

VIRTUAL BODIES, REAL DECISIONS? EMBODIMENT, SOCIAL INTERACTION AND IMMERSION IN A VIRTUAL REALITY CONTEXT

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Abstract:

The emergence of new technologies such as virtual reality (VR) has caused a change in how companies and consumers approach shopping. VR offers immersive environments that enrich shopping experiences. The objective of this paper is to explore the impact of VR on the navigation and buying and selling process, analyzing embodiment, immersion, and social interaction in a metaverse. A quasi-experiment with VR glasses was carried out, with a pre-and post-questionnaire, to determine the perception of embodiment, the feeling of immersion, and buying intention when surfing on a metaverse.

Keywords: virtual reality, immersion, embodiment, social interaction, avatar.

JEL classification: M30; M31



¿CUERPOS VIRTUALES, DECISIONES REALES?: PERSONIFICACIÓN, INTERACCIÓN SOCIAL E INMERSIÓN EN UN CONTEXTO DE REALIDAD VIRTUAL

Resumen:

La aparición de tecnologías como la realidad virtual (RV) ha provocado un cambio en cómo empresas y consumidores afrontan la compra. La RV ofrece entornos inmersivos donde mejorar la experiencia de compra. El objetivo principal de este trabajo es explorar el impacto de la RV en la navegación y proceso de compraventa, analizando la personificación, la inmersión y la interacción social en un metaverso. Se ha realizado un cuasi-experimento con gafas de RV, con un pre- y post- cuestionario donde se analiza la percepción de personificación, la sensación de inmersión y la intención de compra al navegar por un metaverso.

Palabras clave: realidad virtual, inmersión, personificación, interacción social, avatar.



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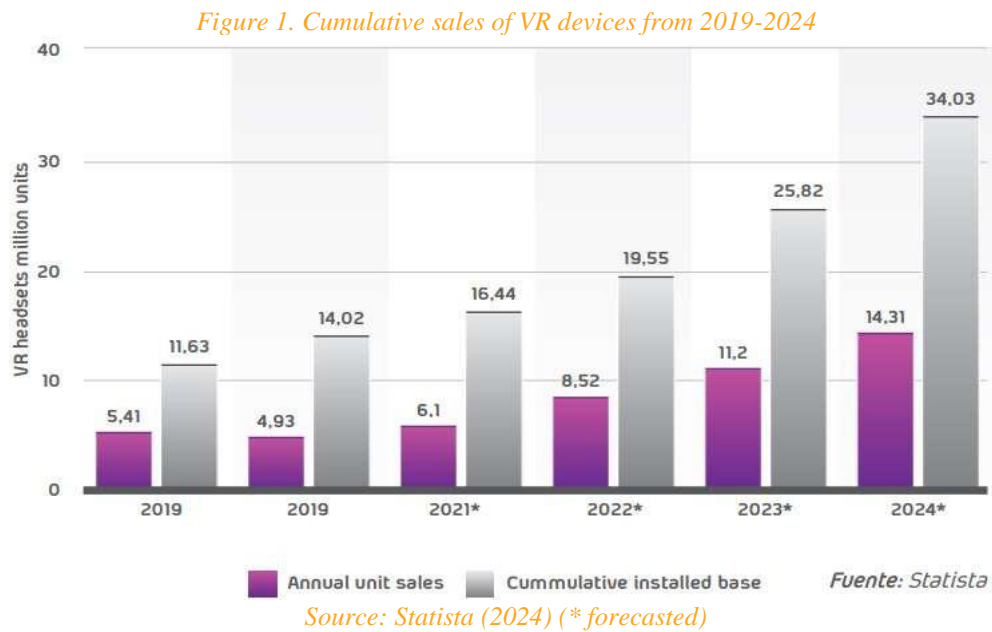
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1. INTRODUCTION

Over the past decade, we have been able to observe a rapid evolution at the intersection between technology, artificial intelligence, and virtual worlds. This phenomenon is materialized in the concept of metaverse, an immersive digital space where human interactions and virtual environments blend in unprecedented ways (Dwivedi et al., 2022). As Statista (2024) indicates (see Figure 1), there is an increasing potential of sales with VR devices.



From an academic perspective, literature has barely addressed the role that virtual reality (VR) plays in the shopping process (i.e. in the tourism experience in Bretos et al., 2024 or in gaming in the study by Pallavicini & Minissi, 2019), in behavioral intentions (Leveau & Camus, 2023) and the interactions with consumers (embodiment in Bovet et al., 2018; immersion in Hudson et al., 2019; physiological stress in Peterson et al., 2018). In this context, this work aims to contribute to VR literature by deepening the understanding of the concept of virtual reality, specifically in the buying and selling process from the consumers' perspective.

The main research questions to be answered in this exploratory paper are:

RQ1: Do embodiment and immersion improve the consumer navigation experience?

RQ2: Is there a shopping intention in a metaverse context with the use of VR glasses?

