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List of Abbreviations

VR	Virtual Reality
AR	Augmented Reality
HDM	Head-mounted Display
E.g.	for example
qtd.	quoted

Abstract (German)

Mit der kürzlich erfolgten Markteinführung von Virtual Reality Headsets zu konsumentenfreundlicheren Preisen ist ein neuer Hype um diese Technologie entstanden. Während sich die Werbung primär an einen frühen Anwenderkreis im Videospielbereich wendet, hat inzwischen auch die Film- und Videoindustrie begonnen, Inhalte für dieses neue Medium zu produzieren. Einerseits haben durch die Internet-Plattform-Giganten Facebook und YouTube 360-Grad Videos an Popularität gewonnen; ebensolche Inhalte präsentieren sowohl Medienkonzerne wie The New York Times, CNN, BBC und ARTE als auch die Werbeindustrie. Andererseits haben Pioniere im Film- und Videospielbereich, die teilweise von großen Medienunternehmen und auch von Hardware-Produzenten finanziert werden, begonnen, erste narrative Virtual Reality Projekte zu realisieren. Diese Arbeit befasst sich damit, wie Virtual Reality für die Video- und TV-Produktion von Bedeutung sein könnte und gibt einen Einblick in einige Pionierprojekte aus diesem Bereich. „Immersion“ und „Interaktivität“, mit denen Virtual Reality häufig beworben wird, brechen die Konventionen der Video- und TV-Produktion und fördern die Entstehung neuer narrativer Formen.

In einem weiteren Schritt präsentiert diese Arbeit, vertieft durch Experteninterviews, Einblicke in einige grundlegende produktionsbedingte Herausforderungen in den derzeitigen Produktionsabläufen und im Workflow. Eine der vielen in dieser Phase der Brückentechnologie ist die stetige Weiterentwicklung der Hardware, welche für die Verbreitung des Mediums in einem breiteren Konsumentenmarkt notwendig ist. Zum aktuellen Zeitpunkt sind die Distributionswege noch weitgehend unerprobt in einem kleinen, obgleich wachsenden Markt, dessen mögliche Größe derzeit noch schwer einschätzbar ist. Eine große Marktteilung zeigt sich im derzeitigen Vertrieb über Plattformen, Filmfestivals und VR-Kinos - in einem Markt, der mehrheitlich noch als Nische gesehen wird. Mit der rasanten technologischen Weiterentwicklung wird sich die Qualität der mobilen VR-Systeme verbessern und die Anzahl der Anwender vergrößern - damit wird auch die Nachfrage nach Inhalten steigen. Diese Arbeit hat das Ziel, einen Überblick über die aktuelle Situation des Marktes von VR im Hinblick auf die sich ständig verändernde Medienindustrie zu geben.

Abstract (English)

With the recent introduction of pro- and consumer priced Virtual Reality system headsets, a new hype about this technology has arisen. While advertisers are primarily targeting a circle of early adopters located in the gaming sector, the video- and film industry has also started to produce content for the novel medium. On the one hand, because of intensive promotion through the internet-platform giants Facebook and YouTube, 360-degree videos have gained popularity. News and TV empires such as The New York Times, CNN, BCC and ARTE as well as advertisers have followed suit. On the other hand, a pioneering group of film- and game-producers and studios, partly funded by big media companies and hardware manufacturers, has started to produce unique narrative Virtual Reality experiences.

This paper deals with how Virtual Reality is crossing into the video and TV-production and vice versa. It introduces some of the recently produced pioneering titles in VR production. 'Immersion' and 'interactivity' are two commonly used buzzwords to advertise Virtual Reality systems and the experience they can provide. With these factors, boundaries of conventional video and TV-production are pushed and new forms of narrative commence to emerge.

In a further step, with additional insights gained through expert interviews, the paper presents some aspects of production-related challenges in current production circles and workflows. One of many is the constant technological progress that is required for VR hardware to spread into a broader consumer market during this current state of innovation. At present, audience size is still difficult to estimate and distribution ways are still largely undefined in this rather small, but growing market. Platform distribution, film festivals and VR cinemas point to a wide market split through in-home and location-based entertainment in - what many still call - an industry niche. With the technological improvements of low-cost mobile VR systems, the number of viewers is likely to increase and demand for content will consequently rise. This paper aims to provide an insight into the current Virtual Reality market with specific regard to its practices in the constantly evolving media industry.

1 Introduction

"Let me take you on a journey. Something you never experienced before. This is a historic moment. We'll share it together."¹ This is how artificial intelligence character Eleanor introduces the 360-degree YouTube video with the title *Enter 103EX* promoting the newest Rolls-Royce technology. Along the same lines, Virtual Reality and 360-degree video itself have been promoted and announced: "VR has been so fully imagined for so long, in fact, that it seems overdue."²

"Many believe that augmented reality and virtual reality could usher in the next big shift in how we use computers."³ "In coming years virtual reality applications will develop into a multi-billion dollar market."⁴ "In 2015, low-cost consumer VR technology is surpassing professional VR/HMD systems."⁵ "2016 sees the VR industry entering the mass market for consumers. Immersive media create an impressive reality, surrounding the user completely. [...] The hype is underway."⁶

Virtual Reality seems to be "here to stay"⁷ with its potential to possibly "give rise to the next generation of personal computing, forever changing our lives"⁸ and even disrupt entire existing industries.⁹ As depicted in these statements the idea of Virtual Reality hitting a mass consumer market faster than later is all around.¹⁰ Others have suggested - more cautiously - that AR and VR might gain traction among enterprise users first, followed by a drop in headset prices resulting in a broader consumer market diffusion.¹¹ In a more pessimistic approach, it has been criticized that Virtual Reality currently does not fulfill the promises of the technology as depicted in films like *Tron* or *The Matrix*.¹² The question whether there will be enough demand for Virtual Reality entertainment for this market to be

¹ YouTube (2016, June 16) [<https://www.youtube.com/watch?v=q7gygumHoos>].

