# The influence of virtual reality in e-commerce

## 1. Introduction

The economic impact of virtual reality (VR) and augmented reality (AR) is forecast to amount to $29.5 billion U.S. in 2020 (Statista, 2017). Brands (Volvo/L'Oréal) and retailers (Carrefour/Lowe's) have introduced on-site VR facilities (Berg & Vance, 2016; Vrechopoulos, Apostolou, & Koutsiouris, 2009) that provide more appealing shopping experiences than traditional environments (Mann, Liu-Thompkins, Watson, & Papelis, 2015). However, the limited and inconclusive research findings in the retail context call for further studies into how to develop more efficient virtual shopping environments (Bonetti, Warnaby, & Quinn, 2018).

The prior literature analyzes the differences between virtual and physical commerce. Comparisons between them show that attitudinal measurements of cognition and intention are similar (Massara & Melara, 2010; van Herpen, van den Broek, & van Trijp, 2016). Similarly, Waterlander, Jiang, Steenhuis and Ni Mhurchu (2015) show that shopping patterns in virtual and actual supermarkets are comparable. By contrast, affective attitude, time spent purchasing and purchase rates are comparably lower in physical stores (Bressoud, 2013). Unfortunately, the vast majority of studies into v-commerce (i.e. virtualizing stores) are based on the use of a single VR system and, thus, there are almost no comparisons between the different VR systems (content formats and devices) and the physical store setting. Furthermore, the mechanism through which VR elicits purchase intentions in commercial settings has not been deeply analyzed and needs further investigation, as recently stated (Grewal, Roggeveen, & Nordfält, 2017).

Therefore, our research goal is twofold. First, to analyze the effectiveness of VR devices (PC monitor, powerwall and head-mounted displays (HMD)) and VR content formats (3D and

360°) in eliciting positive consumer responses and to compare these to responses evoked in physical store settings. To address the lack of empirical evidence, we pose three research questions (RQs). Second, through seven hypotheses, we investigate paths through which VR technology impacts on consumers' purchase intentions. A virtual supermarket was created and subjects were exposed to different content formats and VR devices. This supermarket faithfully recreated an existing physical store, which allowed us to make valid comparisons. The responses of participants were collected to address the RQs and the hypotheses.

Our study contributes to v-commerce literature in various ways. First, we show the effects of both the content format and the VR device on consumers' responses, which allows us to confirm that the HMD is the most effective device. More interestingly, we confirm the preeminence of v-commerce over the traditional store. Third, a dual path model reveals the impact of VR technology on purchase intentions through sense of presence and brand recall (figure 1).

The paper is organized as follows. First, we review the literature on VR in retail; this leads us to propose three RQs. Then, we draw on traditional models of affect, cognition and conation to develop a structural model, based on seven hypotheses of consumer responses to v-commerce. Thereafter, we present our methodological approach, results, main findings, their implications, the limitations of the study and further research lines.

## 2. Theoretical framework, research questions and hypotheses

### *2.1. VR devices and v-commerce content formats*

The benefits of VR are well recognized (e.g. Pantano & Servidio, 2012). Due to the enormous possibilities of VR devices and content formats, v-commerce provides an advanced and enriched sales method that offers (i) more products than physical stores in settings similar to e-commerce; (ii) the potential integration of other communication tools, such as traditional

advertising, online media and eWOM; and (iii) real time interaction with products, the ability to view them in a realistic way and to request personalized information likely to influence purchasing decisions (Fang, Zhang, Şensoy, & Magnenat-Thalmann, 2014; Papagiannidis, See-To, & Bourlakis, 2014).

Expanding the typology of Meißner, Pfeiffer, Pfeiffer, and Oppewal (2017), VR devices can be categorized based on their human-machine interfaces: (i) PC monitors; (ii) big, ultra-high-resolution screens, named powerwalls; (iii) smartphones connected to mobile VR headsets, such as the Samsung Gear VR; (iv) HMDs, such as the Oculus Rift and HTC Vive; (v) immersive cubes, such as CAVE (Bigné, Llinares, & Torrecilla, 2016). In addition, content can be displayed by realistic images or video in 360° or three-dimensional (3D) digital representations. The VR technologies we use were selected based on the accepted components of any virtual experience (LaViola, Kruijff, McMahan, Bowman, & Poupyrev, 2017). In the past, the format most used has been 3D, however, the 360º format is gaining in popularity due to smartphones such as the Samsung Gear. The 3D format is created digitally through computer vision software, the navigation is continuous, and it must be connected to a computer. The 360º format, which is cheaper, is based on videos of real situations and navigation is limited to a 360º view of each photogram. We used three visual output devices: a desktop PC, the powerwall and an HMD, which are differentiated by the level of immersion offered by each interface (LaViola et al., 2017).

Recent studies make comparisons between these types of devices outwith v-commerce (Kim, Rosenthal, Zielinski, & Brady, 2014). Although the devices have been used in retail settings (Algharabat, Alalwan, Rana, & Dwivedi, 2017; Pantano & Servidio, 2012), which of them is the most effective in terms of consumer response and whether they perform better than traditional stores has not been deeply analyzed; this constitutes a research priority (Li,

Daugherty & Biocca, 2001; Verhulst, Normand, Lombart, & Moreau, 2017). To bridge this research gap, the following RQs are posed:

RQ1: Which VR device elicits greater consumer responses in a virtual store?

RQ2: Which VR content format elicits greater consumer responses in a virtual store?

RQ3: Do virtual stores generate greater consumer responses than physical stores?

### *2.2. The VR experience: affect, cognition and conation*

VR can be seen as a new form of experience in which subjects perceive the virtual space as the real world and that what is virtually happening is really happening (Slater, 2009). As psychologists and consumer researchers widely acknowledge (e.g. Zajonc, 1980a, b), any human experience entails three different states: affective, cognitive and conative. Feeling, thinking and acting have been long discussed in psychology but the sequencing of their interactions is still debated, especially "whether (or when) a cognitive or affective response "comes first" (Barry & Howard, 1990, p. 106). We agree with Peterson, Hoyner, and Wilson (1986), who argue that the answer may depend on the definitions of cognition and affect, and that the key question is how do both interact to effect behaviour.

#### *2.2.1. The influence of affect on cognition*

Affect includes all the feelings and emotions (Peterson et at., 1986) experienced by ordinary people. Ulrich (1983) states that affect is central to conscious experience in any environment, whether natural or built. Various authors have studied the sequence affect-cognition; they argue that affective responses, whether specific feelings or emotional reactions, systematically affect cognition (e.g. Ashby & Isen, 1999; Zajonc, 1980a, b). We distinguish three affective measures under the general category of "affect": emotional response, affective appraisal and discomfort.

