

Potential of Virtual Worlds for Purchasing

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ABSTRACT

A previous study concluded that T-shirt choices in 3D virtual worlds are good indicators of consumer preferences when exposed to T-shirts in physical forms. This allows a rapid and cheaper test of the market's potential on new models without the time and cost of manufacturing and shipping physical samples. However, 3D virtual worlds have far fewer users than traditional web platforms, which can limit and bias their potential on this area. This paradigm leads to an increase of the need to analyse and compare the quality of this indicator to other similar indicators in a more usual 2D virtual space, with more users (Web platform). This study compares the differences on the purchasing records between 2D and 3D, with the actual receipt of the physical product, to identify the quality factor of each method as an indicator of consumer preferences of physical products. For this, physical products were created and offered for sale in 2D virtual spaces and 3D virtual world, where users made purchase. Second Life platform was used to the 3D virtual world whilst Webnode platform was used for 2D virtual world. The physical products created were t-shirts, and then recreated on both 3D and 2D. Subsequently, users were invited to choose and buy, for their own money, a t-shirt in the 3D virtual world and group of different users proceed the same way on to the 2D virtual space. In the final step users were introduced to the purchased physical t-shirt for delivery and given the option to modify their choice of t-shirt, previously purchased online. The results conclude that the 3D virtual world choices are more similar to consumers actual choices when experiencing the physical product than the choices made when buying 2D t-shirts online.

KEYWORDS

Virtual Worlds, Second Life, Web Platform Purchases, Physical Store Purchases, 3D Virtual Worlds Purchases

INTRODUCTION

Technological advance has generated significant changes in companies which required a rapid adaptation and new ways of thinking. At this moment, the market presents several and different methods for the consumer to buy a product, distinguishing between two major forms: the traditional physical forms (stores, fairs and similar places) and the virtual forms (mobile applications, web platforms and immersive environments, for example. "Virtual worlds"). In comparison to the physical forms, all virtual channels offer broader collections and are not confined to limited shelf space (K. W. Lau & Lee, 2018). In addition, they offer the possibility to pre-test new products with specific target

groups (Varajão & Morgado, 2012) or to simulate customer contact with products without the risks or costs inherent in doing so in the real world. For example, Pontiac, with the goal of promoting car models, allows users to modify and drive specific cars within Second Life, while Dell offers a virtual simulation of actual Second Life products (Krasonikolakis, Vrechopoulos, & Pouloudi, 2014).

Web platforms, which can be considered non-immersive 2D virtual spaces, have become a popular mean of purchase (Katawetawarakis & Wang, 2011) including online payment systems (eg. PayPal) and supply chain management (Zhang & Shrestha, 2010). Mobile applications resemble them all, including the technology behind the scenes (eg. backend) and are essentially differentiated by the capability of interaction on small touch screens of mobile devices compared to viewing web pages.

Immersive environments or virtual worlds (VW), as buying platforms, have been developing for the past two decades. The variety of products available depends on the focus of each VW, often being just products for internal use in this virtual world (Krasonikolakis et al., 2014). However, there are also cases where companies are betting on 3D virtual worlds that allow consumers to recognize the virtual object as it was a real object, because in a buy and sell business, product perception plays a key role. Therefore, there are several studies that focus on understanding consumer's perception of virtual objects from the interaction between virtual technology and the consumer (H.-F. Lau, Kan, & Lau, 2013).

Users in this virtual space proceed by controlling the representation of a person as an animated character immersed in a virtual world. These virtual "alter egos" are called "avatars" (Krasonikolakis et al., 2014). Through these characters they can navigate the virtual world and participate in countless activities such as buying a product and talking.

3D virtual worlds, such as the well-known Second Life (SL), are computer-generated physical spaces graphically represented in three dimensions that many users can experience simultaneously. SL is a particular case where users themselves can freely create interactive content, including products that they can later sell (Kohler, Matzler, & Füller, 2009).

3D virtual worlds have far fewer users than traditional web platforms, but recent studies show that VW are good indicators in consumption preferences. For example, according to Varajão and Morgado (2012), t-shirt choices in 3D virtual worlds are indicators of consumer preferences when exposed to t-shirts in physical form.

