The Past and the Future of

Virtual Reality

Presented by

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Abstract

Virtual Reality is something that fascinates a lot of people and gives us a lot of possibilities, but what exactly can we do with it at the moment? This paper is going to explain what work has been done in the past and present to establish Virtual Reality in our homes and our lifes. Later it is presenting some things that may lie in a short future, like games that are using the newest technologies, online learning possibilities and medicine breakthroughs. On the other hand, some more distance topics are going to be presented that may still be just a topic in a fantasy novel.

1 Introduction

What can Virtual Reality do for us in our normal lifes and when is it going to establish, if it can at all?

Virtual Reality gives a lot of possibilities. Not only to explore a complete different world as for example Second Life or games where we feel even more like we are part of the world we entered, but also reduces pain in patients, helps optimizing and planning for operations and gives people who live far away a way of studying with each other. There are so many things one can do with Virtual Reality, but why did it not establish on the market yet? The prognose says that Virtual Reality will bring up to 2.300 Million US Dollar with even the doubled sales in the years 2017 ("Virtual Reality - Prognose zum Umsatz weltweit bis 2018 | Statistik," n.d.). Oculus Rift selled 60.000 DevKid1s (Vrland, n.d.) and 45.000 DevKids2 until July 1st 2014 (cybereality, 2014), which indicates that the market is growing and people are aware of the technology, but how long will it still need to become viral? This work presents what has done in the past, what is done right now and what we might see in a short future, by researching about past innovations of the Virtual Reality and observing the news for usage of Virtual Reality devices or plans. This work can therefor be called a "state of the art" report.

2 Past and Present

Most of the inventions that are concerning computers, are made in the military or at least sponsored by it. As we will see later, the military was also the driving force for most of the simulators (Bormann, 1994).

2.1 Virtual Reality

The first one to realize that there hast o be more than displaying content on paper was Douglas Engelbar. His concpet was to combine video screens and computers, which, as we can see today, worked. His lab, the Augmentation Research Center is also responsible for most oft he interfaces developements we use nowadays. In 1966 he gave the first demonstration of his system where he simply opened a document, copy and pasted a part and then closed it. His usage of the mouse and the screen was the beginngin of the Virtual Reality we know nowadays (Pimentel, 1993).

In 1962, Ican Sutherland demonstrated his light pen with which people were able to draw images on a computer screen. 1966 hewent further and developed the first head-mounted display (HDM). Because of its hughness, heaviness and the way it had to be placed on the ceiling over the user, it was called the sword of Damocles. The difference between his version of an HDM and our newer ones is that the newer ones obscure the view of the world while his just overlayed it. He finished his final version in 1970, which had stereoscopic images and improves graphical images compared to the first version he made in 1966 (Pimentel, 1993).

> *“The barrier between the computer and the user had finally been eliminated; the user was now insde the computer.” (Pimentel, 1993, p. 33)*

During World War II, flight simulators for pilot training were used to enhance the chances of survival. With the Virtual Reality training, the survival rate jumped up to 95% after surviving the first 5 missions. The simulators were put on a motion platform so the cockpit could move according to the pilot’s actions to seem more realitstic. In 1950, also the missing visual feedback was solved. Video cameras were put on movable platforms so when the pilot moved, his view changed accordingly. As soon as computers were able to produce these pictures, they got removed (Pimentel, 1993, p. 34).

Evans and Sutherland developed scene generators, which could construct a view from any point. A whole airport could be displayed. They called the process between calculating and drawing rendering. They still had the problem that they needed at least a 20 fps update rate or otherwise the training suffered. With newer computers they always could either improve the graphics or the update rate, but never both (Pimentel, 1993).

In 1979, the military worked on the simpler version of a head-mounted display to reduce the size and complexity of the flight simulators. McDonnell Douglas made an attempt of creating one, but it got rejected because of the unnatural way of looking through the beam-splitters. Due to the military research and their investments, the technology got developed way faster than it would have normally (Pimentel, 1993).

> *“It’s likely that virtual reality could not exist in its present form without this initial investment.” (Pimentel, 1993)*

In 1976, motion capturing was possible. One could draw a line in mid air with the finger, which was visible on the screen. When all five fingers were hold uo, the images were disappeared (Pimentel, 1993).

