DEGREE PROJECT IN MEDIA TECHNOLOGY,
SECOND CYCLE, 30 CREDITS
STOCKHOLM, SWEDEN 2020

Effects of in-game advertising on brand awareness in virtual reality game interactions

SAVVAS PAPADOPOULOS

KTH ROYAL INSTITUTE OF TECHNOLOGY
SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

ABSTRACT

Advertisers keep seeking new ways to target a wider audience while game developers are trying to monetize their game. This study investigates how Virtual Reality (VR) interactions influence user's sense of presence and brand awareness; specifically brand recall and brand recognition. A 2 (familiar/unfamiliar brands) x 2 (high/low game interactions) between subject design user study was created where 40 participants were recruited to participate in a self-made Virtual Reality game built in Unity. The game objective was to walk through a virtual city and locate the stadium while passing by billboards with static advertisements which the users were not informed about. The data have been collected through post and pre-experiment surveys in addition to two memory tests; brand recall and brand recognition. The results show that users that have the option to interact more with the VR environment can have a slight increase in their sense of presence as well as their recognition to both familiar and unfamiliar brands. Virtual reality in-game advertising can make advertisers unlock new audiences who can not target with traditional media while developers can unlock new revenue streams through entire gaming sessions without disrupting the user experience.

SAMMANFATTNING

Marknadsförare letar ständigt efter nya vägar att nå ut till en bredare målgrupp samtidigt som spelutvecklare strävar efter att utveckla spel som genererar inkomster. Denna studie undersöker hur interaktioner i Virtual Reality (VR) påverkar användares känsla av närvaro och medvetenhet gällande varumärken; specifikt vad gäller varumärkesåterkallelse och varumärkesigenkänning. En 2 (kända/okända varumärken) x 2 (hög/låg spelinteraktion) mellan-ämnesdesign har använts i en användarstudie där 40 deltagare rekryterades till att delta i ett egentillverkat VR-spel skapat i Unity. Spelet gick ut på att gå genom en virtuell stad för att hitta Stadion och samtidigt passera skyltar med statisk reklam som användaren inte informerades om i förväg. Data har samlats in genom undersökningar före och efter experimentet och två minnestester har genomförts; varumärkesåterkallelse och varumärkesigenkänning. Resultaten visar att användare som har möjlighet att interagera i större utsträckning med VR-miljön kan ha en ökad känsla av närvaro och igenkänning av kända och okända varumärken. Genom att marknadsföra i VR in-game kan marknadsförare nå ut till nya målgrupper de inte når via vanlig media samtidigt som spelutvecklare kan skapa nya inkomstströmmar i spelsessioner utan att störa användarupplevelsen.

Effects of in-game advertising on brand awareness in virtual reality game interactions

Savvas Papadopoulos
savvapa@kth.se
Media Technology and Interaction Design
EECS, Royal Institute of Technology
Stockholm, Sweden

Figure 1: Screenshots of the Virtual Reality game environment built in Unity.

ABSTRACT

Advertisers keep seeking new ways to target a wider audience while game developers are trying to monetize their game. This study investigates how Virtual Reality (VR) interactions influence user's sense of presence and brand awareness; specifically brand recall and brand recognition. A 2 (familiar/unfamiliar brands) x 2 (high/low game interactions) between subject design user study was created where 40 participants were recruited to participate in a self-made Virtual Reality game built in Unity. The game objective was to walk through a virtual city and locate the stadium while passing by billboards with static advertisements which the users were not informed about. The data have been collected through post and pre-experiment surveys in addition to two memory tests; brand recall and brand recognition. The results show that users that have the option to interact more with the VR environment can have a slight increase in their sense of presence as well as their recognition to both familiar and unfamiliar brands. Virtual reality in-game advertising can make advertisers unlock new audiences who can not target with traditional media while developers can unlock new revenue streams through entire gaming sessions without disrupting the user experience.

KEYWORDS

In-game advertising; Sense of presence; Brand Recognition; Brand Recall; Memory; Virtual reality;

1 INTRODUCTION

The huge expansion of video game industries in the latest years have made advertisers aware of the potential to experiment with other methods of advertisement techniques than the traditional ones. Along with new technological advancements, new devices for playing video games have been introduced to the market. Modern games have become more adjusted to fit everyone's lifestyle and taste not all games require the player to sit for hours in front of their computer. The huge expansion of video game industries in recent years have made advertisers aware of the potential to experiment with other methods of advertisement techniques than the traditional ones. Some gamers are moving outside the stereotypical gaming platforms of computers and consoles to their phones, tablets and even Virtual Reality headsets. Virtual reality is a platform that enables the users to interact with virtual spaces and experience with unreal universes in 360 degrees. It is an interesting addition to the traditional advertising means that gives users the opportunity to connect between the physical and physiological experiences. Catching the eye of consumer is a huge challenge in today's digital world where we are bombarded with millions of pieces of information every day. Companies are trying really hard to draw new customer's attention and change their attitude towards their products. Virtual reality might be the solution to evidence products in a new manner through new advertising media. The current issue with most VR projects is that

they are based on funding and in most cases fail to provide any revenue. The most successful business plans in VR right now are one-time payments up front or a monthly subscription fee. This is kind of problematic if you compare them with the hundreds of great free-to-play games on other platforms that gamers can choose from. "Free-to-play" games no longer correspond to a low level of quality like they used to be. Games like Fortnite: Battle Royale and League of Legends make it possible to play massive high-quality games without having to spend a cent in their efforts. This concludes that VR developers, if they still want to stay competitive in the market they have to be able to monetize their games with adverts without negatively affecting the game experience of the user.

1.1 Research objective

To be able to evaluate static advertisements in a VR environment we have to consider the benefit through the lenses of three major stakeholders that are involved. First are the advertisers who are interested in promoting their brand or product. Next are the developers or producers who provide the platform for advertisers to pass their message, which in our case is the Virtual Reality game stakeholders. Then we have the end-users who will experience the end product or service. This thesis aims to investigate if the game interactions within a Virtual Environment have an impact on the user's sense of presence and brand awareness of familiar and unfamiliar brands. Thus to investigate if they provide additional value for the three major stakeholders involved.

Research question: How can Virtual Reality game interactions affect user's sense of presence and brand awareness in relation to familiar and unfamiliar in-game adverts?