Emotions are states of feelings representing reactions to an experience (Mehrabian & Russell, 1974). They are conceived as general factors, whereas affective appraisals are evaluations of more specific feelings not included in broad emotional factors (Laros & Steenkamp, 2005). In the specific case of VR, the affective appraisal of the simulated environment is associated with the evaluation of specific features and formal attributes in a virtual scenario. The concept has received considerable attention in the VR academic domain, being measured usually through the Semantic Environmental Scale (Küller, 1991). As VR is an effective means of generating affective responses (Riva et al., 2007), we consider broad emotional responses to the VR experience and specific, affective appraisals of the virtual environment and its composite elements. In addition, we measure the discomfort caused to users by wearing the VR devices.

Cognition is typically defined as "mental activity as reflected in knowledge, beliefs or thoughts that someone has about some aspect of their world" (Barry & Howard, 1990, p. 104). VR experiences entail the psychological sense of presence, often referred to as the illusion of "being there" (Biocca, 1997) "in the mediated environment, rather than in the immediate physical environment" (Steuer, 1992, p. 76). When experiencing sense of presence in the virtual environment, subjects act, behave, and interact as they do in real life. In addition, behaviours, attitudes and beliefs can be transferred from reality to virtuality and vice versa in a spontaneous, unconscious, and unaware manner, giving situations a high ecological validity.

Contemporary cognitive theories posit that affect directly influences cognition (e.g. Bless & Fiedler, 2006; Isen, 1984). In the VR domain, the relationships between emotions experienced in virtual environments and sense of presence has been well recognized for some years (Alcañiz, Baños, Botella, & Rey 2003), but the findings are inconclusive (Diemer, Alpers, Peperkorn, Shiban, & Mühlberger, 2015). Some authors report the causal influence of

emotions on presence (Bouchard, St-Jacques, Robillard, & Renaud, 2008; Gorini, Capideville, De Leo, Mantovani, & Riva, 2011; Riva et al., 2007), while others consider that these relationships have been insufficiently tested and emphasize the need to further examine these effects (Diemer et al. 2015; Alcañiz et al., 2003). Based on the affect-cognition theories of psychology and extending previous findings into the v-commerce context, we hypothesize that:

H1: The emotions experienced by a consumer in a virtual store positively influence sense of presence.

Following the affect-cognition postulations, network models of memory (Collins & Loftus, 1975) study the effect of affective responses on memory and cognition. From this perspective, positive affect felt when exposed to stimuli may cause higher levels of consumer recall. Similarly, the affect at the time of retrieval and the match between exposure and retrieval moods have been acknowledged as determinants of recall (see Isen [1984] for a review). In commercial settings, brand recall is the consumer's ability to retrieve the brand from memory (Radder & Huang, 2008). It is considered the highest level of brand awareness and indicates that the brand is strongly positioned in the consumer's mind (Laurent, Kapferer, & Roussel, 1995). Due to the evident effect that affective evaluations have on memory, and since consumers' affective assessments of their environment impact on their subsequent cognitive responses (Küller, 1991), we posit that:

H2: The consumer's affective evaluations of a virtual store positively influence brand recall.

Some theorists suggest that consumers' recall may be influenced by more than just affect. When individuals are deeply engrossed in a virtual environment, the cognitive engagement manifested through the sense of "being there", may also have an effect on memory. Some

researchers find that the greater the level of presence experienced, the higher is the recall score (Mania & Chalmers, 2001). From telepresence theory, Steuer (1992) further argues that a rich virtual electronic retail environment leads to higher levels of presence and, therefore, higher stimuli recall. Extending these effects into v-commerce, we propose that:

H3: The sense of presence experienced by the subject in a virtual store has a positive influence on brand recall.

In addition to generating positive affective responses, virtual environments may also cause negativity due to the characteristics of the VR devices, some of which can cause the user physical discomfort (Yim, Chu, & Sauer, 2017). For instance, Kim et al. (2014) show that, when subjects undertake stressful tasks, HMDs elicit more unpleasant affect than PC monitors. Bonetti et al. (2018) argue that, for VR to succeed in retailing, the devices must be comfortable for the consumer, since devices are a fundamental part of the experience. In the feeling and thinking paradigm, the interplay between affect and cognition has been shown to be congruent (e.g. Forgas & Eich, 2012); therefore, discomfort felt in a VR experience may negatively affect both measures of cognition. Thus, we hypothesize that:

H4: Perceived discomfort in a virtual store negatively impacts on sense of presence.

H5: Perceived discomfort in a simulation experiment in a virtual store negatively impacts on brand recall.

### *2.2.2. The influence of cognition on conation*

The term "conation" refers to both the intention to perform a behaviour and performance of the behaviour (Barry & Howard, 1990). This "acting" component of the feeling-thinking-acting sequence is the least debated, since there is a common view that people, after feeling and/or thinking, act; thus, behaviour occurs last.

Purchase intention is one of the most studied conative variables in e-commerce (Hausman & Siekpe, 2009). Recently, some authors emphasize the potential of VR to revolutionize the shopping experience (e.g. Grewal et al., 2017) and, therefore, purchase intention is gaining increasing research attention (e.g. Meißner et al., 2017; van Herpen et al., 2016). The impact of presence on consumer behaviour has been analyzed in e-commerce and VR (Li et al., 2001) and, more recently, its effect on purchase intention has been corroborated in v-commerce (Beck & Crié, 2018). Following the cognition-conation sequence (Zajonc 1980a, b), we therefore posit that:

H6: The sense of presence in a virtual store positively impacts on purchase intention.

As Radder and Huang (2008) state, the easier it is for a consumer to recall a brand the higher will be his or her purchase intention. Research has found a positive influence of brand recall on purchase intentions (Memon, Arif, & Farrukh, 2016), which supports our proposal about the effect of memory and cognition on conation. Based on the above, similar effects may be seen in a v-commerce setting. Therefore:

H7: Brand recall positively impacts on purchase intention in a virtual store.

**Fig. 1.** Proposed conceptual model.

## 3. Method

A multiphase study was carried out. In the first phase, addressing RQ1 to RQ3, we compared different VR formats and devices and consumers' responses in a virtual and a physical store. In the second phase, we ran a structural model of affective, cognitive and conative responses to test the research hypotheses.

### *3.1. Research design*

A 3 (display devices: 24" PC monitor, a large-screen powerwall, 6 metres wide x 3 metres high, and an HTC Vive HMD) X 2 (Virtualization formats: 360º, 3D) + 1 (control group (CG)) inter-subject design was performed. CG participants (n = 30) were taken to a physical supermarket outside opening hours to avoid interaction with customers and employees. The study was conducted in the beer, water and wine areas. The physical supermarket was identically recreated in two virtual environments, one with a navigable sequence of 360º images (90 subjects) and one with free 3D navigation (58 subjects). This identical recreation ensured participants were exposed to the same stimuli (number, size, appearance, order and placement of products) across the experimental conditions. Experimental sessions were timed to control exposure time. A pretest was performed (n = 30) to check the experimental protocols and to discover and correct detected errors in both store settings. An entry zone was used in all the conditions for participants to receive initial training and familiarization. Participants had to perform a series of search tasks and brand choices. The water and wine areas were used for training and the beer area was used for the study.

