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## **ANALYSIS OF PERCEPTIONS ACCORDING TO THE TECHNIQUE OF PRODUCT DISPLAY. COMPARATIVE AMONG 360° ROTATION, VIRTUAL AND AUGMENTED REALITY**

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Online shopping has caused a radical change in individual-product interaction. In this new context, it is key to optimize product display to ensure that the information offered can be perceived correctly by the consumer, and generate the confidence needed for the purchase decision. The development of new techniques has made it possible to evolve product presentation. In addition to the traditional static 2D images, it is common to find displays where the product can rotate 360° to consumer request, and even that use augmented reality (a virtual image of the product located in a real environment), or virtual reality (a completely virtual presentation of product and environment) techniques. This communication analyses the influence of the display technique on the perceptions generated. A sideboard was shown to 43 participants, using four different techniques: 2D rendering, virtual reality, augmented reality and 360° rotation. Results show different perceptions for individuals up to 25 years old and older ones. The first group prefer the new display techniques. The results obtained provide guidelines to optimize product presentation in web site contexts.

*Keywords: product display techniques; online shopping; augmented reality; virtual reality; 360° rotation; product perceptions.*

## **ANÁLISIS DE PERCEPCIONES EN FUNCIÓN DE LA TÉCNICA DE PRESENTACIÓN DE PRODUCTO. COMPARATIVA ENTRE REALIDAD VIRTUAL, AUMENTADA Y ROTACIÓN 360°**

La compra online ha provocado un cambio radical en el modo de interacción individuo-producto. En este nuevo contexto, resulta necesario optimizar la presentación de producto, para que la información ofrecida pueda percibirse correctamente por parte del consumidor, y genere la confianza y seguridad necesarias para la decisión de compra. El desarrollo de nuevas técnicas ha permitido evolucionar las formas de presentación de producto. Además de las tradicionales imágenes 2D estáticas, es habitual encontrar presentaciones donde el producto puede girar 360° a demanda del consumidor, e incluso presentaciones que utilizan técnicas de realidad aumentada (imagen virtual de producto en un entorno físico real), o virtual (presentación completamente virtual de de producto y entorno). Esta comunicación analiza la influencia de la técnica de presentación de producto en las percepciones generadas. Se ha mostrado a 43 participantes un mueble aparador, utilizando cuatro técnicas distintas: imágenes 2D, realidad virtual, realidad aumentada y rotación 360°. Los resultados muestran distintas percepciones para los individuos de hasta 25 años y los mayores. El primer grupo prefiere las nuevas técnicas. Los resultados obtenidos ofrecen pautas para optimizar la presentación de producto en contextos web.

*Palabras clave: técnicas de presentación de producto; compra online; realidad aumentada; realidad virtual; rotación 360°; percepciones de producto*

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## **1. Introduction**

Online shopping has changed the way user and product interact. In web environments there are no physical interaction with the product, and this may produce as a result the generation of different perceptions (Vergara et al., 2011). With the growth of online sales, and taking advantage of the advance of new technologies, websites are developing new ways to display their products in virtual windows, using new display techniques to improve product visualization and perception. It is common in these webs to find product photographs, detail pictures, or renders.

Among the new techniques, 360° rotation, and augmented and virtual reality applications can be highlighted. The 360° rotation technique allows to display of the product from all orientations. The augmented reality technique allows to display virtual images of the product in a real environment. Images can be displayed in devices such as smartphones, tablets, or interactive screens (Carmigniani et al., 2011). Its scope includes studies in psychology (Botella et al., 2011), health and welfare (Carlson & Gagnon, 2016) or education (Akçayira et al., 2016, Martin-Gutierrez et al., 2015). Virtual reality immerses the individual in a completely virtual environment. Its application has been studied in fields such as medicine (Dubin et al., 2018; Huber et al., 2018), psychology (Formosa et al., 2018), education (Ye et al., 2017) industry (Segura et al., 2018) or marketing (Van Kerrebroeck et al., 2017). The analysis of the response to these new techniques implementation, for the display of different types of products and consumers, will allow to adjust and improve the shopping experience on-line (Huang & Hsu Liu, 2014; Javornik, 2016).

