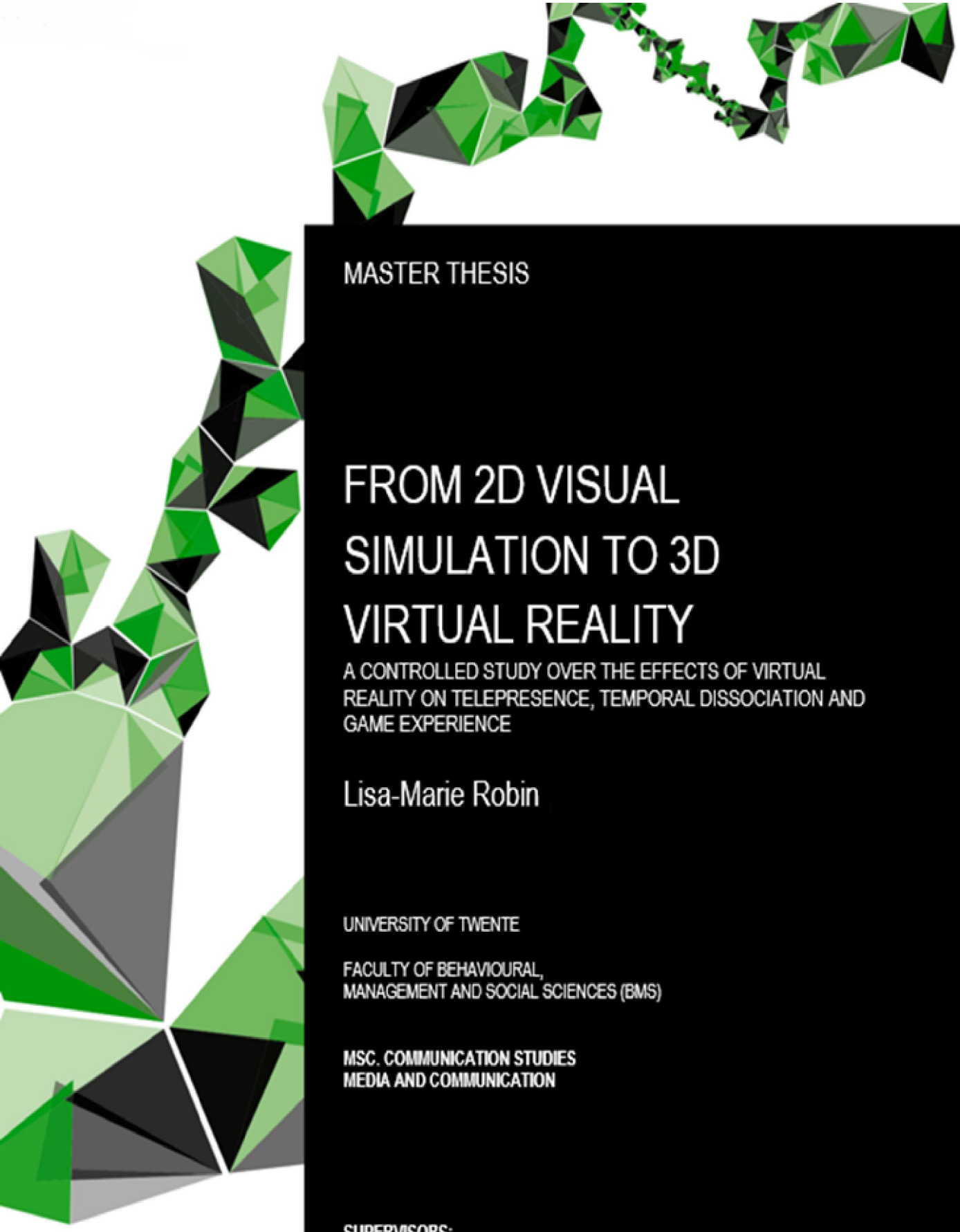

MASTER THESIS

FROM 2D VISUAL SIMULATION TO 3D VIRTUAL REALITY

A CONTROLLED STUDY OVER THE EFFECTS OF VIRTUAL REALITY ON TELEPRESENCE, TEMPORAL DISSOCIATION AND GAME EXPERIENCE

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Foreword

As I began to contemplate and plan writing my master thesis in the context of graduating from the University of Twente in Enschede with the course Media and Communication, I did not have to think long about the general topic I wanted to take a closer look at. Being enrolled in the subject "Research Topics", I began to develop interest into emotional and social responses towards interactive technologies. By virtue of the fast developing and spreading new technologies supporting Virtual Reality, it was not only interesting for my course of study, which new opportunities are offered with regard to the educational sector, but also appealing to my personal interests respecting the area of entertainment. I was always interested in the evolution of new media and how these are capable of influencing human beings. Furthermore, I heard of people who spend day after day, year after year, plenty of time in virtual worlds, while the sum of this time spent in unreal environments amounts to a few years. I asked myself whether new technologies offering computer graphics which are almost not distinguishable with the surroundings we know can lead to an increasing period of time being mentally present in virtual realities.

That is why I was deeply satisfied as I heard that the University of Twente gave me the chance to further examine this area of interest. This master thesis is the result of an intensive period which I completed with full contentment.

Thanks to abundant people around me, I was finally able to realize this thesis. First, I want to thank my two supervisors Dr. Joyce Karreman and Dr. Alexander van Deursen who took care of this project and who constantly granted me flexibility. Their expertise and instructive critique surely supported the quality of this research. Moreover, I want to thank Dr. Maartje de Graaf, who was originally the supervisor for the current thesis, but unfortunately, she was not able to supervise the whole project due to her move to the U.S.A. She gave me the strength and the self-confidence to make this venture concrete. Without the cooperation of all these experts, this research would not have been accomplished.

In the end, I want to thank my family, friends and boyfriend who always supported me. Thanks to their support, love and understanding, primarily in the stressful moments, it was possible to finally complete my study.

Lisa-Marie Robin
Hamburg, December 2017

Abstract

Background: Virtual Reality serves as influential discipline in creating intense gaming experiences. Those intensities could lead to deep involvements in the medium itself and lead to an ignorance of the actual physical settings. Such a deep involvement is characterized by the emotional state called telepresence. There are certain consequences, often associated with risks, like a distortion of time administration in gamers' minds. However, the recent literature still contains little information about the fallouts of virtual reality in gaming environments.

Purpose: The goal of this study was to analyze the potency of using a virtual reality technology leading to the sense of being in the environment generated by the medium, which is called *telepresence*. Furthermore, this study aims to discover whether people perceive time as distorted while being fully immersed in virtual worlds. Ultimately, the study should gain more insight into specific and general gaming experiences by means of virtual reality.

Method: Following a between-subjects design with one evaluation moment, 50 subjects were randomly assigned to an experimental or control condition. On the one hand, the experimental group consisted of a 30-min session in which participants were exposed, with the help of a virtual reality headset, to a virtual environment of the game X-Racer to induce the state of telepresence, having an intense gaming experience and to manipulate their sense of time. On the other hand, the control group played X-Racer with a laptop. After the experimental gaming sessions, questionnaires were handed out and an interview was held.

Results: Overall, results showed significant differences between the two groups concerning telepresence and temporal dissociation. Game experiences including senses of immersion, flow, challenge, positive affect and returning to reality also had significant effects on virtual reality. However, game experiences with reference to competence, negative affect and tension/annoyance did not show significant differences between the experimental and control condition.

Conclusion: In line with previous studies, the experiment demonstrated that the adoption of virtual reality was successful in inducing the perception of actually "being there" – being in the virtual environment a technical device has created. Moreover, participants using a VR headset also experienced a distortion of time perceptions. However, it is assumed that, due to the simple structure of the game X-Racer and the brevity of the experimental session, the gaming experience concerning competence, negative affect and tension/annoyance did not differ between the two conditions. For future research it is suggested to conduct multiple gaming sessions with a more demanding video game applying virtual reality.

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1. Introduction

Nowadays, human interaction is able to be researched not only in our „real world“, but also in a digitalized version of what we call reality: the virtual reality. People engaging with virtual reality immerse in a sensory-rich and evocative environment. Particularly, it stands out due its ostensible authentic experience of a „sense of presence“ in the virtual environment (Difede, Hoffman & Jaysinghe, 2002). Thus, the center of attraction when paying attention to virtual reality is technological (Steuer, 1992).

Presently, individuals migrate from traditional entertainment types, like the television, to more involving and interactive technological activities. Currently, devices used to create a virtual reality (VR) experience corner the market of new media. Clearly, video games have achieved a fundamental position in today's landscape of entertainment media. The most relevant attribute, the creation of most realistic experiences bring to mind that actual theoretical accounts of media enjoyment may be reevaluated (Vorderer & Bryant, 2012). Especially, glasses which convert digital appearances into individual experiences are entering the social media, movie and gaming industry. VR headsets, or Head Mounted Displays (HMDs) play a vital part for the virtual reality experience. Thereby, the venerable ambition to establish new technological devices in order to conquer limited human sensory channels is currently on its way of becoming realized. Simultaneously, it portrays the "major impetus" (Lee, 2004, p. 27) for the improvement of reality-simulation technologies (Biocca, Burgoon, Harms & Stoner, 2001; Biocca, Kim & Levy, 1995; Lombard & Ditton, 1997; Rheingold, 1991). The technology provokes a three-dimensional world while the user is capable of manipulating and self-explore the digital environment (Strickland, 2007). By being in a 360 degrees virtual world, the user obtains the feeling to be truly immersed in the prevailing setting from all angles of perception (Lemle, Bomkamp, Williams & Curbirth, 2015). Thereby, McLuhan's (1964, p. 21) definition of a medium as any "extension of man" draws nearer, due to the extensions of natural processes through technology.

The incitement about virtual reality is mostly led by the company Oculus VR, which is responsible for the Oculus Rift headset. By observing the immense enthusiasm presented for virtual reality, technologies enable the unique experience need to be further explored. Also, due to the expeditious growth of the online game business in general, it seems necessary to investigate the key factors why individuals feel the need to involve in online gaming and specifically, why they enjoy playing digital games (Wu, Li & Rao, 2008). In addition, the

activity of online gaming has reached such an enormous popularity, that the Interactive Digital Software Association reports 145 million people above 6-years-old who give attention to video games (Rau, Peng & Yang, 2006). For instance, multiplayer online games like World of Warcraft count over 11 million players worldwide (Peters & Malesky, 2008). Other, free-accessible online computer games reach 32 million registered players all around the world (Lin, Lin, Lee, Lin, Lin, Chang, Tseng, Yen, Yang & Kuo, 2015).

Virtual Reality already serves as educational technology as a result of its capabilities of simulating an understandable ambience only acknowledging information emphasizing teaching objectives (Liou, Yang, Chen & Tarng, 2017). Therefore, students achieve the chance of testing hypothetical sequences of events and investigating a virtual world conveniently (De Jong, Linn & Zacharia, 2013). Besides, VR and its technical devices are already successful for therapeutic purposes (e.g. Anderson, Zimand, Hodges & Rothbaum, 2005; Bouchard, Cote, St-Jacques, Robillard & Renaud, 2006; Difede, Cukor, Patt, Giosan & Hoffman, 2006). With behavioral therapies aiming at treating addictions, for example tobacco cessation, health care providers find in virtual reality technologies a new aid of which the content is possible to be personalized to the individual patient (Kim, Schwartz, Catacora &Vaughn-Cooke, 2016). Not only substance-based obsessions can be treated with the help of VR, but also posttraumatic stress disorder, dental phobia, flight anxiety, spider phobia and plenty more.