1.2 Delimitations

This study didn't explore different game genres but rather focused on a specific one that involves an exploration/adventure game with some shooting elements. Due to time and hardware memory constraints no realistic graphics were used either, so decided used low poly/cartoon graphics instead. Lastly, the study was designed in a controlled way so that the users would not be able to step off their path and get "lost" within the virtual environment.

2 BACKGROUND

2.1 Advertising in video games

Advertising in video games usually falls into one of these three categories: in-game advertising, avergames and gamercials (Mallinckrodt and Mizerski, 2007) (Nelson et al., 2006). People usually tend to confuse these terms. Advergames are games which are tailored around a specific product or brand, but in-game advertising can be any video game that includes brand and product placement. It is usually a short game with a low learning curve that requires little cognitive effort from the player. One example is the "Yaris" racing advergame that Toyota released on Xbox360 for free before the launch of their new car Toyota Yaris.[1] Current research around advergames is focused on the attitude towards the game and the promoted brand (Hernandez et al., 2004) (Mallinckrodt and Mizerski, 2007) (Waiguny et al., 2012) (Wise et al., 2008) (Moore and Rideout, 2007) as well as the information process of the targeted brand (Tina and Buckner, 2006)(Hernandez and Chapa, 2010)(Cauberghe and De Pelsmacker, 2010). Gamercials are similar to watching an advertisement during a movie or a TV program but are viewed in between active gameplay. The game player has no control over it and has to wait for the brand information advertisement to finish before being able to continue the game. Gamercials require a low cognitive capacity for the players to watch/experience them. Lastly in-game advertising is a method that focuses on brands and products that are directly placed in the game, just exactly as it happens in the movies and television series. Unlike gamercials and advergames these games require a higher cognitive capacity from the player and are not designed to promote a specific brand. In this study I will focus only on in-game advertising through advertisements on billboards.

2.2 Virtual Reality Head Mounted Displays

Virtual Reality is a core part of and umbrella term called Cross Reality which also includes Augmented Reality and Mixed Reality (Paradiso and Landay, 2009). Virtual Reality is an alternative reality in which the users can be totally immersed in and able to interact with. Such a world is completely computer simulated and is up to the designer to decide if he wants to mimic the properties of real-world environments or not (Milgram and Kishino, 1994). Out of the three head-mounted displays (HMD) under the Cross Reality umbrella, Virtual Reality is the most advanced with the most affordable price for the consumers. There is a big range of Virtual Reality HMDs currently available in the market and are classified in two groups according to their price tag and performance. The low performance HMDs with a cheaper price tag can only enable three degrees of freedom (3DOF) tracking, which means that is limited to only a three dimensional tracking by only being able to look upwards downwards and sidewards without the possibility of rotation. On the other hand the high performance HMDs have a higher price tag and require the support of a high-end computer to be able to deliver six degrees of freedom (6DOF) tracking, which means that the body can move forward/backwards, upwards/downwards and sideways within the Virtual Environment. A VR HMD

[1] https://web.archive.org/web/20080801125128/http://www.xbox.com/en-US/games/y/yarisxbloxlivearcade/default.htm

with a room tracking of 6DOF and field of view of 100 degrees will be used for this study.

2.3 Advertising in virtual environments

Grigovici's study on "impacts of ad type and presence on brand effectiveness in 3D gaming immersive virtual environments" in 2004 was the first published research we know of that is related to interactive advertising in immersive virtual environments (Grigorovici and Constantin, 2004). The reason that makes this research study interesting is that it combines two positive advertising mediums together; Virtual Reality and video games. Virtual reality is created using Virtual environments by using computer generated 3D graphics and is considered as a new communication channel that creates new marketing opportunities. Traditional media fail to recognise the spatiality of their consumers while Virtual Reality can. If you compare it to existing traditional media like television and radio, Virtual Reality is superior by being able to enable a sense of presence and immersion to the users which other media lack. Sense of presence and immersion affect how users process information and have a powerful impact on brand attitude (Grigorovici and Constantin, 2004). Sanchez-Vives and Slater state that the sense of presence is based on the "transportation of consciousness into Virtual Reality" and occurs only when the real sensory data are completely replaced by the computer-generated ones (Sanchez-Vives and Slater, 2005). Suh and Lee results claims that Virtual Reality interfaces increase the overall consumer learning towards products (Suh and Lee, 2005). Besharat tried to leverage virtual attribute experience in video games in order to improve in game advertising. His results shown that "associating a brand with virtual attribute experience by exposing consumers to the brand name and the virtual experience simultaneously has a positive effect on brand recall" (Besharat et al., 2013). Only in the recent years researchers started to explore the potential opportunities for brands to utilise Virtual Reality platforms for commercial purposes (Chen and Wang, 2019) (Martínez-Navarro et al., 2019) (Roettl and Terlutter, 2018)(Wang and Chen, 2019). One of the latest research related to advertising in Virtual Reality examines if the 2D advertising in VR is more effective than in the classic banner ad format (Berki, 2018). Results confirm that adverts in VR evoke better memory, thus more participants remembered the advertisement displayed in VR than the web based banner ad formats. A similar study wanted to examine if mobile VR advertising can positively impact brand personality impressions, brand attitude and purchase intentions compared to traditional 2D advertising (De Gauquier et al., 2019). Results show that VR advertising can be effective to obtain more positive consumer attitudes and higher purchase intentions towards their brands. Another recent study confirms that Virtual Reality generates higher perceptions of vividness and presence than a regular two-dimensional video which makes it a potential tool for a marketing communications (Van Kerrebroeck et al., 2017). It is important to state that in this study the focus will be on a desktop VR device rather than a mobile VR device.

