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Abstract

This research examines how brand resonance is influenced by Virtual Reality (VR). More precisely, we analyze how it would be impacted based on the visualization format used to present a product's brand (2D vs VR). We focused on evaluating how VR's dimensions of immersion and interactivity influence brand resonance among customers. By conducting a mixed design experiment, we compare the main effect that the format (VR vs 2D) has on brand resonance, and in addition we evaluate how VR's dimension of interactivity and immersion also affect brand resonance. We demonstrate that a higher interactivity level leads to higher brand resonance; the same conclusion is made for the dimension of immersion.

Comparing the main effect of format (VR vs 2D) on brand resonance, we observe that contrary to what we expected, the levels of brand resonance were slightly higher in 2D than in VR, however the difference is not significant. This part of our research led to a further discussion on the different conditions that need to be met for VR technology to lead to significant increases in the levels of brand resonance. The findings have important implications for further academic research on the topic.

Introduction

The sudden outbreak of the Covid-19 pandemic completely shook our economical, environmental and societal world (Fernandes, 2020). Indeed, shutdowns and lockdowns caused the industrial and business scene to completely rethink their way of conducting their business and operations (Bilińska-Reformat & Dewalska-Opitek, 2021). Consequently, consumers' daily life was greatly impacted as they had to find ways of responding to their needs without being in physical contact with the outside world (Eger et al., 2021). Indeed, as governments imposed business closures, people turned to online channels to shop. Businesses were pushed to invest in their online channels (Bilińska-Reformat & Dewalska-Opitek, 2021). As of April 2022, the world counted 5 billion internet users, which represent 63% of the global population (Statista, 2022), with e-commerce sales expected to reach up to \$5,5 trillion by the end of 2022 (Barber, 2022). These numbers are expected to grow even more post the Covid-19 pandemic.

In parallel, the industry of immersive technology greatly benefited from the Covid-19 pandemic. Indeed, as the world experienced global lockdowns, companies turned to virtual platforms for meetings and supervise business operations (Karl et al., 2022). Thus, it is no surprise to see that the VR market was valued at USD 21,83 billion in 2021 and expected to grow at a compound annual growth rate (CAGR) of 18% until reaching USD 69,90 billion in 2028 (Grand View Research, 2021). In comparison, in 2019, before the pandemic, it was valued at USD 3,10 billion (Insights, 2021).

Therefore, the need for brands to keep in touch with their customers became crucial, as they could no longer have direct physical contact with their customers for an unknown period of time. These uncertain times forced brands to face challenges and create new opportunities to encourage their customers to shop (Bilińska-Reformat & Dewalska-Opitek, 2021). Companies need to create and invest in shopping experiences through online channels. Indeed, literature supports that the consumer's shopping experience is one of the most important aspects of e-commerce competitiveness (Molinillo et al., 2017). Based on Keller's (1993) customer-based equity model, brand resonance represents the willingness for a customer to engage to a particular brand and the degree by which they feel "in sync" with the brand (Keller, 2009). A high level of brand resonance can be achieved through a good customer's shopping experience, where the customer's cognitive

and affective psychological dimension are stimulated (Molinillo et al., 2017). Achieving a good shopping experience and therefore a high level of brand resonance, is easier done through physical than online channels. Traditional in-store shopping is able to create a personal interaction and closeness with the product, as the customer has a direct contact with it (Davis & Hodges, 2012). Through online channels, establishing a good strategy is essential to maintain and increase brand resonance (Huang et al., 2015). Therefore, creating sensory experiences is becoming fundamental in building relational experiences and increasing levels of brand resonance (Huang et al., 2015).

As the use of e-commerce and online channels are increasing through global changes, we ask ourselves if brands could potentially use immersive technologies such as VR to create better online shopping experience and therefore create higher levels of brand resonance. Looking at the literature, research analyzing the effect of immersive technologies on customer experiences can be found (Flavián et al., 2019; Petit et al., 2021; Wagler & Hanus, 2018; Wang et al., 2021). However, literature evaluating the effect of immersive technologies and brand resonance is limited. Thus, the objective of this research is to fill this gap by answering the following questions:

Can brands positively influence brand resonance through immersive technologies? More precisely, how VR, relative to traditional media formats such as 2D, can influence brand resonance? And, What are the effects of VR's dimension of interactivity and immersion on brand resonance?

The purpose of this research is to understand how companies can benefit from the use of immersive technologies to create brand resonance and explore the role that VR's dimensions of immersion and interactivity play in influencing brand resonance. The results are compared to a 2D format also including different interactivity levels. We focus on the 4 main influential factors that compose Brand Resonance, namely brand loyalty, brand attachment, brand engagement and brand community to measure brand resonance. Our choice of industry turns to the footwear industry, as people were already familiar with fashion online shopping before Covid. Moreover, the fashion industry was one of the industries that has been hit hard by covid, leading to losses in revenues (Youn et al., 2021). Besides, the industry also suffers from sensory improvement, when retailing online (Blazquez

Cano et al., 2017), thus analyzing the effect of VR on this industry could be interesting.

Literature review

Virtual Reality

Although the concept of VR has existed for decades, it is only recently that industries started to use VR as a new media of consumption experience (Mütterlein, 2018). While immersive technologies are gaining more attention from both the industry and the public eye, it is still quite challenging to grasp the concept of what VR is specifically (Flavián et al., 2019). Indeed, multiple definitions can be found throughout the literature that grasp the same ideas: an assortment of various technologies that creates different types of scenarios where the participants feel “immersed” in a spatial environment (Mütterlein, 2018; Riva et al., 2007; Wang et al., 2021). A VR experience can go from looking at a simple computer screen to fully immersive rooms (Wang et al., 2021). Therefore, it is necessary to ask, which are the immersive technologies that can be considered as VR? To fully understand and classify the different range and variation of immersive technologies, we present the Reality-Virtuality (RV) Continuum model first introduced by Milgram & Kishino (1994). Later on revisited through the literature as new terms surface and technology improves, this model includes all variations from real to virtual objects/environments (Lindeman & Noma, 2007; Mann et al., 2018; Normand et al., 2012; Skarbez et al., 2021).

Starting from left to right, the continuum model introduces the Real Environment (RE) which designates the environment as we see it without any aid from technology. Then the model distinguishes two types of technologies that compose the Mixed Reality (MR). MR consists of any environment where real and virtual objects are blended together (Skarbez et al., 2021). What falls into this term is continuously discussed and improved through the literature as the leaps in technologies have considerably increased in the last 25 years (Mann et al., 2018; Skarbez et al., 2021; Speicher et al., 2019). However, the two main technologies that fall under the term of MR are Augmented Reality (AR) and Augmented Virtuality (AV). These two different types of technologies differentiate by the fact that AR represents the real world augmented with virtual objects (view on top of reality e.g. Pokémon Go or Snapchat filters), while AV’s content is virtual but keeps

some awareness/objects from the real world (Milgram & Kishino, 1994; Skarbez et al., 2021). Lastly, Milgram and Koshino (1994) limit the RV Continuum with the Virtual Environment (VE), where the physical reality is completely separated from the virtual world. However, Skarbez et al. (2021) pushes the limits of Milgram and Kishino (1994) model by supporting that the RV continuum is discontinuous: the perfect virtual reality can not be reached. They support that the VE falls into the spectrum of the MR in some aspects and that the only environment that could exists outside the spectrum of MR would be a “Matrix-like” virtual environment, where both the interoceptive and exteroceptive senses of a person are stimulated by a technology (Skarbez et al., 2021) (see Fig. 1).