Some theoretical models about the generation of product meanings and/or emotions consider the environment of the individual-product interaction (Agost & Vergara 2014; Fenech & Borg, 2007), the senses involved (Crilly et al., 2004) or the experience of product (Desmet & Hekkert, 2007) among the factors influencing perceptions.

In this work, the influence of some new display techniques on the generation of product perceptions and on the purchase experience is analysed. To do this, perceptions generated by using 360° rotation, augmented and virtual reality displays are compared to those generated using more traditional presentations (static 2D images of the product). Besides, it will be seen the influence of the age range on the experience in online shopping, on the use of new techniques, on the importance given to product perceptions and on the rating of some perceptions, based on the display technique.

## **2. Objectives**

The main objective of this work is to determine whether differences in users' perceptions related to the shopping experience can be found between different product display techniques used in online shopping. The study distinguishes between participants up to 25 years (younger participants) and the rest (older participants).

## **3. Methodology**

Next, the stages followed in the methodology are described.

### **3.1 Selection and generation of the stimuli**

A sideboard was chosen for the study, as furniture is a product widely known and used by users of any age range. Their characteristics (size, texture, colour, etc.) are varied, so a proper display is needed for their correct perception.

To show the sideboard in an online environment, different types of techniques were used. Images were generated and displayed on a 10.5-inc tablet. The most traditional representation was 2D rendering: a first picture where the sideboard was standing alone, and a second one where it was located in a decorative setting (Figure 1). In the 360° rotation display, the sideboard was showed without any other decorative element, using an app. The user could interact with the display, rotating the sideboard and orienting it in any direction. In the augmented reality display, a virtual image of the sideboard was shown through the tablet screen, located into a real environment. In the virtual reality display, the user was shown the sideboard in a virtual decorated room. The orientation of the atmosphere changed according to the rotation movements of the user, who could choose the perspective. Reproducing the actual possibilities of use, the setting was displayed on the tablet, and also on a smartphone fitted with basic goggles.

**Figure 1: Pictures used in the 2D display. The basic image in the 360° rotation and augmented reality displays coincide with the image on the left (sideboard standing alone).**



**Figure 2: Picture used for the virtual reality display (the picture without a display device does not allow appreciate the immersive atmosphere achieved with this technique).**



### 3.2. Study development

A sample of 46 participants (28 men and 15 women) took part in the study. By age, 29 participants were up to 25 years, and 17 were older (5 participants between 26 and 40 years old, 7 between 41 and 55 years, and 2 participants older than 56 years).

First, the participants were asked to rate the degree of importance they assigned to the correct perception of the following product characteristics: general characteristics (such as size or weight), detail characteristics (such as colour or texture), functional characteristics (such as strength or durability) and aesthetic characteristics (such as appeal). A 5-point scale from 1 (Not important) to 5 (Very important) was used for the rating.

Next, the 2D rendering was showed on the tablet to the participants, who had to rate the suitability of the display technique, in a 5-point scale from 1 (Strongly disagree) to 5 (Strongly agree). The suitability items are listed next:

1. Suitable for enable the correct perception of product general characteristics (e.g. size, weight).
2. Suitable for enable the correct perception of detail characteristics (e.g. colour, texture).
3. Suitable for enable the correct perception of functional characteristics (e.g. strength, durability).
4. Suitable for enable the correct perception of aesthetic characteristics (e.g. appeal).
5. It provides additional information about the product.
6. It provides confidence for the purchase.
7. It helps with purchase decision.
8. It improves the user experience.

Subsequently, the sideboard was displayed to each participant, using the rest of the display techniques in a previously established random order. After each display, the participants rated again the 8 prior suitability items, for each technique.