2.4 How game players perceive in-game advertising

Compared to the traditional media like films and television, games can offer a unique opportunity for consumers by enabling a true immersion and interactivity which other mediums lack to do so (Vorderer, 2000). It is proven that immersion and interactivity leads to an increased sense of presence (Steuer, 1992) in addition to overall positive attitudes towards the product (Thorbjørnsen, 2002). Media analyst Screen Digest says that in-game advertising is growing rapidly which makes it an impossible media for brands to ignore and is predicted to be a billion dollar industry in the near future (Durrani, 2009). Some studies have been conducted to find out the effectiveness of in game advertisements but not much has been done on how players experience them. Studies show that consumers do not passively just absorb advertisements but they rather evaluate the attempts that advertisers are trying to persuade them (Hirschman and Thompson, 1997). This is displayed on the Persuasion Knowledge Model (PKM) created by Friestad and Wright created and assumes that when targets(e.g consumers) are exposed to persuasive information created by the persuasive agents they will carry out strategies and in order to response and defend against the persuasion attempts (Friestad and Wright, 1994). Nelson investigates a game player's perception of real vs fake brands. A survey of gamers were tested using empirical tests and netnography observations. Results showed that brands that lead realism to the game are not always accurate. In certain games realism could be highly increased with the use of real brands , but on the other hand it might be advantageous to offer fake/spoof brands or no brands at all (Nelson et al., 2004). Yang did a study on implicit and explicit memory for in game brands placed using a word-fragment test and a recognition task (Yang et al., 2006). Results reported low scores on explicit memory but higher scores on implicit. The results are a proof that in game advertising affects both implicit and explicit memory and suggests that implicit memory lasts longer than explicit and can positively affect player attitude towards IGA. Another interesting study about in game advertising was conducted by Raatikainen who tried to use in game advertising effectively without interfering with players' experience. He built a theoretical model to measure and analyze dynamic in game advertising in 3D games with the purpose of finding an optimal balance between gameplay experience and advertising (Raatikainen, 2012). A recent study tried to examine how identical games played in 2D, stereoscopic 3D and HMD Virtual Reality differ and the results

confirmed that VR can increase the sense of presence but neither arousal nor attitude towards the video game differed (Roettl and Terlutter, 2018). Previous in-gaming advertisements were limited mostly to direct partnerships between the developers and a brand but now with new technological advancements is possible for developers to host dynamic campaigns that include a variety of brands and that is why for this study we will include a variety of brands within the same environment

3 METHOD

To be able to examine if VR game interaction matters on in-game familiar and unfamiliar brands a user study had to be performed. This study was performed using the literature study material as a basis but mostly through a lot of early prototype iterations. The VR applications were built from scratch using the Unity Game Engine. The Virtual Environment was a virtual city created using low poly graphics. The city included buildings, roads, vehicles, trees and others to try and give the user a realistic city environment. The user task was to walk through the virtual city and locate the football stadium with no guidance from the researcher. The design of the environment was build in such a way to ensure that all the users followed the exact same path to reach the stadium (Figure 2); to achieve this some roads were blocked with cones and roadblocks to avoid users trying to take shortcuts and to reassure that everyone will pass through the same billboards. There are different ways to design a user study, e.g. the participants could be divided into independent groups where the test has two or more conditions with different people in each condition; the repeated/related measures approach where the same individuals participate in two or more conditions; or the matched pairs approach where there is different people in each condition but they are selected to be of e.g. similar background, age, gender and social background (Mackay et al., 2009). In order to answer the research question accurately a 2x2 between-subjects (between-groups) study design was created. Which means I had two different independent variables with two subgroups each. The first independent variable was the type of advert (familiar and unfamiliar adverts). The second independent variable was the type of game interaction possibilities between low (only be able to walk around) and high (be able to walk around and also able to shoot vehicles). Great emphasis was put into selecting which specific brands to use as familiar brands for this study. To decide which brands to include and exclude from the study a survey was created in which it featured twenty well known brands with a fairly simple brand design (plain logo and single colour background) and asked participants to rank them from the most known to the least known brands. Based on the set of respondents' answers I was able to produce a familiar brand pool to use as a basis on the study. Before conducting the actual experiment, several pilot experiments were performed to make sure that the VR application was bug free, not causing motion sickness, working as intended as well as to make sure that useful data was collected out of the questionnaires. The first questionnaire was a pre-experiment questionnaire to gather background variables, followed by post experiment questionnaires regarding sense of presence, memory recall and recognition. The pre-experiment questionnaire asked questions regarding the participants demographics like age, gender and education as well as previous experience with VR. After the participants were done with the experiment a presence questionnaire based on Igroup [2] was given to fill out. In addition there was another questionnaire to measure participants' brand recall and brand recognition of brands that were included in the experiments in the form of billboards and posters throughout the virtual city. The participants were informed about the purpose of the study and that they were going to be tested on their memory only after all the questionnaire were filled out. The reason behind this was to prevent participant bias. I didn't want participants to treat the experiment as some sort of competition by trying to perform the best they could on it. I wanted to test out how people will respond to it in a natural manner rather than ruining the experience for them by actively trying to memorize what they saw. After the study was carried out, the results were analyzed.

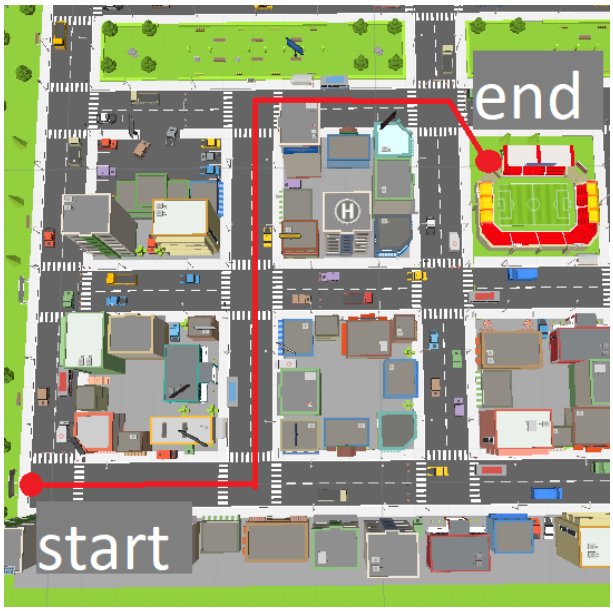

Figure 2: Top down view of the game objective path from start to finish.

[2]http://www.igroup.org/pq/ipq/download.php

3.1 Experiment Design

This was a between-subject design experiment of two independent variables with two subgroups each. This approach was chosen in order to avoid order effects. Based on the research framework and the pilot study results four game versions were created to investigate the impact of VR game interactions on user's brand memory on familiar and unfamiliar brands. The participants were randomly exposed into one of the four versions as seen on Figure 3.