Therefore, VR falls into the spectrum of MR on the RV continuum. Multiple types of technologies can be considered as immersive VR, 360° videos being one of them. Also called omnidirectional video, the literature defines 360° video as “a video that captures from all directions to a camera” (Ching-Ling Fan et al., 2019). It uses spherical signals that enables the users to choose which portion of the content to display by moving their head in any direction (Corbillon et al., 2017). In other words, a 360° video captures scenes of real life and allows users to dynamically change their point of view for an immersive experience (Ching-Ling Fan et al., 2019). It can thus be considered as a derivative of VR technology and fall into the MR of RV continuum (Ching-Ling Fan et al., 2019; Skarbez et al., 2021).

For the purpose of our research, we decided to use a 360° video to represent our VR environment. Further details on this decision will be explained later on this research.

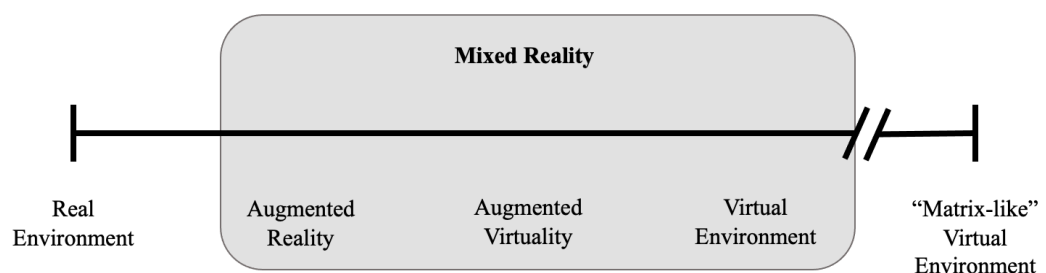


Fig 1. Revisited Reality-Virtuality Continuum (Milgram & Kishino, 1994; Skarbez et al., 2021)

Virtual Reality and Customer Experience

VR links the human perceptual and muscle system with the “virtual environment” in order to place one participant in a virtual environment with the feeling of being there (Zheng et al., 1998). Therefore, one can say that this technology could be used to create a “total experience” for the customer to be immersed in. VR can be used to integrate customer experience across touchpoints along the customer journey to accelerate growth (Gartner, 2022). In addition, the idea of “total experience” is ranked in the top 12 strategic technological trends for 2022 (Gartner, 2022).

Various research suggests that the more immersive the VR experience is, the higher are the participant’s beliefs of actually experiencing the object or action presented and the environment (Dede, 2009). It potentially increases levels of enjoyment (Yee, 2006), but also potentially makes the shopping experience more efficient decision-wise and less time consuming (Serrano et al., 2013). Indeed, research suggests that in a VR environment, the shopping experience is significantly different than in a regular one (Desmet et al., 2013; Pizzi et al., 2019). Participants are exposed to several visuals and auditory stimuli, so they can feel as if they are evaluating a product in a situation in which they are likely to make a purchase decision (Wang et al., 2021). Customers build a higher perception of the value of their experience if they have a more dynamic and autonomous role (Flavián et al., 2019). Consequently, features of brand loyalty are potentially increased as, when placed in an unfamiliar environment, a customer tends to rely on their memory and focus on products they are already familiar with (Desmet et al., 2013), triggering brand resonance between the brand and the consumer. Thus, companies can improve their customer experience by integrating VR into their commercial offers (Flavián et al., 2019). In addition to enhancing the experience, it also increases the value that is provided to the customer, triggering high levels of involvement and engagement (Flavián et al., 2019).

Building Brand Resonance through Virtual Reality

Research showed that the industries that are focusing on building customer relationships through brand experience, are able to build a sustainable competitive advantage on their respective markets (Huang et al., 2015). In other words, transforming product purchase consumption into memorable experiences is a good strategy to maintain and increase brand resonance, and more specifically factors of

loyalty and awareness (Berry et al., 2002; Huang & Sarigollu, 2012). Customers' experience is defined by Lemon & Verhoef (2016) as the "customer's cognitive, emotional, behavioral, sensorial and social response to a firm's offerings during the customer's entire purchase journey". Therefore, if a customer is exposed to several visuals and auditory stimuli in a specific environment created by VR, features of brand resonance could be increased, more specifically when the customer is evaluating the product with the intent of purchase.

Brand resonance is based on a customer-brand relationship. It represents the willingness for a consumer to engage and attach to a particular brand (Keller, 2009). More specifically, it relates to the degree by which a person "resonates" and feels "in sync" with a brand (Keller, 2009). Brand resonance constitutes the highest level of Keller's (1993) customer-based equity model (CBBE), which represents the value that a brand customer holds based on their attitude and recognition of that brand (Keller, 1993). Brand resonance is based on four main influential factors, namely behavioral loyalty, attitudinal attachment, sense of community and active engagement (Keller, 2009).

Behavioral loyalty, is defined as "a deeply held commitment to rebuy or repatronise a preferred product consistently in the future despite situational influences and marketing efforts" (Oliver, 1999). It is measured by the behavior of repeated purchases as well as the attitudinal self-commitment regarding a particular brand (Huang et al., 2015).

Attitudinal attachment is a concept by which the consumer is viewing a purchase of a brand as something "special". It is an "emotion-laden target-specific bond between a person and a specific object" (Thomson et al., 2005). Its strength varies according to the feelings related to the consumer towards a product or brand. A strong attachment is often associated with feelings of love, affection and connection (Thomson et al., 2005).

Sense of community relates to when customers feel a sense of community with the people that are associated with the brand (Burgess & Spinks, 2014). A strong sense of community can be achieved when a consumer feels like being part of a group that differentiates them from the rest of their peers.

Active engagement is the strongest example of brand loyalty and brand resonance. Literature struggles with a limited agreement around the conceptualization of "engagement" in marketing (Brodie et al., 2011). However, active engagement can be defined by customers actively engaging with a brand even when they are not

purchasing or consuming it (e.g. following and interacting with the brand on social media) (Burgess & Spinks, 2014). For instance, it can be translated by customers participating in online tasks, forums, marketing rallies or events or following brands on social media.

As previously stated, brand resonance can be increased through memorable and sensory-oriented experiences (Huang et al., 2015). However, if it is easier to achieve through physical channels, it is more difficult through online channels (Huang et al., 2015). To reach a high level of brand resonance, online retailers need to provide sufficient sensory-oriented content. Indeed, brands that are using technologies capable of providing vivid sensory information to online shoppers, greatly improve their customers' telepresence experience and interactivity which increases brand resonance (Huang et al., 2015).

VR's dimension of immersion and presence on brand resonance

Immersion and presence are key dimensions of the VR experience that are most often mentioned in literature when talking about VR.

Immersion in this context refers to the degree of involvement that individuals experience, or in other words how well the technology blurs the boundaries between the physical and the virtual world (Pizzi et al., 2019). The participants are considered "immersed" in VR when they are surrounded by sensory stimuli from the virtual world and psychologically involved in the narrative of the VR world (Wang et al., 2021).

On the other hand, presence is influenced by the levels of immersion created by the VR environment. More specifically, it refers to that sense of "being" or the degree to which the subject feels transported into the environment. This feeling of presence, however, is considered to be subjective to each individual (Smith & Mulligan, 2021).