This paper starts from the result of this article by Varajão and Morgado (2012). Given the difference in the number of users already mentioned, there is a concern to see if there will be too much bias of results against traditional virtual platforms. This requires comparing the two methods, 2D virtual spaces and 3D virtual worlds, to try to understand which one most closely matches users' physical preferences.

Therefore, the main objective is to compare the relative effectiveness of 2D platforms against 3D as indicators of consumer preferences for physical products they want to purchase - specifically, t-shirts. Factors that motivate customers to purchase both physically and online were analysed to build two prototypes that could be comparable at this level, prototypes were implemented, data were obtained from purchases made on each prototype, and consumers were given the opportunity to exchange the physical products when they received them, to detect if the preference expressed online was maintained when they verified the characteristics of the products in person.

Consequently, the following research question was formulated:

Which platform (web or 3D) most closely matches the physical preferences of customer choices when buying t-shirts online?

In order to answer the research question, five goals were defined, which will be analysed throughout this master's dissertation, based on a theoretical foundation and on the data resulting from the application and analysis of the prototype:

Goal 1: Identify any qualitative aspects or demographic patterns associated with differences that may be detected.

Goal 2: Identify the prototype that features the most intuitive design so that the user can navigate more easily.

Goal 3: Check the percentage of users who physically opted for the same t-shirt as they previously chose in 2D.

Goal 4: Check the percentage of users who physically opted for the same t-shirt as they previously chose in 3D.

Goal 5: Compare the two percentages to see which platform most closely matches the users' physical preference for t-shirts.

LITERATURE REVIEW

Purchase motivators factors

The motivation for consumers to purchase is influenced by a significant number of factors that may be related to the buying environment, the personal traits of the buyer and the product itself and is conditioned by demographic and cultural aspects.

Internal factors

Internal stimuli are related to the different personality factors and emotional states, positive or negative of the consumer. Several studies prove that customers sometimes buy due to psychological variables (eg personality, self-regulation), hedonic experiences (such as shopping fun, emotional state, mood) and situational variables (eg time available, money) (Karbasivar & Yarahmadi, 2011).

Internal factors can be defined as internal psychological cognitions such as needs, values, goals and personality, that is what defines the consumer and his behaviors (Kim & Trail, 2010).

Chang et al. (2011) report in their investigations that consumers who had more positive emotional responses to the store environment were more likely to shop (Muruganatham & Bhakat, 2013).

In addition, we also find consumers looking to improve their mood by buying a product. Typically, this type of acquisition is often associated with individuals who want to evade negative psychological perceptions, such as low self-esteem, negative feelings, or moods (Muruganatham & Bhakat, 2013).

State of mind is a significant mediator between environmental stimuli and human behaviour. In this way, store environments are strategically designed to improve the mood of the consumer. There is a relationship between the general characteristics of a store and the consumer's mood, concluding that a pleasant store environment influences his mood (Lee & Johnson, 2010).

Consumers with a more positive mood tend to have a reduced decision maker factors and shorter decision times. Positive emotional responses increase the possibility that consumers will behave in a particular way because they believe behaviour will have positive results (Chang, Eckman, & Yan, 2011).

In conclusion and based on the above different arguments internal factors are related to the mood and personality of the consumer. There are customers who tend to buy products in order to improve their mood, giving a spontaneous response and without any prior reflection or assessment of consequences.

External factors

External stimuli are related to the store environment. It is found that the customer is influenced by the smells, design, product packaging, color and music of the store and all these factors are strategically studied to improve the psychological and emotional state of the consumer predisposing to purchase (Lee & Johnson, 2010).

The store environment can be divided into three different categories: social, engaging and design (Sherman, Mathur, & Smith, 1997). Social influence can clearly persuade the

purchase. Complementing a friend or store clerk during a search for a product increases the likelihood of the consumer purchasing it (Muruganantham & Bhakat, 2013).

