.3939	1.50516	66
	Total	Low	Low	2.6486	1.79453	37
		Sensory	High	2.4194	1.49497	31
		Breadth	Total	2.5441	1.65659	68
			Low	1.9429	.98348	35
			High	2.2500	1.24395	30

		High Sensory Breadth	Total	2.0846	1.11302	65
		Total	Low	2.3056	1.49071	72
			High	2.3361	1.36846	61
			Total	2.3195	1.43064	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	2.4706	1.65332	17
			High	2.1905	1.52869	21
			Total	2.3158	1.57008	38
		High Sensory Breadth	Low	2.0833	1.11474	18
			High	1.9688	.84595	16
			Total	2.0294	.98428	34
		Total	Low	2.2714	1.39507	35
			High	2.0946	1.26841	37
			Total	2.1806	1.32502	72
	Modality Interactivity	Low Sensory Breadth	Low	2.3500	1.13162	10
			High	2.3500	1.70217	20
			Total	2.3500	1.51515	30
		High Sensory Breadth	Low	2.2667	1.32107	15
			High	2.4048	1.12493	21
			Total	2.3472	1.19415	36
		Total	Low	2.3000	1.22474	25
			High	2.3780	1.41766	41
			Total	2.3485	1.33868	66
	Total	Low Sensory Breadth	Low	2.4259	1.45908	27
			High	2.2683	1.59725	41
			Total	2.3309	1.53470	68
		High Sensory Breadth	Low	2.1667	1.19678	33
			High	2.2162	1.02429	37
			Total	2.1929	1.10103	70
		Total	Low	2.2833	1.31602	60
			High	2.2436	1.34778	78
			Total	2.2609	1.32937	138
Total	No Modality Interactivity	Low Sensory Breadth	Low	2.5278	1.66881	36
			High	2.2917	1.51834	36
			Total	2.4097	1.58853	72
		High Sensory Breadth	Low	1.9730	1.01342	37
			High	2.0333	.92786	30
			Total	2.0000	.96922	67
		Total	Low	2.2466	1.39474	73
			High	2.1742	1.28150	66
			Total	2.2122	1.33783	139
	Modality Interactivity	Low Sensory Breadth	Low	2.5893	1.66140	28
			High	2.3750	1.59183	36
			Total	2.4688	1.61313	64
			Low	2.1452	1.18458	31

		High	High	2.3919	1.24239	37
		Sensory Breadth	Total	2.2794	1.21367	68
		Total	Low	2.3559	1.43554	59
			High	2.3836	1.41549	73
			Total	2.3712	1.41909	132
	Total	Low	Low	2.5547	1.65260	64
		Sensory	High	2.3333	1.54510	72
		Breadth	Total	2.4375	1.59448	136
		High	Low	2.0515	1.08978	68
		Sensory	High	2.2313	1.11915	67
		Breadth	Total	2.1407	1.10402	135
		Total	Low	2.2955	1.40874	132
			High	2.2842	1.35274	139
			Total	2.2897	1.37775	271

Table 66. *Means and Standard Deviations for Ad Attitude in in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low	No Modality	Low	Low	4.0702	1.21502	19
Immersive	Interactivity	Sensory	High	5.6222	1.33848	15
VR		Breadth	Total	4.7549	1.47552	34
		High	Low	4.5789	1.46499	19
		Sensory	High	5.1905	.79221	14
		Breadth	Total	4.8384	1.24756	33
		Total	Low	4.3246	1.35231	38
			High	5.4138	1.11147	29
			Total	4.7960	1.35830	67
	Modality	Low	Low	4.7222	1.01782	18
	Interactivity	Sensory	High	5.6250	1.03905	16
		Breadth	Total	5.1471	1.11068	34
		High	Low	4.6458	1.23209	16
		Sensory	High	5.6667	.86066	16
		Breadth	Total	5.1563	1.16700	32
		Total	Low	4.6863	1.10688	34
			High	5.6458	.93876	32
			Total	5.1515	1.12953	66
	Total	Low	Low	4.3874	1.15607	37
		Sensory	High	5.6237	1.17297	31
		Breadth	Total	4.9510	1.31109	68
		High	Low	4.6095	1.34428	35
		Sensory	High	5.4444	.85021	30
		Breadth	Total	4.9949	1.20976	65
		Total	Low	4.4954	1.24721	72
			High	5.5355	1.02249	61