Confound checks were performed to test whether being a buyer and/or a consumer of the product categories under analysis influenced the dependent variables. Purchase intention was the only factor affected by whether subjects were buyers ($U = 1720$, $p < .001$) or consumers ($U = 1313.5$, $p < .001$) of beers. Since buyers and consumers represented 71.4% of the sample, we controlled this variable by considering the scores of only this group of consumers in the analysis of the purchase intention factor.

### *3.2. Data gathering and sample*

Individuals on the database of the immersive neurotechnologies lab at a *European university* were recruited for the study, following non-probabilistic convenience sampling. The sample

size was 178 (60.1% female, 46.6% 19-30 years and 44.9% university students). Table 1 shows the distribution of the participants according to the relevant demographic variables.

**Table 1.** Sample demographics.

Data were collected between November 2016 and April 2017 through two questionnaires, one completed before and one after the experiment. The first covered sociodemographics, consumption profile and suitability to take part in the experiment (not under medication, no consumption of stimulants in previous two hours, no serious visual impairment). The second collected consumers' responses: emotions experienced, affective appraisal of the virtual environment, perceived discomfort, sense of presence (not for the CG), brand recall and purchase intention.

### *3.3. Measures*

The measurement scales are at table 2. Presence is measured by a 7-point Likert scale (1 = none, 7 = total) and eight items proposed by Usoh, Catena, Arman, & Slater (2000). Emotions are measured through three items in the Mehrabian and Russell (1974) scale, where participants rate the extent to which they experience each of the emotions described in the virtual scenario (1 = nothing, 7 = total). Affective appraisal is measured through eight items on the Semantic Environmental Scale (Küller, 1991). Participants score the extent to which the descriptive items were evoked by the virtual scenario (1 = nothing, 7 = total). To measure perceived discomfort we developed a two item 5-point Likert scale (1 = nothing, 5 = a lot). Thirty beer brands were listed in the test paper. The measures of brand recall and purchase intention were the number of brands reported as remembered and considered for purchase.

**Table 2.** Measurement scales.

### *3.4. Data analysis*

Several significance tests were performed in the first phase of the study to answer the RQs. Furthermore, hypotheses 1 to 7 were tested through Structural Equation Modelling (SEM) using partial least squares (PLS) software, the potential shortcomings of which were overcome by Henseler et al. (2014).

## 4. Results

### *4.1. Phase 1. Comparisons between physical and v-commerce; and among different VR formats and devices.*

To address the RQs we carried out ANOVA tests for the constructs of emotions, affective appraisal and presence. As discomfort, recall and purchase intention did not have normal and/or homogeneous distributions, we performed non-parametric tests, the Kruskal-Wallis and the Mann-Whitney U (MWU). The VR formats and device scores were compared across the different groups and against the control group. Tables 3 and 4 show the results of the tests and the corresponding scores.

**Table 3.** Physical commerce and v-commerce (including formats).

As table 3 shows (RQ1 and RQ3), emotions, affective appraisals and sense of presence do not differ across VR formats or when compared with the physical store scenario used as a CG. The interaction effects between formats and devices were not significant: presence ($F_{1, 143}$ = .3.07, p = .08), affect ($F_{1, 171}$ = .73, p = .40) and emotion ($F_{1, 171}$ = 1.66, p = .20). Nonetheless, we found significant differences in the factors of discomfort, brand recall and purchase intention across the VR formats and in the CG.

As to discomfort, differences were obtained between the CG and those exposed to the 360° format ($U = 1024$, $p < .05$), the latter perceiving the most discomfort (see table 3). Similarly, differences in terms of brand recall were obtained between the two VR formats and the physical scenario ($U_{3D, CG} = 230.5$, $p < .001$; $U_{360°, CG} = 349$, $p < .001$); both VR formats have higher brand recall than the physical scenario.

The results also show differences in purchase intention as a function of VR format, between the two VR formats, 3D and 360° ($U = 977.5$ $p < .05$) and between the CG and both the 3D ($U = 226.5$ $p <.001$) and the 360° formats ($U = 496.5$ $p <.05$). Again, the physical condition obtains the lowest purchase intention scores (table 3).

**Table 4.** Physical commerce and v-commerce (including devices).

As with the VR formats, we did not find differences in the emotion and affective appraisal factors as a function of VR device. Nonetheless, differences in discomfort, sense of presence, brand recall and purchase intention were found.

HMDs show significantly higher levels of discomfort in comparison to both PC monitors ($U = 1462$, $p < .05$) and the CG ($U = 626$, $p < .01$), as shown in table 4 (RQ2 and RQ3). Nevertheless, HMDs significantly increase ($p <. 05$) sense of presence when compared with the powerwall, as the *post hoc* Tukey test showed (table 4).

Brand recall differs between all of the VR devices and the CG ($U_{Powerwall, CG} = 113$, $p = < .001$; $U_{Desktop, CG} = 251$, $p = < .001$; $U_{HMD, CG} = 215{,}5$, $p = < .001$). Again, the physical store gives the lowest recall scores (see table 4). Finally, as regards purchase intention, significant differences were observed between the CG and both the PC monitor ($U = 272$ $p <.001$) and the HMDs ($U = 259$ $p <.001$). Once more, the physical scenario ranks last in purchase intentions.

The results of the first phase of the study show the effectiveness of VR over physical supermarkets. As for the VR format, no significantly different scores emerged from five out of six measures. In a comparison of the different VR devices, the HMD was the highest for sense of presence and obtained the highest scores for affect, emotions and purchase intention; therefore, we conclude it is, overall, the most effective device.

### *4.2. Phase 2. Test of the conceptual model.*

Based on the phase 1 finding showing the effectiveness of VR in retailing, the structural equation model, the second phase of our study, was analyzed only for the VR conditions of the HMDs, in both the 3D and 360° formats (n = 58). We analyzed the main reasons for the superiority of VR through a causal study assessing both the validity of the measurement instrument and of the proposed model.

#### *4.2.1. Reliability and validity of the measurement instrument*

Table 5 shows the reliability and convergent validity of the measurement instrument. In terms of convergent validity, the size of the standardized loadings for each indicator were analyzed, following the data-cleaning criterion of Hair, Hult, Ringle, and Sarstedt (2014). After this phase, there were no standardized loadings below .4 (Hair et al., 2014) or values of average variance extracted (AVE) below .5 (Fornell & Larcker, 1981).