VR has been said to increase the levels of attention in subjects, more specifically by generating a higher sense of immersion compared to 2D scenarios (Smith & Mulligan, 2021). Moreover, presence has been associated with the level of engagement that subjects have with the virtual environment, more specifically through attentional engagement (Darken et al., 1999). This means that a greater feeling of presence results in increased attention towards the virtual environment and less focus on the outside/physical environment (Smith & Mulligan, 2021). In

this context, interactivity could play a significant role in moderating how immersed a person will feel when they are in a VR setting. Previous research studies have found that if participants are only looking at the virtual context without having any type of interaction with the virtual environment, the depth of immersion would be limited (Kong et al., 2020). However, if participants are able to interact with the virtual world (for example with objects), it should theoretically lead to a greater sense of immersion (Mütterlein, 2018; Slater, 2009). We will cover the interactivity aspect in more detail later on this paper.

A study by Wagler & Hanus (2018) analyzed how VR could affect emotional engagement. The researchers went into defining emotional engagement as the “extent to which a subject is focused on content cognitively and affectively” (Mollen & Wilson, 2010; Wagler & Hanus, 2018). Specifically, the researchers conducted a between-subjects design and found that individuals exposed to a 360° scenario reported higher spatial presence or a “sense of being there” than those who were exposed to a 2D scenario. This, because a more realistic scenario induced a higher sense of immersion which in turn influenced the emotional engagement level of participants.

So far, the literature suggests that VR can influence the level of engagement and attention in participants, which led us to believe that VR could also influence brand resonance considering that previous literature has discussed how attachment and engagement are important factors in building brand resonance. Also because it has been said that VR comes closer to a “real” scenario compared to other formats such as two-dimensional pictures; thus:

H1: VR’s dimension of immersion will have a higher effect on brand resonance compared to a 2D setting

H2: VR will lead to a higher brand resonance compared to 2D

The importance of interactivity in VR to influence brand resonance

In the literature, interactivity is also considered one of the key dimensions of the VR experience, along with presence and immersion (Mütterlein & Hess, 2017; Ryan, 2015; Walsh & Pawlowski, 2002). Interactivity refers to the degree by which

an individual can influence the form or content of the environment around them in real-time (Steuer, 1992; Xu & Sundar, 2016). Overall, through online channels, interactivity facilitates the communication, customization of the presented information, image manipulation and entertainment of consumers (A. Fiore et al., 2005). Perceived interactivity includes and is measured by three different dimensions, namely, control (internally based efficacy), responsiveness (externally-based system efficacy) and communication (Song & Zinkhan, 2008).

In a VR context, Mütterlein (2018) supported that the dimension of interaction is deeply correlated with the dimension of immersion and presence and that one cannot occur unrelated to another. Indeed, features of interactivity in a virtual world contribute to presence which are both beneficial to create a state of immersion (Mütterlein, 2018).

In a regular website retail setting, empirical evidence supports the importance of interactivity on consumer attitude and behavior (Griffith et al., 2001; Koufaris et al., 2001). Indeed, Ballantine & Fortin (2009) supported in their research that increased levels of interactivity during online shopping enables customers to gain a greater control of their shopping experience, resulting in greater pleasure (Ballantine & Fortin, 2009). Therefore, perceived control and enjoyment from interaction on, for example, the product search function, sway new consumers to return to the website (Koufaris et al., 2001). Moreover, interactivity on the surface design of the website influenced the consumer involvement and engagement which helped create a vivid experience and positively affected the responses toward the product (Griffith et al., 2001). Based on this, we propose the following:

H3: A higher level of interactivity will lead to a higher level of brand resonance compared to a medium and low interactivity level.

H4: In a VR setting, a higher level of interactivity will lead to a higher brand resonance compared to medium and low interactivity.

1. Interactivity in a 2D setting on brand resonance

On a regular website retail setting, different levels of interactivity can be achieved through different types of technologies. Indeed, Fiore et al. (2005) supported that consumption experience can be satisfied when the said experience provides senses of pleasure and fun (Holbrook & Hirschman, 1982). A way to achieve these

different feelings through a non-physical channel is to create a sensory-oriented experience using Image Interactivity Technology (ITT) (Blazquez Cano et al., 2017). ITT are features used on websites to enable the “creation and manipulation of product or environment images to stimulate (or surpass) actual experiences with the product or environment” (Fiore et al., 2005). The value of ITT is particularly relevant for fashion products and industry, which often suffer from sensory impoverishment through online channels (Blazquez Cano et al., 2017). There are different types of ITT features that can usually go from a simple zoom into the product displayed to assembling different clothing images into one to create one final image (Lee et al., 2010; Merle et al., 2012). Thus, ITT create means for the customers to interact with content displayed through online channels. Xu & Sundar (2016) supported in his research that interactivity has a direct impact on users. Indeed, a high interactivity increases both the recall and recognition of information that is presented, as customers’ cognitive capacities are enhanced to process the information inside the interactive features (Xu & Sundar, 2016). Therefore, the use of ITT helps to increase the value of online retail (Kim & Forsythe, 2007). If consumers are highly involved and consider their online experience to be a success, their intention of purchase as well as their revisit intention are increased (Blazquez Cano et al., 2017; Lee et al., 2010; Merle et al., 2012). Thus we can consider that a high degree of interactivity in an online shopping experiment can potentially result in involvement, awareness and engagement with the brand which naturally creates brand resonance. This led us to develop the following:

H5: In a 2D setting, a higher level of interactivity will lead to a higher brand resonance compared to a medium and low interactivity level.

2. 360° panorama as part of VR immersive technology

For the purpose of our research, we replaced the use of a VR head-mounted display (HMD) by another type of immersive technology, the 360° video, as a mean to measure the effects of VR on brand resonance. The choice of technology for VR experiments has been discussed in previous research, where it was highlighted that many studies researching into VR opted to use 360° format instead of a full VR HMD due to the accessibility and affordability of the 360° format compared to the other (Picket & Dando, 2019; Wen & Leung, 2021). Overall, the 360° format is

commonly accepted as a valid and close alternative to VR HMD scenarios (Higuera-Trujillo et al., 2017; Picket & Dando, 2019; Wen & Leung, 2021).

Indeed, there are studies where the 360° format has been found to be, in some cases, an even better alternative than VR HMD (Higuera-Trujillo et al., 2017). In the HMD the user will see a *computed generated* scenario and be able to move their head as well as to move around the environment as they would do in real life. In a 360° format on the contrary, the user is not able to move himself around, however the user will see the 360° panorama of a *real setting*. In research from Higuera-Trujillo et al. (2017), it was found that the 360° panorama was highly interactive and could in addition create an even higher sense of presence than VR HMD. The authors argued that the reason behind this is that a 360° panorama is composed of photographs of real sceneries, while VR is a computer model simulation, meaning that the level of realism is higher in the 360° scenario than in the VR one. Other arguments also favor the use of 360° format instead of VR. Indeed, VR technologies are known for inducing cybersickness or motion sickness in some users which in turn could undermine the VR experience (Yildirim, 2019), while the risk is lessened or even non-existent when through a 360° format (Breves & Dodel, 2021). Moreover, a 360° format is easier to integrate on an online channel than a VR format. This is because a 360° format can be accessed through publicly available channels such as Youtube (Wang et al., 2021), while using VR would require for the customer to either own or have access to HMD, which still remains an expensive equipment.

As previously mentioned in literature, the 360° format is considered a type of VR immersive technology. Thus, considering this and the fact that 360° panorama has a good rating in terms of realism and is close to the HMD format, we consider that it would be a good alternative for us to use in our research instead of a VR HMD format.