Employee responses can significantly influence the minds of consumers. Often, if they come up with a smile or if they are easily available, it can arouse positive feelings for consumers (Mohan, Sivakumaran, & Sharma, 2012). In addition, when employees treat consumers with sympathy, they arouse a sense of appreciation and self-esteem (Liu & Burns, 2013). So if they are helpful and friendly, consumers are more likely to stay longer in the store and with a higher shop rate.

In different circumstances, online stores lack personal and individual service that customers want and receive when they enter a physical store. Employee service becomes attractive for consumers to make their purchases (Liu & Burns, 2013).

Relative to what surrounds the store, it is the non-visual elements of a store environment. It is found that the customer is influenced by the smells, product packaging, the color and the music of the store being all these factors strategically studied to improve the psychological and emotional state of the consumer predisposing them to purchase (Lee & Johnson, 2010).

Design features are physical and visual elements in the store environment that influence consumers' purchasing decisions (Floh & Madlberger, 2013). The design of a physical store can also contribute as an important basis for consumer assessments of the quality of merchandise. Mazursky and Jacoby (1986) found that store interior images are strongly preferred as suggestions (even more than price suggestions) that consumers use to evaluate product quality (Baker, Parasuraman, Grewal, & Voss, 2002).

Several researchers suggest a direct relationship between store design and perceptions of service quality and consequent purchase. The influence of physical environments is mainly affective, so a poorly designed store design can reduce shopping enjoyment and lead to deteriorating moods of customers (Baker et al., 2002).

Different studies demonstrate the importance of design to create customer-friendly experiences, convey a desired image of the store or service, and promote specific behaviours. Several surveys reveal the importance of store design in creating enjoyable store experiences and the importance of addressing the goals or intentions that underlie people-environment interactions. As a result, customers may want to stay longer, spend more and get more involved in the store. Therefore, store design affects consumer store experiences and purchase intentions (Rompay, Verhoeven, Dijkstra, & Es, 2012).

According to Sachdeva and Goel (2015), the goal of store design is to utilize a variety of emotional and cognitive stimuli to create a unique shopping experience for each customer. People like to touch, feel, smell, taste, inspect and experiment. Companies design store design to increase

positive customer sentiments to drive desired consumer behaviour, such as a greater willingness to shop or spend more time in the store.

If it is an online site, it must be well structured to generate a more positive attitude. Users often see the features of "simplicity" and "clarity" in the face of easy-to-understand design. It also has an impact on pleasure and arousal, which results in different behavioural outcomes, including store fidelity, amount of time spent there, number of items purchased, and amount of money spent (Mummalaeni, 2005). Web aesthetics are a significant stimulus for cognitive and affective reactions in the body (Wang, Hernandez, & Minor, 2010).

Demographic and cultural factors

Roberts (1996) defends that demographic data is used for market segmentation, that is, it is an effective criterion in distinguishing consumers, which can be segmented by gender, age, product preferences, among others. For example, while men tend to engage in the purchase of instrumental and leisure items that project independence and activity, women tend to buy the symbolic and self-expressive goods that are associated with appearance and emotional aspects (Muruganantham & Bhakat, 2013).

Culture is another factor that acts at the level of buying as a dynamic process that occurs within a given society and creates the cognitive map of beliefs and attitudes that drive people's perception, reasoning, actions, responses, thoughts and interactions (Pornpitakpan & Hui, 2013). The same is to say that a subject inserted in a given culture may behave in another who has another way of being.

The influence of gender on decision making and purchasing behavior has been of particular interest in the field of marketing. In the case of online shopping, men choose it more than women, because the relationship of the process of acceptance of new technologies depending on the gender of the individual (Lian & Yen, 2014).

Age is also an important feature for analysing consumer behaviour. Regarding the Information Technology (IT) industry, some studies have found that computer skills are more easily learned by younger individuals. They generally have greater experience with the Internet, while older people perceive greater risks, have more difficulty (Jiménez, Martín, & Hernández, 2011).

Consumers in online worlds

Web sites

As state in the introduction, over the years there has been a rapid advance in technology that has significantly changed the lives of people and businesses. These had to adapt to changes and new challenges. Computer skills are more easily

learned by younger individuals, as mentioned in the previous chapter. Age is related to the difficulty in stimulus processing as well as the amount of time that untrained users need to become familiar with computers. Consequently the lack of experience of older users prevents us from assessing the advantages that the internet offers to purchase products, making it difficult to participate (Jiménez et al., 2011).

