



## Using virtual reality and mood-induction procedures to test products with consumers of ceramic tiles



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### ABSTRACT

This work describes a Virtual Reality Environment (VRE), through which users are able to view and test ceramic tile products. Users' virtual interfacing with the products generated emotional experiences that allowed them to feel "engaged" with the products. Users could choose between different kinds of products and test them out in order to know how they would look in a real-world context. In the VRE several mood-induction Procedures for inducing relaxation were included. The VRE was tested with respect to its ability to induce relaxation and sense of presence in 26 participants. It was also analyzed the level of satisfaction. Measures included the Visual Analogue Scale, the Self-Assessment Manikin, the Presence Self-Assessment Manikin, and a Satisfaction Scale. The results showed that the VRE was effective among participants in inducing relaxation and high sense of presence. In addition, participants' satisfaction with the experience in the VRE was high. The VRE thus could be a useful tool for showing and testing products and for evoking a positive emotional association while users are interacting.

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### 1. Introduction

Virtual Reality (VR) is a computer-based technology that creates a synthetic reality using 3D graphics. VR Environments (VREs) are generated in which a person can interact in real time with different elements and can experience the feeling of being present in that place, otherwise known as "sense of presence", VR is interactive because users are not limited to being passive observers of the environment, they can interact with different objects found in the VREs, while the system responds in real time to their actions. VR is immersive, because with the help of some devices, users have the feeling of being present in the virtual world (Baños et al., 1999). Virtual Reality provides consumers with the ability to interact with products without needing to be physically in a store (Ottosson, 2002), some industries are integrating VR technologies into the product-value chain but its inclusion is quite slow, and its use has been predominantly to provide information about products. Few works have studied other advantages of VR. Söderman (2005) used a VR system for testing car prototypes; he compared different prototypes using VR, hand-made sketches, and a physical car. He propose that while a physical prototype is superior for realism, it is also very costly to produce, difficult to modify, and

expensive and fragile to transport. Therefore, VR might be useful because it could help to reduce costs of developing different physical prototypes. He notes that a higher degree of realism in the product representation did not necessarily bring about a better understanding of it, because participants already had previous experiences with each product. Kim and Forsythe (2008) analyzed the acceptability of a Web-based VR system, whose aim was to show and test some features of a product. The VR system allowed for the rotation of the product or the changing of its color, among other possibilities. They found that the VR system was useful, something participants attributed to its pleasant characteristics. They concluded that the interactivity of the VR system could add value to the shopping experience through the Web. In another work, Bruno and Muzzupappa (2010) studied the feasibility and efficacy of a VR interface for comparing real-product interactions and virtual-product interactions. They suggest that in VREs, it is possible to design, simulate, analyze, and test virtual prototypes in a very user-friendly way, and that amongst its advantages, virtual prototypes may replace the physical mock-ups with a notable reduction of costs and market-distribution time. In a more recent study, Kim, Lee, Lehto, and Hwan Yun (2011) compared the efficacy of a VR system for testing car prototypes. They used virtual objects and images of prototypes on a VR Web-based system. Their results suggest that participants could easily observe details of the design because they could see them from different perspectives. Other works related to use of VR in consumer research have focused on studying the shopping experience. Lee and Chung (2008) assessed

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participants' satisfaction in shopping online through a VR shopping mall and compared it with an ordinary online shopping mall. The ordinary shopping mall consisted of an HTML interface and hyperlinks, the VR shopping mall consisted of 3D graphics and an avatar. Their results reported a significantly increased level of satisfaction in the VR shopping mall. In summary, overall these studies have reported that the physical world representation through VR can provide consumers with an avenue of assessment and identification of preferences with regard to their expectations of products. However, these studies also have some limitations: (1) their use has focused mainly on showing virtual prototypes of products; and (2) in most studies, interaction was limited to a few actions (e.g., to show or change the color of products).