Methodology

Overview of the study

To examine the effect of using VR immersive technologies on enhancing brand resonance, we conducted a study that compares two main visualization settings, 2D versus VR. A product of the same brand was presented in both visualization modes

to later examine the difference and impact that each scenario had on brand resonance. To examine our hypothesis and discussion made in the literature review, we consider three levels of interactivity and measured immersion in each scenario.

Participants

140 of participants took part in the study conducted through an online survey on Qualtrics. Participants consisted of 43% male, 55% female and 2% non-binary. The average age of participants were between 25 and 34 years old ($\mu = 3.16$; $SD = 1.02$) The study followed a 2 (VR vs 2D) x 3 (low, medium, high interactivity) mixed design experiment. The 2D group counted 69 participants, while the VR group counted 71 participants.

Apparatus and materials

For the purpose of the experiment a survey was created in Qualtrics with randomization applied, so that some participants will receive a 2D scenario while others a VR scenario. In the survey we measured brand resonance, interactivity and immersion.

To measure brand resonance, we used a preexisting scale developed by Raut et al. (2019). The scale is formed with a total of nine constructs based on the literature about brand resonance from Keller (1993). We are using the same scale in our study since it was proved reliable by the original authors and was validated in previous literature. In addition, it considers the main components of brand resonance (brand loyalty, attachment, community, and engagement), which makes it consistent with the existing literature on brand resonance.

We have slightly adapted the scale by including only the aspects related to brand loyalty, attachment, community, and engagement (see Table 1). Originally, the scale by Raut et al. (2020) included nine constructs: brand awareness, brand performance, brand image, brand feelings, brand judgment, brand loyalty, brand engagement, brand community, and brand attachment. However, as our brand resonance research focuses specifically on the top of Keller's brand resonance pyramid, we decided to include only the questions that were directly related to

those items of brand resonance; meaning brand loyalty, attachment, community, and engagement.

<i>Brand Resonance Dimensions</i>	<i>Measuring items/statements</i>
Brand loyalty	I buy this brand whenever I can This the brand I would prefer to buy
Brand Attachment	Seeing the brand presented in this format made me think that: I really like this brand This brand is more than a product to me
Brand Community	I really identify with the people who use this brand This is a brand used by people like me
Brand Engagement	I like to visit the website for this brand I really to talk about this brand to others

Table 1. Items for measuring the constructs composing brand resonance adapted from Raut et al. (2020)

The statements presented in Table 1 were worded exactly in the same manner as in the original research by Raut et al. (2020), to guarantee the scale's validity. Only one item was slightly adapted to better reflect the circumstances of our study: “seeing the brand presented in this format made me think: I really like this brand”. This, as it was necessary to identify whether people will like the brand more or less depending on the format it was displayed. Originally the question proposed by Raut et al. (2020) was “I really like this brand” . All of the items were measured on a seven-point Likert scale.

To measure interactivity, we used a pre-existing scale by Song and Zinkhan (2008), examining specifically the control and responsiveness aspects of interactivity (see Table 2), the items were measured on a seven-point Likert scale. Once again, we decided to use this scale as it was previously validated in literature. Moreover, we focus on only the aspects of control and responsiveness as it fitted better with the context of this experiment.

<i>Interactivity Aspect</i>	<i>Measuring items</i>
Control	I felt that I had a great deal of control over my experience with the scenario While I was seeing the scenario, I was always able to do at I thought I was doing
Responsiveness	I was able to see what I want without any delays I felt I was getting instantaneous information

Table 2. Items for measuring interactivity adapted from Song and Zinkhan (2008)

To measure immersion, we adapted the preexisting scale from previous research by Petit et al. (2021), using a seven-point Likert scale measuring: Not all immersed/Deeply immersed, Not absorbed/Deeply absorbed, My attention was not focus/My attention was very focused.

For the 2D experiment we used three different retailer websites: Nike.com, XXL.no, and Zalando.com. For the VR experiment, three videos were recorded with a 360 One X camera (www.insta360.com). A smartphone was used to control the camera app and adjust the settings for the camera. Finally, the videos were edited in the Insta 360 Studio 2022 software.

In both the 2D and VR experiment, we displayed a product from the brand Nike, specifically the *Nike Legend Essential 2* footwear.

Design and procedure

The study followed a 2 (2D vs. VR) x 3 (low, medium, high interactivity) mixed design experiment. In other words, we compare two scenarios 2D vs VR and in both scenarios participants were exposed to three different levels of interactivity.

To measure this, participants had to answer a survey in Qualtrics where they were randomly assigned one of the scenarios; either 2D or VR. Both the 2D and the VR scenarios included the exact same type of pre-existing scales for measuring interactivity and brand resonance. What differed was the format in which the brand was presented. In the 2D scenario, participants were presented with two-dimensional pictures of the same product & brand (Nike Legend Essential 2) displayed with different levels of interactivity to ensure that people's perception of

the brand will be entirely based on the interactivity level visualization mode rather than any other element.

For the lowest level of interactivity in the 2D scenario, participants were redirected to the shoe brand's website where they could see static pictures of the *Nike Legend Essential 2* from different angles, but could not zoom in or interact with the pictures in any other way (see Fig. 2).

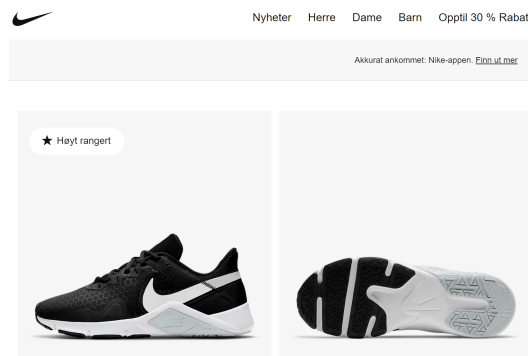


Fig. 2. Static picture scenario 1 for 2D (<https://swoosh.sh/3s2IIGc>)

For the medium level of interactivity in the 2D scenario, participants were redirected to a different retailer website where they could again see pictures of the *Nike Legend Essential 2*, but in this case, participants could zoom in and zoom out the picture (see Fig. 3).

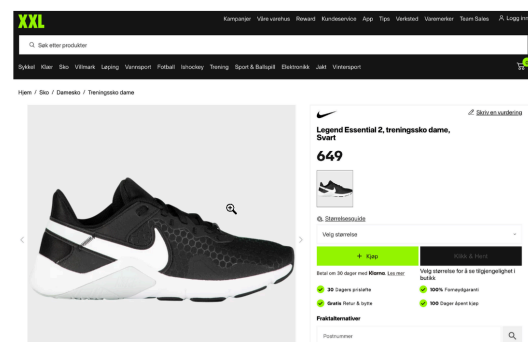


Fig. 3. Picture for scenario 2 for 2D (<https://bit.ly/3F1OIo9>)

Lastly, for the highest level of interactivity in the 2D scenario, participants were again redirected to a retailer website where they could once more see pictures of the *Nike Legend Essential 2*, but in this case, participants could zoom in and move the cursor up and down in the picture (see Fig. 4).