The structure of the paper is as follows. First, the definition of VR and the literature review with emphasis on the influence these technologies have on the buying and selling process. Second, the methodology used as well as the design and development of the empirical study are explained. Third, the main results are presented and finally, the study ends with discussion and conclusion.

2. THE APPLICATION OF VIRTUAL REALITY IN THE BUYING AND SELLING PROCESS

New technologies have been modifying the communication process as we knew them decades ago. By introducing new technological devices and tools, we can gain a more immersive experience as well as a completely different perception of the world. In this context, VR was created and is explained next.

2.1. Virtual reality and related concepts

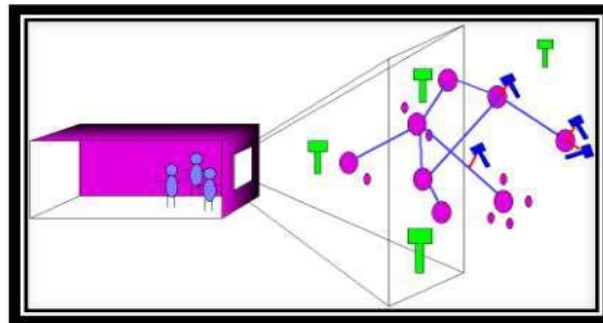
VR is an immersive technology that enables users to access a virtual environment for an interactive, multisensory, real-time experience (Mishra et al., 2021). These VR experiences aim to reinvent the consumption experience (Leveau & Camus, 2023) by creating a memorable experience (Hosany et al., 2022) as well as engagement (Pala et al., 2022) with the introduction of external devices that significantly modify the person's field of vision (Cancino, 2019).

Another immersive technology that is transforming the way we interact with the digital and physical world is augmented reality (AR). It consists of combining the real world with the virtual world through a computer process, enriching the visual experience, and improving the quality of communication. It involves a new window through which the person can see the world enriched. The main difference between VR and AR is that VR creates a completely new environment generated virtually and artificially (see a more detailed review in Bretos et al., 2024). However, AR maintains a real environment, and enriches the perception of the real environment with devices that are not specifically designed for it (i.e. smartphones, and digital screens).

According to Milgram and Kishino (1994), one extreme will be real reality, based on real objects that can be observed both with sight and through screens. The other extreme will be VR, based on virtual objects created with technological devices. In the middle of both extremes

or concepts, there is mixed reality. Mixed reality involves bringing together both virtual and physical worlds by creating a transparent boundary between them (Benford et al., 1999). To explain this better, the example of an application called The Internet Foyer can be useful. Here, from a room (representing the real world) the user can see the virtual world, artificially created (see Figure 2).

Figure 2. The Functionality of the Internet Foyer



Source: Benford et al. (1999)

Just as the main objective of VR is to create immersive digital environments where users can interact and collaborate, the metaverse has a similar objective. The metaverse is a computer-generated world with a consistent value system and an independent economic system linked to the physical world (Wang et al., 2022). In metaverse the user will be the main character of the information because he/she will explore it first person (Iab Spain, 2024).

Metaverses thus represent a strong new opportunity to promote and sell products and services (Leveau & Camus, 2023). A big potential that the metaverse represents is that each time more people, specifically, young people are interested in it. Additionally, the technological opportunities are much superior to those of a few decades ago. Besides, interaction between users is higher and there are millionaire investments for the research and improvements in this field, which is making many brands focus on it. Moreover, many users are moving from having a passive attitude as spectators to having a more active attitude as consumers (Dwivedi et al., 2022).

As for the impact of VR on the purchase process, with the emergence and evolution of new technologies, the phase of product design has become more comfortable and cheaper. This process is crucial to determining all the other stages of the purchasing process and, thus, being able to carry it out with efficiency and effectiveness. On many occasions, this phase can be interrupted or limited by the costs or time involved in it. In this case, VR is a great solution to

these problems, as it allows to prove the design and the necessary changes or adjustments before the prototype is produced or the experience is offered (Leveau & Camus, 2023). This will be useful when matching the quality of the product and the rendered standards. Another advantage that VR offers in this field is being able to view it holistically as it interacts with the "real world". In this way, it allows evaluation of conceptual alternatives for optimizing the functioning of the product in that context (Pallavicini & Minissi, 2019).

Moreover, VR is involved in the communication with the consumer, specifically, the one carried out before the launch of a product or in the need recognition. When a user enters the metaverse and interact both with other users and with the brand's advertisements or banners, they are showing their preferences. These preferences can be used by the brands and designers to improve the satisfaction of the consumer's needs. Therefore, establishing effective communication between customers and the design team requires a mutual understanding of the future product; that is, that the customers and the design team have a shared conception of the product (Söderman, 2007). This communication can be affected by the differences in the background or the goals. However, if the environment in which this communication occurs is one in which the consumer feels comfortable, such as the metaverse, these problems can be solved. VR also helps in the enhancement of information research, since it allows the consumer to receive the product information more interactively and concretely than without this new technology (Bretos et al., 2024). This will generate curiosity in the user to discover, which will lead to the desire to test it. Furthermore, it creates greater cognitive elaboration of the product information in comparison to a static way of presenting the same kind of information.