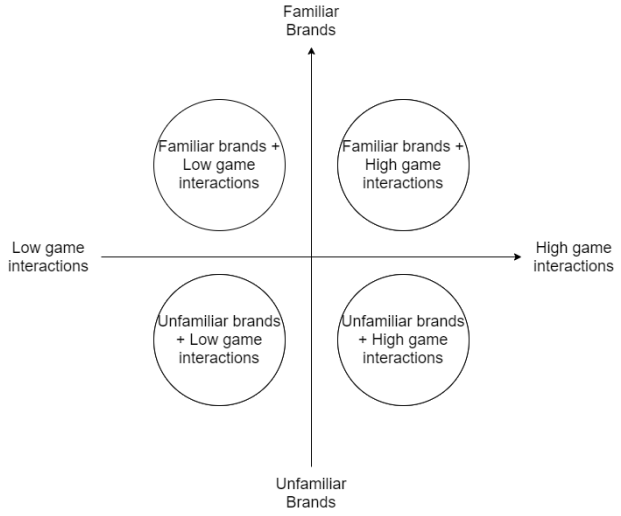

Figure 3: Diagram of the 2 (familiar/unfamiliar brands) x 2 (high/low game interactions) between subject design.

3.2 Participant recruitment

The participants of this experiment were mostly recruited from a Stockholm meetup group named "Test my Product" where entrepreneurs, product managers, and User experience people both give and get feedback on each other's products or prototypes. For the recruitment of this study, a target group of potential participants was created. One of the requirements was that all participants needed to have no considerable sight problems that could have interfered with being able to use the HMD comfortably. In addition to not having any physical movement system impairment limitation that they could limit them for moving in the Virtual environment. It was equally important to find participants that have used VR before at least once and considered themselves as VR enthusiasts. This was important to know that the results will be free from novelty effects due to their previous experience with Virtual reality devices.

3.3 Setup

The experiment was conducted using the Acer's (AH101-D8EY) Windows Mixed Reality Headset and Logitech G231 gaming headset for the background music. The headset has display size of 2.89 inches x 2 and resolution of 2,880 x 1,440 (1,440 x 1,440 per eye) and enables room tracking with 6DOF and field of view of 100 degrees [3]. The Head mounted display was used with the gaming laptop Lenovo Legion Y720 (VR-Ready) which is powered by 7th Gen Intel Core processors along with NVIDIA GeForce GTX 1060 discrete graphics and Windows 10. The decision behind this HMD and laptop combination was that it was easier for me to transport around and easy to set up to various locations. The reason I managed to recruit a lot of participants was that I could conduct the experiment independent of the location. The experiment was developed using the Unity 2018.4.14 version along with the 2.2.0 SteamVR plugin.

3.4 Procedure

Each experiment lasted around 20 minutes and involved all the steps as they are listed below: Welcome and Introduction to the Procedure (2min) 2. Participant Consent Form (1min) 3. Pre-Experiment Survey (3min) 4. Introduction to the Experiment (2min) 5. Practice Session (2min) 6. Experiment Session (4min) 7. Post-Experiment Questionnaires (6min). When the participants entered the experiment room they were welcomed and briefly introduced to the study procedure. After reading and signing the participant consent form and asked any relevant questions, the participant was asked to fill in the pre-experiment survey that collected demographic and educational information as well as previous VR experience. After that instructions were given about the game objective and game controls. Then the participant was guided through a short two-minute practice session of an ad free version of the game with a plain white background. The aim behind this was to familiarize all participants with the game controls and give them some time to adjust the HMD on their head. This was a crucial step to make sure that all participants will conduct the experiment under the same conditions. When the participants were comfortable with the game controls then they were introduced to the VR game. There was no pressure on the time limit for the participants to complete the game objective. It was clear from the start that no communication with the researcher was allowed once the experiment had started. This was to make sure that participants could focus on the game itself and not get distracted from external sources. Afterwards participants had to fill out the post experiment online questionnaires on a separate laptop where they independently answered all the questions and asked if something was not cleared to them. Before leaving the study the participants were thanked for their time investment.

[3] https://www.acer.com/ac/en/US/content/model/VD.R05AP.002

3.5 Sense of Presence

Likert-scale questionnaires were used to measure the sense of presence. The Sense of presence was measured by a modified version of the Igroup Presence questionnaire. "While this immersion is a variable of the technology and can be described objectively, presence is a variable of a user's experience, therefore, we obtain measures of the sense of presence from subjective rating scales" [4]. The Igroup Presence Questionnaire (IPQ) is constructed using a large pool of items in addition to two surveys with about 500 participants and is used as a scale for measuring the sense of presence experienced in a Virtual Environment. The original version of the IPQ has three different sub-scales and one additional general item that does not belong to a sub-scale. The three sub-scales emerged from principal component analyses and are the Spatial Presence, Involvement and Experienced Realism with the additional item that assesses the general "sense of being there". The original version had been modified and broke down to fewer questions to meet the goals of this study. The experienced Realism sub-scale was completely removed since the game was based on low poly graphics and measuring realism was out of the scope of this study. The participants after they were done with the experiment they were asked to complete seven questions a one to five Likert-scale questionnaire. Three of the questions were measuring Involvement (measuring the attention devoted to the Virtual Environment and the involvement experienced), two of them measuring Spatial Presence (the sense of being physically present in the Virtual Environment), one of them measuring the general one "sense of being there" and one last one that measured the overall enjoyment of the game.

3.6 Brand selection

The selection of familiar brands that were used on this study was based on a questionnaire that I created and asked participants to rank twenty brands from the most recognisable to the least recognisable brands. The questionnaire was filled out by 20 participants and the top six brands were selected for the study. The six brands selected were Samsung, AirBnB, McDonalds, Uber, BMW and Adidas. It was crucial to make sure that all the participants who were involved in the familiar brand experiment were familiar with the brands prior to the experiment but that was not possible since I couldn't inform them about the purpose of the study before all the questionnaires have been filled in. In order to tackle this problem everyone that was involved with the familiar brand versions had to answer honestly if they knew about the six familiar brands prior the experiment and if someone didn't I had to discard their data and not take them into consideration for the analysis. For the unfamiliar brands I created ten fictional names and logos myself which the six were used as in-game advertisements and the other four as foils for the aided brand awareness questionnaire. I designed them all to look "simple" by using only one colour for the background and having the logo and name in the center with a different colour. This helped to keep consistency between familiar and unfamiliar logos and avoid bias.