Aroung 1970, a man named Brook realized that no one focused on tactile feedback. After he assembled a system in 1971, he realized that the technology was not there yet. In the 1980ies, Brook and his team got a new building where they wanted to develop their ideas further. During this time, they used a powerful graphic computer to create the building where they could change the viewpoint to any point in the model. They could wander down the hallway before the building was even built. Later they even added a treatmill so they could iterally walk down the hall and display it on a HMD. Architects coud now see their designs before they were built (Pimentel, 1993).

So it seems like all of the important components for Virtual Reality systems already existed, but there were still more possibilities to be explored. One of them was a more accurate way for finger and hand tracking. The developer of this was Thomas Zimmerman, who created a glove that tracked the movenments of the fingers. He intended to use it to play airguitar, but because of its accurate tracking, Fisher wanted to use it as an input device. He intended to use it as a virtual hand that would be displayed in the screen and move according to the normal one.

> *“For the first time, a representation of a person’s physical body would bevome part of the simulation.” (Pimentel, 1993, p. 47)*

Ralph Mosher went even a step further and constructed an exoskeleton, which enabled the user to move a roboter arm. When the US Navy found rockets in the deep sea and needed something to recover them, they used Moshers invention and extended it. The “Greenman” mimics the movements of the user shortly after he has done them. The users body is thereby covered on head, armsm hands and fingers (Bormann, 1994).

By 1986, the NASA had developed the first virtual world where users could use voice commands, hear speeches and manipulate objects. They used a diving mask that contained an LCD display, the DataGlove and some headphones. The quality of the visual was poorly and when the user moved the head, the images moved with a noticeable delay. On the other hand, they solved a hughe usage problem. When putting on a head-mounted display, users were unable to use normal input devices since they were unable to see the real world and their hands. Through the DataGlove and the commandes that were given through the microphone, it got solved (Pimentel, 1993).

By 1989, Reality Build for Two was published. This was a Virtual Reality system that gives the opportunity to meet on the same time in the same environment to interact, which is a form of Virtual Reality we are using mostly at home nowadays (Bormann, 1994).

So the functionals are there and we can now meet online together, but what about the sounds? Fisher did also invent something here. He has the vision of a real life 3D-sound system that could also follow an object while moving. So when picking up a radio, the sound would follow it around (Pimentel, 1993). The 3D sound also might be used in the flighting department. Pilots could use the 3D sounds to differencate between the sounds by hearing the ones that are important more loudly and near than the not so important ones (Bormann, 1994).

Borman (2014) also says that bigger companies are investing in the Virtual Reality market because they have hopes of the according financial results. With all the competition between the big and the small companies, the author thinks that the smaller and local companies are going to specialize on one component of the Virtual Reality, as we will see later on in this paper (Bormann, 1994).

Borman (2014) also thinks that the components should be developed further. Especially the input devices since we need so many. Alone for the head we need sensors for the movements, the facial expression and the point of view. We need microphones for the voice. Displays, headsets, smell and taste creating systems and some way to create haptical feedback for the output (Bormann, 1994). As we

will see later, some solutions might already been found but we yet cannot use HMD and record the facial expressions.

2.2 Games

One oft he first Virtual Reaity games was BattleTech. Players could communicate over a microphone with each other. The user was moving a roboter in the game. This roboter was controlled over footpedals. In his cabin, the player had many speakers who gave him not only the sounds of the machines but also the haptical feedback, which means that the seat shook due to the subwoover when he got hit (Bormann, 1994).

Sensorama and the systems of W-Industries were easy to breake and therefore not usable for amusement halls. In 1991 the first Virtual Realiy systems were on the market. One oft he games was legend Quest (Bormann, 1994). Which is like an old version of Skyrim.

2.3 Medicine

In 1990, Virtual Reality was already used for treating specific phobias. Limited by the technical components, treatments were mostly limited. Not only for phobias but also for Anxiety disorders and panic disorders. Because of their fear to be exposed to the real phobic situation and the possibility to control the virtual situation, this way of therapy has been revolutionary (Claudio & Maddalena, 2014).

In the past, Virtual Reality has been used as a method of therapy for Post-Traumatic Stress Disorder (PTSD) affected people in the military. One of these programs is „Argaman Systems“. It is an improvement for already existing systems like the Desert Storm PTSD simulation system from 2006 and the Vietnam VR scenario from 1997 (Dayan, 2006). The Argaman System uses video footage and projects it into the Virtual World, while other Virtual Reality systems need the

patient to be cut off from the real world and put into the virtual environment through audio and video. Therefor the therapist cannot visually be there and help if needed. This is why the Argaman System projects the therapist in real time into the virtual environment. Thanks to this new system, traumatic events can be built in a short time and customized to the patient. The sound system is based on real world sounds. The ones from the front are clearer than the ones from behind, which get muffled. The sounds from the left and the right change their sound level for each ear (Dayan, 2006).