Virtual Reality is an applicable relief for the sole reason that the sufferers' responses build up regarding to specific actions and their ability to perform these actions (Difede et al., 2002). Also, the gaming sector starts to implement the new technology for their aspiration. As an aim, users should undergo the imagination of being "active agents" of their own experience. Definitely, being an "active agent" of one's own experience is a natural process in unmediated situations, thus "being present" in physical surroundings is taken for granted. However, in the case that communication technologies are involved, users are forced to identify two independent environments, or "realities" at the same time (Steuer, 1992).

The term which succeeds in designating the above-mentioned experience is called "telepresence". Minsky (1980) firstly contrived a description of this concept. By maintaining the possibility that human users are transported via teleoperating systems to a remote work space, they can perceive the sense of "being there". In other words, in the case that human operators perceive the feeling being physically present in a remote environment, telepresence occurs (Schloerb, 1995).

First, simple activities like racing a car and doing sports virtually were established, while

steady more and more games become open for selling compatible with Head Mounted Displays, for example: Half Life, Alien, QUAKE, Doom and as a more present example, Ark: Survival Evolved.

Owing to these facts, virtual reality succeeds in being a credible entertainment medium in its own right in contradistinction of only named as simple act of technical discovery (Aylett & Louchart, 2003). Therefore, online games appeal to have the most obsessive character (Young, 1998). According to Brian and Wiemer-Hastings (2005), online role-playing games compatible with VR technologies are categorized even as “heroin ware” by many of its users, due to its typical, habit-forming elements.

Facing these facts and the enormous popularity of PC games in general, the question raises whether users of video games are still capable of control themselves. Thus, due to its habit-forming elements it occurs that video gamers are so immersed in the world the computer creates that they forget time and place around them. What is especially likely to occur then is the risk of dissociating the own time management when dipping into virtual worlds created by technological devices transmitting virtual reality. Therefore, it seems necessary to measure the different feeling of being present in a virtual environment (VE) while users play online games in a traditional way and with a Head-Mounted-Display.

All in all, new technologies for engaging in virtual reality are entering the market while enjoying great popularity. However, researchers already discovered effects like obtaining the emotional state of telepresence and temporal dissociation for traditional gaming which could be, due to a more intensive game experience, possibly associated with VR gaming. Now it is fundamental to discover whether these consequences are attributive or if they maybe become more drastic.

The current study deals with two ways of experiencing a video game. On the one hand, a video game is experienced through a virtual reality system and on the other hand, through a 2D computer screen - the traditional way of computer gaming. Therefore, an experiment is conducted with an experimental and control condition beneficial to observe potential differences between those groups. Furthermore, after the experiment, participants are asked in an interview about their specific experiences obtained during the experimental session. Hence, this study aims with the help of both quantitative and qualitative data to demonstrate a higher sense of telepresence and a distorted sense of time, both evoked by intensified gaming experiences through 3D virtual reality compared to a virtual encounter in 2D.

Do human beings have a higher inclination towards telepresence and temporal dissociation while they undergo a profound game experience using a 3D VR system than human beings who play a video game with a 2D computer screen?

2. Theoretical Framework

The intent of the current study is to research the effectiveness of a VR system as a medium being more capable of inducing telepresence, temporal dissociation and a distant game experience than a medium which does not support VR including 3D surroundings. Besides, online games which can be used with VR technology are not examined enough yet. Furthermore, while feeling present in mediated environments is already an issue of great concern in social sciences and cyber psychology, research lacks that concentrates on new VR technology with regard to the gaming sector. Thus, the phrase "feeling present" referred to media and technology, is reformulated in the term Telepresence and describes a certain perception of equating virtual reality with the factual reality. Then, people who feel telepresent in virtual environments are susceptible to obliterate the time they spend in those mediated worlds. Moreover, the technical devices which are able to evoke Telepresence contribute to an altered experience of the events happening in the computer game. Therefore, we need to know more about the concepts addressed in this research, in order to obtain an idea whether specific effects of online gaming become more intense by higher immersion into virtual reality. Or, in other words, we need to know more about the approaches which are capable of intensifying a game experience by a technology which stimulates virtual reality compared to a technical instrument which does not arouse a 3D virtual world, although it shows the user the virtual environment in 2D.

2.1 Research Model

By way of illustration, the Research Model is displayed here presenting both independent and dependent variables. As above mentioned, the usage of two distinct technologies will be examined: a VR device stimulating 3D visuals and a non-VR tool inducing 2D computer graphics. On the one hand, "Video Game through HMD" displays the VR technology and simultaneously presents the experimental condition, and on the other hand "Video Game through 2D PC screen" demonstrates the control condition. The two groups are randomly assigned to the conditions in the interest of initial equivalence between the groups. While the division in conditions serves as independent variables, the experimental manipulation takes place here conducive to measure the outcome of the dependent variables Telepresence, Temporal Dissociation and Game Experience.

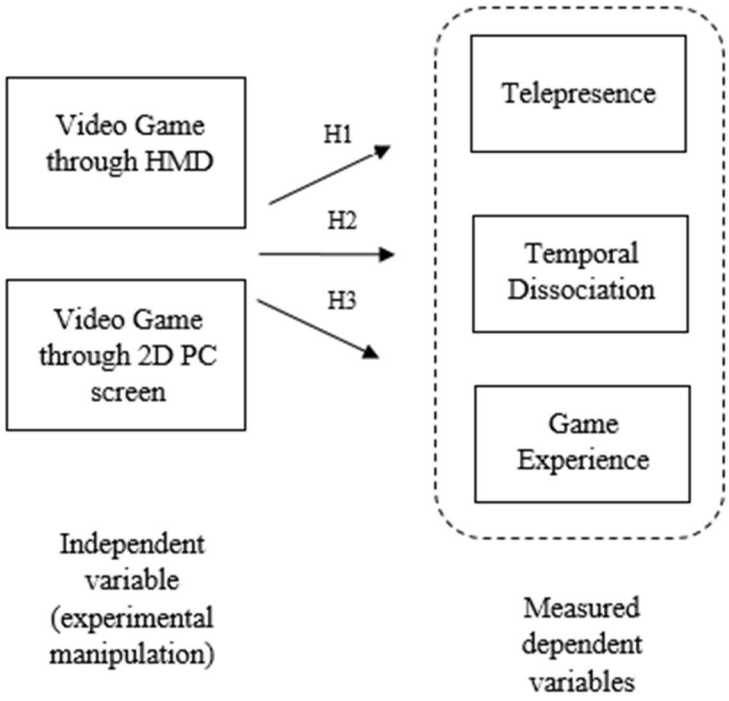

Figure 1. Research Model

In the following, the three concepts addressed in this research are examined in detail. First, the idea of the term Telepresence and its proper interpretation is outlined. Second, the specialist term of the time perception distortion, namely Temporal Dissociation, is portrayed, while it has its roots in the 1970's. Third, the relevance of an altered Game Experience through new VR technology is communicated. Additionally, all three hypotheses which go with the approaches are formulated.

2.2 Telepresence

Presence, as users' sense of "being there" in a VE, is called the psychological state that can be aroused by dipping into artificial worlds computers are capable to create (Slater, Usoh & Steed, 1994). The term telepresence belongs to the concept of mediated presence and therefore addresses a psychological state in which virtual environments or objects are experienced as actual objects (Lee, 2004; Nowak & Biocca, 2003), or as Steuer (1992) defines the term as "the experience of presence in an environment by means of communication medium" (p. 76). While experiencing telepresence, the user obtains the feeling of "being there" in the virtual

environment without recognizing where their physical body is positioned. Through this phenomenon individuals access an impression of being in a mediated environment (Held & Durlach, 1992; Steuer, 1992). Further, users believe more in virtual reality being a representation of the reality than the actual, real setting does. According to Witmer and Singer (1994), a user becomes telepresent when feeling immersed in the represented surroundings of the medium. In other words, individuals are capable of designing a misconception that includes the feeling of being present and being exceedingly occupied in a mediated world, although they are physically present in reality (Kim & Biocca, 1997).

Besides, various often broad definitions of the term telepresence exist, one is possibly the most convenient one when integrating it into VR technologies. In their research about representation systems, perceptual position and presence in immersive virtual environments, Slater and Usoh (1993) defined telepresence as temporal mistrust of people using VR systems experience themselves in another world where their real bodies are positioned. Moreover, according to Steuer (1992), a definition of virtual reality is inconceivable without involving telepresence as crucial aspect. Consequently, when attempting to research VR, it is urgent to associate telepresence whereby users are led to disbelieve in their own auditory and visual senses.

In the context of this research, highly realistic objects and interactive items provide a profound illusion of being present in the world the technology constitutes (Lee, 2004). For the reason that telepresence advances the quality of the virtual reality experience given by specific media, it is hypothesized that this psychological state is easier to be reached with modern VR technology. Thus, the following hypothesis is formulated:

***H1*:** The 3D virtual reality environment provides a higher sense of telepresence than the 2D virtual reality environment.

2.3 Temporal Dissociation

Research by Chen (2006) shows that intense engagement in virtual reality can lead to a distortion of time perception. This phenomenon comes to the fore as users experience the feeling of being actually in the environment the medium creates. Thus, users can overlook the physical reality. Why do some people pay attention to online games a whole day without recognizing it and although they might feel depleted? The answer for this question lies in the

phenomenon called *temporal dissociation*. According to Csikszentmihalyi (1996), people being involved in preferred activities they like may undergo an optimal experience, whereby their sense of time is multi-faceted. Thus, persons playing video games may become subject to immense distortion, while they remain in a specific comfort zone, where an appropriate awareness of time does not exist anymore. Accordingly, the real world and the virtual world consolidate.

This appearance can also be expounded by neuronal circumstances. With reference to Ornstein (1972), memoirs of pleasant events do not need as much cortical space than less satisfying experiences obtained. Consequently, favorable happenings are better organized in our memory. Furthermore, Levine (1997) refers to the term "psychological clock" to illustrate time distortion. On the one hand, if the clock runs fast, occurrences seem to appear moderately. On the other hand, if the psychological clock runs slow, happenings around someone seem to develop rapidly. Resulting from these circumstances, time "flies" when someone keeps himself busy with an entertaining video game.

Since time distortion takes place while gamers play video games, particular emotions must occur during the activity. Rau, Peng and Young (2006) refer to feelings of joy or euphoria coming up during an optimal experience where self-consciousness vanishes. Deformity of time, in general, repeatedly lead "to a very unique sense of well-being" (Rau, Peng et al., 2006, p. 398). Besides, it is the fact that people are occupied with something which deforms their judgement of time. So, as human beings are actively engaged in tasks or ventures evoking satisfaction and geniality, variety and a limited sense of necessity, the temporal length of the event seems to pass more rapidly (Geelhoed, Toft, Roberts & Hyland, 1995; Priestly, 1964). Therefore, it seems rather accessible that video gamers perceive their time going by more quickly while being involved in entertaining virtual adventures. Moreover, it seems indeed more accessible that video gamers using additional equipment for playing, just like HMDs, perceive their time going by even more rapidly, due to the fact that more stimuli are activated, and the experience appears to be more realistic.

While being entirely occupied with a video game, players do not only become less aware of the gaming-duration, but also of their surroundings in general, their selves and any negative concerns of their everyday lives. Additionally, users interact in the given surroundings and become more isolated from their physical context the more immersed they are. These are indicators of high involvement (Jennett, Cox, Cairns, Dhoparee, Epps, Tijs & Walton, 2008), encompassing temporal dissociation and cognitive absorption. Hence, the more a technology is

able to lead somebody to believe in the virtual reality and to ignore the physical setting, the more temporal dissociation in this virtual environment takes place. Consequently, head-mounted displays are useful gadgets to become deeply involved in the VR setting, due to their visual exclusion of the real, physical environment (Witmer & Singer, 1998; Johns, Nunez, Daya, Sellars, Casanueva & Blake, 2000). Thus, new technologies providing this isolation in virtual environments are prerequisite in order to obtain a distortion of the actual gaming time.