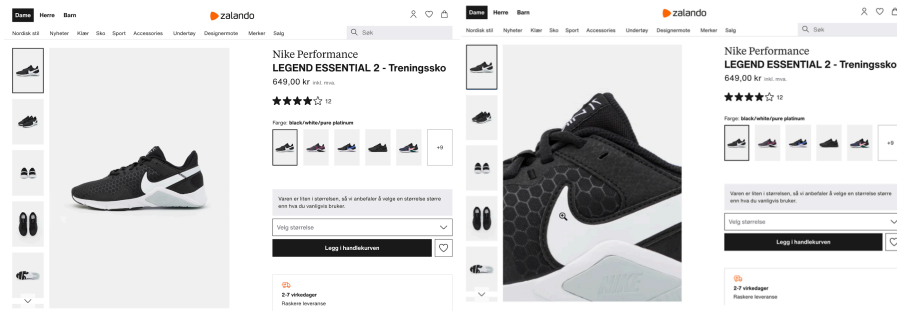


Fig. 4. Picture for scenario 3 for 2D (<https://bit.ly/3MFEbBB>)

In the VR scenario, participants were also presented with the *Nike Legend Essential 2*, the same brand introduced in the 2D scenario. Similarly to the scenario for 2D, the product was displayed in three different levels of interactivity. Determining the different levels of interactivity in a VR context is more challenging as different degrees of interactivity are perceived differently from one user to the other (Mütterlein, 2018). In addition, empirical evidence between the different levels of interactivity and VR is limited (Mütterlein & Hess, 2017). Therefore, we based our research for the VR scenario interactivity levels on the literature for interactivity in a 2D setting (Blazquez Cano et al., 2017; Song & Zinkhan, 2008; Xu & Sundar, 2016). Considering that perceived interactivity is measured by the dimensions of control, responsiveness, and communication (Song & Zinkhan, 2008), we opted for a static video as the lowest level of interactivity for the VR first scenario (see Fig. 5). This, as the dimensions of control, responsiveness and communication will be lowest as the user would neither be able to control, respond or communicate with its environment. To variate the different levels of interactivity, we decided to use a 180° video format for the low and medium level of interactivity in VR. This, because similarly to 360° videos, the 180° format has been used in previous research on immersive technologies (Sinesio et al., 2019).



Fig. 5. VR scenario 1: Static video (<https://youtu.be/AA5GrvibDHE>)

In the medium level of interactivity, participants saw a 180° video but this time they could see movement (see Fig. 6).



Fig. 6. VR scenario 2: video with movement (<https://youtu.be/tCbNO0XBzyU>)

Finally, in the highest level of interactivity participants saw *Nike Legend Essential 2* presented in a 360° video with which they could interact by moving the screen to see the whole 360° panorama (see Fig. 7).



Fig. 7. VR scenario 3: 360° video (<https://youtu.be/hHvTpKYZEX0>)

All of the videos were uploaded on YouTube to facilitate the viewing for participants.

Analysis

Through this experiment, we examine how VR can influence brand resonance depending on the level of interactivity and immersion. Specifically, we test how brand resonance levels differ in VR vs 2D, depending on three levels of interactivity (2D vs VR) x (low, medium, high interactivity). As immersion is a dimension of VR, we are also measuring it across the three levels. We start by testing the role of immersion on brand resonance (H1) by performing a Mixed ANOVA model where we compare the means of brand resonance across three levels of immersion and between 2D and VR respectively. A second Mixed ANOVA analysis is conducted to make an overall comparison of brand resonance in 2D vs VR (H2), as well as

comparing the effect of different interactivity levels on brand resonance for 2D and VR together (H3). We also evaluate in this analysis, the effect for 2D and VR on interactivity levels separately (H4 & H5). For H1, the “between-subject” factors constitute of the two formats 2D vs VR, and the “within-subject” factors constitute the immersion levels (low, medium, high). Similarly to H1, H3, H4 & H5 tested 2D and VR as factors for the “between-subject”, whereas the “within-subject” factors tested the three interactivity levels (low, medium, high). H2 was only a “between-subject” factor between 2D and VR. All analyses are performed using SPSS.

Results

Effect of immersion on brand resonance

A mixed ANOVA was used to assess H1, that is the role of immersion on brand resonance. The results are presented in Table 3. This test was selected for the analysis of H1 as we needed to compare the difference in means between our groups, having immersion as a “within- subjects” factor and 2D vs VR as “between-subjects” factors. The Mixed ANOVA relies on three assumptions: independent observations, normal distribution, and sphericity. In the case of the present study, the Mauchly's Test output obtained in SPSS showed that the sphericity assumption was violated as the significance level was under .05 ($p = .011$). For solving this issue, we looked into the output for both Greenhouse-Geisser and Huynd-Feldt correction. Huynd-Feldt correction is recommended when the estimated epsilon (ϵ) is greater than .75. In our case the estimated epsilon (ϵ) was .95, a value that is greater than .75; thus, we proceeded with Huynd-Feldt correction ($p = .959$).

Furthermore, the Test of Within-Subjects Effects output showed to be significant under the Huynd-Feldt correction pointing that that there is in fact a difference in the brand resonance means between the different levels of immersion (Huynd-Feldt Sig = < .001).

The descriptive statistics (see Table 3) show that the higher level of Immersion for both the 2D and the VR setting has on average a higher brand resonance ($\mu_{\text{high}} = 5.0381$), and this is higher for the VR setting than for the 2D setting ($\mu_{\text{highVR}} = 5.4930$; $\mu_{\text{high2D}} = 4.5700$). The average brand resonance for the medium level of

immersion for both the 2D and the VR setting was slightly higher than in the low level of immersion ($\mu_{\text{med}} = 3.6238$; $\mu_{\text{low}} = 3.1976$).

	Format	Mean	Std. Deviation	N
IM_low	2D	3.9130	1.70893	69
	VR	2.5023	1.24578	71
	Total	3.1976	1.64659	140
IM_med	2D	3.7729	1.58061	60
	VR	3.4789	1.19487	71
	Total	3.6238	1.40106	140
IM_high	2D	4.5700	1.10421	69
	VR	5.4930	1.39028	71
	Total	5.0381	1.33578	140

Table 3. Descriptive Statistics for levels of immersion and format

After conducting a post hoc test using the Bonferroni correction, we observe that the level of brand resonance is higher when immersion is high compared to when it is medium (MD = 1.406, $p < .001$) and low (MD = 1.824, $p < .001$). A medium level of immersion also resulted in higher brand resonance when compared to low immersion (MD = 0.418, $p < .001$). The same is observed in the Profile Plot (see Fig. 8), where we see that overall, brand resonance has higher levels for high immersion, than for low and medium. The effects are even more noticeable in the VR setting.

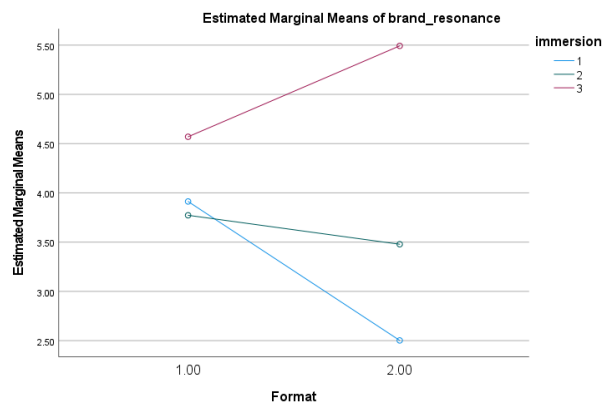


Fig. 8. Profile Plots of estimated marginal means of brand resonance depending on immersion

Effect of format (2D vs VR) on brand resonance

We performed a Mixed ANOVA to assess hypothesis H2. Here we tested the effect of the format on brand resonance. Focusing on the Between-Subject output, the results showed us that the format has a significant effect on brand resonance ($p < .001$). Looking further, we also observed that brand resonance is higher in the 2D setting (format 1, $\mu = 4.183$), than in the VR setting (format 2, $\mu = 3.502$) (see Table 4).