			Total	4.9724	1.25800	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	4.7451	1.25571	17
			High	5.7778	1.06632	21
			Total	5.3158	1.25190	38
		High Sensory Breadth	Low	5.2222	.97014	18
			High	5.4583	.78764	16
			Total	5.3333	.88382	34
		Total	Low	4.9905	1.12745	35
			High	5.6396	.95703	37
			Total	5.3241	1.08622	72
	Modality Interactivity	Low Sensory Breadth	Low	5.6667	.87489	10
			High	5.3167	.93955	20
			Total	5.4333	.91873	30
		High Sensory Breadth	Low	4.8889	.86984	15
			High	5.5079	1.12851	21
			Total	5.2500	1.06122	36
		Total	Low	5.2000	.93789	25
			High	5.4146	1.03220	41
			Total	5.3333	.99572	66
	Total	Low Sensory Breadth	Low	5.0864	1.20040	27
			High	5.5528	1.02092	41
			Total	5.3676	1.11099	68
		High Sensory Breadth	Low	5.0707	.92705	33
			High	5.4865	.98318	37
			Total	5.2905	.97294	70
		Total	Low	5.0778	1.04938	60
			High	5.5214	.99724	78
			Total	5.3285	1.04014	138
Total	No Modality Interactivity	Low Sensory Breadth	Low	4.3889	1.26366	36
			High	5.7130	1.17149	36
			Total	5.0509	1.38136	72
		High Sensory Breadth	Low	4.8919	1.27428	37
			High	5.3333	.78784	30
			Total	5.0896	1.09879	67
		Total	Low	4.6438	1.28540	73
			High	5.5404	1.02576	66
			Total	5.0695	1.24882	139
	Modality Interactivity	Low Sensory Breadth	Low	5.0595	1.05820	28
			High	5.4537	.98288	36
			Total	5.2813	1.02735	64
		High Sensory Breadth	Low	4.7634	1.06177	31
			High	5.5766	1.01120	37
			Total	5.2059	1.10484	68
		Total	Low	4.9040	1.06143	59
			High	5.5160	.99232	73
			Total	5.2424	1.06457	132

	Total	Low	Low	4.6823	1.21633	64
		Sensory	High	5.5833	1.08157	72
		Breadth	Total	5.1593	1.22858	136
		High	Low	4.8333	1.17534	68
		Sensory	High	5.4677	.91941	67
		Breadth	Total	5.1481	1.09927	135
		Total	Low	4.7601	1.19322	132
			High	5.5276	1.00474	139
			Total	5.1538	1.16381	271

Table 67. *Means and Standard Deviations for Brand Attitude in in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low	Low	3.9474	1.11811	19
		Sensory	High	4.8000	1.44640	15
		Breadth	Total	4.3235	1.32443	34
		High	Low	4.3333	.77778	19
		Sensory	High	4.3333	.62703	14
		Breadth	Total	4.3333	.70711	33
		Total	Low	4.1404	.96991	38
			High	4.5747	1.13353	29
			Total	4.3284	1.05807	67
	Modality Interactivity	Low	Low	4.3148	.77098	18
		Sensory	High	4.9167	.95452	16
		Breadth	Total	4.5980	.90185	34
		High	Low	4.6250	.92596	16
		Sensory	High	4.5417	.90982	16
		Breadth	Total	4.5833	.90399	32
		Total	Low	4.4608	.84890	34
			High	4.7292	.93685	32
			Total	4.5909	.89595	66
	Total	Low	Low	4.1261	.96976	37
		Sensory	High	4.8602	1.19807	31
		Breadth	Total	4.4608	1.13300	68
		High	Low	4.4667	.84868	35
		Sensory	High	4.4444	.78459	30
		Breadth	Total	4.4564	.81345	65
		Total	Low	4.2917	.92257	72
			High	4.6557	1.02914	61
			Total	4.4586	.98610	133
High Immersive VR	No Modality Interactivity	Low	Low	4.0196	1.07025	17
		Sensory	High	4.6190	.95618	21
		Breadth	Total	4.3509	1.03960	38
			Low	4.3889	.79418	18
			High	5.0833	.84765	16