But not only sounds and environments can be customized, also figures can be made to look alike the ones the person saw in the real traumatic event (Dayan, 2006).

Since many patients are unable or unwilling to talk and visualize the things that happened in the traumatic event, the urgency for a Virtual Reality treatment got higher. The most positive aspect of such a Virtual Reality therapy is that the therapist can control how much they are going to see, do and hear in the session. Due to multisensory cues, the patient easily retrieves missing memories. The reactions of the patient to different inputs are taped and make it easier for the therapist to analyze it (Rizzo, Hartholt, Grimani, Leeds, & Liewer, 2014).

Virtual Reality has also a way of distract people from their pain, which is why it is also used in pain management. It was used the first time in 2000. Later, more reports surfaced. Some also talked about cancer therapy and transurethral prostate ablation. The largest study happened in 2007. There were three different stuies which concluded that the pain intensity was reduced by 20%, the pain unpleasanteness by 29% and the time spend thinking about pain got reduced by 37%. Nausea was only reported 15% of the time (Sharar et al., 2007).

Not only for therapy but also for education, planning and training of operations and clinical investigations is Virtual Reality used in medicine. It helps building a model of a patient or a part of him or her. Models of organs give surgeons the possibility to plan and rehears operations (Claudio & Maddalena, 2014). The models allow the viewer to see the body and the organs as if they were seeing it from the

outside and also from the point of view of an endoscopy (Rosen et al., 1996). The only disadvantage of Virtual Reality is that there is no realistic haptic feedback, which is why Augmented Reality is used more often for training since it combines all benefits of the normal box trainers and the VR technology (Claudio & Maddalena, 2014).

The goal of the patient's model is to have a virtual reconstruction of his or her body. MRT, CT scans etc. are a 3D construction where each point sits on a specific point of space. But this information cannot be used for modeling since the computer does not know where the points are connected and which material they depicture (Rosen et al., 1996).

The surgical simulators and the flight simulators have 3 similar components: the computer, the interface and the physical model. This model is the patient, the room and the instruments, which are moved with a computer mouse (Rosen et al., 1996).

2.4 Data Visualization

Data Visualization is a way of displaying data and giving people a way of understanding abstract information. We use Data Visualization to understand pattern (Stone, Erickson, Bederson, Rothman, & Muzzy, 1994).

To find and understand pattern, we need to move it, to *"twist it, shake it, change its color mapping, expand it, rotate it, shrink it, or slice and dice it."* (Stone et al., 1994). All of these things are possible in Virtual Reality. Due to this technology, users can merge with their data. If this data has more than three dimensions, it can be visualized with size, texture, shape, color and so on (Stone et al., 1994).

Already in 1994, the market was interested in Virtual Reality products, but the prediction said that the real needs of the application will show, if it will be used or not. Still, it is an easy way of showing results also to people who are not as affiliated as experts (Stone et al., 1994).

In one test, the data was displayed as different objects, which were placed and shaped depending on underlying data. During the test, participants using the monitor and the Virtual Reality version were compared. There were about 43% more errors in giving the answer on the normal monitor than there were with the Virtual Reality display (Bayyari & Tudoreanu, 2006, p. 371).

2.5 Second Life

Second Life is an online 3D Virtual Reality environment that can be described more as a chat than as a game since there are no obstacles.

Published by Linden Lab from San Francisco it is one of the most popular virtual worlds. One can create an Avatar and explore the world to complete missions. Through Avatars people can explore the Virtual World, which got published in 2003. It is used for fun and for serious business. Not only for job interviews or research but also for education, disaster simulation and nursing training. As we will discuss at “Education”, Second Life also give a new possibility for online learning(Claudio & Maddalena, 2014).

But even for “normal” people there are not only the gaming and talking options. It is a whole world online. You can even visit the doctor, but a study showed that no one in Second Life was interested in visiting the medical sites there. Only one clinic was visited by other avatars than the researcher: a clinic for sexual role play (Claudio & Maddalena, 2014).