Figure 4: Fictitious Brand 'Whaleet' in 2D and 3D space.

3.7 Brand Recall

Similar to previous studies (Mackay et al., 2009) (Sreejesh and Anusree, 2017) (Sreejesh et al., 2018) (Vashisht and Royne, 2016) (Walsh et al., 2008) (Nelson et al., 2006) brand recall was measured by asking participants to list all brands they remembered seeing while playing the game. Recall was a dichotomous variable (i.e. recall or no recall). In line with prior studies (Coker and Altobello, 2018) (Jin, 2003) (Lee and Faber, 2007), a brand recall metric was created. The unaided questionnaire came after the sense of presence questionnaire and wanted to test the participants if they remembered the brand names without a prompt. This was done by having an empty box and asking participants to write down as many brands as they remember that they encounter throughout the game; the highest recall score possible was six and the minimum zero.

3.8 Brand Recognition

Brand recognition was measured by presenting participants a list of ten possible brands. Participants were then asked to answer by yes/no whether each of the brand names appeared or not in the video game they played . This is a consistent method used in previous studies (Herrewijn and Poels, 2015). Out of the ten brands presented to participants, only six had actually appeared in the game and the remaining brand names were foils . The highest possible recognition score was six and the minimum zero. Such a procedure only considers correct answers and controls for false reporting. For example, selecting the foil brand Coca Cola does not increase brand recognition.

[4]http://www.igroup.org/pq/ipq/index.php

3.9 Pilot study

For the pilot study the Rapid Iterative Test and Evaluation (RITE) method was used. The RITE method is a usability test in which changes can be made after each participant (Medlock et al., 2002). With the RITE method data were analysed after each participant had finished with the pilot testing and changes to the game itself happen as soon as the problem is identified and the potential solution is clear. Finally the game with the new changes is tested with the subsequent participant to check if the changes made a difference without introducing any new problems. If we compare RITE testing versus standard usability testing it is proved that when used in an appropriate context the RITE usability test results in a number of advantages, one of them is that issues get fixed in a shorter period of time (Medlock et al., 2002). The responsibility for both the development and design of this study was entirely on me so I could apply the changes needed as soon as they were identified.

Figure 5: List of all twelve familiar and fictitious brands used as in-game advertising billboards.

4 RESULTS

4.1 Background results and Demographics

The pre-experiment survey was used for collecting people's demographic data, educational background and experience related to Virtual Reality devices. In a three week period, 40 people participated in the study in which 23 (57.5%) of them were male and 17 (42.5%) were female. The average age was 28 years old and the median was 26 while 85% of them were bachelor degree holder's and above. Regarding the level of computer game experience and the level of video game experience (on PC, mobile, web, console etc.) the average was 4 and 3 respectively. As for the VR experience all 40 participants have used VR Head Mounted Display at least once in their lifetime.

4.2 Time Spent

For this study there was no time limit of completing the game, so participants were advised to take as much time as they needed to explore the Virtual Environment in order to locate the stadium. There was a certain path that everyone had to walk through in order to find the objective, this made it easier for me to estimate the time that participants will spend. Thus during the pilot testing phase I tried to adjust the environment and the path to make it last roughly 2 minutes. The average time that all 40 participants spent on the experiment excluding the practice was 162.5 seconds and the median 163 seconds. The average time of those who participated in the restriction to walking only with unfamiliar brands was 144.9 seconds and the median 147.5 while the ones with the familiar brands took 147.8 seconds on average and the median was 150.2. Whereas the average time on those who participated on the walking/shooting with unfamiliar brands version was 168.4 seconds and the median 175.5 while the ones with familiar brands took 189.2 seconds on average and the median was 175 seconds.

4.3 Sense of Presence and Overall Enjoyment

From the Igroup's Presence Questionnaire (IPQ) responses the overall average was 3.49 which is considered on the upper scale of the 5 point Likert Scale. This answer is created by compiling all the subscales of the questionnaire together by all the results on all four versions of the experiment which indicates that most participants felt highly present in the Virtual Environment. In addition to this the overall enjoyment of the game was high with an average of 3.8 and a median of 4 on a 5 point scale. The results of the three questions that were measuring Involvement (measuring the attention devoted to the Virtual Environment and the involvement experienced) had an average and median of 3. Moreover the results of the two of the two questions measuring Spatial Presence (the sense of being physically present in the Virtual Environment) had an average of 3.7 and a median of 4. Last question that was measuring the general "sense of being there" had an average of 3.8 and a median of 4. The average sense of presence of those who participated on the restriction to walking only with unfamiliar brands version was 3 and the overall enjoyment 3.3; whereas the ones who did the same but with the familiar brands had an average of 3.2 on both sense of presence and overall enjoyment. On the other hand the average sense of presence of those who participated in the walking/shooting with unfamiliar brands was 4 and the overall enjoyment was 4.3 whereas the ones who did the same but with the familiar brands had an average of 3.5 and 4.3 on sense of presence and overall enjoyment respectively. On the question "I would have enjoyed the game more if:" most people answered that they liked the game as it was

with few exceptions from the low interaction group who said they would have preferred if the game didn't include any adverts at all. It's also worth mentioning that on the question "What is your opinion about the adverts in regards to your game experience? Were they intrusive or seamless? Did they affect your game experience positively or negatively in any way?" most people found them seamless and non intrusive. One said "I found them seamless like in the real world. Well I think they make the game more real which means i feel more sense of embodiment." and someone else said "I am so used to being bombarded by logos so I just disconnected them and had fun playing". As expected the people who found them intrusive were only from the familiar brand versions.

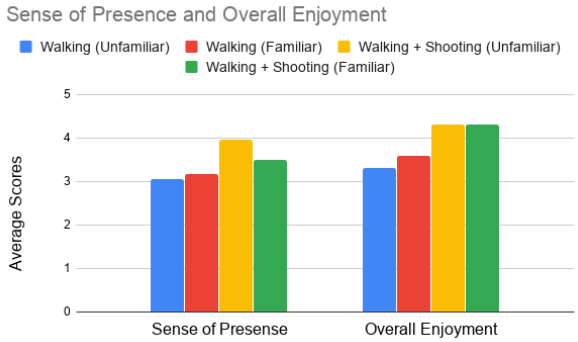

Figure 6: Average scores of all participants for Sense of Presence and Overall Enjoyment.