Based on these findings, one can hypothesize that video gamers undergo a deformity of their estimated time spent in the virtual world. What is more, these findings should have a higher effect when operating in an even more engaging and involving virtual reality. Head-mounted-displays support a more intensive absorption into virtual environments, while reinforcing a crooked sense of time. Thus, the second hypothesis is formulated:

***H2*:** The 3D virtual reality environment provides a higher sense of temporal dissociation than the 2D virtual reality environment.

2.4 Game Experience

First of all, it appears unavoidable to mention that it is an arduous task describing game experiences in general. Such experiences are not able to be characterized in one word or one experience someone obtained. Both, the tremendous variety of game classifications and, of course, the nature of diverse concepts of personal experiences, seem to portray huge losses when someone has in mind to measure an experience.

However, game experiences can be construed with the help of some essential perceptions that came to the surface from recent video game research and the psychological effects of gaming. Hence, two accompanying approaches appear from literature on video gaming, while occurring appropriate to distinguish and potentially measure the considerably holistic yet relevant idea of playing a digital game: flow and immersion. Not only game critics but also game designers commonly point out these two concepts while examining the interactive experience of video gaming with reference to both, the game's interface and content.

Csikszentmihalyi (1996) portrays a crucial researcher of the two named concepts. Accordingly, he was most interested in what exactly makes experiences so pleasing to human beings. During his studies, he interrogated people's experiences when they were, according their own statements, taking the most pleasure in live and were absorbed in those activities. The psychological state *flow* was central in all described events, displaying an optimal state of

enjoyment where people are completely occupied mentally. In fact, the researcher discovered that this experience agreed for everyone – no matter which cultural background, social class, age or gender the respondents had. Regarding Csikszentmihalyi (1996), the dynamics of a flow experience create a positive affect and individuals enjoy the specific action they are involved in. So, enjoyment appears when people perceive their opportunities for action equivalent to their abilities to perform (Ijsselsteijn, de Kort, Poels, Jurgelionis & Bellotti, 2007). As a result, flow can be defined as a balancing condition between skill and challenge. Competence and challenge are referred to a more satisfying game experience by means that users must be skillful enough to enjoy that specific activity.

Taking a look at the other named approach, *immersion*, which is quite accompanying with the psychological state called *flow* explained before, it comes to attention that, in the gaming domain, immersion is particularly used to assign a specific intensity of involvement or engagement a video gamer has with the video game. With reference to Sweetser and Wyeth (2005), immersion illustrates the "deep but effortless involvement, reduced concern for self and sense of time" (p. 4).

In the context of this research, a gaming experience is measured on the basis of the previously assigned conceptions: Immersion, Flow, Returning to Reality, Competence, Challenge, Positive Affect and Negative Affect (including Tension/Annoyance).

For the reason that game experiences are surrounded by the surface features of a game, the multi-sensory attributes and the design in respect of the imaginative, virtual reality the game and its technology is able to create, it is hypothesized that present upcoming devices intensify the experience. Thus, the third hypothesis is formulated:

***H3*:** The 3D virtual reality environment provides a more intense game experience than the 2D virtual reality environment.

3. Research Method

3.1 Research Design

A randomized study is performed containing an experimental and a control group in order to research the effectiveness of Virtual Reality as an increasing factor of the variables Telepresence, Temporal Dissociation and Game Experience. Therefore, a between-subjects-design is used with one evaluation moment and two conditions (experimental- and control condition). The participants of the experimental condition played a digital game with a Virtual Reality system experiencing a 3D environment, while participants of the control condition engaged in the same digital game but on the laptop having a 2D experience. On the one hand, the type of condition serves as independent variable, and on the other hand the degrees and intensities of Telepresence, Temporal Dissociation and Game Experience operate as dependent variables. Besides, both quantitative and qualitative data are collected beneficial to obtain more in-depth outcomes of the current research. So, respondents had to fill in questionnaires including the contents of the dependent variables (quantitative examination) and afterwards reply to questions asked in a semi-structured interview (qualitative examination).

3.2 Participants

Basically, all participants of this study were recruited via convenience sampling of the general public. Further, almost all participants were approached via personal contact and mobile phone. The collection of the data took place between July 1st and August 15th 2017. Criterion of inclusion was the prerequisite being 18 years old or older. The exclusion criteria, however, were visual and/ or auditive impairments combined with the non-use of visual and/ or auditive aids. Finally, insufficient knowledge of the English or German language was also a criterion of exclusion by cause of both the English language adopted in the game and the held interview in German or English (dependent on the Nationality of the respondent) as part of the research method.

A total of 50 participants took part in this experiment. The random sample includes 24 women and 26 men with an age between 21 and 30 years old (M = 24.72, SD = 2.08). All participants had a high level of education due to the fact that all of them were matriculated as

students. More than half of the participants (64%) were registered as Bachelor students. In order to obtain an overview regarding the general video gaming behavior of all participants, or rather to find out if there exists any gaming behavior, people were also asked whether they are regularly engaged in digital gaming. The results show that there are 28 respondents describing themselves as "Gamer", 13 in the experimental and 15 in the control condition. Thus, it can be said that there is a certain balance respecting the gaming behavior of the respondents between the two conditions. Table 1 presents an overall view of all demographic data classified per condition.

Table 1: *Overview demographic measurements of test population*

Characteristic	Category	Total (n=50)		Experimental (n=25)		Control (n=25)	
		M	*SD*	*M*	*SD*	*M*	*SD*
Age	(years)	24.72	2.08	24.76	2.33	24.68	1.84
		N	*%*	*N*	*%*	*N*	*%*
Gender	Female	24	48	11	44	13	52
	Male	26	52	14	56	12	48
Educational grade	Bachelor	32	64	17	68	15	60
	Master	14	28	7	28	7	28
	Pre-Master	4	8	1	4	3	12
Gamer	Yes	28	56	13	52	15	60
	No	22	44	12	48	10	40

3.3 Equipment

3.3.1 Software

The software used in this study is called "VR X-Racer" which helped to create the virtual environment. The game is an iOS application developed by Nisco – DTA Technology Application and Distribution Company Ltd., Rugao, China. The smartphone-app is generated

for the use of a Virtual Reality headset and is obtainable via the App Store. The Virtual-Reality surroundings simulate a combat jet, flying through a geometric world with buildings moving up and down (Figure 2). The smartphone application offers users having an exciting flight through an ever-changing, virtual environment. In order to establish a real-time head-tracking-effect, the software adopted an input of moving sensors of the mobile phone. The position- and orientation-trackers changed the field of view as reaction of head movements. Thus, the participants could explore the unknown environment at all times, just as they were in the real world.

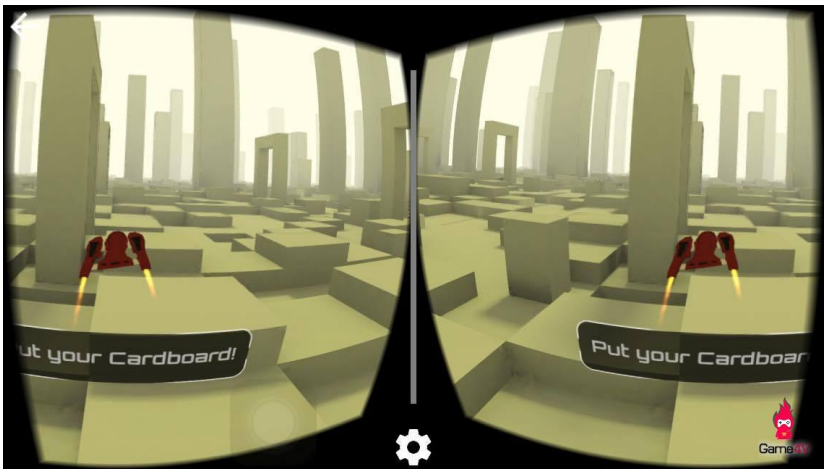

Figure 2: First-person view in the environment of "VR X-Racer". The software splits the screen in two separate pictures for every eye creating a Virtual-Reality-effect when used in combination with a VR-headset.

3.3.2 Hardware

Resulting from the stated preconditions, there is a need for an instrument which is capable of isolating the user in virtual environments. As reported by Witmer and Singer (1998), head-mounted displays (HMD) are typical and effective devices beneficial to create a high sense of immersion into the virtual world. Slater, Linakis, Usoh, Kooper and Street (1996) even state that technology created to establish virtual reality could be objectively viewed as "immersive" or "non-immersive" respectively. Consequently, in this paper HMDs are viewed as VR technology in order to create an individual experience. Conversely, this response disappears when attempting to remain in the simulated setting using a traditional 2D flat screen from an

Asus computer.

In consideration of offering the participants a virtual environment, the experiment made use of a Google Cardboard "POP! 3.0" Virtual Reality-system. It is a smartphone-based mobile Virtual Reality headset (Figure 3). The gadget is one of quite a number of accessible commercial VR-systems which are also mentioned as "Cardboard VR" or "DIY VR" (Tong, Gromala, Amin & Choo, 2016). The system consists of a display which is mounted on the head (HMD) and includes two optical lenses in order to establish a perception of depth. As display served in this experiment the Apple iPhone 6 with a screen diagonal of 11.94 cm, a resolution of 1334 x 750 pixels and an iOS version 11.0.3.

Figure 3: Google Cardboard "POP! 3.0" Mr. Cardboard Virtual Reality-system (vr.google.com, 2017)

3.4 Measuring instruments

3.4.1 Telepresence Scale

In this study, Klein's (2003) Telepresence scale is used consisting of seven items, which is a variation of the ones employed by Kim and Biocca (1997) and Novak, Hoffman and Yung (2000). Examples of items are "The computer-generated world seemed to me 'somewhere I visited' rather than 'something I saw' ", or "I forgot about my immediate surroundings when I was navigating through the exercise"). Besides, the measurement uses a 7-point Likert scale from 1 (Strongly Disagree) to 7 (Strongly Agree) in order to adjust the degree of feeling rather in the used medium or in the real location. The scale had a high level of internal consistency, as determined by a Cronbach's alpha of 0.94. The complete Telepresence scale can be found in Appendix E.

3.4.2 Temporal Dissociation

In order to measure Temporal Dissociation as a dependent variable, the Cognitive Absorption Questionnaire by Agarwal and Karahanna (2000) is given to the participants. Hereby, only the first subscale for Temporal Dissociation is adopted. An example for one item of the scale is „Time appears to go by very quickly when I am playing the video game“. These items are measured with a graduated system reaching from 1 to 5 (from “Not at all” to “Extremely”). The scale had a sufficient level of internal consistency, as demonstrated by a Cronbach’s alpha of 0.72. The entire Temporal Dissociation scale can be found in Appendix F.

3.4.3 Game Experience Questionnaire (GEQ)

The common study makes use of Ijsselsteijn’s et al. (2007) Game Experience Questionnaire beneficial to examine the dependent variable Game Experience and to analyze whether there is a difference between the experimental and control condition. Originally, the GEQ has a modular structure and consists of three modules: 1. The core questionnaire, 2. The Social Presence Module and 3. The Post-game module. Part 2, the social presence module, exploring psychological and behavioral engagement of the player with other social individuals, be they virtual (i.e., in-game characters), mediated (e.g., others playing online), or co-located. Due to the fact that this module should only be conducted when at least one of these categories of co-players are involved in the game, this module is omitted. However, the first part displays the core part of the GEQ and assesses game experience as score on seven components: Immersion, Flow, Competence, Positive and Negative Affect, Tension, and Challenge. For a sturdy measure, five items are included per construct. The Core Module of the GEQ can be found in Appendix C.