The younger generation has more positive reactions to new technologies. This makes it easier for them to adopt innovative technologies compared to older people who are intimidated by computers. Finally, the younger generation is less concerned with the security and reliability aspects of Internet technology (Nayyar, 2011).

Furthermore, gender can also influence decision making and the process of accepting new technologies. Males are more pragmatic, while women experience greater anxiety when faced with new activities. On the other hand, despite the marked differences, more recent studies suggest that a growing number of women using the Internet are growing, so the gender gap is narrowing, so, statistically, the differences between men and women are no longer significant. (Jiménez et al., 2011).

Regarding the websites used to sell products, they expose a large amount of information in text form, such as weight, dimensions, material, brand, among other details.

An informative and well-communicated website can be especially valuable for customers planning to buy a more complex product. Currently, there are businesses that feature both physical and online stores, as there are customers looking for more complex products via the web because of the need for product and pricing information, and then go to a physical store for touch, smell, sound features to buy the product more confidently and safely (Pauwels, Leeflang, Teerling, & Huizingh, 2011).

At this point it is possible to create product sales sites quicker and more economical, as today's market presents several very simple solutions, so that small and medium companies can build their own platforms. Users, through this type of tool, can customize the web page to their liking, having various options of layouts, fonts, page navigation, among others (Khalid, 2017).

The set goal of this research is to create a simple and easy to navigate site, so that users can choose the t-shirt they want. The platform will be tested by both genres of different ages.

Virtual worlds

Virtual worlds have shown extraordinary growth during the first decade of the 21st century, which is undoubtedly associated with the increased capacity of computing technology and telecommunications networks. This development effectively opened a new field for exploration (Bainbrigde, 2011), allowing thousands of people to interact

simultaneously in the same three-dimensional space simulated by the computer. Users can navigate the virtual world through graphical representations of them, which are called avatars and simulate the attitudes and actions of consumers. In this way, they can engage in rich interactions with each other, exchange messages, objects and money, communicate, navigate, try on clothing, change avatars' shapes, touch products, and build buildings, bridges and anything else they can imagine (Messinger et al., 2009).

According to Varajão and Morgado, virtual worlds are part of the new reality, especially the immersive three-dimensional environments, which immerse the user in a virtual environment that detects sounds, images and even the slightest movement that fits the person's experience. This type of environment allows people to reproduce part of the routine in a virtual way. This means you can experience real life aspects such as shopping, design, chat, work, sitting at your desk, behind a computer. Studies indicate that presence, the sense of being within a virtual space, plays an important role in the psychological processes and personal importance of online events.

Briefly, the virtual world is a spatial representation of a persistent virtual environment that can be experienced by numerous participants at once, represented in space by avatars (Bell, 2008).

In fact, virtual worlds can provide the freedom to experiment and create something new. Built-in tools encourage users to innovate, to present something they can imagine. As a result, they engage many users to create and innovate in such an environment, turning the virtual world into a breeding ground for new ideas and products. That is to say that as the boundaries of the virtual world and the real-world dissolve, avatars can unquestionably use creativity to design products with real-world potential (Kohler et al., 2009).

There are several web applications from virtual worlds such as Habbo Hotel, Active Worlds and Second Life. They all use avatars and also allow the creation and display of urban buildings (John, Gatzidis, Boucouvalas, & Liarokapis, 2011).

Second Life was used on this document which is a web-based virtual world developed and launched in 2003 by Linden Research, Inc., founded in California. Through this software users can create a great diversity of objects. (Subirana, Muñoz-Guerra, Aymami, Radermacher, & Frank, 1985).

In this virtual world, the company sells land and users, called "residents," design and build properties, that is, do what they want and want. In addition, any resident can create or open a store and sell the products they want (Subirana et al., 1985).