About of impact of emotions in consumer behavior few empirical researches have studied the relation between emotions and product evaluation. Gorn, Goldberg, and Basu (1993) studied the effects of emotions on product evaluations. They used music for inducing positive or negative emotions and then asked participants to evaluate a product. They hypothesized that emotions can bias the evaluation of a product because some participants evaluated the product more favorably when the mood-induction was positive. Fedorikhin and Cole (2004) analyzed the evaluation of products after positive or negative mood-induction through film clips. They found that consumers with a positive mood-induction perceived lower probabilities of incurring losses when purchasing a new product than did consumers with a negative mood-induction. These authors indicated that understanding how emotion influences consumers' behavior is important because consumers bring a variety of emotions into decision-making and that the shopping experience itself can induce different emotions. A good alternative for study the impact of emotions in consumers' behavior are the Mood-Induction Procedures (MIPs) which are methods designed to instill a transitory emotional state in a controlled way. The most used are pictures, videos, self-statements, and music. Lang, Bradley, and Cuthbert (2008) developed a picture system capable of eliciting emotions, which has shown that affective evaluations are trustworthy and stable. Gross and Levenson (1995) developed a standardized system of videos capable of eliciting different emotions. They found a high correlation between the videos and the emotions that they wanted to elicit. Emotional self-statements is a MIP developed by Velten (1968) to induce emotions through statements written in first-person and relative to a particular emotion. The use of music for inducing emotions is another of the most studied MIPs; works such as those by Baumgartner, Lutz, Schmidt, and Jäncke (2006) have proven the usefulness of music in mood-induction. MIPs have proven to be effective in eliciting different emotions in a laboratory, but they do have some limitations. Studying a phenomenon as complex as an emotional change in a controlled environment such as the laboratory can translate into a loss of external and ecological validity; even though in field studies, unlike in laboratory testing, the control of the variables is often more limited. This is where the use of VREs could represent a good alternative in helping to reduce the limitations of the field studies without sacrificing the accuracy of the laboratory studies.

Some controlled studies have evaluated the use of VREs along with MIPs. Baños et al. (2004, 2008), Riva et al. (2007) have used VREs that changed progressively depending on the emotion (relaxation, joy, sadness, anxiety, or neutral) it intended to evoke. In order to build different emotional VREs, they included self-statements, pictures, video-clips, music, and autobiographical recalls. Baños et al. (2004) studied the affective valence of two VREs (one for inducing sadness, and the other without specific emotional elements) and tested the role of immersion and media content on the sense of presence. The results suggest that the VRE with emotional content seemed to be more engaging and real than the non-emotional VRE. They concluded that both emotional contents and

immersion have an important effect on sense of presence. In a later study, Baños et al. (2008) used VREs to induce positive emotions (relaxation and joy); they measured both positive and negative emotions. After mood-induction, participants reported an increase in the positive emotions and a decrease in the negative emotions (sadness and anxiety). In addition, a correlation existed between the sense of presence and the intensity of positive emotions. Riva et al. (2007) used VREs to induce relaxation and anxiety, and then they compared the results with those derived from a neutral VRE. Their results confirmed the efficacy of VREs in mood-induction, because each one was successfully able to induce the intended emotion. In addition, the sense of presence was stronger in the VREs with emotional content. Their data showed a bidirectional relationship between emotions and sense of presence. Moreover, they also suggest that sense of presence is influenced not only by the graphic realism of VREs, displays, or other technological features, but also to a great degree by the characteristics of the experience, including the emotional traits provided by the technology. Although, some works have focused on evaluating the effectiveness of VREs for inducing some emotions, a review of the literature does not reflect controlled studies that combine the use of VREs and MIPs to apply to consumers' behavior research. Thus, in research, the possibility of using VREs for study emotions in consumers has received scarce attention.

Considering the previous studies, this work aims to describe a flexible and highly interactive VRE suitable for showing and testing different products and to evaluate its capability to induce relaxation and sense of presence while users interact with products. The following hypotheses were tested:

- H1.** The VRE will be able to induce relaxation. Scores on relaxation will increase after the mood-induction.
- H2.** The VRE will be able to induce a high sense of presence.
- H3.** Participants will report a high degree of satisfaction.

## 2. Materials and methods

### 2.1. Participants

The sample consisted of 26 participants, 18 women and eight men, whose ages ranged from 18 to 63 years ( $M = 29.5$ ,  $SD = 12.2$ ). Participants were recruited using different strategies. They received a financial reward of 12 Euros.

### 2.2. Measures

Visual Analog Scale (Gross & Levenson, 1995): four VASs were used to evaluate sadness, joy, anxiety, and relaxation. Participants were asked to rate how strongly they were experiencing each of the emotions evaluated. This was done on a 0–10 point Likert scale.

Self-Assessment Manikin (Bradley & Lang, 1994): this is a non-verbal pictorial-assessment method that measures the affective valence, arousal, and dominance associated with a person's affective reaction to a stimuli. Participants could select any of the five figures in each scale, or between any two figures, which resulted in a nine-point Likert scale for each dimension. Semantic differential correlation for the factor scores was high for affective valence ( $r = 0.97$ ) and arousal ( $r = 0.94$ ); dominance correlation was not significant. SAM data also indicates that these ratings are stable when assessing within or between participant reliability.

Presence Self-Assessment Manikin (Schneider, Lang, Shin, & Bradley, 2004): this is a nine-point pictorial scale adapted from

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