2.5.1 Friendship

Another study in Second Life revealed something about friendships in virtual reality. Since it is a virtual world where the users can explore and share activities, do not rely on shared activities. They rely more on frequent texting than on co-presence. During the interview, people made a difference between the “friend list” and their “real friends” (Welles, Rousse, Merrill, & Contractor, 2014).

> *„Interviewer: How many friends do you have in SL[2]?*
>
> *mW[3]: on list or proper friends that I talk to every day?“*
>
> *(Welles et al., 2014)*

> *„Interviewer: Do you have any friends in Second Life? Interviewer: If yes, how many friends do you have?*
>
> *RG: Yes, I have made several in second life , my last check of friends list had over 400 players Ive swapped friend cards[4] with is that what you mean by friends*
>
> *RG: or do you mean close bonds ?“ (Welles et al., 2014)*

> *„Interviewer: Do you have any friends on SL, if so how many?*
>
> *BS: well my friends list consist of about 32 people but i would only consider about 9 of them to be real friends BS: the rest seem more like aquantices.“ (Welles et al., 2014)*

One even said that he uses the “friends list” only to see when people he would like to talk to are online, but he does not consider them as friends (Welles et al., 2014).

When asked what they do with their friends online different than what they do with the ones offline, they answered that they hang out more often with the ones online. Also the expectations for their online friends are the same ones as the expectations for the offline friends (Welles et al., 2014).

2.5.2 Education

Children with autism are suggested to acquire new pieces of information from Virtual environments (Claudio & Maddalena, 2014).

We already discussed that Second Life is a huge vitual world that is developing through their users and that there is a potential use for education (Zhao & Wu, 2009). The students are more active than in normal classes. They want to learn through the Internet by themselves and are not completely bount to the teachers. In group projects, they can integreate their knowledge easier and faster (Ruan & Deng, 2009). Through demonstrations and simulations the normal learning process can be made more exiting. There are other people from different countries with different cultures who might have another aproach to a problem we are facing. On this plattform, we are able to exchange each other’s ideas, problems and solutions. Plus, there are more senses that are used while learning which makes it easier to remember something (Zhao & Wu, 2009).

Another advantage is that we are able to do the same things as in real life in SL, but we can also go farer and do the impossible. Avatars can dive without a shortage of air and dying. National Oceanic and Atmospheric Aministration set up a simlation that included an interactive ocean and weather demonstration (Zhao & Wu, 2009).

The keyword here is interactive. Second Life-based learning is centered torwards the learner, which means that they can gain their knwoledge through different ways, depending on how he or she learns it most efficiently. They can get access to published books and papers and write some themselves. All of the possibilities are interactive and time consuming. They spend a lot of time and attention on their learning and therefore see results faster and easier (Ruan & Deng, 2009).

A big problem, as we will see later on too, is that it takes a lot of time to learn how to use Second Life. Building a house, accomblishing tasks, learning tools and so on needs a lot of time and at least some understanding of Virtual Worlds and computers, especially in the beginning. It has not yet an ensured quality and reliability. As we will see later on, students may have the feeling to loose sense of control or not behave anymore (Mandal & Lim, 2008). Also, using it for the wrong ideas may be a problem.

Many universities are alreasy present in SL and are lecturing some of their classes there. The University of Phoenix even offers a whole degree program online (Daniel C. Cliburn & Jeffrey L. Gross, 2009). Daniel C. Cilburn and Jeffrey L. Gross examined how online learning influences the overall learning expierence.

According to their test results, the students who visited the course in Second Life were not as good as the ones that were present in the class room at a posttest quiz. Their participants were a complete class that they were teaching during that time. The class was divided into two groups, the Second Life group and the controll group. After both of them heard the topic in their classes, they met and had the posttest. To be sure that there has been or has not been an improvement to their knowlegde, students had to take a pretest (Daniel C. Cliburn & Jeffrey L. Gross, 2009).

1. Students who were participating in the Second Life group had a lower rate of improvement than the students who were participating in the controll group (Daniel C. Cliburn & Jeffrey L. Gross, 2009).

2. Students in the SL group where mostly new to this technologie and had to take pre-lessions with their lectors for the basics of SL (Daniel C. Cliburn & Jeffrey L. Gross, 2009).

When the students took a survey after their class, 8 out of 15 said that they would take another Virtual Reality class while 4 strongly disagreed. 3 out of 15 were netural. The biggest problems in this study were that the lector and the classmates had the same color in the chatbox. It was hard for the students to follow the context (Daniel C. Cliburn & Jeffrey L. Gross, 2009).