4.4 Brand recall

The unfamiliar brand recall results show that in the low interactivity version (walking only) people could recall more brands than those in the high interactivity version (walking and shooting) but none manage to recall all 6 fictitious brands. The mean score of the low interactivity version was 2.7 while the median was 3 and for the high interactivity version the mean was 0.9 and the median was 1. When it comes to standard deviation for the low and high interactive versions it was 0.82 and 0.87 respectively. The familiar brand recall results show that in the low interactivity version (walking only) people could recall more brands than those in the high interactivity version (walking and shooting) but the difference is much smaller than the previous results. The mean score of the low interactivity version was 3.7 while the median was 4 and for the high interactivity version the mean was 4 and the median was 2. When it comes to standard deviation for the low and high interactive versions it was 0.67 and 0.97 respectively.

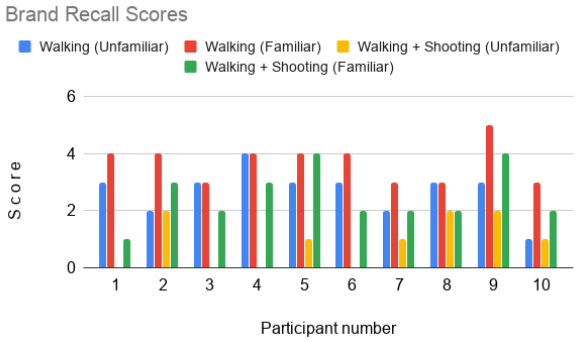

Figure 7: Brand Recall overall scores. Brand recall was higher on both low interaction game versions that included familiar and the unfamiliar brands.

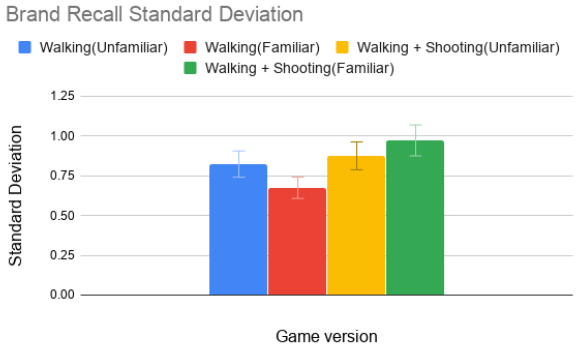

Figure 8: Standard Deviation bars of brand recall scores. Walking versions of both familiar and unfamiliar brands have the lowest standard deviation.

4.5 Brand recognition

The unfamiliar brand recognition results show that in the high interactivity version (walking and shooting only) people could recognise more brands than those in the low interactivity version (walking only) but none manage to recognise all 6 fictitious brands. Both the mean and median score of the low interactivity version was 4.5 and for the high interactivity version the mean was 4.9 and the median was 5. When it comes to standard deviation for the low and high interactive versions it was 1.08 and 1.29 respectively. The familiar brand recognition results show that in the high interactivity version (walking and shooting only) people could recognise more brands than those in the low interactivity version (walking only) but none manage to recognise all 6 brands. The mean score of the low interactivity version was 2.1 while the median was 2 and for the high interactivity version the mean was 2.4 and the median was 2.5. When it

comes to standard deviation for the low and high interactive versions it was 0.99 and 1.43 respectively.

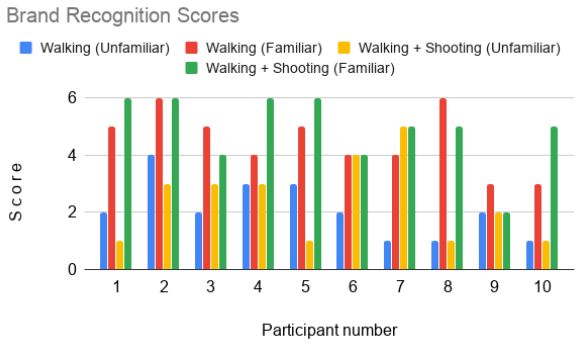

Figure 9: Brand Recognition overall scores. Brand recognition scores were slightly higher on both high interaction game versions that included familiar and the unfamiliar brands.

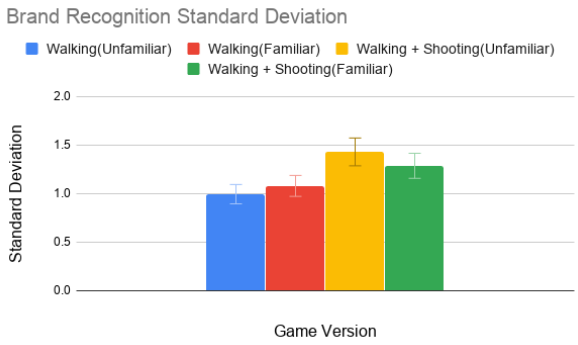

Figure 10: Standard Deviation bars of brand recognition scores. Walking versions of both familiar and unfamiliar brands have the lowest standard deviation.

5 DISCUSSION

The purpose of this study was to evaluate static advertisements in a VR environment through the lenses of developers, advertisers and end-users. Based on the research question "how can Virtual Reality game interactions affect user's sense of presence and brand awareness in relation to familiar and unfamiliar in-game adverts?" the results show that users that have the option to interact more with the VR environment can have a slight increase in their sense of presence as well as their recognition to both familiar and unfamiliar brands.

5.1 Time Spent

The results on how much time each participant spent in the VE showed that people who participated in the shooting/walking game version spent significantly more time to complete the task than those who were restricted only to walking. This was expected since they had more gaming interaction options to explore with (e.g. shooting vehicles). It is also worth mentioning that participants who experienced the game versions that included familiar brands have spent more time in the VE than those who only seen the unfamiliar/fictitious brands. This was also expected if you consider strong brands like Uber and AirBnB will most likely attract player's attention compared to fictitious brands which have never interacted with before.

5.2 Sense of Presence and Overall Enjoyment

The results show that there is a significant increase on the overall enjoyment and sense of presence of the users who participated on the shooting/walking game on both the familiar and unfamiliar version. This was expected if you consider that users had more options to interact with their environment and their surroundings which made them more engaged in the game and less aware of the physical environment.