Furthermore, the third part, the post-game module, assesses how players felt after they had stopped playing. Original, this is an appropriate module for assessing naturalistic gaming (i.e., when gamers have voluntarily decided to play), but may also be suitable in experiment research (Ijsselsteijn et al., 2007). It adds the constructs “Returning to Reality” and “Tiredness”. Component scores are computed as the average value of its items. The Post-game Module can be found in Appendix D.

Both, the core questionnaire and the post-game module are given immediately after playing the game. The scale for the core questionnaire consisting of 33 items in total, had an acceptable level of internal consistency, as determined by a Cronbach's alpha of 0.76.

Examples for the five-item subscale Positive Affect are: "I enjoyed it" or "I felt happy". This subscale reaches a high level of internal consistency with an Cronbach's alpha of 0.9. Further, the subscale Flow also presents a high degree of internal consistency ascertained by a Cronbach's alpha of 0.88. Example items of the five items in total are: "I was fully occupied with the game" or "I forgot everything around me". Next, Competence had an Cronbach's alpha of 0.9 and examples of this five-item subscale are: "I felt skillful" or "I was good at it". The next subscale (Sensory and Imaginative) Immersion consists of six items and presents a high level of internal consistency, verified with an Cronbach's alpha of 0.85. For instance, the participants picked up statements like "I felt I could explore things" or "It felt like a rich experience". Additionally, the subscale Challenge possessing an Cronbach's alpha of 0.72, contains five items in total, for instance: "I felt pressured" or "I had to put a lot of effort into it". Tension/Annoyance depicts one more subscale of the Game Experience Core Module consisting of three items, for example "I felt irritable". The moderate level of internal consistency is determined here with an Cronbach's alpha of 0,68. Results of these items should be construed carefully. Finally, the subscale Negative Affect reaches an internal reliability on the borderline, as demonstrated by an Cronbach's alpha of 0,62. Examples of individual items are: "I found it tiresome" or "I felt bored.".

The scale for the post game module consists originally of 17 items in total. However, one subscale (Tiredness) did not pass the reliability analysis. Therefore, the two items of the Tiredness subscale had to be deleted. Then, the Cronbach's alpha for the Game Experience Post Game Module reaches a value of 0,69. After deleting one item of the Negative Affect subscale, the Cronbach's alpha rate is 0,75 and has thus an acceptable level of internal consistency. The subscale Positive Experience had six items, for instance "I felt revived" or "It felt like a victory. This subscale had an Cronbach's alpha of 0.88. Besides, the subscale Returning to Reality also showed a high level of internal consistency, ascertained by a Cronbach's alpha of 0.81. Examples for the three-item subscale are: "I found it hard to get back to reality" or "I had a sense that I had returned from a journey". Furthermore, there is the Negative Affect subscale including five items, for example "I found it was a waste of time" or "I felt regret". The Cronbach's alpha is 0,63. Consequently, results of this subscale must be interpreted with caution.

All items are scored with a 5-point scale from 1 (not at all) to 5 (extremely).

3.4.4 Interview

After the participants have filled in the questionnaires, a short semi-structured interview of averagely five minutes in is held. Thereby, the researcher wants to investigate the experience the participants obtained with their own words. Besides, propensities should be investigated whether the participants are rather easily become intensely involved in media features, like video games. The questions are based on the "Immersive Tendencies Questionnaire" by Witmer and Singer (2004), examples are: "Do you ever become so involved in doing something that you lose all track of time?" or "Do you ever become so involved in a video game that it is as if you are inside the game rather than moving the joystick and watching the screen?". So, the researcher used a topic list with various subject matters she wants to talk about. However, the participant was still the one who set the actual topic during the interview. By directing the interview with the help of the answers by the participant, the researcher had the opportunity asking diverse questions per respondent. All interviews were recorded with an integrated audio recorder of a mobile phone. Afterwards, they were transcribed.

After transcribing the interviews, a set of codes was created producing a codebook. This codebook is based on the memories and transcriptions of all interviews, wherein all remarks and statements were coded. The coding scheme establishes the base for the analysis of the qualitative data: all comments to a particular topic were gathered in individual codes. With these codes, all relevant remarks on each topic of the interviews could be organized.

The codebook was tested on inter-rater reliability: 14% of the collected qualitative data (seven out of 50 transcribed interviews) was coded with the formed codebook first by the researcher and afterwards by a second coder. Those coded interviews were measured with the Cohen's Kappa formula for inter-rater reliability, which is, according to Blackman and Koval (2000), a well-known measure of accordance between two different raters concerning dichotomous outcomes. The Cohen's Kappa value is 0,84. With reference to Warrens (2011), the limit of reliability of the Cohen's Kappa lies at least between 0,6 and 0,7. Thus, the current codebook is highly reliable and therefore suitable to work with.

3.5 Procedure

All participants were recruited in July 2017. Afterwards, individual appointments were arranged for several home visits. The prearranged meetings were extended until August 2017. A total of 50 participants was randomly allocated to the control group or the experimental group after signing the form of agreement (Appendix G).

In the beginning of the experiment the participants had to fill in a questionnaire revealing their demographic data including age, gender and which educational grade they are striving for at the moment. Furthermore, participants gave information about their gaming behavior or rather if they play digital games on a regular basis. Before participants received their assurance for their study participation, the researcher made sure that none of them had any visual or auditive impairments which served as criterion of exclusion. Then, previous to the original experiment, participants of the experimental group did a short training of approximately five minutes beneficial to familiarize with the, eventually, new technology. This action insured that a lack of familiarity with the Virtual Reality-system will be less probably of inhibiting the experiment. Therefore, a neutral 360 degrees VR-video of a sunny beach was shown on the system. Afterwards, the researcher gave instructions in order to guarantee a proper handling of the head-mounted display, followed by practical support. After the training with the Virtual Reality-system, the original experiment started, and the participants arranged themselves in the virtual environment of “VR X-Racer”. Accordingly, participants had to move their heads up-, or downwards, left or right, to fly along the moving buildings and to gain more and more points in the game. According to earlier experiments concentrating on telepresence in virtual environments, there is a substantial prerequisite to curtail the contact between the respondents and the researcher, after beginning with the experiment (Slater, Usoh & Steed, 1994). So, the researcher left the participant during the session, however, standing available in front of the room in the case of any occurring problem, for example nausea or technology dysfunctions. After 30 minutes the session was over and the researcher entered the room in order to switch off the system.

Participants assigned to the control condition also played the game “VR X-Racer” for 30 minutes, but not including the Virtual Reality factor. The session was held on the laptop and participants had to steer the combat jet with the help of the left and right arrows on the keyboard through the virtual environment. As well as in the experimental condition, the participants of the control group were also been left alone in the room during the gaming session. All

participants received the information that it is not relevant how successful they perform in the game, it is only the obtained experience mattering.

Immediately after the session every participant filled in the questionnaire, in order to receive the most authentic answers concerning the whole game experience. The questionnaire was filled in on the laptop with help of “Qualtrics”, an online data collection software by Experience Management Industries. The last page of the questionnaire said: “Please inform your researcher you’re ready for the semi-structured interview”, so participants gave the researcher to understand having completed answering the statements. As a result of the query about the demographic data and whether participants regularly play online games or already obtained experiences with Virtual Reality in the beginning of the experiment, the researcher had some background information about the gaming behavior respectively and was able to resume to those facts. In the end of the experiment, all participants were given the information about the aim and method of the study. First, all participants found out that there is also a second condition and people of the control group got the chance, if they wanted to, testing the Virtual Reality-system. Beneficial to collecting all data in a standardized way, a protocol was followed including all instructions for the respondents’ procedures for the whole experimental session (Appendix A).

3.6 Data analysis

The data is analyzed by help of the program Statistical Package for the Social Sciences (SPSS, version 24.0, SPSS Inc, Chicago, IL, USA). First, the internal reliability for the individual scales and subscales were calculated and determined with Cronbach’s alpha values. Second, the means and standard deviations of the scores on every (sub-) scale per condition is calculated. With those variables the descriptive statistics are developed resulting in a clear overall view of the data. After that, further types of analyses are carried out in order to explore the collected data and to test the given hypotheses.

To analyze the quantitative data and to compare the two conditions, a t-test for independent samples is executed. A p-value higher than .05 should give the information that the two groups did not distinguish significantly from each other after exposing them to different circumstances during the experiment.

Furthermore, the qualitative data is analyzed. Followed Grounded theory by Corbin and Strauss (1990), repeated ideas, interview elements or concepts become noticeable. Those are

identified with codes extracted from the data. Afterwards, they got grouped into categories and sub-categories. The set of codes created presents a codebook (Appendix H). The coding scheme establishes the base for the analysis of the qualitative data: all comments to a particular topic were gathered in individual codes. With these codes, all relevant remarks on each topic of the interviews could be organized.

4. Results

4.1 Descriptive statistics

Table 2 depicts an overview of the means and standard deviations of the scores from all respondents with reference to the different subscales and scales per condition.

The participants' mean scores of the subscale Negative Affect present the lowest mean scores of all variables, while the mean scores of Positive Affect are positioned a little lower than the mean value of the used 5-point Likert scale. Flow shows the highest mean scores in both conditions. The subscale Competence is positioned around the mean value and thus implicates a moderate level of abilities in both conditions. The mean score of the subscale Challenge also arranged round the mean value of the 5-point Likert scale. Furthermore, inspecting the mean scores of Returning to Reality, the mean value of the control group is located below the average, whereas the one of the experimental group are ranged around the average value. Both, Immersion and Tension show mean rates around the average value of the used scale. Telepresence used a 7-point Likert scale from -3 to +3. Here, participants present an average score that is positioned above the mean value in both conditions. The mean scores from all respondents of the Temporal Dissociation scale are positioned around the mean value of the used 5-point Likert scale. So, there is a moderate level in both conditions, in which the value is minimally higher in the experimental condition (M=3.79) than in the control group (M=3.09).

Table 2: *Means and standard deviations of the scores of the different (sub-)scales per condition*

				Condition			
		Total (n=50)		Experimental (n=25)		Control (n=25)	
Variable	Subscales	*M*	*SD*	*M*	*SD*	*M*	*SD*
Telepresence* **		-.12	1.62	1.01	1.12	-1.25	1.19
Temporal Dissociation*		3.44	1.08	3.79	0.91	3.09	1.14
Game Experience	Competence	3.01	0.91	2.98	1.02	3.04	0.79
	Flow*	3.16	1.01	3.84	0.78	2.48	0.71
	Challenge*	2.92	0.79	3.14	0.58	2.69	0.91
	Negative affect	1.67	0.59	1.56	0.56	1.79	0.58
	Positive affect*	2.52	0.92	2.81	1.03	2.22	0.69
	Returning into reality*	2.13	1.04	2.79	1.04	1.48	0.48
	Immersion*	2.41	0.81	2.85	0.79	1.96	0.55
	Tension/Annoy -ance	2.40	0.90	2.44	0.88	2.36	0.94

Note. Scores run from 1-5. * Scores are significant. ** Scores run from -3-3.