Also, their peers distracted them by not behaving and dancing in the classroom. Due to this, some students could not see the presentation properly. Additionally, the names of their peers's avatars and the other avatars standing blocked their view. For some, the loading time was too long and others just basiclly were too distracted by the possibilities to misbehave. On the other hand, some were exicted that they did not have to leave their home and have to come all the way to the university. Another participant said that he or she enjoyed the possibility, but the immature peers destroyed it. The authors also claim that it could be that the topic itself, which has been college wrestling, was not appealing enough to make them concentrate (Daniel C. Cliburn & Jeffrey L. Gross, 2009).

Another approach to learn through Virtual Reality came from Haiyan Wu and Xun Wang, who presented a prototype of a system that was supposed to make historical facts more interesting. The idea was to create a virtual world where people can expierence the history through a roleplay. Their problem was that the historical events had to be true, so they would loose the game aspect, which means that they would have to have different outcomes. They decided to let the player choose his side and relive the events. For their prototye, they developed "the Silk Road" and the fitting events (Wu & Wang, 2008).

3. Future

We heard a lot about the past and present. Sometimes even things that are a little bit more in the future, but what can we say right now about the future of Virtual Reality?

A possible way of influencing the world is that Virtual Reality may change the way a company works. The company may exist only in a virtual world, it could be virtual for different projects, it could be a normal company that also includes Virtual Reality or it could sell their work over Virtual Realities (Bühl, 1996).

3.1 Medicine

There are many already existing systems for therapy, but one is new: “Bravemind”. “Bravemind” is based on Unity, which is actually a game engine. Due to the graphical improvements, the environment feels more real to the patient than before. This system is not only used for PTSD but also for sexual trauma in the military, which means they had to add barracks, tents and other possible places for sexual assault. Different from previous systems, this one does not show the sexual assault itself, but the location, time and the context may be recreated for the therapy. In summer 2014, first tests with 34 participants were planned (Rizzo et al., 2014). For the future the team says “new interactive and immersive technologies, such as VR could have a lasting influence on civilian healthcare long after the las Afghanistan war veteran has returned home”(Rizzo et al., 2014, p. 36). This indicates that the system may be used also for “normal” therapies outside of war zones.

Another aspect of operations and Virtual Reality is given by Rosen et al. (1996). They say that in the future, a glove that moves the instruments and gives haptic

feedback might be used. The authors also talk about having done some work of bringing computers into the operation room. The plan is to use it with an actual surgery (Rosen et al., 1996). They “have a system that by using a three-dimensionally tracked arthroscope the actual arthroscopic view is superimposed on a three-dimensional reconstruction of the preoperative CT scans.” (Rosen et al., 1996)

The authors dream about a simulator that shows physical dimensions, pathophysiology and the healing process (Rosen et al., 1996).

3.2 Second Life

> *“We can assume that this field of study will offer great opportunities in the world of e-learning and simulators.” (Claudio & Maddalena, 2014)*

We talked about the problems of Cilburns and Gross’s (2009) study, but here are also some ways on how to fix the problems for the future.

First of all, the teachers should be trained to use the technology and the software. They also should be able to provide sifferent ways of learning a skill (Ruan & Deng, 2009). Students should be able to discuss, but when talking randomly about different topics, they should be able to be blocked (Daniel C. Cliburn & Jeffrey L. Gross, 2009).

Secondly, there should be rules on how to behave in online classes. If someone does not behave accordingly, an option of kicking that person for the teacher would be handy. This also means that students or participants need to learn basic usage of Second Life to not accidently disturb the lecture. Maybe a class on how to learn Second Life Education would be a solution, since there are already classes on how to use Second Life normally (Ruan & Deng, 2009).

Thridly, as soon as the techniqual compomonents are able to handle SL smoothely, the problem of accessibility needs to be solved. Bandwith and expensive equipment are here the problems. If the accessibility is solved, then we are one step further to online learning (Ruan & Deng, 2009).

Furthermore, cassrooms can be build so that avatars and their name boxes, if they cannot be distinguished, will at least not block the view of other students (Daniel C. Cliburn & Jeffrey L. Gross, 2009). Power Point files may be downloaded before the lecture begins so the problems of not seeing the material might be reduced and in case of visual problems, students have their own copy to rely on.