Reliability was evaluated based on Cronbach's alpha (CA) (Cronbach, 1951) and the composite reliability index (CR) of each factor. As for the former, one value was obtained below the standard criterion of .7 (Nunnally & Bernestein, 1994). However, its CR index exceeds the .6 criterion established by Fornell and Larcker (1981). Therefore, since CR is commonly accepted as a more potent and appropriate measure of internal factor consistency than CA (Hair et al., 2014), this result do not raise any problems for the analysis.

**Table 5.** Validation of the measurement model. Reliability and convergent validity.

Table 6 shows the results of the discriminant validity evaluation of the measuring instrument. Each construct must share more variance with its indicators than with the other constructs of the model (Fornell & Larcker, 1981). The matrix of correlations between latent variables is shown below the diagonal. As can be observed, the correlations between pairs of factors are below the corresponding square roots of the AVE values of each factor depicted in the diagonal.

As a criterion of discriminant validity, the Heterotrait-Monotrait correlations (Henseler, Ringle, & Sarstedt, 2015) are analyzed and reflected in table 4, above the diagonal. The values are no greater than .85 (Kline, 2011). Therefore, the measuring instrument is reliable and valid.

**Table 6.** Validation of the measurement model. Discriminant validity.

### *4.2.2. Evaluation of the structural model*

Table 7 shows the results of the estimation of the structural part of the model. Since there is no global goodness of fit in PLS (Hair et al., 2014), our tests of model fit rely on the bootstrap-based test, blindfolding process and other indexes (Henseler, Hubona, & Ray, 2016). Through a bootstrap resampling procedure, the standardized β coefficients and t values were obtained to analyze the significance of the relationships between the variables proposed in the hypotheses. In addition, the $R^2$ and $Q^2$ indexes were obtained (Fang et al., 2014; Stone, 1974) to evaluate the predictive relevance of the model (the latter through blindfolding).

**Table 7.** Results of the structural model. Hypotheses testing.

In accordance with the standard criteria, the $R^2$ values obtained are greater than .1 (Falk & Miller, 1992) and the $Q^2$ values are above zero (Aldás, 2012). As shown in table 5 and figure 2, the evaluation of the structural model leads us to accept four of the seven hypotheses. Both the effect of emotions on sense of presence (H1; β = .40; p <.001) and sense of presence on purchase intention (H6; β = .19; p <. 05) are confirmed. The impact of affect appraisal on recall (H2; β = .38; p <.001) was demonstrated, as was recall on purchase intention (H7; β = .49; p <.001). However, no evidence was obtained for the effect of perceived discomfort on sense of presence (H4; β = -.05; p = .79) and recall (H5; β = .09; p = .50), or for the impact of presence on recall (H3; β = .06; p = .56).

**Fig. 2.** Results of the proposed conceptual model. β Coefficients

As table 7 and figure 2 show, the model shows good psychometric properties. Nevertheless, an additional model was tested to confirm the robustness of the hypothesized model. In particular, we analyzed whether the effect of presence on purchase intention was mediated by product familiarity (consumers' level of product purchase and consumption). The mediation model was tested using Baron and Kenny's (1986) procedure. First, to confirm the mediation effect, the independent variable (presence) must significantly affect the dependent variable (purchase intention). Second, the independent variable should significantly affect the mediating variable (familiarity) and the latter should also influence the dependent variable when controlled by the independent factor. In addition, the indirect effect of the independent variable on the dependent variable should also be significant. Although the results of the validity and reliability analyses were acceptable, no mediation effect was found, thus confirming the robustness of the hypothesized model.

## 5. Discussion

Our phase 1 findings show that the two VR content formats (3D and 360°) (RQ1) do not elicit significant differences in consumers' cognitive and affective responses. Purchase intention was found to be the only response affected by VR format; the 3D imagery to a significant extent encouraged this effect. As for the VR devices (RQ2), differences were found only in discomfort and sense of presence. HMDs encourage higher levels of presence (compared to powerwalls) but also generate more discomfort (in comparison to PCs). In any case, HMDs were found to be the most effective devices, obtaining the highest scores in 4 out of the 5 positive measures.

One of the main contributions of this study is the comparison made between virtual and physical stores (RQ3). Virtual stores are more effective in generating cognitive and conative responses. In fact, the strongest effects in the study were obtained when the physical store was compared to the different VR formats and devices rather than when the different VR formats were compared to each other. In particular, brand recall appears to be significantly higher in all v-commerce conditions than in the physical store. Similarly, the two VR formats and two of the three VR devices significantly increase purchase intentions in comparison to traditional stores. This interesting finding needs further explanation, which we will address in the second phase through a SEM. These results are consistent with previous literature (Mann et al., 2015) and emphasize the business opportunities that VR offers the retail sector (Bonetti, et al., 2018).

The results of phase 2 show that VR elicits consumer purchase intentions in v-commerce through two different paths, consistent with the traditional hierarchy effects of affect-cognition-conation (e.g. Zajonc, 1980a, b). First, we show that emotions experienced in a virtual store impact on sense of presence (H1), which, in turn, increases consumers' purchase intentions (H6). The influence of emotions on presence is consistent with previous studies (Bouchard et al., 2008; Gorini et al., 2011; Riva et al., 2007) and supports the need to study

further the relationship between these two variables (Alcañiz et al., 2003; Diemer et al., 2015). Recent studies (Beck & Crié, 2018) support our result on the impact of presence on purchase intention, confirming the commercial potential of v-commerce and the need to create immersive environments which increase the feeling of “being there".

The second path shows that the consumer’s affective assessment of a virtual environment impacts on brand recall (H2), influencing his/her purchase intention (H7). These findings, widely accepted in consumer behaviour, have been extended to the virtual store, both for the impact of affect on recall (e.g. Collins & Loftus, 1975, Isen, 1984) and recall’s impact on purchase intention (Memon et al., 2016).

Contrary to our expectation, discomfort perceived in a virtual store does not influence sense of presence (H4) or brand recall (H5). This finding is of great interest given that, in the first phase analyses, discomfort was shown to be the only advantage of the physical over the virtual store. Although these results are limited as regards the effect of discomfort on presence and recall, it can be stated that, despite the fact that VR devices cause more discomfort than is experienced in a physical store, this does not affect cognition measures, which are directly and positively related to purchase intention.

Finally, contrary to H3, sense of presence does not influence brand recall. This result might be attributed to the the fact that brand recall might depend to a greater extent on factors introduced by retailers (e.g. advertising), or previous consumer familiarity, rather than in-store factors related to sense of presence (Chandon, Hutchinson, Bradlow, & Young, 2009). In addition, the high level of cognitive engagement provoked by the virtual experience may discourage people from paying attention to specific stimuli, as previous studies have noted (Nichols, Haldane, & Wilson, 2000).