In order to compare both the participants of the Virtual Reality condition and the participants of the condition playing the game with the laptop, an Independent samples t-test is carried out. After that, a few significant deviations are uncovered. The results of the t-test for independent samples show that there are significant differences with reference to Flow between the experimental group (M = 3.84, SD = .78) and the control group (M = 2.48, SD = .71); $t(48)$ = -6.464, $p < .01$. Furthermore, results also demonstrate significant differences for Challenge between the experimental (M = 3.14, SD = .58) and control group (M = 2.69, SD = .91); $t(48)$ = -2.12, $p < 0.05$. Besides, Positive Affect displays significant differences between both groups, in the experimental condition (M = 2.81, SD = 1.03) and control condition (M = 2.22, SD = .69); $t(48)$ = -2.39, $p < 0.05$. Moreover, the subscale Returning into Reality shows differences in its scores between the experimental group (M = 2.79, SD = 1.04) and the control group (M = 1.48, SD = .48), $t(48)$ = -5.68, $p < .01$. Significant differences are also detected at Immersion between both the experimental condition (M = 2.85, SD = .79) and control condition (M = 1.96, SD

= .55), $t(48) = -4.61$, $p < .01$. Temporal Dissociation also offers significant differences between the experimental group ($M = 3.79$, $SD = .91$) and the control group ($M = 3.09$, $SD = 1.14$); $t(48) = -2.36$, $p < 0.05$. Finally, Telepresence shows significant differences between the experimental condition ($M = 1.01$, $SD = 1.12$) and the control condition ($M = 1.25$, $SD = 1.19$), $t(48) = -6.9$, $p < .01$.

However, there are also insignificant differences uncovered. First, Competence does not demonstrate significant differences between the experimental group ($M = 2.98$, $SD = 1.02$) and the control group ($M = 3.04$, $SD = .79$); $t(48) = .25$, $p > .05$. Second, there are no significant differences between the experimental condition ($M = 1.56$, $SD = .56$) and the control condition ($M = 1.79$, $SD = .58$); $t(48) = 1.38$, $p > .05$. referring to the subscale Negative Affect. Third and last, Tension/Annoyance does not offer significant differences between the experimental group ($M = 2.44$, $SD = .88$) and the control group ($M = 2.36$, $SD = .94$); $t(48) = -.31$, $p > .05$.

Taking these results into account, declarations whether *H1*, *H2* or *H3* will be confirmed or rejected can be made. First, due to significant results with reference to Telepresence, *H1* can be confirmed. In this sample, it is proved that the 3D virtual reality environment provides a higher sense of telepresence than the 2D virtual reality environment. Also, when discoursing on the construct Temporal Dissociation, the second hypothesis can be confirmed. Due to significant differences between the experimental and control group, it is validated that the 3D virtual environment contributes to a higher feeling of temporal dissociation than the 2D virtual reality atmosphere. Last, *H3* which refers to the obtained Game Experience, can be confirmed with reference to Flow, Challenge, Positive Affect, Returning into Reality and Immersion. Although the GEQ's subscales Competence, Negative Affect and Tension/Annoyance did not demonstrate considerable differences between the two conditions, an appreciable divergence between the experimental and control condition who used distinct technical devices for playing the video game, can be attributed.

4.2 Results section qualitative data

4.2.1 Specific experiences

The following experiences deal with the specific experience all participants obtained during the experimental session of the current study. Participants of both the experimental and control condition communicated their approval or disapproval of the game played. Furthermore, they defined more details about this specific game participation. Besides, they expressed whether the gaming session has included them into the world the computer created or whether they did not obtain the feeling of being inside the medium, or in other words, attained the mental state of telepresence.

4.2.1.1 Telepresence

Respondents were asked whether they feel mentally alert again after the gaming session. In this way the researcher wanted to examine whether participants became absent-minded in the virtual world. Table 3 demonstrates the amount of statements made by the interviewees of the experimental and control conditions and more specifications about the mental involvement in the gaming session.

Table 3: *Qualitative Results for Telepresence*

(Sub-)Codes	Segments/Interviewees		Sample quotations	
	Exp	Ctrl	Exp	Ctrl
Completely involved in game	5/4	1/1	"I was very into the game." (R42)	"I kind of thought afterwards that I came back from another world. I am really able to sink in into something like that." (R38)
Distracted	5/4	-	"I'm really tired." (R5)	-

Four respondents of the experimental condition mentioned that they were completely involved in the game and only one person of the control group said the same. Below there are quotations

listed made by participants who used Google Cardboard and claimed they fully dipped into the virtual environment.

"I am a bit tired now. I had to concentrate a lot because I couldn't see anything else during the whole game." (R6)

"The Virtual Reality experience I generally liked because you're really in the game." (R24)

"It was amazing! I was fully occupied with the game." (R36)

Furthermore, four respondents of the VR-condition mentioned not having the perception being completely involved in the virtual world, however, they reported a feeling of distraction after the experimental session.

"You need some time to get out of the game again, I think. Because you can't see anything but the game and you are really in this game experience. But now I feel present again." (R2)

Finally, no one of the control condition said being inattentive afterwards.

To summarize the findings of this section, the specific experience of telepresence acquired during the gaming session of the current study, there were generally more participants in the experimental condition than in the control condition who claimed that the game was drawing them in to the virtual environment. The gaming session exerted influence on eight participants who used the Virtual Reality headset and on one person who played it without the headset.

4.2.1.2 Game Experience

All respondents were asked whether their gaming experience obtained in the current experiment was either associated with enjoyment or not. The following table demonstrates the amount of statements made by the interviewees of the experimental and control condition and more specifications about the acquired gaming experience of the experimental session.

Table 4: *Qualitative Results for Game Experience*

(Sub-)Codes	Segments/Interviewees		Sample quotations	
	Exp	Ctrl	Exp	Ctrl
Enjoyable	18/17	25/19	"Yeah, I really liked it." (R47)	"For that moment it was quite funny." (R18)
Enjoyable – Highscore	17/13	19/11	"At the point where the bricks are start moving you just want to get better and you want to score higher" (R2)	"[It was fun] because I wanted to make a new record. I wanted to beat the system." (R1)
Enjoyable – Flight simulator	13/8	11/7	"It was cool." (R5)	"Yeah, it was really fun." (R21)
Enjoyable – Game itself	27/17	16/13	"I think for a short time you could get addicted" (R2)	"I wanted to know what will still happen and what will change" (R27)
Fascinated by VR	14/10		"It was fun and interesting to play." (R17)	
Not Enjoyable	10/5	12/6	"[It was] not really enjoyable." (R22)	"I couldn't recognize what's the meaning of the game, I hadn't actually a real goal or interim results. You could only beat your own record. It was also not so clear what's the meaning of the rings in the game. I had no real target." (R23)
Not Enjoyable – Monotonous	5/4	24/13	"…but it was also very repetitive." (R13)	"It was a little bit monotonous." (R23)
Not Enjoyable – Nausea	15/7	-	"But at times I felt a little sick and dizzy. So, I tried avoiding moving my head too much. Maybe it could be more fun, if you don't get sick." (R2)	
Not Enjoyable – Steering	2/2	3/3	"The steering leaves a lot to be desired." (R41)	"It was challenging because of the record, but I didn't like the steering." (R28)

The researcher kept an eye on the assurance that every participant knows that it is not relevant how well they perform in playing the game or in which degree they either approve or disapprove the session. So, participants could point out whether they thought the game was fun to play or rather a waste of time. First and noteworthy to mention is that more participants assessed the gaming session as enjoyable (36) than not enjoyable (11). Besides, there is no discernible difference in these opinions in respect of the two conditions: 17 interviewees who played the game with the Virtual Reality system valued it as enjoyable, while there were 19 people of the 2D computer screen condition who classified their experience also as amusing. However, there were seven more segments in the interviews of the control group concerning the enjoyment of the session than in the experimental group.

Furthermore, 17 interview segments were mentioned by 13 interviewees of the experimental condition about the enjoyment of the gaming session due to the incentive measure of the game's highscore. There is no considerable difference compared to the other condition, displaying 19 interview segments by eleven participants.

"It was sure enjoyable. And I was very good in it, I made a new highscore." (R6)

Participant 6 already made the highscore from about 9000 points which also stayed as the highscore until the end of the data collection. Besides, it is clearly observable that the participant associated the enjoyment of the gaming session with the success he had in the game. This number appealed to several participants who played X-Racer afterwards:

"In the beginning it was like I felt also challenged by the highscore. I couldn't even reach the half, so it was challenging. I was thinking about the person who got it." (R19)

Also, the numbers of interview segments stay nearly the same as one takes a look to the codes of game enjoyment and its specifying subcode "flight simulator". On the one hand, there were eight people in the experimental group who mentioned the fact 13 times that they like flight simulator games anyway. On the other hand, there were seven respondents in the control group who alluded eleven times to the fact they liked the game for they enjoy playing games with flight simulators anyway.

With reference to those who mentioned they approved the session due to the game itself (30 interviewees), it is noticeable that respondents of the experimental group (17) appreciated

the game more than those out of the control group: on the one hand, there were 17 participants who played X-Racer with the Virtual Reality headset gauging the session enjoyable owing to the fact that the game itself was fun. On the other hand, merely 13 participants who played the game with the laptop shared this view. Besides, users of the Virtual-Reality faction mentioned this argument eleven times more than respondents of the Laptop condition. As to be seen in Table 3**,** one participant who played X-Racer with the Virtual Reality headset even reported that it could be possible becoming addicted to it.

Only pertaining to respondents of the Virtual-Reality condition, there were seven people who suffered from nausea, resulting in more than a quarter of the whole experimental condition. However, respondents added that they understand that nausea was a cause of the Virtual Reality experience and has nothing to do with the true enjoyment of the game itself. They pointed out enjoying the game nevertheless:

"It is definitely interesting but due to slightly nausea I don't know how much I really enjoyed it. But I enjoyed it." (R7)

So, due to the fact that only four respondents were already familiar with Virtual Reality systems, suffering from nausea was a legitimate appearance.

Generally, there were eleven participants in total who mentioned they were not enjoying the gaming session. Five people were positioned in the experimental condition and six in the control condition. There are twelve interview segments in the control group conveying the displeasure of the game and ten segments in the experimental group.

"I thought it was rather a waste of time. And I don't really think the time was passing by quickly." (R40)

Above there is a citation by a respondent positioned in the control condition. He did not think the game was enjoyable. Furthermore, he claimed that time did not pass due to felt boredom during the session. In the following a citation is displayed claimed by a respondent who used the VR headset:

"Not really [enjoyable]. *It was interesting, but I felt a little bit uncomfortable and a bit noxious and slightly sick. And because you really sunk into the game or really got into the game it was quite uncomfortable."* (R24)

Respondent 24 did not apply to the game itself concerning the enjoyment of the gaming session, but referred to the consequences of Google Cardboard which was responsible for the visual transmission. Apparently, this respondent suffered from nausea. Nevertheless, the person did not enjoy the Virtual Reality experience, owing to unusual and soaring immersion. With reference to those who mentioned they disapproved the session due to a monotonous character of the game, it is eye-catching that more respondents of the control group (13) alluded to this reason than respondents of the experimental condition (4). Furthermore, this argument was mentioned 24 times by the Laptop condition and five times by the Virtual Reality condition. One control group participant explained the phenomenon in this way, after he was asked whether the gaming session was fun:

"Fun is maybe not the right word. It was kind of diversionary. I mean, you could focus on something. You need a little bit more content for having fun. It's always good having a storyline or characters." (R33)

Another participant of the experimental group expressed his perception of the game in the following way:

"It seemed to me like never-ending." (R14)

Finally, a subcode was created referring to the steering of the combat jet through the virtual world as a reason for dissatisfaction. There was one more person in the control group who mentioned disliking the steering than in the experimental group. The difference between the steering settings was that people who were using the Virtual Reality glasses had to steer with the help of their head. They had to bend it either to the left or to the right. Respondents positioned in the control group must use the keyboard arrows.

"The steering leaves a lot to be desired." (R41)

"I just clicked left and right and left and right… I think it was quite boring." (R48)

All in all, it can be said that the qualitative results referring to the obtained game experience give insight into the precise reasons why respondents of both conditions enjoyed or disliked the

game session. One notable difference is the displeasure with reference to the monotonous character of the game X-Racer by the control condition. Since those participants did not receive the modern Virtual Reality technology they assessed the experimental session as rather boring while they did not experience something “new”. Another notable difference is, of course, that the suffering of nausea only took place in the experimental condition. However, referring to the general enjoyment of the gaming session, it is clear that there are no extraordinary differences between the two groups.