Second Life offers users the ability to build an alternate identity that could be a real-life replication, an enhanced version with improvements over certain attributes or a completely different self. Compared to other virtual worlds, users in SL face no restrictions on the type of self-

presentation that can be produced, making it possible for avatars to emerge in an innovative and non-stereotyped format and surround themselves with any object of their choice (Kaplan & Haenlein, 2009).

Basic SL membership is free, and users can explore, shop and participate in various events. In addition, premium membership allows residents to own virtual property and create, buy, and sell virtual objects such as fabrics, cars, furniture, or even virtual animals (Zhang & Shrestha, 2010).

Many SL users have made a profit selling virtual objects and services. Virtual companies such as shopping malls, clubs and bars hire virtual employees to act as assistants, security guards and waiters. Some experienced programmers and graphic designers sell professional consulting products or services to novice users who are just starting to use SL. There are some individual entrepreneurs who have managed to convert hobbies into legitimate virtual businesses (Zhang & Shrestha, 2010).

Methodology

This master thesis aims to find out which of the virtual worlds 2D or 3D is the one that presents the most preference from the consumer's perspective. This required a simple product with a reasonable budget to test.

The product must be viable to produce in both virtual and physical versions, both versions must be recognized as similar by consumers. We chose to develop t-shirts as it is a low-cost product of physical manufacture and common in the virtual market.

1. Create a brand to make the t-shirts;
2. Design two t-shirts;
3. Produce the physical t-shirts;
4. Produce the t-shirts in 2D and 3D;
5. Build the virtual store in SL;
6. Build a 2D online store;
7. Ask several people to try the t-shirts at the SL store;
8. Ask so many other people to try the t-shirts at the online store;
9. Sell the t-shirts physically;
10. Analyse the data by comparing the two result sets.

Each virtual product test participant also participated in the physical product test, which allowed us to analyse which of the virtual worlds comes closest to customers' choices when buying physical t-shirts.

For this, people were invited to visit the online stores, and a few days later presented the physical t-shirts to each one of them, to check if they would be interested in buying the physical item, giving the possibility to change the decision made virtually. To test the two prototypes performed it was necessary to ask fifty people to experiment, of which twenty-five tested in 2D and another twenty-five in 3D. Each user can only try one of the prototypes, that is, if a person testing in 2D can no longer test in 3D and vice versa. This condition

is important because in this master's thesis it is intended that the user only chooses from one point of view (either in 2D or 3D).

During the prototype tests, demographic data such as age and gender were analysed in order to characterize in greater detail the sample used in the present investigation. In addition, it was also measured how long it took people to access the first t-shirt. In the case of the 2D prototype, the time was timed from the moment they were on the homepage to navigating to one of the t-shirts. On the other hand, the prototype in 3D counted from the moment they entered Second Life and donned the first t-shirt on the avatar.

The 2D prototype, built on Webnode, consists of three different screens: Home (Home), Store, and Cart. In all screens there is a top bar with the logo in the left and right side, accesses to the three different screens, as we can see in figure 1.



Produtos em destaque

Fig. 1. 2D store



Fig. 2. 2D white t-shirt



Fig. 3. 2D black t-shirt

For the 3D prototype, the user goes to Second life and selects the t-shirt he wants to buy, having the opportunity to try the t-shirt on his own avatar before purchasing it. To buy the desired t-shirt.



Fig. 4. 3D t-shirts in Second Life



Fig. 5. 3D white t-shirt



Fig. 6. 3D black t-shirt

Data analysis and results

The fifty users were between the ages of sixteen and sixty-two. The predominant age group is between the ages of twenty-six and thirty, corresponding to 25.5% of the entire sample. The 21-25 and 46-50 age groups correspond to the second most frequent group, corresponding to 14%. The least frequent age group is users over sixty-one years old, with only one test recorded, corresponding to 2% of the sample.

Furthermore, most users were female, and 32 tests were recorded, corresponding to 64% of the sample. The male gender recorded 18 responses, consequently accounting for 36% of all respondents. By observing the data collected, it can be concluded that the time difference between genders is negligible, both have an average of very close times.

Descriptive Analysis of Results

For goal 1, we intend to identify if gender and age can influence the time participants spend in both 2D and 3D prototypes.