According to Zhu, Wang and Jia (2007), students spend more time in the online course than in the real life one. Also the environment promotes cumulatively possible, which often fails to emerge in real life. This means that the interactive learing expierence is hard to dulicate in real life. Still, the language supportion and the problem that the usage of SF takes a while are obstacles we need to solve in the future (Zhu, Wang, & Jia, 2007).

Ruan and Deng (2009) state that a Second Life school should be build in SL and offer standard courses with a flexible shedule so that learners can adjuste to their own speed of learning. Different courses for different ages, developement stages and expierences should be offered. This would be another step forward to the future of learning (Ruan & Deng, 2009).

> *"However, they do believe that 3D virtual wold will become a mainstream in e-learning. Inanticipation of this growth, the universities, buisness companies and professioal institutions focus on applications and the effecive and efficient implementation of SL. Everones will expierence the greatest benefits that e-learning hs to offer now and in the future"* (Zhao & Wu, 2009)

> *"The authors believe that the Second Life-based education will be more and more popularized in future."* (Ruan & Deng, 2009)

The Second-Life based education may be an extention of normal learning nowadays, but in the future it may become mainstream, thanks to educational reforms and developements (Ruan & Deng, 2009).

Another aspect of this is the one of Bormann (1994) who tells about a game that learns the characteristics of the student and during his learning, the program adapts to learn more about the student and help him learning faster and more efficient (Bormann, 1994). Orson Scott Card has a similar idea in his book Ender's Game where he talks about the "Fantasygame" which helps Ender to learn and think different to solve problems and puzzles. Everytime he solves one the game creates new ones that fit perfectly to him (Card, 1991).

3.3 Problems with Second Life

Since Second Life is another world online, it copies many social aspects of our world. One of the biggest fears is that they could also use this virtual space to recruit terrorists, teach them and rehears attacks. Already existing groups like "SL qaeda", " SL Terrorists" and "Elite Jihad Terrorist Group" seem to be fictional and no real terrorist groups, but how long until they find out what oppurturniy this is? (Mandal & Lim, 2008)

First of all, even with the connection between the virtual world and the real world, the identities can be fictional and the information can be false. When they log in through a proxy, it gets even harder to find out who is behind that personality, even when tracking their IP adress. Linden Lab introduced a system where the Users have to enter a Passport Number or the last digits of their social security number which is checked with a system containing public records. But even if they

can find an identitiy behind the avatar, the numbers could be stolen from someone else. Another way of tracking the person is their credit card. When users buy something in Second Life, they have to use a credit card, which normally is owned by them and has their name on it (Mandal & Lim, 2008).

The second worry is that the terrorists can use the plattform for education and recruiting. In Second Life, you can have your own land which, when set to private, cannot be seen from other users or tracked unless you want them to. What ever the owner of this land wants to do is private and will not be monitured until someone fills out a claim. Then Linden Lab might do something against it. We already discussed that the avatars are mostly anonymus, but may be somehow tracked down, but with this big space of privacy, an online training camp seems to be realistic. Not only texting, but the voice and pictures or videos can be displayed on SL, which means that not only passing information over textst or vioce are possible, but also "having virtual training videos on bomb making and virtual classrooms for indoctrination." (Mandal & Lim, 2008)

Due to the different camera angles and the possibility to rebuild every building from the real world, attack rehearsals are also easily made (Mandal & Lim, 2008).

Last but not least, recruiting is another fear. With about 25.13% the 18-24 year-olds make out the biggest group of users in SL. Therefor, especially younger people might get in touch with the extreme terrorists and might catch on their ideology (Mandal & Lim, 2008).

Even if there have "only" been attacks to the American Appearal's store and one the Reebock, the possibilities are there and no one knows when they might get used. For now, the scare reason of SL being from the US holds them back (Mandal & Lim, 2008).

3.4 Games

Bormann (1994) thinks that the already exisiting VR-Cafes and VR-Studios may have the same effects on the distribution of Virtual Reality in private homes as the amusement hall had on computer games.

When hearing of Virtual Reality, many people think about games and the Oculus Rift that was is hyped at the moment. There has been so much improvement the last few years that thinking of what might be in the future gets every gamer excited.

3.4.1 Head-mounted displays

For example, the Oculus Rift head-mounted display is not only small but also affordable for a private person and working. With the newer DevKid we are now also able to tracke the heads movement from the outside of the HMD. The graphics are getting better and the developing team wants to publish the finished version of the Oculus Rift with an HD display.