2.3. Key aspects of the VR shopping experience

With the emergence of new digital technologies and the significant increase in online purchases and sales, new aspects have become fundamental for both consumers and sellers. These aspects will highly influence and determine their shopping experience. In this context, factors that mostly influence the customer's experience will be explored, taking into account that the sellers will be the ones who need to know several points. Among these, what the consumers value in these new trading forms, how they will use them, and how all this will lead to the creation and improvement of shopping experiences that are attractive and satisfying for users. In the same way, consumers will also pay attention to these variables related to what they demand.

After reviewing recent literature on VR and conducting a pre-test with 5 experts, the key variables for consumers' experience in shopping that will be studied here are embodiment, immersion, and social interaction.

2.3.1. Embodiment

Embodiment translates to a feeling of fusion between the human body and the virtual body (Tussyadiah et al., 2017). What we know about the world is embodied, it is constructed from patterns of energy detected by the body. When we walk or reach for an object in the virtual or physical world, we guide the senses in this exploration of space in the same way that a blind man stretches out a white cane to explore space while in motion (Biocca, 1997). Matching the physical contacts of the real body with the contacts of the virtual body provides the illusion of self-contact (Bovet et al., 2018). It is translated as having the illusion of actually being inside that virtual place and that what is happening inside of it can be felt in reality.

Botvinick and Cohen (1998) developed an experiment called the Rubber Hand Illusion (RHI). It consisted of leaving your left hand on a table and covering it so that you could not see it. That hand was "replaced" by a rubber one which is the hand the participant is seeing during the experiment. With a brush, both hands (the real and the rubber one) were touched at the same time, until reaching a point where the participant began to feel that brush in the rubber hand. Furthermore, the rubber hand is hit by a hammer at the end of the experiment, and the fear and pain that the participants feel, is real. This illusion demonstrates the relationship between what we see and what we feel (see Figure 3).

Figure 3. The Rubber Hand Illusion



Source: Botvinick & Cohen (1998).

When speaking about the virtual body, the concept of avatar is key. An avatar is a virtual entity (Abade, 2017) associated with a particular user for its identification in a video game, internet forum, etc. In other words, an avatar is the digital incarnation of an individual in a virtual world. The use of avatars in VR artistic experiences has a great capacity to expand the bodily and sensory experience of users. The avatars allow the user to explore the virtual environment from the interaction. In this way, the connections of the immersed users with the avatars provoke reactions in the real bodies of those who experience it (Gárgoles, 2023). The reason for using them is because it allows the user to have access to information and a virtual world through a unique experience. This can be modified or not depending to what extent the avatar fits the appearance of the real body or personality of the user.

2.3.2. Immersion

Biocca (1997) states that immersive virtual environments are places where vision and other senses are meant to be active. In this way, the structure of the virtual world is perceived in ways similar to the manner they construct the physical world. Immersion requires mental effort from people engaged in the activity and is intended to be a dynamic process that evolves (Dwivedi et al., 2023). In this process, the user goes beyond the traditional barriers of the screen allowing the information surrounding him/her completely or partially (Iab Spain, 2024).

To enhance and create a three-dimensional virtual experience, VR-HMD (Virtual Reality – Head Mounted Device) devices are used. These are placed on the head, close to the eyes, thus, reducing the user's field of vision of the real world to a minimum and maximizing the immersion within the virtual world. This is because only those images produced by the computer will be perceived and played by the HMD device. Thus, the users can immerse themselves in a virtual world and explore it as if they were physically present.

Pallavicini et al. (2019) discovered that VR-HMDs tend to have a more palpable sense of presence compared to traditional two-dimensional (2D) displays. Indeed, the availability of HMDs has made immersive VR systems a feasible alternative to 2D video conferencing. Moreover, some authors have carried out studies with VR-HMD devices and they have analyzed their effectiveness and level of immersion, reaching different conclusions. On one hand, Simeonov et al. (2005) used the screen VR simulation, and they observed that the immersion was not total. They verified this by simulating a nine-meter-high ladder and the risk of falling. Then, they perceived that the levels of anxiety, nerves, and fear were similar to those

experienced in reality. However, these were not completely the same (the levels were lower) due to the visual limitations that this device presents in comparison to VR-HMD which offers a higher-quality immersive experience. On the other hand, Peterson et al. (2018) carried out a similar test. In this case, the participants had to walk through a wooden beam. The results showed that VR allows the individual to have an experience like that of real life. Besides, VR is also associated with poorer physical and cognitive performance.

2.3.3. Social interaction

One of the most important aspects of the relationships between humans is social interaction and, more specifically, contact and communication. With the emergence of new technologies, it has been necessary to develop new forms of communication and interaction between users. Indeed, the metaverse is thought and it was created to be experienced in a group, although it can be enjoyed individually too. As IAB Spain (2024) affirms, one of the virtues of this new Internet space is to promote collaboration between people, breaking physical barriers. It is about an Internet in which it is possible to go beyond the limitations of a two-dimensional screen and facilitate the exchange, interaction, and collaboration of people under the same context, real or imaginary.