4.2.2 General Experiences

Moreover, all respondents were asked about their gaming experiences, practices and background in general. During the interview, they communicated whether it earlier happened forgetting everything around them while obtaining the feeling of being present in the virtual world. Thus, not only claims concerning unintended time management while gaming, but also telepresence experiences are investigated.

4.2.2.1 Temporal Dissociation

Participants of both conditions were asked about their past and present performance of time management with reference to their gaming behavior. Table 5 depicts how many interviewees pointed out being not always aware of the time they spent in virtual worlds.

Table 5: *Qualitative Results Temporal Dissociation*

(Sub-)Codes	Segments/Interviewees		Sample quotations	
	Exp	Ctrl	Exp	Ctrl
Time underestimation – Past Behavior	10/7	11/4	"It already happened that I played for five hours and thought it was actually just two." (R6)	"There were moments when I forget the time completely, but I only allowed me to forget the time when I knew that I could." (R26)
Time underestimation – Present Behavior	12/9	10/7	"Yes, definitely I forget about the time." (R41)	"Then you are very into it and the time is running faster. And you don't keep an eye on the time." (R18)

In total, 27 participants said that it heretofore occurred that they underestimated the time while they were into the game. Apparently, there are more respondents claiming that the problem of time underestimation happens more often in present time (16) than in the past (11).

"Yes, I think it's absolutely a main fact when I'm playing a game." (R11)

Most respondents reacted to this question like it's natural forgetting the time:

"I think it's quite human." (R9)

Besides, some participants mentioned they already took it into account before starting the game. The following citation confirms this assumption:

"Yes, of course this already happened. Sometimes we play on the games console and watch outside and recognize that it's already dark outside. That's a bit creepy then. But when this happens, it's okay. We knew that we don't want to do other things on that day." (R50)

In general, there are more or less extreme cases when it is about time underestimation with reference to gaming behaviour. The following participant describes a gaming session with a few friends and related in the interview to his former gaming addiction time.

"*Then we started at eight pm and suddenly it was five or six am in the morning and all of us thought 'Wow, that went very fast!'."* (R26)

Respondent 9 disclosed during the interview playing digital games with his housemate. He responded to the question, if he obtained the experience of underestimating the time while playing digital games especially when he is playing a video game with his housemate like follows:

"Yes, sure that can happen. Especially when you're competing. It goes like 'let's go for a game' and then it's many games later and still haven't found the true champion." (R9)

Another participant responded to the question if it already happened that he forgot about the time while playing a digital game, in this way:

"Yes. I think it depends on where you live. When you are younger and live at your parent's and say you want to play for two hours and they don't control you, it could happen that you realize then you were playing for three hours. Nowadays I think people say, like for example in World of Warcraft, I play one raid which could last one to three hours. But of course, you forget the time anyway." (R33)

This participant confesses himself in present days as a regular gamer and simultaneously as a person who earlier played digital games more excessively. He suggests that his parents were a decisive criterion concerning his time management of playing digital games.

4.2.2.2 Telepresence

During the interview, participants were asked whether they already obtained the feeling of being inside the medium in order to find out whether they previously experienced Telepresence.

In the following, Table 5 presents how many participants stated being familiar with the feeling of Telepresence and the number of segments came to the fore during the questioning.

Table 6: *Qualitative Results Telepresence*

(Sub-)Codes	Segments/Interviewees		Sample quotations	
	Exp	Ctrl	Exp	Ctrl
Inside medium	14/9	16/9	"Yes, I'm completely gone then" (R36)	"Then, I really feel like I'm in the game and one of the characters." (R43)
Distracted by medium	7/6	17/9	"It's always present in my head." (R35)	"I'm a bit absent and I don't answer instantly." (R40)

It can be recognized that there are 18 respondents claiming already have experienced a feeling of being inside the world a computer created – nine people positioned in the experimental condition and nine people in the control condition. Furthermore, there are 15 participants who revealed that they were not entirely involved in the medium, but absent-minded or inattentive afterwards or during their gaming sessions. The following quotation depicts an example of being "distracted by the medium":

"[…] mostly I think I'm in the story, but not part of it, […] but I don't really feel like playing a part in it or something." (R25)

Moreover, there were participants who referred to specific video games as they obtained the feeling of Telepresence. So, it has something to do with how realistic the game is created and how much free play a user has when playing it:

"I had it before, it was a really crazy game. It was no shooter, but it was a game with a story mode, where you must decide on your own how the game goes on. And after you made a decision the game changed, but it was very emotional organized. I really found myself in that game." (R18)

Respondent 18 even said, that "found himself" in the game he described. Hence, one can say he was inside the medium. The distance between the virtual world and the real world was minimalized.

In addition, participants described how it feels being completely involved in the virtual world. The following interview segment demonstrates that people who are playing a video game deeply concentrated push everything else to the back of their mind:

"[…] because you always have times where you have to concentrate a lot and then everything around you is like it doesn't matter. " (R21)

To summarise the general digital gaming experiences, it stands out that participants already experienced underestimations of their time management. By cause of being in the medium, time seems to run faster, and people do not recognize the exact time they spend in virtual environments. Moreover, the feeling of being rather present in the computer-generated world than in the actual reality, did not just arise in the current experimental session, but also in the private life of the participants. Due to the fact that nobody of the present sample owns a Virtual Reality headset, telepresence even occurs with a 2D computer screen. Applying to the quantitative results of the current study, both demonstrating a higher inclination of feeling telepresent and experience a distorted sense of time aroused by the VR device, it can be concluded that telepresence and temporal dissociation will be a natural by-product of computer gaming in future.

5. Discussion

The goal of the current study was to further examine the effect of Virtual Reality on people who play video games. To be more precise, the goal was to find a decisive difference between the impact of Virtual Reality headsets on telepresence, temporal dissociation and the game experience. The intensity of the gaming experience, the feeling of being inside the medium and the distortion of the sense of time of an experimental group who was involved in a controlled gaming activity with a Virtual Reality headset was examined in contrast to a control group who played the game in a traditional manner, namely with a laptop. Thus, this study displays a randomized research combined with both an experimental and a control condition which is, considered in general as one of the most reliable type of scientific evidence (American Psychological Association, 2006) with reference to systematic reviews and meta-analyses. The implementation of an active control group assured the measurement of a pure effect of a Virtual Reality experience applied to gaming. Furthermore, a strong circumstance of this study is that the experiment was conducted in the private apartments of the participants, instead of a laboratory, due to the research materials which were uncomplicated to carry with. So, one can say that this study was an experimental study in an ecological setting. The implementation of different locations granted a more precise examination of the actual effectiveness of Virtual Reality use in gaming at private homes. As a result, the ecological validity of the results is increased (Schmuckler, 2001).

The outcomes of the actual study demonstrate that there is a convincing impact of Virtual Reality on people's dimensions of telepresence, temporal dissociation and their game experience. However, the game experience regarding competence, negative affect and tension/annoyance did not show noteworthy differences between the two groups. Nevertheless, some branches of game experience combined with Virtual Reality exhibit significant impact on video game players: perceptions of flow, challenge, positive affect, returning to reality and immersion.

The following sections comprise a reflection of the findings and offer possible explanations for the found results.

5.1 Virtual Reality as intensifying factor for Telepresence

The actual study deals with the examination whether technological devices which support Virtual Reality are in a position to create the psychological state of telepresence. This term is defined by Slater and Usoh (1993) as temporal mistrust where users experience themselves in another world where their real bodies are positioned. Dealing with the outcomes of the current study, it is noticeable that there are meaningful differences between the people who experience a digital game via a 3D VR headset and people who experience a digital game with a 2D computer screen. Those who used a Head mounted display capable of creating Virtual Reality claimed being more in the "computer world" than the "real world" when they were going through the experimental exercise. Thanks to the Virtual Reality headset, the user obtained a sense of "being there" – being in the world the computer created, instead of being in their actual room where they live and which they are familiar with. As a consequence of the all-round view of the VR tool, users are not capable anymore to perceive anything else but the virtual environment with the help of their visual or auditive senses. Obviously, this fact can be used as argumentation for the credible outcomes with reference to telepresence in the actual study. There is a significant dissimilarity between participants playing X-Racer with a laptop or computer and respondents playing X-Racer with a head mounted display. Users who play the digital game with a 2D flat screen would need more effort to immerse in the represented surroundings of the medium. For instance, with reference to the qualitative analysis of the current research, there was only one participant of the control condition expressing the feeling of being rather inside the medium than outside.

All in all, the current research confirms the assumption that Virtual Reality has a crucial impact on feeling telepresent in gaming environments. Obviously, the statement made my Steuer (1992), that virtual reality is inconceivable without involving telepresence as critical aspect, is quite accurate.

5.2 Virtual Reality as intensifying factor for Temporal Dissociation

The current paper deals with the exploration whether video gamers using HMD's perceive their time going by more quickly while being involved in virtual environments. Those virtual environments can become intensified by technical devices supporting Virtual Reality. It is proven with the actual dataset, that people who play video games with additional equipment, or

in other words, with a Virtual Reality headset, perceive their time going by even more quickly, owing to the fact that more stimuli are activated. Thus, the experience appears to be more realistic. Averagely, participants who used the Google Cardboard stated that the time appeared to go by faster than participants who played the game without a Virtual Reality headset, while they were involved in the gaming session of the current experiment. Additionally, referring to general experiences concerning time dissociation, it is noticeable that for some people, even ten hours of continuously gaming do not seem like nearly a half day. This implements that gamers perceive the activity as a common hobby. So, they don't recognize dipping into virtual worlds as a type of loss of control. It is a part of their free time activity, not more and not less – yet simply a part of their everyday life.

The findings about time underestimation suggest that it is relevant in which housing conditions people live when it comes to gaming behaviour. Owing to the fact that all respondents of the current research were students, they do not live at their parents' anymore. Participants confess that their parents were a decisive criterion concerning time management in playing digital games. What supports this argument is that the majority of the respondents claimed that in present gaming behaviour time is underestimated more than in past behaviour. So, people need a type of control. Apparently, there are people not capable of controlling themselves yet. As young adolescents move in another city or even in another country to study, it is nearly always the case they live the first time in their life alone without their parents. Besides, it is also the first time they experience absolute freedom. Then, they must be competent enough to control themselves.

Furthermore, participants of the current study claimed that a new criterion for how long a gaming session should last, is given by the digital game itself, a time unit called "*raid*". If the fact that the computer game itself regulated the time spent in the virtual world would be applicable to more gamers, the gaming industry and especially the upcoming Virtual Reality industry would have an unimpeded leeway of controlling its users.

To summarise the findings of the actual section referring to Temporal Dissociation, one can say that video gamers using a HMD supporting a Virtual Reality experience undergo a deformity of their estimated time spend in that virtual environment. Hence, the more a technology can lead a user believing in the artificially created world by the computer and the more the device is able to let users ignore their actual physical settings, the more temporal dissociation takes place.

5.3 Virtual Reality as intensifying factor for Game Experience

With reference to Ijsselsteijn et al. (2007), the experience obtained while playing video games is attributed to several aspects that has been identified through evaluating theoretical accounts of player backgrounds. Those are: being skilful, being fully occupied with the game, getting challenged, enjoying the activity, obtaining the feeling of being on a journey, having the opportunity to explore things while not feeling frustrated. The following section deals with a reflection of the outcomes concerning the game experience obtained during the experimental sessions of the current study.