Sony also made an approach in this directory. The “Wearable HDTV, 2D/3D, Virtual 7.1 Surround Sound” head-mounted display like glasses are enabeling the user to watch a show in 3D or 2D with great sound anywhere the user wants. It is connectable to many mobile devices and a PC. According to the homepage one can also use the glasses for gaming, similar to the Oculus Rift. The difference here is that the Oculus Rift is still in developing while the Sony HMD can already be bought for about $999 (“Wearable HDTV, 2D/3D, Virtual 7.1 Surround Sound | HMZT3W,” n.d.).

In Europe, we have less of the huge companies and the military does not invest the money into Virtual Reality, which means that we have many smaller companies who specialize on one component of Virtual Reality (Bormann, 1994). One of these is the company “Cyberith” who is developing the “Virtualizer”.

3.4.2 Virtualizer

The Virtualizer is like a 360° treatmill that can be used wearing socks and copies your movements from the Virtualizer onto the person in the game, which means while walking in real life the character walks too. Additionally the Virtualizer senses when you duck and copies this movement to the character. The project got successfully founded on August 31th 2014 and, according to their homepage, one is going to be able to pre-order soon ("Cyberith | contact," n.d.). The Virtualizer is compatible with the PC and the Oculus Rift. As the developers say:

> *"The Oculus Rift will be compatible with the Virtualizer, even if they go for seated VR, it is possible to use the Oculus Rift without lateral tracking and only use the rotation sensors. However, we would be very happy to see the consumer rift with 360° lateral tracking."* ("Cyberith | contact," n.d.)

To use the Virtualizer, one has to be at least 1 meter tall and should not weight more than 120kg. The Virtualizer is compatible with many other input devices and is compatible with many games if used with the SDK from the homepage ("Cyberith | contact," n.d.).

Another project like the Virtualizer but from a different country ist he Virtuix Omni.

3.4.3 Virtuix Omni

The Virtuix Omni is also a 360° treatmill but other than one the Virtualizer, the developer recommend the Virtuix special shoes for a better usage. Also the user is able to hold a controller and drive with a car or shoot. Additionally one can sit down and be supported by the waist harness. Another difference to the Virtualizer is that the Virtuix can connect wireless over Bluetooth with a PC or the Samsung Gear VR ("Frequently Asked Questions ‹ Virtuix Omni," n.d.). The Virtuix can be

pre-ordered right now for $699, which does not include a Virtual Reality HDM or any controller, just the treatmill (“Frequently Asked Questions ‹ Virtuix Omni,” n.d.).

On the homepage the developers also say that one can burn 350 – 400 Calories during an hour of game play while the user ran about 3 miles (“Frequently Asked Questions ‹ Virtuix Omni,” n.d.). This opens also a new window for training at home and getting shaped. Gaming might not be the typical “sitting at home gaming all night and eating chips” stereotype in the future; it might be an actual sport that also non-gamers can accept.

3.4.4 Games for Virtual Reality

Since Oculus Rift first published their DevKid1, people are excited for games to be published. Some smaller ones can be found on the Oculus Rift homepage “https://share.oculus.com/” to be downloaded, but people want them to be bigger and better.

This is why some developers are working on patches or mods to make the existing games compatible. One of the third-party drivers is VorpX. Thanks to this, games like “Alice Madness Returns”, “Assassins Creed II”, “Slender”, “Fallout 3” and “Skyrim” can be played with a HMD. Vireio makes it possible to play games like “Left 4 Dead” and “Portal” (“List of Oculus Rift Compatible Virtual Reality Games and Software,” n.d.). There are many pages on the Internet keeping gamers up to date with patches. According to “Road to VR”, many are still in development or got cancelled.

Another way of publishing games for Virtual Reality HMDs is to program them in a Game Engine that is supported. At the end of the year, Pollen, a game from Mindfield Games in Helsinki is going to be published and will enable the player to walk around a lonely space station called “Station M” where you have to help your crew survive (“Pollen,” n.d.).

Also, Second Life is now able to be explored with the Oculus Rift (“Oculus Rift DK2 Project Viewer Now Available,” n.d.).

3.5 Software

Anthony Steed (2008) talks about the software problems that are still occurring and may not be solved soon. The skripts cannot be used broady because of the defferent devices, skripts etc. who do not inter-operate. His conclusion is that instead of using standarts or unified platforms, programmers and developers should think more about making their part usable for more people in the future.