		High Sensory Breadth	Total	4.7157	.88051	34
		Total	Low	4.2095	.94311	35
			High	4.8198	.92828	37
			Total	4.5231	.97837	72
	Modality Interactivity	Low Sensory Breadth	Low	4.7333	.87206	10
			High	4.6333	1.11292	20
			Total	4.6667	1.02460	30
		High Sensory Breadth	Low	4.3111	.72885	15
			High	5.1111	1.08184	21
			Total	4.7778	1.02043	36
		Total	Low	4.4800	.79977	25
			High	4.8780	1.10995	41
			Total	4.7273	1.01596	66
	Total	Low Sensory Breadth	Low	4.2840	1.04474	27
			High	4.6260	1.02251	41
			Total	4.4902	1.03739	68
		High Sensory Breadth	Low	4.3535	.75434	33
			High	5.0991	.97457	37
			Total	4.7476	.94866	70
		Total	Low	4.3222	.88929	60
			High	4.8504	1.02162	78
			Total	4.6208	.99813	138
Total	No Modality Interactivity	Low Sensory Breadth	Low	3.9815	1.08069	36
			High	4.6944	1.16938	36
			Total	4.3380	1.17418	72
		High Sensory Breadth	Low	4.3604	.77531	37
			High	4.7333	.83230	30
			Total	4.5274	.81680	67
		Total	Low	4.1735	.95114	73
			High	4.7121	1.02263	66
			Total	4.4293	1.01854	139
	Modality Interactivity	Low Sensory Breadth	Low	4.4643	.81820	28
			High	4.7593	1.04079	36
			Total	4.6302	.95418	64
		High Sensory Breadth	Low	4.4731	.83787	31
			High	4.8649	1.03774	37
			Total	4.6863	.96520	68
		Total	Low	4.4689	.82145	59
			High	4.8128	1.03337	73
			Total	4.6591	.95662	132
	Total	Low Sensory Breadth	Low	4.1927	.99701	64
			High	4.7269	1.09962	72
			Total	4.4755	1.08232	136
			Low	4.4118	.80033	68

	High	High	4.8060	.94664	67
	Sensory Breadth Total	Total	4.6074	.89486	135
		Low	4.3056	.90427	132
		High	4.7650	1.02580	139
		Total	4.5412	.99373	271

Table 68. *Means and Standard Deviations for Purchase Intention in in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	2.2807	1.51235	19
			High	2.9333	1.70992	15
			Total	2.5686	1.61126	34
		High Sensory Breadth	Low	2.6491	1.19399	19
			High	2.4762	.83425	14
			Total	2.5758	1.04507	33
		Total	Low	2.4649	1.35686	38
			High	2.7126	1.35613	29
			Total	2.5721	1.35190	67
	Modality Interactivity	Low Sensory Breadth	Low	2.6852	1.20170	18
			High	3.4583	1.24648	16
			Total	3.0490	1.26633	34
		High Sensory Breadth	Low	2.5208	1.32200	16
			High	3.0833	1.33611	16
			Total	2.8021	1.33832	32
		Total	Low	2.6078	1.24308	34
			High	3.2708	1.28526	32
			Total	2.9293	1.29762	66
	Total	Low Sensory Breadth	Low	2.4775	1.36658	37
			High	3.2043	1.48742	31
			Total	2.8088	1.45845	68
		High Sensory Breadth	Low	2.5905	1.23692	35
			High	2.8000	1.15337	30
			Total	2.6872	1.19443	65
		Total	Low	2.5324	1.29723	72
			High	3.0055	1.33817	61
			Total	2.7494	1.33233	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	2.6667	1.16070	17
			High	3.3810	1.36742	21
			Total	3.0614	1.31258	38
		High Sensory Breadth	Low	2.7778	1.13183	18
			High	3.5000	1.44016	16
			Total	3.1176	1.31779	34
		Total	Low	2.7238	1.13035	35
			High	3.4324	1.38079	37