Measure : brand_resonance		95% Confidence Interval		
Format	Mean	Std. Error	Lower Bound	Upper Bound
2D	4.183	.129	3.927	4.438
VR	3.502	.127	3.250	3.754

Table 4 . Estimates of the effects of format on brand resonance

Effect of interactivity levels on brand resonance

The samed Mixed ANOVA was used to assess hypothesis H3, H4 and H5. Here, we tested the effect of interactivity and format on brand resonance. We observed that on average, the overall level of brand resonance is similar for low and medium interactivity, whereas it is slightly higher for high interactivity level ($\mu_{low} = 3.5578$; $\mu_{med} = 3.5585$; $\mu_{high} = 4.3955$) (see Table 5).

Breaking down the conditions, we see throughout all interactivity levels, brand resonance is slightly higher in a 2D setting (format 1; $\mu_{low} = 4.2373$, $SD_{low} = 1.1936$; $\mu_{med} = 3.9068$, $SD_{med} = 1.2112$; $\mu_{high} = 4.3955$, $SD_{high} = 1.0713$) than in a VR setting (format 2; $\mu_{low} = 2.8974$, $SD_{low} = 1.0727$; $\mu_{med} = 3.2201$ $SD_{med} = 1.2063$; $\mu_{high} = 4.3873$, $SD_{high} = 1.4753$).

The same conclusion can be brought from the Profile Plot (see Fig. 9), we can observe that overall, brand resonance has higher levels when interactivity is high, than when it is low and medium. We also see that depending on the format tested, low interactivity creates higher brand resonance in a 2D setting compared to medium interactivity but creates lower brand resonance in a VR setting compared to medium and high interactivity.

	Format	Mean	Std. Deviation	N
INT_low	2D	4.2373	1.19264	69
	VR	2.8974	1.07273	71
	Total	3.5578	1.31429	140
INT_med	2D	3.9068	1.21124	60
	VR	3.2201	1.20634	71
	Total	3.5585	1.25273	140
INT_high	2D	4.4040	1.07125	69
	VR	5.3873	1.47527	71
	Total	4.3955	1.28744	140

Table 5. Descriptives Statistics of interactivity levels on brand resonance depending on interactivity

Similarly to our previous Mixed ANOVA that tested the effect of immersion on brand resonance, we assess the sphericity assumption. The output presented a significant sphericity level ($p < .001$) and thus, violates this assumption. We then looked at the Huynh-Feldt value ($p = .915$ as Greenhouse-Geisser Epsilon $> .75$) to see if our test within-subject is significant. We observed that based on the Huynh-Feldt value, all values are significant showing that there are significant effects between interactivity levels and format on brand resonance ($p < .001$). There is also a significant main effect of interactivity on brand resonance ($F(1.83, 252.44) = 67.22, p < .001$).

A mixed ANOVA requires as an assumption homogeneity of variance for each group. In our analysis, the Levene's test came back significant for one of the groups tested. Therefore, the assumption is violated. However, for the purpose of study, we decided not to take into account the Levene's test for the homogeneity of variances and continue with the analysis. Indeed, as our groups roughly have the same sample size (format 1: $n = 69$; format 2: $n = 71$), the assumption of homogeneity does not need to be met.

We then found that the mean for the highest level of interactivity ($\mu = 4.396$) is slightly higher than the medium and low level ($\mu_{\text{low}} = 3.567, \mu_{\text{med}} = 3.563$). Thus, a high level of interactivity should naturally create higher levels of brand resonance, compared to low and medium interactivity.

Therefore, we conducted a post hoc test using Bonferroni correction (see table 6). We observed that there are significant main effects between low and high interactivity (1 and 3) ($p < .001$) as well as medium and high interactivity (2 and 3), but not between low and medium interactivity (1 and 2) ($p = 1.000$). In addition, we observe based on the mean difference that a high level of interactivity will lead to a higher level of brand resonance compared to a low level ($MD = .828$) and a medium level ($MD = .832$). On the other hand, the low level of interactivity presented a higher brand resonance compared to the medium level ($MD = .004$), however this difference is not statistically significant ($p = 1.000$).

Measure: brand_resonance

(I) interactivity	(J) interactivity	Mean Difference (I- J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
1	2	.004	.067	1.000	-.159	.167
	3	-.828*	.091	<.001	-1.048	-.609
2	1	-.004	.067	1.000	-.167	.159
	3	-.832*	.088	<.001	-1.046	-.618
3	1	.828*	.091	<.001	.609	1.048
	2	.832*	.088	<.001	.618	1.046

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Table 6. Pairwise Comparison of interactivity levels effect on brand resonance

As we saw that the interaction between the interactivity levels and format is significant. Therefore, we want to test the significance for each level of interactivity, based on the format they were tested in (see Table 7).

In a 2D setting, we see that low interactivity has a higher brand resonance than medium interactivity ($MD = .330$) and the difference is statistically significant ($p = .002$). Furthermore, the high interactivity level presented higher brand resonance compared to the low interactivity ($MD = .167$) and the medium interactivity ($MD = .497$). This difference was significant between the high and medium level of interactivity ($p = .001$), but not between the high and low level ($p = .595$).

In the VR setting, we see that the differences on brand resonance between all levels of interactivity is significant. High interactivity has a higher level of brand resonance compared to low interactivity ($MD = 1.490$) and medium interactivity ($MD = 1.167$). In addition, compared to low interactivity, medium interactivity creates a slightly higher brand resonance ($MD = .323$).

Measure: brand_resonance

Format	(I) interactivity	(J) interactivity	Mean Difference (I- J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
						Lower Bound	Upper Bound
2D	Low	Medium	.330*	.096	.002	.098	.563
		High	-.167	.129	.595	-.479	.146
	Medium	Low	-.330*	.096	.002	-.563	-.098
		High	-.497*	.126	<.001	-.802	-.193
	High	Low	.167	.129	.595	-.146	.479
		Medium	.497*	.126	<.001	.193	.802
VR	Low	Medium	-.323*	.095	.003	-.552	-.094
		High	-1.490*	.127	<.001	-1.798	-1.182
	Medium	Low	.323*	.095	.003	.094	.552
		High	-1.167*	.124	<.001	-1.467	-.867
	High	Low	1.490*	.127	<.001	1.182	1.798
		Medium	1.167*	.124	<.001	.867	1.467

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Table 7. Pairwise Comparison of format and interactivity levels on brand resonance

Discussion

The purpose of this study is to test whether VR can have a positive influence on brand resonance. To do so, we based our measurement on two dimensions of VR's, immersion and interaction, while comparing their influence on brand resonance through three different levels of interaction (low, medium and high). We conducted the results in two different setting environments, a 2D and a VR setting and compared the results to see which environment creates higher levels of brand resonance. Therefore, we conducted a 2 (2D vs. VR) x 3 (low, medium, high interactivity) mixed design ANOVA. We run the test two times to evaluate two different conditions: the effect of interactivity on brand resonance and the effect of immersion on brand resonance.

Effect of immersion on brand resonance

Based on the results obtained from the Mixed ANOVA, all indicated that the level of brand resonance was higher when people's immersion was high, thus confirming our hypothesis H1 that VR's dimension of immersion has a positive effect on brand resonance.