Social interaction is defined as the process of reciprocal influence exercised by individuals over one another during social encounters. Meaningful interaction between customers and service staff as well as between customers and other customers is of prime importance in the experience (Hudson et al., 2019). Facebook made a study (2020) to discover the level of social interaction between people through VR. The results demonstrated that the commitment and feelings were similar to those experienced in real life. Indeed, the most introverted people were the most emotionally committed to the experiment (see Figure 4).

At this point, the existence of VR allows users to achieve these interactions through avatars making this a much more immersive, sensitive, enjoyable, and real experience. Avatars allow social interaction and makes the consumer perceive and feel embodiment.

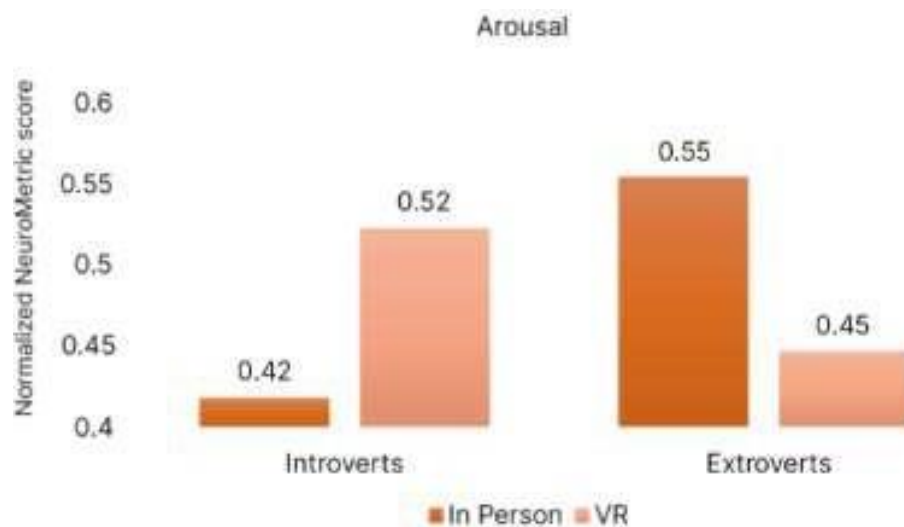
3. EMPIRICAL STUDY

This empirical analysis consists of a quasi-experiment inside the metaverse and a pre- and post-questionnaire.

3.1. Selection process of sample subjects

The selection process of the sample subjects was convenience-based with a gender quota of 50% and they were young people of similar ages, to homogenize the results as much as possible. We chose both subjects who had had previous experiences with VR, as well as subjects who had not (approximately half and half of each condition) to compare their results and to analyze whether those who had previous experience did it better than those who did not.

Figure 4. Level of appearance of social interaction between people through VR



Source: Facebook (2020).

The sample chosen to carry out the quasi-experiment consisted of 25 people: 12 men, 12 women, and 1 person who avoided disclosing their gender. All of them were in the age range of 20 to 25 years old. The quasi-experiment was carried out by attending to a series of conditions to control it and, thus, avoid the appearance of biases. Because of this, the final sample was 21 people as 3 individuals did not fulfil the conditions exhibited in Table 1. Some characteristics of the final sample are in Table 2.

3.2. How the quasi-experiment was carried out

The quasi-experiment was made up of three parts. The first part consisted of surveying using VR glasses. In this survey, aspects about the age, gender, studies, and preferred free time activities of the participants were asked. In addition, they were asked about possible previous experiences using VR glasses or having entered the metaverse. 45% of those surveyed agreed with knowing the functioning of VR glasses but they had not used them, while 43% of them had used this kind of device. When they were asked about having previous experiences in

similar activities, 48% of the participants confirmed having entered the metaverse. Finally, none of the participants had previously bought products or services through VR or the metaverse.

The second part of the quasi-experiment consisted of carrying out the activity itself. The VR glasses used in the quasi-experiment were the Meta Quest Pro, a VR glasses from Meta that offer a premium experience in the field of VR thanks to the 10 sensors included that track the users' hands, eyes, and face. These glasses allow the user to enjoy immersive VR experiences.

Table 1. Conditions of the quasi-experiment

1	Signing a consent to participate.
2	Start the experiment in the same position, facing the windows of the room.
3	All the participants were standing during the experiment.
4	Same virtual space and same activities for all participants.
5	Same duration of the experiment.
6	Prior and post fulfillment of questionnaires.
7	Silence in the room during the development of each experience.
8	Participants did not talk to each other about the experience and did not see others making the experiment (they waited in a different room).

Source: Own elaboration.

Table 2. Characteristics of the final consumer sample

Studies or employment	High-school 14%; university degree 72%, work 14%
Preferred free time activities	Sports 33%; videogames 14%; series or films 24%; reading 5%; social media 24%
Previous participation in similar activities entering the metaverse	Yes 48%; no 52%

Source: Own elaboration.