### 3.3 Statistical analysis

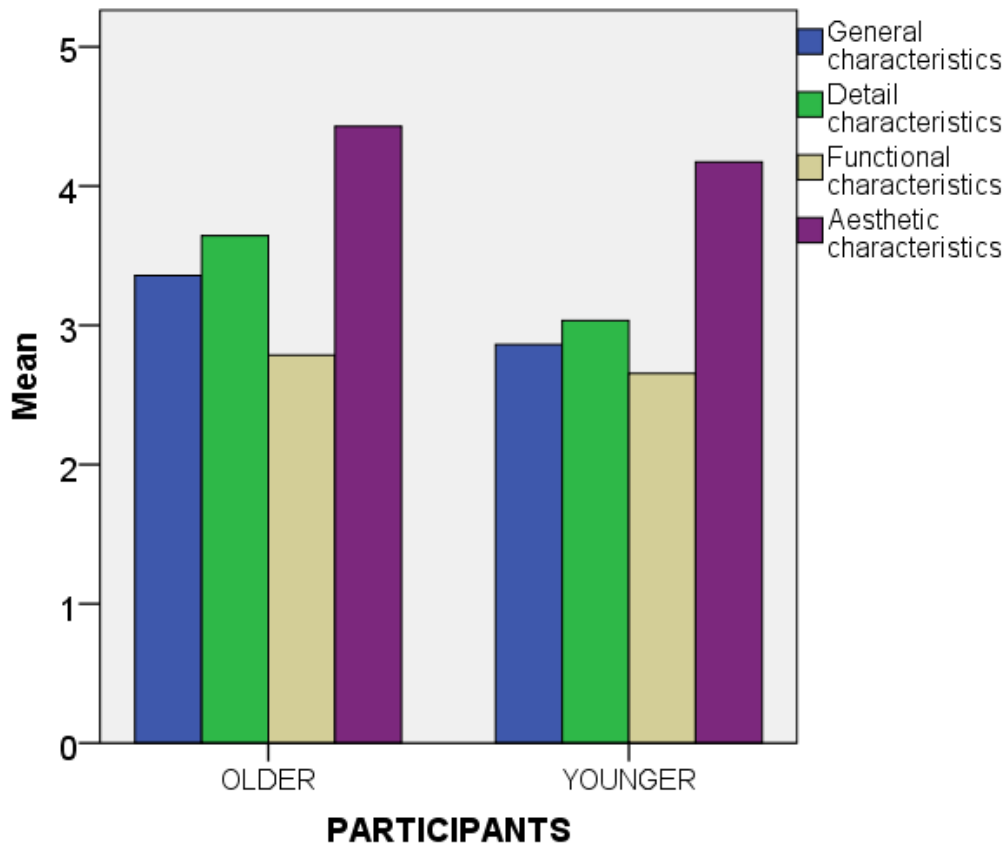
Statistical analyses were performed with the statistical software SPSS (IBM SPSS Statistics v23). First, the influence of the age on previous experience in online shopping and in the use of the new display techniques was analysed. The influence of the age on the importance of the perception of product characteristics was also analysed. Analysis of variance (ANOVA) and U Mann-Whitney test were performed, considering the age (younger or older than 25 years) as the independent variable, and the next dependent variables: previous experience in online shopping, previous experience in using 360° rotation, augmented reality and virtual reality displays, importance of the perception of general, detail, functional and aesthetic features.

Next, differences among the display techniques were analysed. ANOVAs (with Bonferroni coefficient in the post hoc when the Levene test showed critical levels  $>0.05$ ) and Kruskal – Wallis test were applied considering the display technique as the independent variable and the ratings about their suitability as the dependent variables. The analyses were performed for younger and older participants separately.