Although both the 2D and the VR setting showed a positive increase in the levels of brand resonance when immersion was higher, the difference between the levels was even more visible in the VR setting. This can be explained by the fact

that immersion is fundamental in VR as a factor that facilitates participants to feel involved in the VR narrative (Wang et al., 2021). Something that is also consistent with the results in Table 5 showing the positive interaction that immersion and format has on brand resonance. Indeed, the high level of immersion in VR presented a higher level of Brand Resonance when compared to the high level of immersion in 2D.

Effect of format (2D vs VR) on brand resonance

Contrary to what was expected, the results of the mixed ANOVA showed that brand resonance is slightly higher for the 2D setting than the VR setting ($\mu_{2D} = 4.404$ vs. $\mu_{VR} = 4.389$) (see Table 5).

Nonetheless, we suggest being cautious in concluding that a 2D format leads to higher brand resonance, as there are a few considerations to take into account. For example, we observed that overall the scores for brand resonance varied more in the VR format than in the 2D format. In the 2D format, the results were in comparison more uniform, due to the fact that there was not such a drastic difference between the three levels presented within the 2D scenario. On the contrary, the VR scenario presented a slightly more drastic difference between the three levels, since the first two videos were VR 180° panorama while the third video was a fully 360° panorama. For the purpose of the discussion, it is worth to mention that when observing the different scores for brand resonance in VR in each interactivity level, it is possible to see that overall participants rated brand resonance quite low for the low and medium interactivity level, while rating it much higher for the high interactivity level, the 360° panorama.

As for H2 we needed an average score of brand resonance, then it means that when computing the average for VR the overall score went down due to the low and medium level having more weight in terms of quantity of observations.

Another explanation to this result can rely on the quality of the content for the VR experiment, as we were limited by the lack of technology and skills. With this we mean that more realistic scenarios could have been created with the use of more advanced technology and video editing skills. This problem was not present in the 2D scenario as the pictures were already made and published by companies in their respective websites. In addition the pictures were high resolution and of good quality as most likely they were captured with professional cameras, using special

lighting and then photoshopped by an expert to make the product look as best as possible.

Effect of interactivity on brand resonance

1. Effect of interactivity levels on brand resonance

Looking further into the output for the Mixed ANOVA, we found out that there was a significant effect of the interactivity levels on brand resonance. Based on the mean difference, a higher level of interactivity leads to a higher brand resonance, compared to a low and medium level. This confirms our H3, suggesting that a high level of interactivity does lead to a higher level of brand resonance. However, it is important to also consider that there was not a statistically significant difference when comparing brand resonance between the low and medium level of interactivity. In this regard, there are two possible explanations that could be further explored in future research. The first being that interactivity matters in affecting brand resonance only when the interactivity levels are extremes (low vs high). The second being that the customers' perception of interactivity is subjective. For the 2D scenario specifically, we see that the low level of interactivity scored slightly higher in brand resonance compared to the medium level. Although the difference is so small that it is not considered statistically significant. We suspect that the reason for the higher brand resonance result in the low level of interactivity relies on the fact that the picture of *Nike Legend Essential 2* was presented on the website of the original brand Nike. On the contrary, for the medium level of interactivity the picture of *Nike Legend Essential 2* was presented on a retailer website (XXL.no). However, this does not necessarily mean that displaying *Nike Legend Essential 2* on the original brand's website (Nike.com) creates higher brand resonance than when displaying it on a retailer's website. Rather that people's perception of the interactivity level was subjective or their perception of brand resonance was biased by the webpage where the product was displayed.

In fact, the picture presented for the high level of interactivity was displayed on another retailer's website (Zalando.com), and generated higher scores of brand resonance compared to the low level of interactivity, where the product was presented on Nike.com.

In the following sessions, we will go deeper into each treatment to see how high interactivity affects brand resonance in 2D and in VR respectively.

2. Effect of different interactivity levels on brand resonance in a VR setting

In a VR setting, we found that the differences in brand resonance among all levels of interactivity are significant when compared with each other. A higher level of interactivity creates higher brand resonance compared to low and medium interactivity, which supports our H3 stating that in a VR setting, a higher level of interactivity will lead to a higher brand resonance, compared to low and medium interactivity. We also found that, compared to low interactivity, medium interactivity creates higher levels of brand resonance. Moreover, as interaction is a VR's dimension that is correlated with immersion and presence (Mütterlein & Hess, 2017), we can establish that VR can influence the level of engagement and attention of participants when the interaction with their environment is considered as high.

3. Effect of different interactivity levels on brand resonance in a 2D setting

Conversely, in a 2D setting, the output showed us that low interactivity had a higher brand resonance score compared to medium interactivity and this difference was significant. The high interactivity level presented a higher brand resonance level compared to both low and medium interactivity, the difference was significant for the medium level but not for the low level. This means that although the high level of interactivity in 2D presented a higher brand resonance score compared to the low interactivity level, the difference is not big enough for us to consider relevant. Moreover, the low interactivity level in this setting also presented a higher level of brand resonance compared to the medium interactivity level. Surprisingly, we cannot fully confirm our H5, as the high level of interactivity has no significant effect on brand resonance compared to low interactivity. We can only partially confirm H5 if we consider that the high level of interactivity does present significantly higher brand resonance compared to the medium interactivity level. Based on the theoretical background, the higher the interactivity, the higher should be the brand resonance compared to a low interactivity level. Indeed, we build our 2D setting experiment by increasing interaction through different ITT, which creates means for participants to interact with the content displayed (Lee et al., 2010; Merle et al., 2012). A higher interactivity supposedly increases recall and recognition, which indirectly impacts engagement and attachment that influence brand resonance (Ballantine & Fortin, 2009; Blazquez Cano et al., 2017; Xu & Sundar, 2016). Thus, if we only consider the mean differences, a high level of

interactivity does create higher brand resonance compared to medium and low, but because there is no significant effect between low and high interactivity so it can not be fully proven.

This difference can be explained by the fact that the product selected for our experiment is from a well-known brand, which might have caused some biased results. Indeed, as previously stated, we used a pair of shoes from the brand Nike as the product displayed for our different scenarios. In the low interactivity scenario, we directly used the website of the brand Nike, as this was the best example we found showing 2D static pictures. Our survey showed that 79% of participants were already familiar with the brand presented and that 70% already liked the brand before answering this survey. We can then assume that some participants were probably biased on the low interactivity level as they were already familiar with the brand and most likely the website. For our high interactive scenario, we decided to choose Zalando.com which proposed a user-friendly interface as well as a high interactivity picture to display the product, which created higher brand resonance. The fact that both the low and high interactivity almost created the same level of brand resonance ($\mu_{\text{low}} = 4.237$ vs. $\mu_{\text{high}} = 4.404$) might explain why there is no significant effect between low and high interactivity (see Table 5).

4. Summary

In the previous study, we examined the effect of VR on brand resonance while accounting for different levels of interactivity and immersion, and comparing it to 2D. In the first analysis, we showed that a higher level of immersion leads to higher brand resonance, and that the effect is even higher in the VR format (confirming H1). When comparing exclusively brand resonance in the 2D and the VR settings, without accounting for the variables of interactivity and immersion, the results showed that brand resonance was slightly higher in the 2D setting, which does not support H2. However a few elements need to be considered. For example, if we consider the results from H1, where VR lead to a higher brand resonance when accounting for both the format and the level of immersion, then we may say that the format along is not enough to have a positive effect on brand resonance, but rather that other interaction factors such as immersion are needed. Regarding the effect of interactivity, we were able to prove H3, a high level of interactivity leads to a higher level of brand resonance in both 2D and VR when compared with low

and medium interactivity levels. Going into each format separately, we were able to confirm H4, a high level of interactivity leads to a higher level of brand resonance in VR compared with a low and medium interactivity level. H5 was confirmed only partially as the high interactivity level led to higher brand resonance in 2D when compared to the medium interactivity level, but not when compared to low interactivity.