			Total	3.0880	1.30605	72
	Modality	Low	Low	3.3667	1.35583	10
	Interactivity	Sensory	High	3.2833	1.70062	20
		Breadth	Total	3.3111	1.57064	30
		High	Low	2.9556	.87166	15
		Sensory	High	3.1746	1.31917	21
		Breadth	Total	3.0833	1.14469	36
		Total	Low	3.1200	1.08389	25
			High	3.2276	1.49896	41
			Total	3.1869	1.34879	66
	Total	Low	Low	2.9259	1.25859	27
		Sensory	High	3.3333	1.52023	41
		Breadth	Total	3.1716	1.42646	68
		High	Low	2.8586	1.01047	33
		Sensory	High	3.3153	1.36297	37
		Breadth	Total	3.1000	1.22290	70
		Total	Low	2.8889	1.11937	60
			High	3.3248	1.43847	78
			Total	3.1353	1.32273	138
Total	No Modality	Low	Low	2.4630	1.35290	36
	Interactivity	Sensory	High	3.1944	1.51265	36
		Breadth	Total	2.8287	1.47169	72
		High	Low	2.7117	1.14978	37
		Sensory	High	3.0222	1.28634	30
		Breadth	Total	2.8507	1.21340	67
		Total	Low	2.5890	1.25157	73
			High	3.1162	1.40633	66
			Total	2.8393	1.34856	139
	Modality	Low	Low	2.9286	1.27772	28
	Interactivity	Sensory	High	3.3611	1.49788	36
		Breadth	Total	3.1719	1.41171	64
		High	Low	2.7312	1.13012	31
		Sensory	High	3.1351	1.30871	37
		Breadth	Total	2.9510	1.23823	68
		Total	Low	2.8249	1.19603	59
			High	3.2466	1.39999	73
			Total	3.0581	1.32472	132
	Total	Low	Low	2.6667	1.33069	64
		Sensory	High	3.2778	1.49700	72
		Breadth	Total	2.9902	1.44868	136
		High	Low	2.7206	1.13238	68
		Sensory	High	3.0846	1.29014	67
		Breadth	Total	2.9012	1.22242	135
		Total	Low	2.6944	1.22806	132
			High	3.1847	1.39943	139
			Total	2.9459	1.33901	271

Table 69. *Means and Standard Deviations for Sharing Intention in in All Conditions of Study 2*