## 4. Results

Significant differences were not detected for the experience on online shopping nor for the use of the new display techniques. The importance given to the perception of general characteristics was significantly higher for the older participants ( $M= 4.64$ ) than for the younger ones ( $M= 4.17$ ) ( $F(1,41) = 4.427$ ,  $p = .042$ ), ( $U = 124,500$ ,  $p = .024$ ). Also, the rating of the importance of the perception of detail characteristics was significantly higher for the older participants ( $M=4.50$ ) than for the younger ones ( $M= 3.97$ ), ( $F(1,41)= 4.520$ ,  $p= .040$ ), ( $U= 108,500$ ,  $p= .009$ ). Again, with respect to the importance of the perception of aesthetical characteristics, ratings were significantly higher for the older participants ( $M= 4.50$ ) than for the younger ones ( $M= 3.97$ ) ( $F(1,41) = 4.520$ ,  $p = .040$ ), ( $U = 130,000$ ,  $p = .044$ ) (Figure 3).

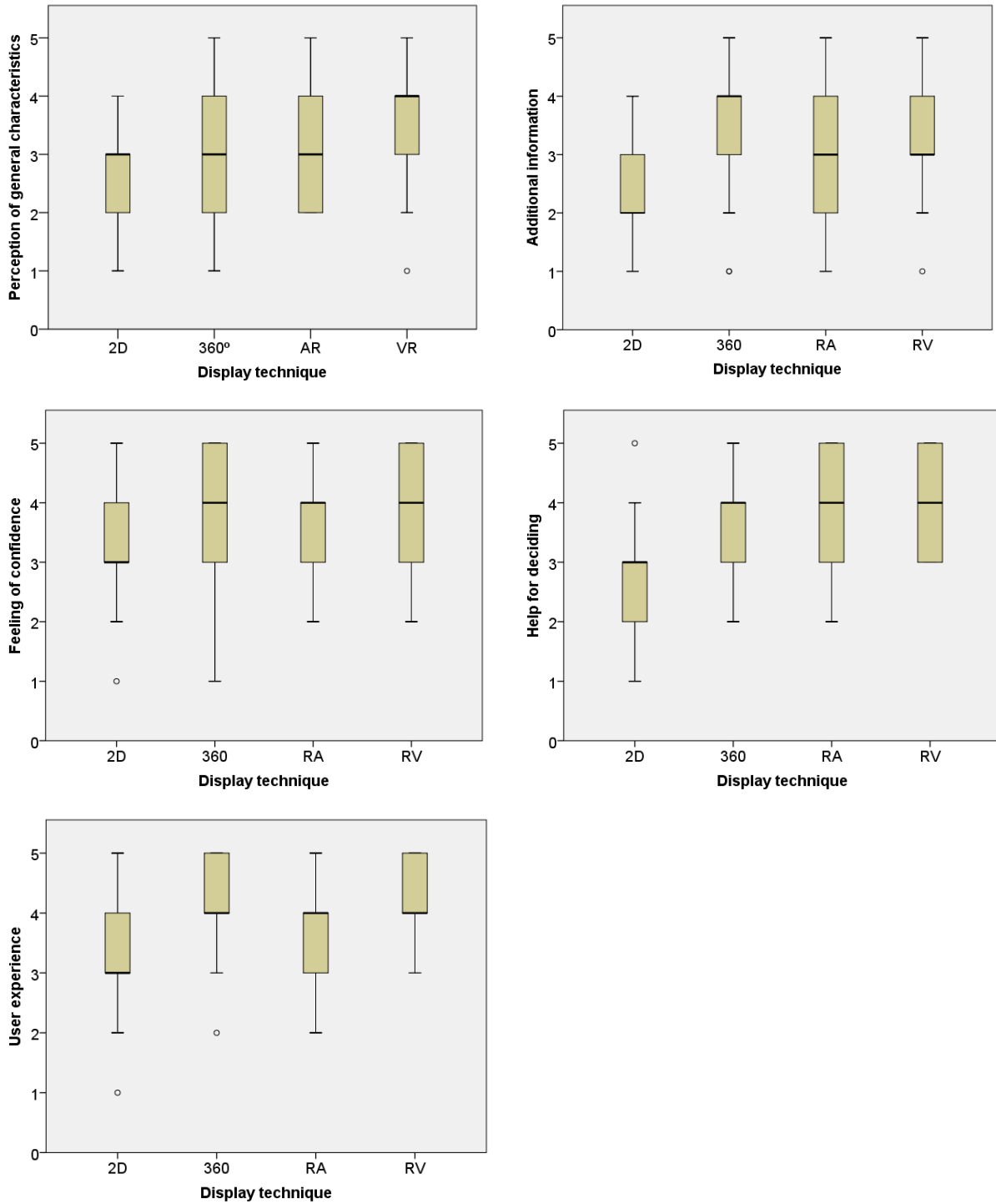
**Figure 3: Bar graph of the rating on the importance given to the correct perception of product characteristics**