## 6. Conclusions, implications, and further research directions

VR is one of the most promising innovations in retailing and will revolutionize the consumer shopping experience in the next years (Grewal et al., 2017). Our study contributes to the v-commerce debate from a dual perspective. First, it demonstrates the advantages of v-commerce over physical stores in generating positive consumer responses. In addition, the pre-eminence of the HMD over other VR devices has been confirmed. Second, we demonstrate a dual route mechanism through which virtual stores elicit purchase intentions: (i) through emotions and sense of presence, and (ii) through the affect caused by the virtual environment and brand recall.

These findings have several implications. First, the development of VR environments in retail businesses is highly recommended due to their superiority in comparison to physical environments. In addition, the use of HMDs is highly recommended. Although HMDs are more uncomfortable than other devices, they provide better experiences and greater consumer responses. Furthermore, the discomfort does not impact on sense of presence or brand recall. Second, it is important to note other key factors needed for VR to succeed in the retail context. As derived from the results of the tested model, affective responses must be evoked to encourage a satisfactory consumer cognitive state, which is directly connected to intended behaviours. This implies the need to develop appealing, stimulating virtual environments with features capable of generating emotional experiences and positive affect. We would recommend the integration of interactive features combining VR and AR technologies and social media and website links, as these have the potential to enhance the user experience. Engaging virtual environments generate affect, a profound sense of presence and increase other cognitive responses that enhance business performance, such as brand recall, which impact on purchase intention. Our recommendation comes from the need, as VR devices become more popular, to implement in-store VR solutions and in-home applications, to

provide more natural consumer interactions in familiar contexts that may enhance the shopping experience and increase purchases.

This study has some limitations, which suggest several directions for future research. First, the study data were collected based on exposure to a virtual supermarket. Further research is needed to extend the results to other types of virtual stores. Second, data was gathered through questionnaires. Future research might consider functional magnetic resonance, transcranial doppler and electroencephalography (Alcañiz, Rey, Tembl, & Parkhutik, 2009). Third, sense of presence might be considered as a multidimensional factor, as suggested in other contexts (Riva et al., 2007).

**References**


Alcañiz, M., Baños, R., Botella, C., & Rey, B. (2003). The EMMA project: Emotions as a determinant of presence. *PsychNology Journal*, *1*(2), 141-150.

Alcañiz, M., Rey, B., Tembl, J., & Parkhutik, V. (2009). A neuroscience approach to virtual reality experience using transcranial doppler monitoring. *Presence: Teleoperators and Virtual Environments*, *18*(2), 97-111.

Aldás, J. (2012). Partial least squares path modelling in marketing and management research: An annotated application. In L. Moutinho, & K. H. Huarng (Eds.), *Quantitative Modelling in Marketing and Management* (pp. 43-78). London: World Scientific.

Algharabat, R., Abdallah Alalwan, A., Rana, N. P., & Dwivedi, Y. K. (2017). Three dimensional product presentation quality antecedents and their consequences for online retailers: The moderating role of virtual product experience. *Journal of Retailing and Consumer Services, 36,* 203-217.

Ashby, F. G., & Isen, A. M. (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review*, *106*(3), 529.

Baron, R., & Kenny, D. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social, 51*(6), 1173-1182.

Barry, T. E., & Howard, D. J. (1990). A review and critique of the hierarchy of effects in advertising. *International Journal of Advertising, 9*(2), 121-135.

Beck, M., & Crié, D. (2018). I virtually try it … I want it ! Virtual fitting room: A tool to increase on-line and off-line exploratory behavior, patronage and purchase intentions. *Journal of Retailing and Consumer Services, 40*(1), 279-286.

Berg, L. P., & Vance, J. M. (2017). Industry use of virtual reality in product design and manufacturing: a survey. *Virtual Reality, 21*, 1-17.

Bigné, E., Llinares, C., & Torrecilla, C. (2016). Elapsed time on first buying triggers brand choices within a category: A virtual reality-based study. *Journal of Business Research, 69*(4), 1423-1427.

Biocca, F. (1997). The Cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, *3*(2).

Bless, H., & Fiedler, K. (2006). Mood and the regulation of information processing. In J.P. Forgas (Ed.), *Affect in social cognition and behavior* (pp. 65-84). New York: Psychology Press.

Bonetti, F., Warnaby, G., & Quinn, L. (2018). Augmented Reality and Virtual Reality in Physical and Online Retailing: A Review, Synthesis and Research Agenda. In T. Jung, & M. C. tom Dieck (Eds.), *Augmented Reality and Virtual Reality. Empowering Human, Place and Business* (pp. 119-132). Cham, Switzerland: Springer.

Bouchard, S., St-Jacques, J., Robillard, G., & Renaud, P. (2008). Anxiety increases the feeling of presence in virtual reality. *Presence*: *Teleoperators and Virtual Environments, 17*(4), 376–391.

Bressoud, E. (2013). Testing FMCG innovations: experimental real store versus virtual. *Journal of Product & Brand Management*, *22*(4), 286-292.

Chandon, P., Hutchinson, J. W., Bradlow, E. T., & Young, S. H. (2009). Does in-store marketing work? Effects of the number and position of shelf facings on brand attention and evaluation at the point of purchase. *Journal of Marketing*, 73(6), 1-17.

Collins, A. M., & Loftus, E.A. (1975). A Spreading-Activation Theory of Semantic Processing. *Psychological Review, 82*(6), 407-428.

Cronbach, L. J. (1951). Coefficient Alpha and the internal structure of tests. *Psychometrika, 16*(3), 297-334.

Diemer, J., Alpers, G. W., Peperkorn, H. M., Shiban, Y., & Mühlberger, A. (2015). The impact of perception and presence on emotional reactions: a review of research in virtual reality. *Frontiers in Psychology*, 6, 1-9.

Falk, F. R., & Miller, N. B. (1992). *A Primer for Soft Modeling.* Akron, OH: The University of Akron Press.

Fang, H., Zhang, J., Şensoy, M., & Magnenat-Thalmann, N. (2014). Reputation mechanism for e-commerce in virtual reality environments. *Electronic Commerce Research and Applications, 13*(6), 409-422.

Forgas, J. P., & Eich, E. (2012). Affective influences on cognition: Mood congruence, mood dependence, and mood effects on processing strategies. In I. B. Weiner, A. F. Healy, & R. W. Proctor (Eds.), *Handbook of Psychology* (pp. 61-82) (4, 2nd Edition). Hoboken, NJ: Wiley.

Fornell, C., & Larcker, D. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research, 18*(3), 382-388.

Gorini, A., Capideville, C. S., De Leo, G., Mantovani, F., & Riva, G. (2011). The role of immersion and narrative in mediated presence: the virtual hospital experience. *Cyberpsychology, Behavior, and Social Networking, 14*(3), 99-105.