Interface	Modality Interactivity	Sensory Breadth	Perceived Novelty	*Mean*	*SD*	*N*
Low Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	2.3289	1.56802	19
			High	3.6833	1.94676	15
			Total	2.9265	1.84794	34
		High Sensory Breadth	Low	2.6842	1.53397	19
			High	4.2321	1.51424	14
			Total	3.3409	1.69076	33
		Total	Low	2.5066	1.54054	38
			High	3.9483	1.74282	29
			Total	3.1306	1.77117	67
	Modality Interactivity	Low Sensory Breadth	Low	2.9444	1.64843	18
			High	4.4688	1.61986	16
			Total	3.6618	1.78576	34
		High Sensory Breadth	Low	2.3594	1.46904	16
			High	3.9063	1.82546	16
			Total	3.1328	1.80946	32
		Total	Low	2.6691	1.57119	34
			High	4.1875	1.72154	32
			Total	3.4053	1.80318	66
	Total	Low Sensory Breadth	Low	2.6284	1.61549	37
			High	4.0887	1.79994	31
			Total	3.2941	1.84115	68
		High Sensory Breadth	Low	2.5357	1.49157	35
			High	4.0583	1.66698	30
			Total	3.2385	1.73961	65
		Total	Low	2.5833	1.54624	72
			High	4.0738	1.72140	61
			Total	3.2669	1.78567	133
High Immersive VR	No Modality Interactivity	Low Sensory Breadth	Low	3.1912	1.71967	17
			High	4.2976	1.69856	21
			Total	3.8026	1.77459	38
		High Sensory Breadth	Low	3.9306	1.49707	18
			High	4.2813	1.72210	16
			Total	4.0956	1.59190	34
		Total	Low	3.5714	1.62875	35
			High	4.2905	1.68481	37
			Total	3.9410	1.68542	72
	Modality Interactivity	Low Sensory Breadth	Low	4.5250	1.46463	10
			High	3.8750	1.63936	20
			Total	4.0917	1.58860	30
		High Sensory Breadth	Low	2.8667	1.81479	15
			High	4.6429	1.73308	21
			Total	3.9028	1.95510	36

		Total	Low	3.5300	1.84746	25
			High	4.2683	1.71153	41
			Total	3.9886	1.78694	66
	Total	Low	Low	3.6852	1.73010	27
		Sensory	High	4.0915	1.66279	41
		Breadth	Total	3.9301	1.68888	68
		High	Low	3.4470	1.70907	33
		Sensory	High	4.4865	1.71386	37
		Breadth	Total	3.9964	1.77773	70
		Total	Low	3.5542	1.70809	60
			High	4.2788	1.68790	78
			Total	3.9638	1.72850	138
Total	No Modality	Low	Low	2.7361	1.67539	36
	Interactivity	Sensory	High	4.0417	1.80525	36
		Breadth	Total	3.3889	1.84996	72
		High	Low	3.2905	1.62288	37
		Sensory	High	4.2583	1.60076	30
		Breadth	Total	3.7239	1.67260	67
		Total	Low	3.0171	1.66110	73
			High	4.1402	1.70583	66
			Total	3.5504	1.76833	139
	Modality	Low	Low	3.5089	1.73803	28
	Interactivity	Sensory	High	4.1389	1.63494	36
		Breadth	Total	3.8633	1.69671	64
		High	Low	2.6048	1.63780	31
		Sensory	High	4.3243	1.78717	37
		Breadth	Total	3.5404	1.91353	68
		Total	Low	3.0339	1.73234	59
			High	4.2329	1.70443	73
			Total	3.6970	1.81202	132
	Total	Low	Low	3.0742	1.73301	64
		Sensory	High	4.0903	1.71073	72
		Breadth	Total	3.6121	1.78881	136
		High	Low	2.9779	1.65366	68
		Sensory	High	4.2948	1.69386	67
		Breadth	Total	3.6315	1.79365	135
		Total	Low	3.0246	1.68680	132
			High	4.1888	1.69954	139
			Total	3.6218	1.78793	271

Appendix B: Major IRB Documents

Online Consent to Participate in Research

Would you like to be involved in research at the University of Oklahoma?

I am Rahnuma Ahmed from the University of Oklahoma and I invite you to participate in my research project entitled Immersive Virtual Reality Advertisements: Examining the Effects of Vividness and Interactivity on Consumers' Psychological Responses. This research is being conducted at Gaylord College, University of Oklahoma. You were selected as a possible participant because you study at the University of Oklahoma Norman campus. You must be at least 18 years of age to participate in this study.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The goal of this study is to test the effectiveness virtual reality advertisements. For scientific reasons, you may be misled about the nature or purposes of the research.

How many participants will be in this research? About 300 people will take part in this research.

What will I be asked to do? If you agree to be in this research, you will be asked to participate in a survey both before and after seeing an advertisement. The survey will contain questions regarding your thinking, attitudes and behavioral intentions.

How long will this take? Your participation will take about 15-20 minutes.