Each subject was placed in a specific position with the device on. Once they were ready, the activity began, where they had a total of 8 minutes of experience. 1 minute was dedicated to play basketball and then they had another 7 minutes to explore to their preference the same metaverse in which the basketball game is played. They were able to see other users and avatars, play other games such as Trivial or cook hamburgers, as well as explore the entire room that included the game. All the experience was carried out inside the same metaverse, to promote the concentration of the participants.

While performing the activity, the user was standing, allowing him/her to move around the room as they pleased and, thus, feel that the experience was even more real (Figures 5 and 6). To guarantee their safety, and because there were tables in the room where the quasi-experiment was carried out, within the metaverse, safe areas were delimited so that the participants were not in danger. If any user went out of those limits, the glasses stopped functioning as a warning of danger. Once their 8 minutes of experience were over, each participant was asked about the position in which they considered they had finished the experience, to compare it with the position in which they had begun.

Figure 5. Sample individuals using VR glasses (left) and playing basketball in the NBA metaverse (right)



Source: Own elaboration.

Figure 6. One sample participant in the basketball game and trampolines game



Source: Own elaboration.

The third and final part of the quasi-experiment was a survey after completing the activity, where they were asked about their experience within the metaverse. The survey, which estimated duration of response was approximately 6 minutes, was divided into 4 parts or sections, based on the key aspects or variables for the consumer in shopping with new technologies and taking literature and experts' opinions as a reference.

3.3. Measurement scales

Most measurement scales were 5 positions Likert (being 1 completely disagree to 5 completely agree with the item of the questionnaire) and based on literature and experts help to refine the scales and avoid a very long questionnaire. As for embodiment and avatar measurement, we used the Gonzalez-Franco and Peck (2008) 16 questions. The questionnaire was built around six different recurrent themes in embodiment science, which include: body ownership, agency and motor control, tactile sensations, location of the body, external appearance, and response to external stimuli (Piran et al., 2020).

To measure immersion, we followed the recommendation for this kind of experiment designed by Bouchard (1990) in which participants are asked to carry out an activity inside the virtual reality and then be able to measure the level of immersion they have reached through questionnaires. The final objective and the most interesting thing in this section was to discover if they had reached the state of flow. Flow was regarded by Csikszentmihalyi (1990) as a state in which individuals are so involved in an activity that nothing else seems to matter, they are deeply immersed in the activity itself and feel the optimal experience. Experts developed 6 items to measure flow and immersion after de navigating experience. With the aim of measuring social interaction, we considered related scales of the Social Interaction Anxiety Scale and the Social Phobia Scale. They were both developed by Mattick and Clarke (1998) due to the necessity of having an instrument to assess various commonly feared situations. These scales are widely used in clinical settings and among social anxiety researchers but can be related to the interaction within virtual reality as people tend to feel less social anxiety when they "hide" behind a screen or an avatar. Moreover, it is convenient to analyze the behavioral changes experienced by the participants in the same situation but experienced in the real reality and the virtual reality.

Experts selected the most key aspects of these scales to measure social interaction in a VR context. The aim was to compare the experience lived by the participants in the metaverse with what they would have lived in real life, to see if their level of social interaction was higher or lower. Finally, the last section was made up of questions related to the purchase intention of goods or services within the metaverse or VR. The intended objective was to analyze whether, after the experience, users decided to start or increase their purchases through VR.

4. RESULTS

Once the quasi-experiment was finished, the information obtained from the post-questionnaire revealed the following results. As mentioned before, this questionnaire was divided into four sections, so the results will be analyzed based on those four parts. Only the main results are going to be reported here and graphically and other results can be seen in the Appendix.

4.1. Embodiment

To start with, talking about embodiment and avatars, overall, 62% (see Figure 7) of the participants reported feeling out of their own body during the quasi-experiment (they answered with positions 4 or 5 in the Likert scale). Specifically, and regarding the movements that the avatar made, 81% (see Figure 8) actually felt that the movements of the virtual body were caused by their own movements. Most had the sensation that their body was going to the same place where the avatar was going (by 66% of the participants). Furthermore, 71% felt that their virtual body was their real body (see Figure 9). 47% believed that their own body could be affected by what the avatar was doing. This sensation was also increased by an activity that consisted of jumping on trampolines, causing some participants an amazing real sensation of vertigo.

Figure 7. During the quasi-experiment, there were moments in which I felt out of my body

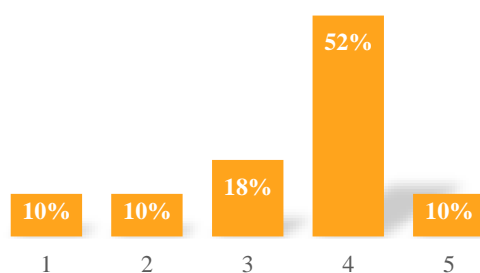
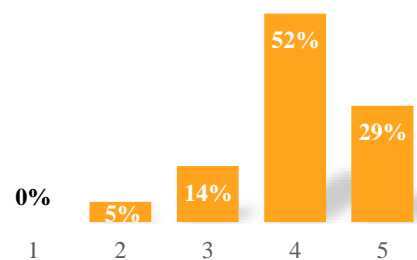


Figure 8. During the quasi-experiment, there were moments in which I felt as if the movements of my virtual body were influencing my own movements



Source: Own elaboration.