No differences between the ratings of suitability for the new display techniques were found for the older participants. However, for the young participants, some significant differences were found between the techniques (Figure 4):

- Suitability of the perception of general characteristics of the sideboard: between virtual reality (M= 3.66) and 2D rendering (M = 2.86). ( $F(3,112)= 3,240$ ,  $p = .025$ ), ( $\chi^2 (2, N= 116) = 10,512$ ,  $p = 0.015$ ).
- Provision of additional information: between virtual reality (M= 3.38) and 2D rendering (M= 2.41), and between 360° rotation (M= 3.34) and 2D rendering ( $F(3,112) = 5,689$ ,  $p = .025$ ), ( $\chi^2 (2, N= 116) = 15,960$ ,  $p = 0.01$ ).
- Feeling of confidence in the purchase: between virtual reality (M=3.90) and 2D rendering (M= 3.10), and between 360° rotation (M= 3.90) and 2D rendering, ( $F(3,112)= 5,060$ ,  $p = .003$ ), ( $\chi^2 (2, N = 116) = 13,851$ ,  $p = 0.03$ ).
- Feeling of help for the purchase decision: virtual reality (M=4.00), augmented reality (M= 3.76) and 360° rotation (M = 3.79), with 2D rendering (M= 2.90). ( $F (3,112) = 8,742$ ,  $p = .000$ ), ( $\chi^2 (2, N = 116) = 20,967$ ,  $p = 0.00$ ).
- Perception of improvement of the shopping experience: virtual reality (M = 4.28), augmented reality (M=3.90) and 360° rotation (M= 4.03), with 2D rendering (M=3.07). ( $F(3,112) = 12,165$ ,  $p = .000$ ), ( $\chi^2 (2, N = 116) = 27,550$ ,  $p = 0.00$ ).

**Figure 4: Box and whiskers plot of the rating given to the suitability items depending on the display technique**



## 5. Conclusions

In this study, some perceptions generated by the user-product interaction, according to the display technique, have been analysed. Techniques of 360° rotation, augmented reality and virtual reality have been compared with rendered 2D images of the product, distinguishing between younger (up to 25 years) and older participants.

The main conclusion of the study is that, while for the older participants no differences have been detected in the ratings of suitability, based on the display technique, for the group of younger participants some significant differences have been detected. Particularly, younger participants consider that the techniques 360° rotation, virtual reality and augmented reality provide significant more help for the purchase decision and enhance the shopping experience significantly more than 2D rendering.

In addition, younger participants stated that virtual reality and 360° rotation provide greater confidence in the purchase than 2D rendering, and virtual reality provides additional information and enables a better perception of general characteristics of the product than 2D rendering.

No differences have been observed between age ranges for experience in online shopping nor for the use of new display techniques. However, younger participants have demonstrated to be more critical with these techniques, and have shown a preference for virtual reality, 360° rotation and augmented reality, over 2D rendering. These results can help optimize product presentation in online shopping contexts.

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## Communication aligned with the Sustainable Development Objectives