Grewal, D., Roggeveen, A. L., & Nordfält, J. (2017). The future of retailing. *Journal of Retailing, 93*(1), 1-6.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM).* Thousand Oaks, CA: Sage.

Hausman, A. V., & Siekpe, J. S. (2009). The effect of web interface features on consumer online purchase intentions. *Journal of Business Research, 62*(1), 5-13.

Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., Ketchen, D. J. Jr., Hair, J. F., Hult, G. T. M., & Calantone, R. J. (2014). Common beliefs and reality about PLS: Comments on Rönkkö and Evermann (2013). *Organizational Research Methods, 17*(2), 182-209.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems. 116*(1), 2-20.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science. 43*(1), 115-135.

Isen, A. M. (1984). Toward Understanding the Role of Affect in Cognition. In R., Jr. Wyer, & T. Srull (Eds.), *Handbook of Social Cognition* (3) (pp. 179-236). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Kim, K., Rosenthal, M. Z., Zielinski, D. J., & Brady, R. (2014). Effects of virtual environment platforms on emotional responses. *Computer Methods and Programs in Biomedicine, 113*(3), 882-893.

Kline, R. (2011). *Principles and Practice of Structural Equation Modeling*. New York: Guilford Press.

Küller, R. (1991). Environmental assessments from a neuropsychological perspective. In T. Gärling, & G. W. Evans (Eds.), *Environment, Cognition and Action: An Integrated Approach* (pp. 111-147). New York: Oxford University Press.

Laros, F. J., & Steenkamp, J. B. E. (2005). Emotions in consumer behavior: a hierarchical approach. *Journal of Business Research, 58*(10), 1437-1445.

Laurent, G., Kapferer, J., & Roussel, F. (1995). The underlying structure of brand awareness scores. *Marketing Science, 14*(3_supplement), G170-G179.

LaViola Jr, J. J., Kruijff, E., McMahan, R. P., Bowman, D., & Poupyrev, I. (2017). *3D user interfaces: Theory and practice.* Redwood City, CA: Addison-Wesley Professional.

Li, H., Daugherty, & T. M., Biocca (2001). Characteristics of virtual experience in electronic commerce: A protocol analysis. *Journal of Interactive Marketing, 15*(3), 13-30.

Mania, K., & Chalmers, A. (2001). The effects of levels of immersion on memory and presence in virtual environments: A reality centered approach. *CyberPsychology & Behavior, 4*(2), 247-264.

Mann, M. K., Liu-Thompkins, Y., Watson, G. S., & Papelis, Y. E. (2015). A multidisciplinary examination of 3D virtual shopping environments: Effects on consumer perceptual and physiological responses. In K. Kubacki (Ed.), *Ideas in Marketing: Finding the New and Polishing the Old* (pp. 752–755). Springer International Publishing.

Massara, F., Liu, S. S., & Melara, R. D. (2010). Adapting to a retail environment: Modeling consumer–environment interactions. *Journal of Business Research, 63*(7), 673-681.

Mehrabian, A., & Russell, J. (1974). *An Approach to Environmental Psychology*. Cambridge, MA: The MIT Press.

Meißner, M., Pfeiffer, J., Pfeiffer, T., & Oppewal, H. (2017). Combining virtual reality and mobile eye tracking to provide a naturalistic experimental environment for shopper research. *Journal of Business Research*, in press.

Memon, B. A., Arif, H., & Farrukh, M. (2016). Impact of brand recall on customer purchase intention. *Journal of Marketing and Consumer Research. 25*, 51-59.

Nichols, S., Haldane, C., & Wilson, J. R. (2000). Measurement of presence and its consequences in virtual environments. I*nternational Journal of Human-Computer Studies, 52*(3), 471-491.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*. New York, NY: Mc-Graw-Hill.

Pantano, E., & Servidio, R. (2012). Modeling innovative points of sales through virtual and immersive technologies. *Journal of Retailing and Consumer Services, 19*(3), 279-286.

Papagiannidis, S., See-To, E. W, & Bourlakis, M. (2014). Virtual test-driving: The impact of simulated products on purchase intention. *Journal of Retailing and Consumer Services, 21*(5), 877-887.

Peterson, R. A., Hoyner, W. D., & Wilson, W. R. (1986). Reflections on the role of affect in consumer behavior. In R. A. Peterson, W. D. Hoyner, & W. R. Wilson (Eds.), *The Role of Affect in Consumer Behavior: Emerging Theories and Applications* (pp. 141-159), Lexington, MA: Lexington Books.

Radder, L., & Huang, W. (2008). High-involvement and low-involvement products: A comparison of brand awareness among students at a South African university. *Journal of Fashion Marketing and Management: An International Journal, 12*(2), 232-243.

Riva, G., Mantovani, F., Capideville, C. S., Preziosa, A., Morganti, F., Villani, D., Gaggioli, A., Botella, C., & Alcañiz, M. (2007). Affective interactions using virtual reality: The link between presence and emotions. *CyberPsychology & Behavior, 10*(1), 45-56.

Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society of London B: Biological Sciences. 364*(1535), 3549-3557.

Statista. (2017). Projected Economic Impact of Virtual and Augmented Reality Technologies Worldwide from 2016 to 2020 (in Billion U.S. Dollars), http://bit.ly/2NNW5ay Accessed 15 October, 2017.

Steuer, J. (1992). Defining virtual reality: Dimensions Determining Telepresence. *Journal of Communication, 42*(4), 73-93.

Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. *Journal of the Royal Statistical Society, Series B, 36*(2), 111-147.

Ulrich, S. R. (1983). Aesthetic and affective response to natural environment, behavior and the natural environment. In I. Altman, J. Wohwill (Eds.), *Human Behavior and Environment. 6: Behavior and Natural Environment* (pp. 85–125). New York, NY: Plenum.

Usoh, M., Catena, E., Arman, S., & Slater, M. (2000). Using presence questionnaires in reality. *Presence: Teleoperators and Virtual Environments*, *9*(5), 1-16.

Van Herpen, E., van den Broek, E., van Trijp, H. C., & Yu, T. (2016). Can a virtual supermarket bring realism into the lab? Comparing shopping behavior using virtual and pictorial store representations to behavior in a physical store. *Appetite, 107*, 196–207.

Verhulst, A., Normand, J.-M., Lombart, C., & Moreau, G. (2017). A study on the use of an immersive Virtual Reality store to investigate consumer perceptions and purchase behavior toward non-standard fruits and vegetables. *Proceedings of The IEEE Virtual Reality* 2017 (pp. 55 – 63), Los Angeles.