Regarding the position of the avatar, 48% (see Figure 10) of the participants felt that their body was placed in the same position as the avatar, thus, having control of it. The same percentage of participants agreed having the sensation of being physically touching the surface which was touched by the avatar.

Figure 9. During the quasi-experiment, there were moments in which I felt as if the virtual body was my own body

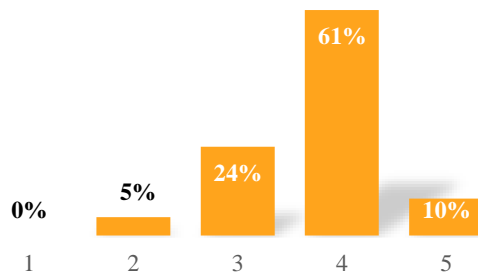
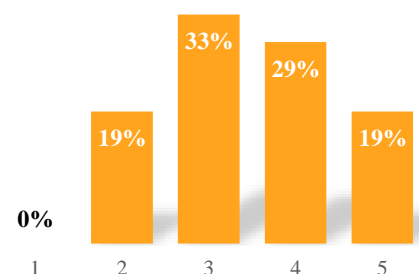


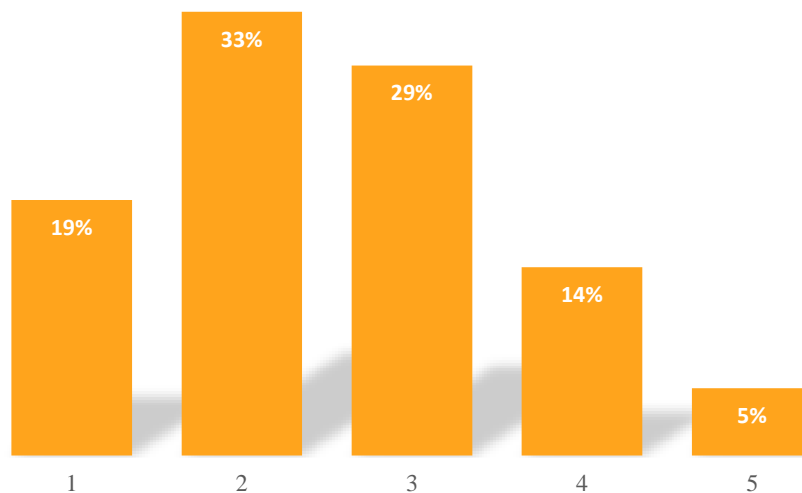
Figure 10. During the quasi-experiment, there were moments in which I felt as if I could control the virtual body as if it was my real body



Source: Own elaboration.

Finally, and talking about the physical appearance of the avatar, the participants could only virtually see their hands. This meant that, in general, they did not feel as if their body was transforming into that of the avatar or as if they had changed their clothes or skin tone. Therefore, only 19% (see Figure 11) of the participants felt that they could control their virtual body was looking like their real body.

Figure 11. During the quasi-experiment, there were moments in which I felt as if my body had changed.



Source: Own elaboration.

4.2. Immersion

Continuing with immersion, 90% (see Figure 12) of the participants said they felt absorbed or very absorbed by the quasi- experiment, even forgetting about the real environment that was surrounding them (67%) and possible external distractions (81%). Furthermore, 72% of the participants agreed on having felt a distortion in time while carrying out the activity. Indeed, a large part of those surveyed thought that the time elapsed within the activity was about 5-6 minutes, when it was in fact 8 minutes. Finally, 57% (see Figure 13) of the participants approached the so-called state of flow.

Figure 12. During the quasi-experiment, I felt absorbed by the activity

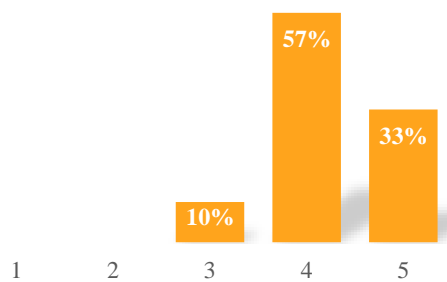
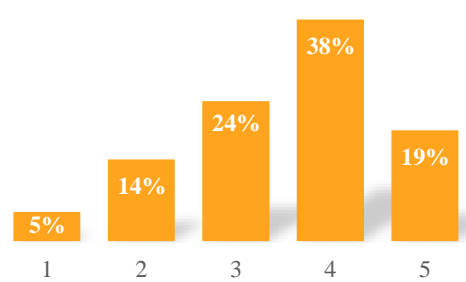