First, the considerable different amount of statements between the experimental and control group concerning the enjoyment of the gaming session due to the game itself could be interpreted as follows: people who played X-Racer with the Virtual Reality headset were entirely included in the virtual environment the game offers. There is nothing else to look at during the gaming session. Participants had to concentrate only on the combat jet which they were steering through the buildings to reach the next level. The fact that people who could only keep an eye on the virtual environment reminds about the well-known phenomenon relevant to content marketing: the mere exposure effect. It refers to an event in which repeated stimuli are evaluated more positively than novel stimuli (Inoue, Yagi & Sato, 2017). In other words, person who play a digital game via a 3D VR headset are more exposed to the world the technology creates. Thus, they have a more intense feeling of returning to reality due to the fact that they are visually exposed to the virtual world ultimately. Similarly to the respondents of the current experiment who were playing X-Racer with the Virtual Reality system and claimed they found it harder to revert to the real world than those who did not use the 3D VR headset.

Although, or rather by virtue of the simple structure of the game, it is not particularly remarkable that 24 participants mentioned they have been tempted by the highscore. The only aim of the game was to come as far as possible in order to gain as much points as possible. Respondents just had to steer to the left or the right to escape from obstacles in the form of squares. Two more participants in the experimental group mentioned this as a reason for their personal amusement of the game. Since participants of the condition using the Virtual Reality system are totally included in the virtual world, the display of the highscore appears right in front of their eyes after each round's end. There is nothing left for inspecting, while respondents playing the game with the Laptop are free to investigate elements of the real environment.

Contrary to this, participants of the control condition who played the game without a Virtual Reality system, did have more than the virtual environment in their field of view. Although they had to concentrate on the various obstacles which came towards the combat jet in the world the computer created, they were free to look up of the screen or even just see their own hand or the laptop. Those participants had a more closer relation to reality than participants using the Virtual Reality glasses, since they were constantly confronted with the technical device they used which created the gaming experience. Owing to the fact that people of the experimental condition did not have to work with their hands to steer through the virtual world, they were entirely condensed with their visual senses.

With reference to the displeasure of the gaming session due to the steering, it seems reasonable to suppose that respondents who used their head had a more intense feeling of having control. They were able to bend their head to one side or the other and had thus a more sensitive feeling of steering, whereas people in the control condition pushed the arrows on the keyboard, while there was no sensitive feeling of steering.

Furthermore, there are significant differences found between the two conditions with reference to flow. Referring to Csikszentmihalyi (1996) who did considerable research on Flow Theory, it can be assumed that participants who used the Virtual Reality system during the experimental session were mentally more occupied in the activity than participants who did not use the HMD.

Moreover, the current study proves that participants positioned in the experimental condition were more challenged during the gaming session than participants in the control condition. These findings can be attributed to the novelty of Virtual Reality systems. There were just four participants who already had experience with this kind of headset.

Additionally, there were no significant results found in the subscale Competence. These finding can be attributed to the monotonous and simple structure of the game X-Racer. Statements like “I felt skillful” or “I thought it was hard” were for most respondents rather dubious. There was no considerable distinction in the degree of difficulty between the two types of gaming.

Next, there is a significant difference between the two groups with reference to positive affect. Participants of the experimental condition claimed that they were happier during playing the game than those of the control condition. Also, this fact could be attributed to the novelty of Virtual Reality systems. Most respondents enjoyed having the opportunity to try the device

out. On the contrary, negative affect did not have a significant difference between the experimental and control group.

Furthermore, immersion demonstrates significant differences between participants used the Google Cardboard and participants who used the laptop. Immersion is particularly used to assign a specific intensity of involvement or engagement within a video game. The results of the actual study confirm that people who experience virtual reality do have a reduced concern for their self, aroused by immersion. So, virtual reality leads its users to an absorbed involvement in the gaming activity.

Finally, the subscale tension/annoyance did not have significant differences between the two conditions. This discovery can also be ascribed to the uncomplicated structure of the game. There was no noteworthy distinctness between potential frustration of the game X-Racer.

To summarise the claims made by all participants of both conditions, it seems that the gaming experience obtained during the experiment was, in general, quite related referring to enjoyment or displeasure. Most apparently is the evaluation regarding the monotony and the estimation of the game itself by people of the two conditions. It is remarkable that participants who played the game with a well-known technical device, a laptop, judged the gaming session as rather tedious, whereas participants using the Virtual Reality system appraised the game itself as enjoyable. Thus, respondents did not recognize that not the game itself was entertaining, but rather the device they used was spectacular. These findings suggest that there is found a novelty effect which transferred to the subject of entertainment, specifically the game X-Racer. With reference to Chen, Tutwiler, Metcalf, Kamarainen, Grotzer & Dede (2016) it is not unusual that highly immersive technologies are capable of distracting users from the salient and real content.

5.4 Limitations & Suggestions for Future Studies

The actual study has a few limitations that should be taken into account while interpreting the results. Besides, a multitude of theoretical and methodological implications follow from the current research and give reason and occasion for future studies and explorations.

A possible inadequacy could be referred to the used random sample. All respondents were students with a mean age of 24.72 years (SD = 2.08). However, although the population could be representative for that group who uses Virtual Reality technologies the most, the results could not be generalized for all potential users. So, future studies should implement a

random sample clasping people from all age groups in order to gain an understandable insight in the effect of Virtual Reality. Eventually, differences could be asserted concerning reactions or effects of VR between the diverse age groups.

Concerning another limitation of the current study and a following suggestion for future research, the used Virtual Reality system, the Google Cardboard "POP! 3.0" Mr. Cardboard Virtual Reality-system (vr.google.com, 2017), leads to giving the advice of using another, more immersive HMD, for example the Oculus Rift or the HTC Vive. In contrast to the Google Cardboard, more expensive Virtual Reality systems are capable of presenting high-quality pictures and creating fast picture-updates. Besides, it offers an extensive field of vision of about 110 degrees. With the help of these characteristics, users gain a more intense feeling of being actual present in the virtual environment. Furthermore, the emotional impact of Virtual Reality becomes more advanced (Boas, 2013). Undoubtedly, the fast development of technology should make this type of high-end-systems more affordable in the future.

Following the rapid development of new media and technology and the continuously changing methods of communication, there could be more advanced technologies tested with reference to virtual environments. Today, there are 360-degree full-motion flight simulators, 4D theatres or 3D space shuttle rides and more (MacLean, 2008). With the help of such advanced electronic components researchers gain the possibility to investigate telepresence, temporal dissociation and game experience in a more sensible and genuine way.

Next, (emotional) self-reporting measurements assume a certain level of emotional consciousness which is applying to every person. With reference to the Differential Emotional Theory by Izard (1992), emotions are not only a subjective feeling, but also a particular physiological activity. Hence, measurements of virtual reality and the feeling of being present in that world the computer generated should also apply unconscious measures, like for example the heart rate. Users could, from a cognitive point, know that the atmosphere presented is artificial. However, from an unconscious degree they could reveal that they respond in a way as if there was something real. Consequently, future research should apply also physiological measurements, next to explicit ones, representing a more intensive objective evaluation.

Another method of measuring Virtual Reality in the entertainment sector of gaming could be the use of physiological measurements. So, analyses of skin responses or EKG recordings (Meehan, Insko, Whitton & Brooks, 2002) could derive more precise results concerning experience presence with the help of virtual reality. Generally, this idea is based on the knowledge of common reactions of persons within reality to a specific situation. If the

person demonstrates the same reaction within the world the computer created, researchers could claim that virtual reality has physiological effects. As a result, one could say then that users are telepresent in the virtual world.

Moreover, future studies should support behavioural methods to research Virtual Reality in gaming environments. This implies that respondents within a virtual environment act as if they were in an equivalent physical environment (Sanchez-Vives & Slater, 2005). As a result, users would reach a higher and more intensive state of telepresence. Typically, behavioural measures would demand the establishment of features into the environment that would cause physical responses, for example dropping down as reaction to a flying object.

Besides, there could be one limitation associated with the characteristics of the game itself. X-Racer, the game chosen for this research, displays a particularly uncomplicated game which does not demand abundant effort. It is rather a simple game without any storyline or characters. The only goal was to fly as far as the user can. That is why it is suggested that future studies should implement games who have more demanding characteristics. Thus, it is assumed that other games with more than one goal are capable of arousing one's interest or curiosity in a more intense way. Then, gamers would be mentally occupied to a greater extend. So, in following studies, games should be used which are cognitive challenging and require more brain activities.

Last, the shortness of the gaming sessions demonstrates a limiting circumstance. People participating in the current study played X-Racer for 30 minutes. However, video gamers usually play for more than half an hour and often spend a whole day with entertaining themselves with digital games (Rau, Peng & Yang, 2006). Therefore, future studies examining behavior by digital gamers referring to effects of Virtual Reality technologies should handle longitudinal studies to gain a more realistic insight into gamers' conscious and unconscious attitudes. Thus, an intervention should be created with a number of sessions in order to be able to analyse the effect of repeated emotion inductions. It seems that several gaming sessions could be optimal, for users become more familiar with the new technology in the meantime.

5.5 Practical implications

The found outcomes of the current study are able to deliver added values for researchers, developer of video games and therapists who are interested in technical attempts to help people and make them happier.

First, referring to the role of telepresence in learning and performance, potential positive suggestions can be made. Typically, a person sits in front of the computer and communicates with it via interface devices (a keyboard or a mouse) over an indirect link, just like the control condition in the current research. Thus, a two-way communication exists, for the user and the world generated by the computer do not share a common environment. As a result, achievable interactions are limited due to the fact that the person is not able to interact straightaway with the world the computer creates. With the help of virtual reality though, it is possible for the user to act within the computer world. As the user feels telepresent in the virtual environment, the computer-created surroundings enclose the user with continuously altering perceptions, while at the same time reacting to the user's movements. Therefore, users in virtual environments become operating seekers of information who are capable of steering and commanding what is experienced. Moreover, the forthright participation in the virtual environment becomes more meaningful by virtue of the immediate proximity in that computer-generated world. So, when combining the fact that learning enhances when a person is an elemental part of the stimulus flow (Witmer & Singer, 1998), and being in total control over one's own experience while the meaning becomes clearer to the user, technologies supporting virtual environments are expected to be a superior education instrument compared to traditional computer programs. Hence, a relationship between telepresence and heightened education performance could be conceived.
Furthermore, telepresence or the feeling of being actually in a medium, can be referred to therapeutic purposes. There is a little percentage of human beings who actively search for help in order to fight their fears or just to become a little bit happier. Virtual Reality offers intense experiences which can contribute to, for instance, meditation. Referring to the current study outcomes, virtual reality is able to transfer feelings of being actually in the medium. People can use this positive outcome to reduce stress and transport themselves into other environments, namely into other virtual worlds they want to be in specific moments. Besides, telepresence triggered by virtual reality can serve as useful tool to fight fears, for example common fears like flying with an airplane or animals like spiders. Referring to Hoffman (2004), virtual reality is capable of relieving pain, both physical and psychological. With the help of technological devices supporting telepresence, patients can alleviate their unpleasantness by engaging in virtual reality programs during pain treatments. Thus, people are not directly confronted with their therapy but could become distracted by virtual worlds.

Moreover, the results of the current study point out that technology with richer and more appealing interfaces contribute to the user's enjoyment of the activity. With reference to

Agaewal and Karahanna (2000), amusing exercises serve as a crucial predictor of usage intentions. With reference to the working sector, managers could use this knowledge for successfully implementing new information technology in the organizational environment. According to Webster and Martocchio (1993), enjoyment represents an influential and powerful feature of work. So, managers who want to implement new technologies should be both aware of the relationship between play and labour and strive to create an organizational setting that strengthens testing and inspecting new technologies. Anticipated users should believe they can enjoy new technologies while being supported by their managers; such enjoyment will then probably indicate a positive influence on their intentions to use the new technology.