Vrechopoulos, A., Apostolou, K., & Koutsiouris, V. (2009). Virtual reality retailing on the web: emerging consumer behavioural patterns. *The International Review of Retail, Distribution and Consumer Research, 19*(5), 469-482.

Waterlander, W. E., Jiang, Y., Steenhuis, I. H. M., & Mhurchu, C. N. (2015). Using a 3D virtual supermarket to measure food purchase behavior: a validation study. *Journal of Medical Internet Research. 17*(4), e107.

Yim, M. Y-C., Chu, S-C., Sauer, P. L. (2017). Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective. *Journal of Interactive Marketing, 39*, 89-103.

Zajonc, R. B. (1980a). Feeling and thinking: preferences need no inferences. *American Psychologist, 35*(2), 151-175.

Zajonc, R. B. (1980b). Cognition and social cognition: a historical perspective. In L. Festinger (Ed.), *Retrospections on social psychology* (pp. 1-42). New York, NY: Oxford University Press.

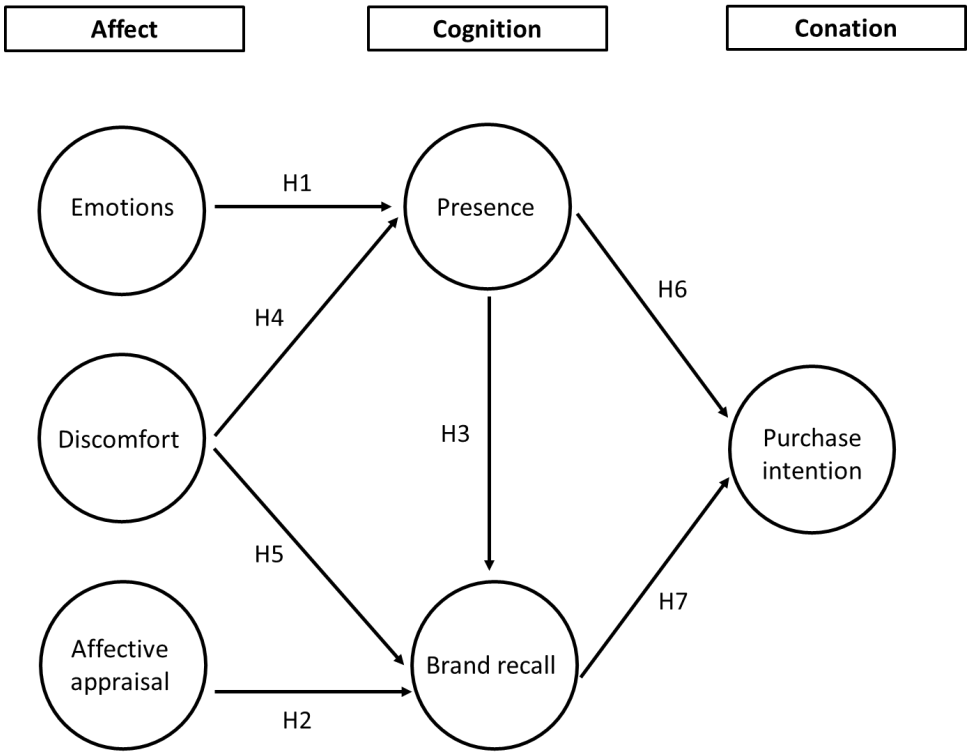
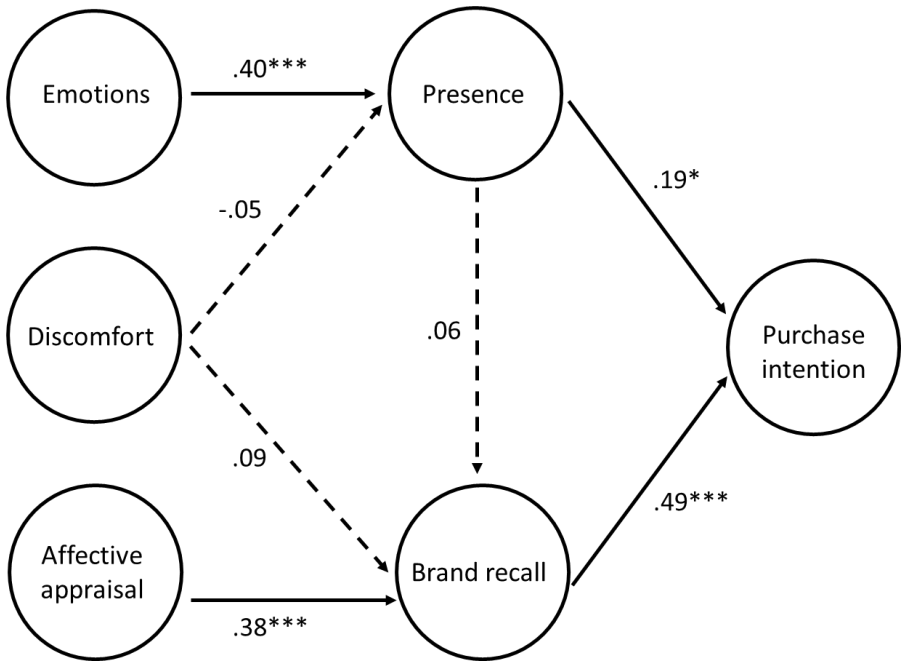



**Fig. 1.** Proposed conceptual model.




Note: **p < .01; ***p < .001

**Fig. 2.** Results of the proposed conceptual model.

**Table 1.** Sample demographics.

| Gender | Age | Education | Income |
|---|---|---|---|
| Men: 39.3% | < 18 years: 1.1% | Primary: 3.4% | < 15000€: 50,6% |
| Women: 60.1% | 19-30 years: 46.6% | Secondary: 30.9% | 15000€-30000€: 23% |
| NA: 0.6% | 31-40 years: 28.7% | University: 44.9% | 30001€-60000€: 5.1% |
| | 41-50 years: 17.4% | Postgraduate: 19.1% | 60001€-75000€: 0% |
| | 51-60 years: 5.1% | NA: 1.7% | > 75001€: 0% |
| | > 61 years: 0.6% | | NA: 21.3% |
| | NA: 0.6% | | |

Note. NA = no answer.