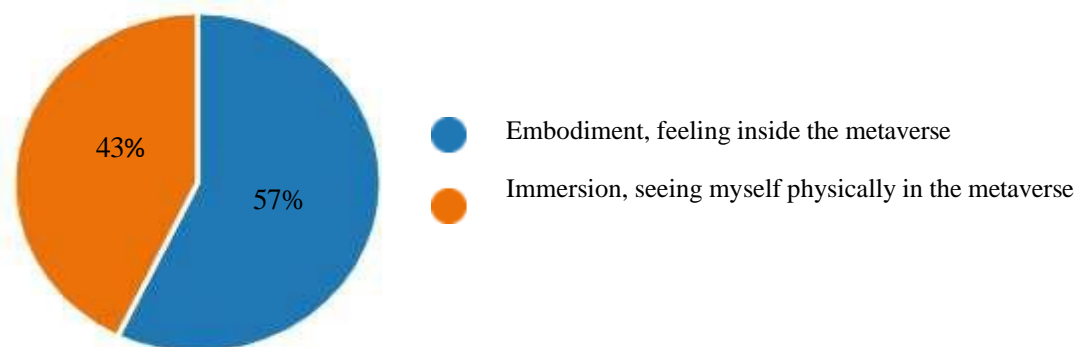
Figure 13. During the quasi-experiment, I consider that I reached a state of the flow



Source: Own elaboration.

Participants were also asked whether if they valued more feeling physically inside the metaverse (embodiment) or if, to the contrary, they preferred to see themselves physically in the virtual world (immersion). 57% (see Figure 14) stated that they preferred to feel inside the metaverse.

Figure 14. Which have you valued the most: embodiment or immersion?



Source: Own elaboration.

4.3 Social interaction

Thirdly, in the social interaction section, the results could have been affected by the short duration of the quasi-experiment and the impossibility to communicate with other users. This explained why 86% (in this case, the percentage is based on the sum of the individual percentages of answers 1 and 2 of the Likert scale) (see Figure 15) of the participants feel more comfortable in the real world. According to the results, 71% (see Figure 16) confirmed being more sociable in the real world than inside VR; in addition to feeling less embarrassed (58%) performing activities in the real world than within the metaverse. Finally, only 14% felt frustrated for not being able to handle themselves well.

Figure 15. Globally, I feel more comfortable in VR than in the real world

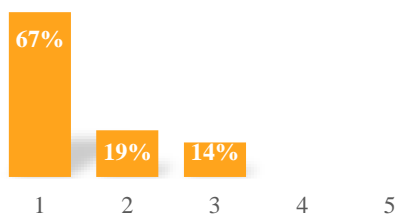
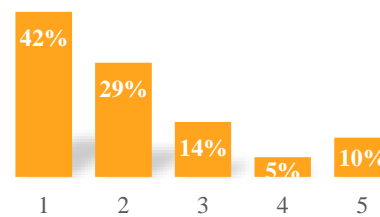


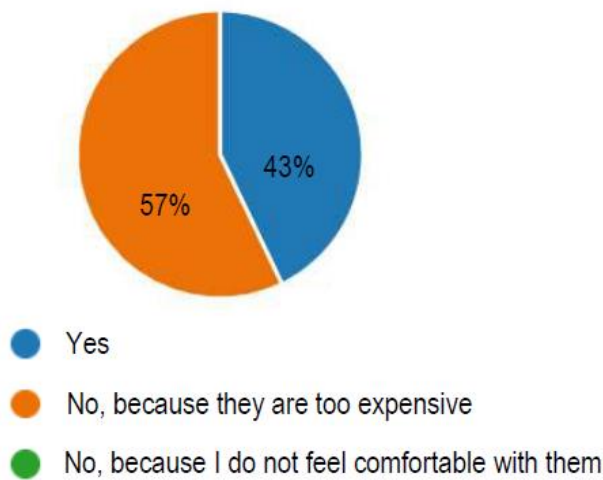
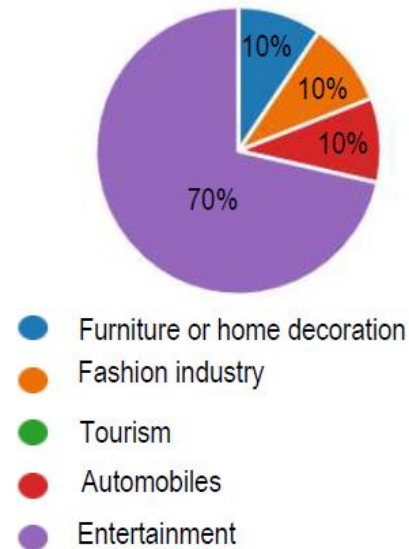
Figure 16. I think I can be more sociable in VR than in the real world



Source: Own elaboration.