As confirmed in the current study, temporal dissociation becomes more intensive in gaming environments experienced with a Virtual Reality headset. Consequently, hardcore gamers who experience a specific loss of control during gaming could spend too much time in the world the computer creates. There are some cases known where people became sick due to their high amount of time spent in virtual environments without eating, drinking or sleeping. Game developers should take account of this potential danger. Therefore, it is proposed to install specific gaming timers in games which are able to be played with a virtual reality function. Such timers should include an automatic pause of the game and a visible warning stating that the user spends a supernumerary time in the game.

Then, a linkage to the significant outcomes referring temporal dissociation and the working life can be made. Due to the results of the current study, it can be asserted that users who play digital games with 3D VR technology estimate the time differently than users who play digital games with a 2D computer screen. According to Rau, Peng and Yang (2006), positive stimuli lead to an underestimation the time spent, while negative conditions drive users to an overestimation of time. So, implementing more immersive technologies in the organizational environment could lead to a more enjoyable working situation while the user obtains successful experiences which are more advantageously organized in the memory. Workers could have a more positive impression of their work considering that their activity is experienced as having taken less time of their daily life.

5.6 Conclusion

The current study was one of a few controlled studies about the effects of Virtual Reality as an intensifier of telepresence, temporal dissociation and game experience. Moreover, this is the first study carried out in an ecological environment. In spite of its limitations, this study

contributes to a better understanding of the effect of virtual environments and the induction of obtaining the feeling of actually being in a medium and its consequences like temporal dissociation and a more intensive game experience. Being accord with earlier studies, the current study demonstrated that virtual reality can let people forget their immediate surroundings. Further, this can lead to a distorted sense of time management. Also, the obtained game experience concerning perceptions of flow, immersion, challenge, positive affect and returning to reality differs between people using 3D VR devices and people using 2D computer screens for playing video games. However, the specific game experience obtained during the experimental sessions did not display significant differences between the two conditions regarding the competence, negative affect and feelings of tension/annoyance. Nevertheless, it is assumed by using other types of games which are cognitive more demanding, that also the game experience can contain all-encompassing significant findings combined with virtual reality systems. The from the current experiment resulting methodological and theoretic implications could serve as helping tool to optimize virtual reality both with reference to the gaming or educational sector and as an apparatus to improve the well-being of people in general or of workers in organizations.

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Appendix A: Transcript Data Collection

TRANSCRIPT DATA COLLECTION

Research Title:

Putting the Virtual into Reality - The effect of Virtual Reality in Gaming Environments on Telepresence, Temporal Dissociation and Gaming Experience

Control the needed materials:

Hardware:

- ✓ Google Cardboard “POP! 3.0” Mr. Cardboard Virtual Reality-system
- ✓ Smartphone
- ✓ Laptop/ Computer

Software:

- ✓ App VR X Racer (Smartphone)
- ✓ App X Racer (Laptop)
- ✓ Qualtrics survey tool

Documents:

- ✓ Informed consent form
- ✓ Debriefing form

Questionnaires (online):

- ✓ GEQ
- ✓ Telepresence Scale
- ✓ Temporal Dissociation Scale

Questionnaire (hard copy)

- ✓ Immersive Tendencies

Hand over the informed consent form. If necessary, explain and answer questions. In the case of consent:

- Sign the informed consent form
- Allocate respondent to one of the two conditions randomly

Appendix B: Respondent characteristics and demographic background

Researcher: VR our UR?

- VR
- UR

How old are you?

What is you gender?

- Male
- Female

Which final certificate do you strive for?

- Bachelor
- Pre-Master
- Master
- phD

Are you playing digital games regularly? (via smartphone, computer, games console, etc.)

- Yes
- No

Show this question:

If “Researcher: VR or UR?” VR is chosen

Did you have experience with VR prior to this experiment?

- Yes
- No

Appendix C: Game Experience Questionnaire (GEQ) – Core Module

Please indicate how you felt **while** playing the game on the following scale:

	Not at all	Slightly	Moderately	Fairly	Extremely
I felt content	○	○	○	○	○
I felt skillful	○	○	○	○	○
I was interested in the game's story	○	○	○	○	○
I thought it was fun	○	○	○	○	○
I was fully occupied with the game	○	○	○	○	○
I felt happy	○	○	○	○	○
It gave me a bad mood	○	○	○	○	○
I thought about other things	○	○	○	○	○
I found it tiresome	○	○	○	○	○
I felt competent	○	○	○	○	○
I thought it was hard	○	○	○	○	○
It was aesthetically pleasing	○	○	○	○	○
I forgot everything around me	○	○	○	○	○
I felt good	○	○	○	○	○
I was good at it	○	○	○	○	○
I felt bored	○	○	○	○	○
I felt succesful	○	○	○	○	○
I felt imaginative	○	○	○	○	○
I felt that I could explore things	○	○	○	○	○
I enjoyed it	○	○	○	○	○
I was fast at reaching the game's targets	○	○	○	○	○

I felt annoyed	○	○	○	○	○
I felt pressured	○	○	○	○	○
I felt irritable	○	○	○	○	○
I lost track of time	○	○	○	○	○
I felt challenged	○	○	○	○	○
I found it impressive	○	○	○	○	○
I was deeply concentrated in the game	○	○	○	○	○
I felt frustrated	○	○	○	○	○
It felt like a rich experience	○	○	○	○	○
I lost connection with the outside world	○	○	○	○	○
I felt time pressure	○	○	○	○	○
I had to put a lot of effort into it	○	○	○	○	○

Appendix D: Game Experience Questionnaire (GEQ) – Post-game Module

Please indicate how you felt **after you finished** playing the game on the following scale:

	Not at all	Slightly	Moderately	Fairly	Extremely
I felt revived	○	○	○	○	○
I felt bad	○	○	○	○	○
I found it hard to get back to reality	○	○	○	○	○
I felt guilty	○	○	○	○	○
It felt like a victory	○	○	○	○	○
I found it was a waste of time	○	○	○	○	○
I felt energised	○	○	○	○	○
I felt satisfied	○	○	○	○	○
I felt disoriented	○	○	○	○	○
I felt exhausted	○	○	○	○	○
I felt that I could have done more useful things	○	○	○	○	○
I felt powerful	○	○	○	○	○
I felt weary	○	○	○	○	○
I felt regret	○	○	○	○	○
I felt ashamed	○	○	○	○	○
I felt proud	○	○	○	○	○
I had a sense that I had returned from a journey	○	○	○	○	○

Appendix E: Telepresence Scale

Please indicate how you felt during the experiment on the following scale.

	Strongly disagree	Disagree	More or less disagree	Undecided	More or less agree	Agree	Strongly agree
During the experiment, I felt I was in the world the computer created	○	○	○	○	○	○	○
During the game, I forgot that I was in the middle of an experiment	○	○	○	○	○	○	○
During the experiment, my body was in the room, but my mind was inside the world created by the computer	○	○	○	○	○	○	○
The computer-generated world seemed to me "somewhere I visited" rather than "something I saw"	○	○	○	○	○	○	○
I felt I was more in the "computer world" than the "real world" around me when I was in the middle of the experiment	○	○	○	○	○	○	○
I forgot about my immediate surroundings when I was navigating through the game	○	○	○	○	○	○	○
When the experiment ended, I felt like I came back to the "real world" after a journey.	○	○	○	○	○	○	○

Appendix F: Temporal Dissociation Scale

Please indicate how your playing behavior had an effect on **time** with reference to the following statements.

	Not at all	Slightly	Moderately	Fairly	Extremely
Time appeared to go by very quickly when I was playing the game	○	○	○	○	○
I lost track of time when I was playing the game	○	○	○	○	○
Time flied when I was playing the game	○	○	○	○	○
↳ Most time when I play digital games, I end up spending more time that I had planned	○	○	○	○	○
↳ I often spend more time playing digital games than I had intended	○	○	○	○	○

Appendix G: Informed consent

Study: **Virtual Reality**

Dear participant,

with this letter I would like to inform you about the current study you are invited to. This study takes place within the context of a master thesis in communication science. I'm studying Media & Communication at the University of Twente and my supervisors for the current Master thesis are Dr. Joyce Karreman and Dr. Alexander van Deursen. The aim of the current study is to examine whether virtual reality has a significant impact on individual gaming experiences. I like to ask you kindly to support us in this research which is described more in detail in the following section. Only with your support it is possible to gain scientific insights in the above-mentioned study topic. Please read the following information thoroughly.

What will happen?

The study will last approximately 45 minutes. In general, the study consists of three parts: First, I like you to play a video game with a specific technological device. This gaming session will be followed by several questions I like you to answer on the laptop. Please fill in the questionnaires with the needed thoroughness and sincerity. Afterwards, I like you to ask a few questions in short interview of approximately five minutes. These questions deal with the just obtained experience during the gaming session. There are no right or wrong answers. I'm just interested in your thoughts, feelings and experiences.
After the whole study, it is possible that I inform you about the results of the current experiment. For questions, further information and/ or information about the results you may contact me. My contact data can be found at the end of this letter.

What will happen with the collected data?

The evaluation of the data will be collected in a report for the University of Twente as part of a qualification work in order to reach the academic degree Master of Science. All data is

anonymized. There are no conclusions allowed to be drawn about individual persons. Furthermore, all information is treated strictly confidential and will not be given to third parties.

Kind regards,

Lisa-Marie Robin
Student Master Communication Science
E-Mail: l.robin@student.utwente.nl

Informed consent

I am fully informed about the aim of the current study. I have read the information material about the experiment entirely and I understand it. I had the opportunity asking questions. My questions were answered to my complete satisfaction. I had enough time and information to think about my participation. I am able to withdraw my agreement for the participation in this study without any reasons.

I agree that all my answers are collected, stored and may be used for scientific purposes.

[DD-MM-YYYY]	[Place]	[Name]	[Signature participant]

[DD-MM-YYYY]	[Place]	[Name]	[Signature researcher]

Appendix H: Codebook

GAMING BEHAVIOR/EXPERIENCE

Category	Sub-category	Code	Subcode
OWN EXPERIENCES	Console	Hardcore gamer **1** Regular gamer **2** "With Friends" gamer **3** Former hardcore **4** Occasionally **5**	Side Activity **a** Compensation **b**
	Mobile Phone	Occasionally/ Relaxation 6	
	PC	Hardcore gamer **7** Regular gamer **8** "With Friends" gamer **9** Former hardcore **10** Occasionally **11**	Side Activity **a** Compensation **b**
	VR	Experience	Yes **12a** No **12b**
		No own gaming activity **13**	
EXPERIMENT	Enjoyable	Yes **14**	Tempted by highscore **14a** Likes flight simulators anyway **14b** Liked Game itself **14c** Fascinated by VR **14d**
		No **15**	Monotonous **15a** Nausea **15b** Steering **15c**

TEMPORAL DISSOCIATION

Category	Sub-category	Code	Subcode
MEDIA	Gaming	Time underestimation **16** Right Time Estimation 17	Past Behavior **a** Present Behavior **b**

	Series	Time underestimation **18** Right Time estimation **19**	Past Behavior **a** Present Behavior **b**
Other/Non-Media		Time underestimation **20** Right Time estimation **21**	Past Behavior **a** Present Behavior **b**

TELEPRESENCE

Category	Sub-category	Code	Subcode
Own experience	Inside medium	Yes **22** No **23**	
	Distracted	Yes **24** No **25**	
Experiment	Completely involved in game	Yes **26** No **27**	
	Distracted	Yes **28** No **29**	

IMMERSIVE TENDENCIES

Category	Sub-category	Code	Subcode
Media	Gaming	Yes **30** Moderately **31** No **32**	
	Series	Yes **33**	Binge watching **33a**
		Moderately **34** No **35**	
Other/Non-Media		Yes **36** Moderately **37** No **38**	