**Table 2.** Measurement scales

| Factor | Authors | Items |
|---|---|---|
| Emotion | Adapted from Mehrabian and Russell (1974) | Pleasure |
| | | Dominance |
| | | Arousal |
| Affective appraisal | Adapted from Küller (1991) | Complexity (degree of variation, intensity and abundance) |
| | | Unity (the degree to which the different parts of the environment are coherent one with the other) |
| | | Enclosedness (sense of spatial enclosure and demarcation) |
| | | Potency (expression of the power of the environment and its various parts) |
| | | Social status (assessment of the environment in socio-economic terms) |
| | | Affection (the quality of recognition giving rise to a sense of familiarity) |
| | | Originality (the unusual and surprising in the environment) |
| | | Pleasantness (the environmental quality of being pleasant, beautiful) |
| Discomfort | Own | During the test I felt sensory discomfort |
| | | After the test I felt sensory discomfort |
| Presence | Usoh et al. (2000) | I had a sense of "being there" in the supermarket |
| | | There were times during the experience when the supermarket space was the reality for me. |
| | | Thinking about the supermarket reminds you of an image you've seen |
| | | Thinking about the supermarket reminds you of a place where you have been |
| | | Your general sense is that you have been in the supermarket |
| | | Your general sense is that you have been in another place looking at an image of the supermarket |
| | | The experience reminds you of a place where you have been |
| | | During the experience you often thought you were actually in the supermarket |

**Table 3.** Physical commerce and v-commerce (including formats). Analyses of significance.

| Dependent variable | Independent variable | Mean | Std. deviation | Significance |
|---|---|---|---|---|
| Emotions | 360° | 3.89 | .89 | $F_{1, 171} = 3.41$, $p = .07$ |
| | 3D | 4.24 | .74 | |
| | CG | 4.17 | .94 | |
| Affective appraisal | 360° | 4.51 | .78 | $F_{1, 171} = .32$, $p = .57$ |
| | 3D | 4.66 | .78 | |
| | CG | 4.74 | .96 | |
| Discomfort | 360° | 1.29 | .55 | $\chi^2_{(2)} = 6.81$, $p < .05$ |
| | 3D | 1.18 | .39 | |
| | CG | 1.07 | .31 | |
| Presence | 360° | 5.05 | .83 | $F_{1, 143} = .91$, $p = .34$ |
| | 3D | 5.04 | .62 | |
| Brand recall | 360° | 7.36 | 3.71 | $\chi^2_{(2)} = 41.56$, $p < .001$ |
| | 3D | 6.98 | 3.59 | |
| | CG | 3.30 | 1.24 | |
| Purchase intention | 360° | 1.95 | 1.53 | $\chi^2_{(2)} = 16.87$, $p < .001$ |
| | 3D | 2.55 | 1.52 | |
| | CG | 1.12 | .44 | |

**Table 4.** Physical commerce and v-commerce (including devices). Analyses of significance.

| Dependent variable | Independent variable | Mean | Std. deviation | Significance |
|---|---|---|---|---|
| Emotions | Desktop | 3.93 | .86 | $F_{2, 171} = 2.52$, $p = .08$ |
| | Powerwall | 3.78 | .92 | |
| | HMD | 4.25 | .76 | |
| | CG | 4.17 | .94 | |
| Affective appraisal | Desktop | 4.47 | .74 | $F_{2, 171} = 2.55$, $p = .08$ |
| | Powerwall | 4.37 | .68 | |
| | HMD | 4.76 | .83 | |
| | CG | 4.74 | .96 | |
| Discomfort | Desktop | 1.14 | .29 | $\chi^2_{(3)} = 9.26$, $p < .05$ |
| | Powerwall | 1.17 | .28 | |
| | HMD | 1.40 | .68 | |
| | CG | 1.07 | .31 | |
| Presence | Desktop | 5.05 | .73 | $F_{2, 143} = 3.24$, $p = < .05$ |
| | Powerwall | 4.78 | .77 | |
| | HMD | 5.18 | .75 | |

| | | | | |
|---|---|---|---|---|
| Brand recall | Desktop | 7.41 | 3.71 | $\chi^2_{(3)} = 41.79$, $p < .001$ |
| | Powerwall | 6.55 | 3.21 | |
| | HMD | 7.33 | 3.82 | |
| | CG | 3.30 | 1.24 | |
| Purchase intention | Desktop | 2.32 | 1.55 | $\chi^2_{(3)} = 16.67$, $p < .01$ |
| | Powerwall | 1.67 | 1.72 | |
| | HMD | 2.33 | 1.44 | |
| | CG | 1.12 | .44 | |

**Table 5.** Reliability and convergent validity.

| Factor | Indicator | Factor loading | t-value | AVE | CR | CA |
|---|---|---|---|---|---|---|
| Emotions | Emot1 | .96*** | 6.78 | | | |
| | Emot2 | .79** | 3.04 | .77 | .87 | .74 |
| Affective appraisal | Affect3 | .65*** | 3.53 | | | |
| | Affect5 | .77*** | 5.85 | .55 | .79 | .60 |
| | Affect6 | .80*** | 7.36 | | | |
| Presence | Presen1 | .78*** | 5.94 | | | |
| | Presen2 | .89*** | 13.56 | .69 | .90 | .85 |
| | Presen5 | .84*** | 10.57 | | | |
| | Presen8 | .81*** | 10.14 | | | |
| Discomfort | NA | NA | NA | NA | NA | NA |
| Brand recall | NA | NA | NA | NA | NA | NA |
| Purchase intention | NA | NA | NA | NA | NA | NA |

Notes: (1) *** $p < .001$; ** $p < .01$. (2) AVE=Average Variance Extracted; CR=Composite reliability; CA=Cronbach's alpha; NA = Not applicable.

**Table 6.** Discriminant validity.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Affective appraisal | .74 | .64 | .35 | .12 | .26 | .51 |
| 2. Emotions | .42 | .88 | .13 | .19 | .46 | .30 |
| 3. Purchase intention | .28 | .12 | NA | .31 | .27 | .51 |
| 4. Discomfort | .02 | -.17 | .31 | NA | .22 | .09 |
| 5. Presence | .18 | .41 | .25 | -.12 | .83 | .13 |
| 6. Brand recall | .40 | .24 | .51 | .09 | .12 | NA |

Note. NA = Not applicable.

**Table 7.** Results of the structural model. Hypotheses testing.

| Hypothesis | Standardized path coefficients | t-value (Bootstrap) | Result |
|---|---|---|---|
| H1: Emotions → Presence | .40*** | 2.55 | Accepted |
| H2: Affective appraisal → Brand recall | .38*** | 3.77 | Accepted |
| H3: Presence → Brand recall | .06 | .59 | Rejected |
| H4: Discomfort → Presence | -.05 | .26 | Rejected |
| H5: Discomfort → Brand recall | .09 | .68 | Rejected |
| H6: Presence → Purchase intention | .19* | 2.13 | Accepted |
| H7: Brand recall→ Purchase intention | .49*** | 6.30 | Accepted |

Notes: (1) *p < .05; **p < .01; ***p < .001. (2) $R^2$ (presence) = .17; $R^2$ (brand recall) = .17; $R^2$ (purchase intention) = .30; $Q^2$ (presence) = .10; $Q^2$ (brand recall) = .12; $Q^2$ (purchase intention) = .25.