In relation to 2D prototype shows discrepant gender-averaging times, the female gender is 6 seconds shorter in duration than the male gender. Furthermore, through standard deviation it can be stated that it is not possible to conclude whether male or female gender is easier to navigate in 2D online stores because it is too high, which means that there is a wide variation between times.

Instead, 3D prototype the average times between genders are very close, as there is a difference of 5.12 seconds. However, the standard deviation is too high, that is, there is a wide

variation between times, so it is not possible to identify which genre is easier to navigate in 3D virtual worlds.

Also, we can't conclude if age influences the time users spend navigating, in 2D and 3D prototypes. The correlation coefficient squared is negligible, for the both cases, because the times are too dispersed in relation to the line.

About the second goal, users spend less time on the 2D prototype than on 3D, as we can see on figure 7. Therefore, we can conclude that users are more likely to navigate 2D online stores than with 3D virtual worlds, so 2D prototype design is more intuitive than 3D.

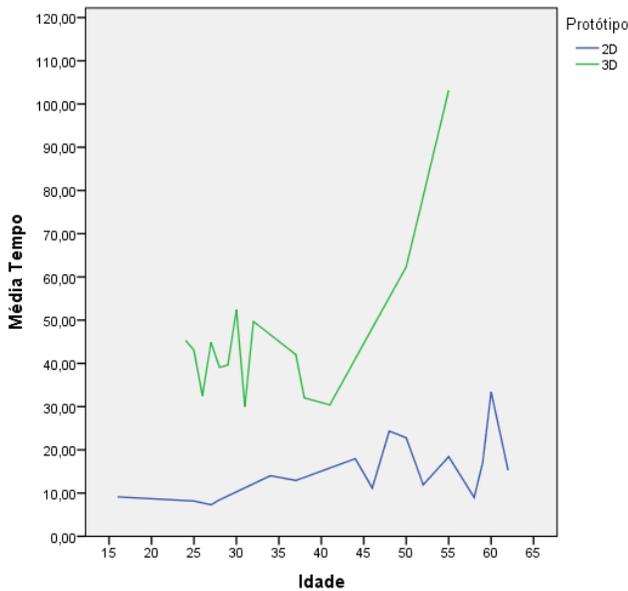


Fig. 7. Graph with sample of age and time of the two prototypes

The third goal was checking the percentage of users who physically opted for the same t-shirt as they previously chose in 2D, which is 76%. And the fourth goal was checking the percentage of users who physically opted for the same t-shirt as they previously chose in 3D, which is 84%.

Finally, it can be concluded that the prototype that most closely matches the user's physical preferences is the 3D prototype.

	2D Prototype	3D Prototype
Change (%)	24	16
Keep (%)	76	84

Table 1. Counting users who have changed and maintained virtual choices

Conclusion

The research developed was designed to answer the question of which of the 2D or 3D virtual worlds most closely matches

the physical preferences of customer's choices when buying t-shirts online. Considering the purpose of this study as well as the objectives outlined, it is possible to state that the present investigation fulfilled its purpose and achieved the goals previously set and the results are relevant.

As an investigation instrument two prototypes were made, which were tested by fifty users and the statistical data were analysed with the SPSS software. The results concluded that the achieved outcomes allowed to answer the five proposed goals and also to answer the investigation question initially framed.

Through data analysis and objectives, one can answer the proposed research question, which was to identify which of the methods, 2D online stores or 3D virtual worlds, most closely matches the physical preference of users over t-shirts. It was found that the virtual world that most closely matches the physical preferences of users is 3D, as it has the highest percentage of users who maintained the virtual choice, corresponding to 84%, while the 2D prototype has a value 76% of users who kept the virtual choice. Consequently, we can see that there is a difference of 8% of customers who maintain the virtual choice.

In a futurist perspective the model created would benefit from the opportunity to test with less common colours or a more diverse user pool. It could also have been tested by more users to get more data to analyse. A different way to improve the study is to give the consumer the opportunity to have a very similar avatar to try on the t-shirts and analyse if the virtual sizes match the actual ones. Finally, it could also be tested with other types of products, besides clothing, as well as furniture, technology or automobiles.

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