5.3 Brand Awareness

Based on Figure 7 and Figure 8 we can draw some conclusions regarding the brand recall. As expected the brand recall of the unfamiliar brands was low and none managed to score all the brands without aid. It's important to mention that in most of the cases participants from the walking only interaction have scored higher than those who had the possibility to shoot as well. Brand recall scores on familiar brands were higher than the unfamiliar ones but still none of the 20 participants managed to score all six of the brands included in the game. Again all participants on the walking only interaction had the same score or higher than those who has the possibility to shoot as well. If we look at Figure 9 we can see some differences between the two versions regarding brand recognition. The brand recognition of the unfamiliar brands was obviously higher than the brand recall one but still none managed to score all correctly all of the six brands. When it comes to brand recognition of familiar brands the participants that were involved in the walking/shooting versions scored higher in most of the cases compared to those who could only have the possibility to walk. It's also worth mentioning that 4 out of 10 of them have managed to recognise all 6 brands.

5.4 Users, Advertisers and Developers Perspective

In this section we will discuss what our results mean in the perspective of the advertisers, users and developers. From the user perspective, the overall game enjoyment and sense of presence score was high on all four versions. As expected users have felt more immersed in the high interaction versions and the enjoyment was slightly higher than those who were restricted to only a walking interaction. Most users have found the adverts seamless and said that they feel well with the environment of a virtual city but few found the familiar brands intrusive and distracting them to focus on the main game objectives. No users had any problems with seeing the unfamiliar brands as distracting or intrusive. From the advertisers perspective the results show that with higher game interaction comes higher brand recognition and higher user experience. This does not necessarily prove that the more game interactions a developer adds to the game users will score higher on the brand recognition tests. In this game the minimum game interactions were one (walking) and the maximum two (walking and shooting). Having too many game interaction options for the user might overload the working memory and end up in a negative experience instead. On the developer's point of view the results show that adding in-game brands in the form of billboards or posters in their VR game in most cases does not affect the overall game experience of their users. Some users are biased towards specific familiar brands and can affect their opinion about the game in a more positive or negative way. Based on the results the advertisements worked well in this specific game genre of adventure/exploration with the theme of a virtual city but does not mean it will work well in other contexts.

5.5 Method Critique

A contributing factor that lead to such low scores overall on brand recall can be due to the fact that participants were focused on the game objective even though there was no time limit. This made a lot of participants to think that this experiment was some sort of competition on who will be the faster to complete the objective. It is worth mentioning that each version of the game was played only once by each participant and no one had to do the experiment twice. Even though the game by nature was an exploration game, the game objective was relatively easy to spot which made it hard for users to lose focus of the task. It is possible that if participants had a prolonged game session or a repetitive experience would lead to higher brand memory scores. One of the reason that the overall enjoyment of the game had such high scores can be related to the research setting itself. All of the participants were aware that they were participating in a research study for a thesis paper and could guess that I created the whole thing by myself. Even though that all data were anonymous still people wanted to give high scores. When it comes to unfamiliar brands it's difficult to guess which brands are commonly unfamiliar to all of the participants so the only choice was to create fictitious brands. This lead to Inattentional Blindness with participants failing to notice a fully-visible, but unexpected object because attention was engaged on the game objective.

5.6 Limitations and Future Research

There are few limitations about this study that should be listed. First we used only one type of video game for this study. Future research should examine the impact of in game advertising on other genres like role playing, racing. fighter, etc. It would be interesting to see a similar study on different cross reality platforms as well; Mixed Reality or Augmented Reality. Will the results differ if the users experience advertisements in context of being in a mixed of both real and virtual world? Another limitation was that I was limited on how much hardware power I had available to work on. Future research can involve this research on newer VR devices that remove the potential restrictions that are coming from the hardware. New Head Mounted displays can support top tier graphics and even more interactions that can create more immersion to the player without being laggy and causing motion sickness. It would also be interesting to redo the study but instead of using the controllers to walk around the virtual city to use an omnidirectional treadmill instead.

6 CONCLUSIONS

The conclusions that we can draw out of this study is that low game interactions can make the game less immersive and rather boring no matter if the advertisements that are included in the game are familiar or unfamiliar to the user. It is also worth mentioning that low game interactions lead to higher brand recall scores on both familiar and unfamiliar brands while high game interactions lead to slightly higher sense of presence and brand recognition scores. In this study the low interaction versions included only one interaction which was walking and the high interaction versions had only two which was walking and shooting which for some is still considered low. We can not draw any conclusions that the more interactions we add into a VR games will always lead to higher brand recognition scores.

ACKNOWLEDGMENTS

I would like to thank my supervisor Christopher Peters for his amazing support throughout the full cycle of this thesis. I would also like to thank Adverty AB who provided me with the lab rooms as well as all the necessary equipment (Laptop and Head Mounted Display) to conduct this experiment.

REFERENCES

B. Berki. 2d advertising in 3d virtual spaces. *Acta Polytechnica Hungarica*, 15(3):175–190, 2018.

A. Besharat, A. Kumar, J. R. Lax, and E. J. Rydzik. Leveraging virtual attribute experience in video games to improve brand recall and learning. *Journal of Advertising*, 42(2-3):170–182, 2013.

V. Cauberghe and P. De Pelsmacker. Advergames. *Journal of advertising*, 39 (1):5–18, 2010.

H. Chen and Y. Wang. Product placement in virtual reality videos from the perspective of dialogic engagement. *Journal of Interactive Advertising*, 19(2):133–147, 2019.

K. K. Coker and S. A. Altobello. Product placements in social settings: The impact of coviewing on the recall of placed brands. *Journal of Business Research*, 87:128–136, 2018.

L. De Gauquier, M. Brengman, K. Willems, and H. Van Kerrebroeck. Leveraging advertising to a higher dimension: experimental research on the impact of virtual reality on brand personality impressions. *Virtual Reality*, 23(3):235–253, 2019.

A. Durrani. Screen digest forecasts 1 bn boom for in-game advertising. *Brand Republic*, 26, 2009.

M. Friestad and P. Wright. The persuasion knowledge model: How people cope with persuasion attempts. *Journal of consumer research*, 21(1):1–31, 1994.