3.6 Present developings on the news

3.6.1 Drones

As we heard before, the US Navy invented the Greenman, which is the exoskeleton that enabled the user to move a roboter somewhere else (Bormann, 1994). This invention makes people wonder if it might be possible to use other things from more far away. Orson Scott Card writes in his book “Ender’s Game” about the young Ender who thinks he is playing a game to prepair for a war while in real life, the game is a war and due to his movements, he is ordering a real fleet (Card, 1991). Something like this seems not real? It is. The US is recruiting gamers to fly their drones and kill people for them while they are sitting miles away on their computers (“Spieler als Soldaten,” n.d.)

3.6.2 Telerobotic

On the other side, through telerobotic, we may be able to do most of our work from our home. Not only by sharing data and meeting in virtual environments but also by moving a rovoter somewhere else to do the persons work (Bormann, 1994).

3.6.3 Facebook

According to Zuckerberg, the inventor of Facebook who also bought Oculus Rift VR in 2014, Virtual Reality might need some more years before it can be successful, but it will. It could take another 10 or 20 years and needs 100 Million users before it is relevant. He also says that Virtual Reality might be a platform that comes after the computer (“Zuckerberg,” n.d.).

Another point where Zuckerberg is working on Virtual Reality is with his own Apps. After buying Oculus Rift, he already has one of the most important Virtual Realitycompanies of this time and is now worker further into this department. He wants to publish the Apps so that users can share their life easier with their friends (“Facebook arbeitet an Virtual Reality-Version,” n.d.).

3.6.4 Pornography

Whenever the technology found something new for games or films, the porn industry is there to invest in the process and developing. In the 1970ies they published most of the videocassetts and later, they started their first video streaming sites. According to people in the industry, head-mounted displays are perfect for porn since people around them won’t see or hear what they are watching. Additionally, Virtual Reality eliminates the line that makes people realize that they are watching a film. With this technology, it feels like being there (“Pornografie erobert Virtual Reality,” n.d.).

Ela Darling, who owns VRtube, already produced a small film and the result was incredible to her. She says that it still might take some time, but it will be revolutionary for the industry (“Pornografie erobert Virtual Reality,” n.d.).

4 Conclusion

In conclusion, we have many things that might change or changing right now. The problems we had before with size and prices are solving themselves, companies are investing and people are expierencing the wonders.

According to Bühl (1996), the healthcare, the life and especially the workingplace will be changed by Virtual Reality in the next few years. Bormann (1994) also says that with all the positive side effects and great things Virtual Reality makes possible, we should not forget one thing, not everyone can see and use it. We should not change our whole lifes accordingtly to this technology before we can make sure everyone is able to use it (Bormann, 1994). Part of our society is not able to see at all, which makes it even harder since a blind person cannot see Virtual Reality with their hands, which might be something we should work on in the future.

People are used to have a good quality when watching films or gaming. The DevKid2 of Oculus Rift now has also a resolution of 960 x 1080 per eye, while the first one had ony a resultion of 640 x 800 pixels per eye (“The All New Oculus Rift Development Kit 2 (DK2) Virtual Reality Headset,” n.d.). This means that when using the Oculus, one can see each pixel with the eye, which distracts people. The main problem with these technologies are that they are mostly still in their developing phase or in the first one published, as we can see in the example above. For the Oculus Rifts this means that they have yet just published the Development Kids. The Virtualizer has just selled his Kickstarter pre-orders and the Virtuix Omni is still expensive and so new that people need to hear about it first. The second problem also is that people just do not know about the technology or just too afraid to pay a lot of money for new things that have not been accepted by the majority.

As we can see in the news, more and more companies are finding the Virtual Reality for their usage. Facebook is developing their apps (“Facebook arbeitet an Virtual Reality-Version,” n.d.), Qantas has now Samsung Gear VR in their First

Class to entertain people on long flights (“3D-Filme im Flugzeug,” n.d.) and the porn industry trys new methods of filming for Virtual Reality devices (“Pornografie erobert Virtual Reality,” n.d.).

It might be slowly, but Virtual Reality is wining its way into our lifes and everyday we find new stories in the news where we use it now. As already said in the Introduction, the prognoses are there, the selling rates are going up and the technology gets better everyday. How long it still needs is hard to say, but we can already see the first impacts in our lifes.

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