4.4. Purchase intention with VR

The final section was about the purchase intentions after the experiment. 76% stated that they would buy VR glasses. In addition, 43% (see Figure 17) would buy products related to VR, however, 57% would not buy them due to the high price of said products. Additionally, and as it is still an unknown concept to the majority of the population and without large amounts of information. 71% of the participants would not buy products from a brand through the metaverse. Finally, and among the products that benefit the most from purchasing through VR, the participants indicated that the most benefited is the entertainment sector (70%), followed by automobiles (10%), fashion (10%), and decoration (10%) (see Figure 18).

Figure 17. Would you buy VR products?*Figure 18. Which products do you think benefit most from VR in shopping platforms?*

Source: Own elaboration.

5. DISCUSSION

The objective of this paper was to explore the impact of VR on the buying and selling process, analyzing embodiment, immersion, and social interaction in a metaverse. An empirical study was carried out through a quasi-experiment and a questionnaire to analyze the behavior of the participants with VR glasses.

Starting with R1 and embodiment, that is, the sensation of being physically within the metaverse, it can be observed how the activity performed with the VR glasses induced in the participants a feeling of fusion between their own body and the avatar. 72% of the participants felt as if their virtual body was their own body. This was what Tussyadiah et al. (2017) described as the fusion between the real and the virtual body. Biocca (1997) and Bovet et al. (2018) described embodiment as the feeling that the movements made by the avatar are influenced by the movements produced by the person in the real world, just as the participants felt during the experience.

Continuing with the avatars, Gárgoles (2023) emphasized the enhancement derived from the use of avatars within VR. This could be observed in the interaction that the participants described concerning their avatars. Indeed, the use of avatars not only improves the experience but also allows the users to interact with other people and live virtual experiences as real. The

quasi-experiment effectively induced a feeling of presence and immersion in the virtual environment, with nearly half of the participants (48%) feeling that their real body was touching the virtual environment. 90% of the participants felt absorbed by the activity and the 67%, forgetting about the real environment surrounding them.

Following with immersion, it is important to emphasize the dynamic process of immersion described by Dwivedi et al. (2023) as a key aspect to enhance the immersion experienced by the participants. Indeed, in the quasi-experiment, a VR-HMD device was used, which, according to Pallavicini et al. (2019) contributes to creating three-dimensional virtual experiences. Besides, it allows participants to explore the virtual world to their preference, being able to feel the virtual world and the experiences lived within it, as if they were real (Peterson et al., 2018). Furthermore, despite immersion being a key aspect of VR experiences, there is a clear preference by the participants (57% of them) for the feeling of physically being inside the metaverse. This means a preference for embodiment over immersion.

Regarding social interaction within the metaverse, in our empirical study, social interaction within the metaverse is not more important than in the real world. This could largely be due to the limitations encompassed by the quasi-experiment referred to the fact that there are not always people playing in the same metaverse when entering it. Other authors, such as Hudson et al. (2019), suggest that social interaction does not seem to be a determining factor in enhancing the overall virtual experience.

Lastly and about RQ2 and speaking about the purchase intentions of the participants after carrying out the quasi-experiment, it can be concluded that there is a positive reception of these new technology's potential benefits. 76% of the participants would buy VR glasses and the 43% of them would buy products related to VR. As Rodríguez et al. (2020) described, COVID-19 was a catalyst for the adoption of new technologies and online shopping methods. This pushes companies and individuals towards digitalization, connectivity, and immersion in virtual environments.

As managerial implications, companies must invest in research and development to explore how these technologies improve customer experiences as well as business performance. Furthermore, they should focus on the personalized and customer-focused experience. As can be observed in the quasi-experiment, what is most valued is the sensation of feeling that virtual

experience as if it was real. These advantages are important in certain sectors such as in tourism (Bretos et al., 2024).

Taking into consideration the rapid adoption that these technologies have experienced after the pandemic and the great acceptance among consumers, companies should continue investing in it and digitalizing their daily activities and tasks, offering new experiences to consumers. Also, due to the continuous change and innovation suffered by new technologies, companies should stay up to date with market trends and consumer behaviors and preferences.

Finally, the limitations that have encompassed the development of the quasi-experiment are exposed. The first was the small sample of young participants available to carry out the experience as it is an incipient technology, still not used by many people, even among young adults. Another drawback in this paper derives from the use of the NBA basketball metaverse, not related directly to shopping. There are only a few real immersive real metaverses, like this one. This limitation does not allow us to test hypotheses or a causal model. Besides, participants could only virtually see their hands and not their whole body. This can impede the evaluation of clothes color, for example, and their avatar appearance. The last limitation was that we presented a quasi-experiment, instead of an experiment, which involves less external validity and a non-random sampling process. Further research can focus on the design and development of a metaverse and use a bigger sample. Moreover, it would be interesting the analysis of the causal influence of embodiment, social interaction, and immersion on shopping intention together with gender and age effects.

6. CONCLUSION

The relevance acquired by these technologies has exponentially increased in the last decade thanks to the innovation and investment that has been allocated to them. With the help of a quasi-experiment, this study yielded an increased understanding of VR perceptions regarding embodiment, immersion, and social interaction in a metaverse. As has been seen, VR represents a great business opportunity, due to the exponential growth and potential that they represent.

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