What are the risks and/or benefits if I participate? There are no benefits to you as a result of your participation in this study. Although the risk is minimal, there is always some risk that an unauthorized third party may find a way around security systems or that transmissions of information over the Internet will be intercepted.

Will I be compensated for participating? You will not be reimbursed for your time and participation in this research. You may receive bonus points or extra credit in one of your classes, if the professor has agreed to do this. Also, you may win a gift voucher of $25 drawn from lottery at the end of data collection.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely and only approved researchers and the OU Institutional Review Board will have access to the records.

Do I have to participate? Participation is voluntary. In case of bonus points, extra credit or gift card (if you win), you will only receive those if you complete all items. Also, any incomplete questionnaire will not be considered for lottery. The survey is set not to allow participants to skip items.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact me at (347) 355-1980 (email at rahnuma.ahmed@ou.edu). You can also contact Dr. Doyle Yoon at 405- 325-5205 (email at dyoon@ou.edu) or Dr. Glenn Leshner at 405- 325-4143 (email at leshnerg@ou.edu)

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher(s) or if you cannot reach the researcher(s).

If you would like a copy of this informed consent information sheet, please ask the researcher for one now.

This research has been approved by the University of Oklahoma, Norman Campus IRB.

IRB Number: 9096 **Approval date:** 3/21/2018

Email to be Sent to the Instructors

Date

Dear Professor/Dr. [**Name**]:

I am Rahnuma Ahmed, a graduate student (Doctoral candidate) of Advertising at Gaylord College. As a part of my dissertation, I am conducting an experimental study to test the effect of emerging new media. It will be conducted in a laboratory setting in Gaylord College (Room 1120).

It would be a great help to get your permission to come to your class [**course name**] to talk about the recruitment. After the announcement, I will collect the name and email address of the students who are interested to participate in the study. This will take 6-8 minutes in total.

As a participating course instructor, you can award extra academic credit or bonus points to students. In this case, you need offer an alternative task, carrying the same amount of award, to students who prefer not to participate in the study.

Attached herewith is the IRB approval confirmation letter. If you have any questions, please call me at (347) 355 1980 or email me at rahnuma.ahmed@ou.edu.

I will look forward to hearing from you. Thank you in advance for your time and consideration.

Regards,

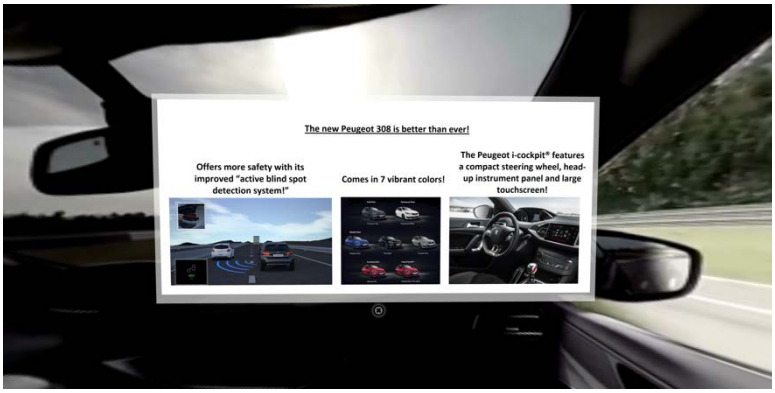
Rahnuma Ahmed
Doctoral Candidate
Graduate Assistant
Advertising
Gaylord College
University of Oklahoma

Appendix C: Screenshots of Stimuli

Screenshot 1: A screenshot of the video used in Study 1

Screenshot 2: A screenshot of the video used in Study 2 under immersive VR with modality interactivity condition. The hotspot is highlighted in a red circle.

Screenshot 3: A screenshot of the video used in Study 2 under immersive VR with modality interactivity and low sensory breadth condition.



Screenshot 4: A screenshot of the video used in Study 2 under immersive VR with modality interactivity and high sensory breadth condition.