Theoretical implications

This research provides new insights on the existing literature. First, we revealed that the type of visualization format does explain some of the variation in the customer's brand resonance. Our findings agree with previous research that indicated that VR can affect emotional engagement when participants are exposed to dimension of immersion and presence in comparison to participants exposed to a 2D scenario (Smith & Mulligan, 2021; Wagler & Hanus, 2018).

Second, our research shows that VR creates a higher effect on brand resonance when the following circumstances are met: the participants need to be stimulated by a high level of interactivity as well as feel immersed in the environment. Previous work already confirmed the importance of interactivity and immersion in VR (Mütterlein, 2018; Mütterlein & Hess, 2017). In addition, it was also supported that a higher level of interactivity with content displayed on websites enables customers to create engagement and have more enjoyable shopping experiences (Ballantine & Fortin, 2009; Xu & Sundar, 2016). Thus, our results provide new contributions by correlating the interactivity and immersion dimension with brand resonance in a VR context. In this sense, our study as a foundation for future studies VR and brand resonance.

Limitations and future research

Our experiment is a representation on how immersive technologies (specifically VR) could affect brand resonance. Thus, there are several limitations to this study that could offer suggestions for future research. Firstly, as explained in prior discussions, a few of these experiment results might be biased because of the experiment parameters and choice of format to present the scenario. It is also

important to note that we chose not to measure the influence of presence on brand resonance, despite what is supported in the literature. Indeed, theories support the fact that when measuring VR, interactivity, presence and immersion are the key dimensions to take into account as they are correlated with each other (Mütterlein, 2018; Mütterlein & Hess, 2017). We justify this decision in our choice for immersive technology. We decided to run our experiment with a 360° video, instead of a traditional VR HMD, due to the feasibility and accessibility of the first one. As our experiment mainly resulted in videos, we considered that the dimension of presence would not be well represented and could possibly confuse participants, resulting in misleading results. It might however be interesting for future studies to examine if the role of presence along with immersion and interactivity has a direct effect on brand resonance through VR and to what degree.

Building on the above, we were limited when choosing the type of technology to use due to the lack of resources and incentives needed to gather the number of participants our study required. We calculated through the software G*Power that in order for our results to have the desired effect size, we would need to recruit a minimum of 128 responses. For this reason, we chose to focus on the VR format specifically related to 360° videos and present them on an interactive platform (Youtube) so that any user could access them by clicking on a link. We did not proceed with an experiment using VR HMD as this requires a lot of equipment, and would need running it in a lab, meaning that a minimum of 128 respondents would have had to physically go to the university lab. We did not believe that gathering more than 128 respondents face-to-face was a realistic goal considering the situation with the Covid-19 pandemic and the fact that although society is opening, there are still many who are having a slow transition back to “normality” and still are struggling with the psychological aftermath of the close-down.

Finally, as we used a 360° video, the perception and experience of the environment might not be the same as when using a HMD. Therefore, if the same experiment was used with a HMD, results could be different and offer even higher effects on brand resonance. Future research might find it interesting to conduct a similar experiment with the right technology to test and examine the role of VR on brand resonance.

Managerial implications

This research provides useful marketing implications for advertisers and marketers who wish to work with immersive technology as a way to create higher brand resonance with their customers through online channels. A key question is whether 2D or VR content creates the highest level of brand resonance. Our results showed that the dimension of interactivity and immersion in a VR environment helps to trigger higher levels of brand resonance compared to a 2D environment. We see that despite the visualization format having an effect on brand resonance, this alone is not enough to create higher levels of brand resonance. Marketers should consider other elements such as interactivity and especially immersion when wanting to advertise using VR immersive technologies. The quality of the content also seems to be an important factor to consider as in some cases a high resolution 2D picture presented a higher brand resonance compared to a static VR 180 video. Thus, if marketers do not have the resources to create good quality content through advanced technology capable of delivering optimal VR content, then it may be wiser to advertise using high quality traditional 2D.

Lastly, the industries of fashion, food or accessories would highly benefit from VR content, especially 360° videos, to increase their brand resonance; considering that is a cheaper alternative compared to other VR tools, such as HMD. Also the 360° videos when combined with high levels of immersion were proven a more attractive option than 2D images. Even though we only tested this research for the fashion footwear industry, it can be logical to think that these results could extend to other similar industries such as accessories.

The goal however is for companies to integrate VR HMD as a means to increase brand resonance. Contrary to 360° videos, incorporating a full VR online experiment would require the use of a VR HMD on the customer's side. Companies like Google offer a very affordable VR headset, the Google Cardboard, that costs only between \$10 to \$30 (Google VR, 2022). However, the quality and interactivity is limited, as it only offers you to watch 360° videos. Higher quality models are more expensive as prices can go up to \$1000 for high quality interactive and immersive environments (Robertson, 2022). Thus, a vast majority of the general public would not be able to afford such technology. Companies can start by incorporating immersive technologies that are easily accessible to the general

public (i.e. 360° videos) and then incorporate more immersive ones when they become more accessible.

Marketers need also to take into consideration the acceptance of such technologies on online channels. Indeed, literature supports that 3D models and incorporated tech inside websites can be harder to use and decrease the user's engagement on brand resonance (Song & Zinkhan, 2008). Thus, brands have to be careful with their decision of VR technology as the content would need to be intuitive and easy for customers to use.

Conclusion

This research aimed to identify whether VR has any effect on brand resonance and more precisely, how it would impact it compared to another type of media format such as 2D images. The analysis focused on two main dimensions specific to VR, namely interactivity and immersion. The hypotheses were tested through a mixed design experiment that tested two conditions: the effects of interaction between different levels of interactivity and format (2D vs VR) on brand resonance, and the effects of interaction of immersion and format on brand resonance. It was concluded that both immersion and format have a high effect on brand resonance, specifically the interaction between high level of immersion and VR presented higher brand resonance compared to a 2D setting. However, it was not concluded that a VR media format alone leads to higher levels of brand resonance compared to a 2D format. Moreover, the interaction of VR format and high level of interactivity did not produce significant increases in brand resonance compared to the 2D setting. This outcome can be explained by the similarity of scenarios presented in the 2D experiment and by the fact that the VR's dimensions of presence was not measured in this research, despite its relevance in literature. Thus, to better understand the implications of these results, it could be interesting for future studies to address the role of presence along with immersion and interaction on brand resonance in a VR environment. In addition, as this research was conducted using 360° videos as the immersive technology, future research could assess the effects of VR on brand resonance, using a full HDM this time, and compare the results.

While the use of 360° videos limits the generalizability of the results, our research provides new insights for the use of immersive technologies in the marketing field. Indeed, literature can be found on the effect of immersive technologies on the

customer experience in general. However, there is a gap in the correlation between immersive technologies and brand resonance specifically. Thus, in addition to supporting theories found in the literature, our findings brings a new kind of understanding of how VR can influence brand resonance and can represent a starting point for future research on the subject.

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