D. M. Grigorovici and C. D. Constantin. Experiencing interactive advertising beyond rich media: Impacts of ad type and presence on brand effectiveness in 3d gaming immersive virtual environments. *Journal of Interactive Advertising*, 5(1):22–36, 2004.

M. D. Hernandez and S. Chapa. Adolescents, advergames and snack foods: Effects of positive affect and experience on memory and choice. *Journal of Marketing Communications*, 16(1-2):59–68, 2010.

M. D. Hernandez, S. Chapa, M. S. Minor, C. Maldonado, and F. Barranzuela. Hispanic attitudes toward advergames: A proposed model of their antecedents. *Journal of Interactive Advertising*, 5(1):74–83, 2004.

L. Herrewijn and K. Poels. The impact of social setting on the recall and recognition of in-game advertising. *Computers in Human Behavior*, 53: 544–555, 2015.

E. C. Hirschman and C. J. Thompson. Why media matter: Toward a richer understanding of consumers' relationships with advertising and mass media. *Journal of Advertising*, 26(1):43–60, 1997.

H. S. Jin. Compounding consumer interest: Effects of advertising campaign publicity on the ability to recall subsequent advertisements. *Journal of Advertising*, 32(4):29–41, 2003.

M. Lee and R. J. Faber. Effects of product placement in on-line games on brand memory: A perspective of the limited-capacity model of attention. *Journal of advertising*, 36(4):75–90, 2007.

T. Mackay, M. Ewing, F. Newton, and L. Windisch. The effect of product placement in computer games on brand attitude and recall. *International journal of advertising*, 28(3):423–438, 2009.

V. Mallinckrodt and D. Mizerski. The effects of playing an advergame on young children's perceptions, preferences, and requests. *Journal of advertising*, 36(2):87–100, 2007.

J. Martínez-Navarro, E. Bigné, J. Guixeres, M. Alcañiz, and C. Torrecilla. The influence of virtual reality in e-commerce. *Journal of Business Research*, 100:475–482, 2019.

M. C. Medlock, D. Wixon, M. Terrano, R. Romero, and B. Fulton. Using the rite method to improve products: A definition and a case study. *Usability Professionals Association*, 51, 2002.

P. Milgram and F. Kishino. A taxonomy of mixed reality visual displays. *IEICE TRANSACTIONS on Information and Systems*, 77(12):1321–1329, 1994.

E. S. Moore and V. J. Rideout. The online marketing of food to children: is it just fun and games? *Journal of Public Policy & Marketing*, 26(2):202–220, 2007.

M. R. Nelson, H. Keum, and R. A. Yaros. Advertainment or adcreep game players attitudes toward advertising and product placements in computer games. *Journal of Interactive Advertising*, 5(1):3–21, 2004.

M. R. Nelson, R. A. Yaros, and H. Keum. Examining the influence of telepresence on spectator and player processing of real and fictitious brands in a computer game. *Journal of Advertising*, 35(4):87–99, 2006.

J. A. Paradiso and J. A. Landay. Guest editors' introduction: Cross-reality environments. *IEEE Pervasive Computing*, 8(3):14–15, 2009.

O. Raatikainen. Dynamic in-game advertising in 3d digital games. *Nordicom Review*, 33(2):93–102, 2012.

J. Roettl and R. Terlutter. The same video game in 2d, 3d or virtual reality–how does technology impact game evaluation and brand placements? *PloS one*, 13(7):e0200724, 2018.

M. V. Sanchez-Vives and M. Slater. From presence to consciousness through virtual reality. *Nature Reviews Neuroscience*, 6(4):332–339, 2005.

S. Sreejesh and M. Anusree. Effects of cognition demand, mode of interactivity and brand anthropomorphism on gamersâĂŹ brand attention and memory in advergames. *Computers in Human Behavior*, 70:575–588, 2017.

S. Sreejesh, M. Anusree, and A. Ponnam. Does game rules work as a game changer? analyzing the effect of rule orientation on brand attention and memory in advergames. *Computers in Human Behavior*, 81:325–339, 2018.

J. Steuer. Defining virtual reality: Dimensions determining telepresence. *Journal of communication*, 42(4):73–93, 1992.

K.-S. Suh and Y. E. Lee. The effects of virtual reality on consumer learning: an empirical investigation. *Mis Quarterly*, pages 673–697, 2005.

H. Thorbjørnsen. Building brand relationships online: the role of interactivity, realtionship motives and internet experience. 2002.

W. Tina and K. Buckner. Receptiveness of gamers to embedded brand messages in advergames: Attitudes towards product placement. *Journal of Interactive Advertising*, 7(1):3–32, 2006.

H. Van Kerrebroeck, M. Brengman, and K. Willems. When brands come to life: experimental research on the vividness effect of virtual reality in transformational marketing communications. *Virtual Reality*, 21(4): 177–191, 2017.

D. Vashisht and M. B. Royne. Advergame speed influence and brand recall: The moderating effects of brand placement strength and gamersâĂŹ persuasion knowledge. *Computers in Human Behavior*, 63:162–169, 2016.

P. Vorderer. Interactive entertainment and beyond. 2000.

M. K. Waiguny, M. R. Nelson, and R. Terlutter. Entertainment matters! the relationship between challenge and persuasiveness of an advergame for children. *Journal of Marketing Communications*, 18(1):69–89, 2012.

P. Walsh, Y. Kim, and S. D. Ross. Brand recall and recognition: A comparison of television and sport video games as presentation modes. *Sport Marketing Quarterly*, 17(4), 2008.

Y. Wang and H. Chen. The influence of dialogic engagement and prominence on visual product placement in virtual reality videos. *Journal of Business Research*, 100:493–502, 2019.

K. Wise, P. D. Bolls, H. Kim, A. Venkataraman, and R. Meyer. Enjoyment of advergames and brand attitudes: The impact of thematic relevance. *Journal of Interactive Advertising*, 9(1):27–36, 2008.

M. Yang, D. R. Roskos-Ewoldsen, L. Dinu, and L. M. Arpan. The effectiveness of" in-game" advertising: Comparing college students' explicit and implicit memory for brand names. *Journal of Advertising*, 35(4):143–152, 2006.

TRITA -EECS-EX-2020:478