² Kelly (2016a) p. 77.

³ Hempel (2015) p. 80.

⁴ Scholz (2016) p. 40.

⁵ Jerald (2015) p. 473.

⁶ Osarek (2016b) p. 12.

⁷ Lang (2016c) online.

⁸ Eadicicco (2017) online.

⁹ Chokkattu (2017) online.

¹⁰ Straw (2016) online.

¹¹ Forrest (2016) online. | It is expected that prices of headsets decrease 15% each year.

¹² Sinclair (2016) online.

profitable for all industry¹³ participants and if the market will live up to its original high expectations is still unanswered and could be reduced to one question: “Why would anyone buy a virtual reality setup?”¹⁴.

1.1 Problem Outline and Research Field

One key component to the question of market potential and the possible democratization of Virtual Reality on a mass market seems to be the availability of content for the new technology. Once the novelty factor of the technology vanishes, compelling high-quality content for Virtual Reality will be necessary to keep consumers interested.¹⁵ At present, scarcity of content impedes the progress of Virtual Reality's diffusion on a mass consumer market.¹⁶

The gaming industry has set its hopes on the VR sector and is fueling the development of content in this market segment.¹⁷ Therefore, “the biggest marketing efforts are aimed at gamers”¹⁸. This might stem from the fact that technological innovation is of higher interest to early adopters, who strive to be state-of-the-art in technology innovation and already possess the high-end computer that is required to run Virtual Reality systems smoothly.¹⁹ In early 2017, 75% of game developers attending the annual Game Developers Conference²⁰ stated to believe that AR/VR will be a sustainable business in the long term.²¹

At the same time, a new movement rooted in the film industry has driven content production in Virtual Reality, led by big studios such as DreamWorks, Disney and Pixar and innovative companies like Jaunt VR or Within.²² Sundance Film Festival

¹³ An industry is a group of firms producing products and services that are essentially the same. Industries are often described as ‘sectors’, especially in public services [...]. Industries and sectors are made up of several markets, which is a group of customers for specific products or services that are essentially the same. Johnson/Whittington/Scholes/Angwin/Regner (2015) pp. 27-28.

¹⁴ Izdebski/Legkov (2016) p. 64.

¹⁵ Osarek (2016b) p. 16.

¹⁶ Ohanesian (2016) online; Heuer/Rupert-Kruse (2015) p. 87.

¹⁷ Sinclair (2016) online; Hines (2016) online; Bruns (2016) pp. 55-56.

¹⁸ Izdebski/Legkov (2016) p. 64.

¹⁹ Izdebski/Legkov (2016) p. 64; Rogers (2003) pp. 280-281. | Roger’s adoption curve describes the percentage of people adopting a new technology. Chapter 2.6 The ‘Innovation Curve’.

²⁰ The Game Developers Conference took place from February 27th to March 3rd 2017 in San Francisco.

²¹ Lang (2017b) online. | Rony Abovitz, founder of Magic Leap, predicts games to be the primary use of Magic Leap’s product. Hempel (2015) p. 80.

²² Osarek (2016b) p. 13.

New Frontier 2017 program hosted twenty virtual reality experiences, ranging from interactive films like *Hue* to *Melting Ice*, a 360-degree documentary showing Greenland's icy landscapes and the effects of climate change, to Oculus Story Studio's artistic piece *Dear Angelica*.²³

It has been suggested that besides being a gaming technology, Virtual Reality might evolve as new storytelling medium.²⁴ Similar to the matter of Virtual Reality's general market potential, opinions on this matter diverge: "Virtual Reality has become the hot topic among film distributors, with some arguing that it will be cinema's savior and others thinking that it will become simply another fad."²⁵ Some say that for filmmakers, Virtual Reality will just be a niche and that more profitable areas besides gaming will arise for Virtual Reality content.²⁶ Others believe that feature movies and TV- movies as well as series will be an integral part of the Virtual Reality market and that within 5 to 10 years this trend will become a common form of in-home entertainment.²⁷ Another prediction is that the VR market will remain smaller than the app-market and the TV-market, whereas mainly professional applications like VR-cinemas and holodecks can make profitable income with Virtual Reality.²⁸

This paper deals with Virtual Reality as a potential market for the film/video/TV industry: What are current developments in this industry sector - what kind of filmic VR experiences have already been produced? How do the two commonly used marketing terms for Virtual Reality, immersion and interactivity, play into production of VR video content? How do the film/video industry and the gaming industry possibly merge in Virtual Reality? What are the economic and production-related challenges in producing Virtual Reality content/ 360-degree video content? As for the current state of technology innovation and diffusion, which areas are likely to be profitable for content producers - in which areas financial risks are undertaken?

²³ Debruge (2016) online.

²⁴ Chocano (2014) online.

²⁵ Anderson (2016) online.

²⁶ Neubauer (2016a) p. 4; Jeckl (2017) Appendix F, pp. 189-190, 204-206. | It is predicted that the aircraft building industry and architecture will be among the most profitable areas for the VR sector. Neubauer (2016b) p. 41.

²⁷ Bruns (2016) p. 32.

²⁸ Neubauer (2016b) p. 39.

1.2 Description of Outline

Following the introduction of this paper's topic in chapter 1, chapter 2 presents a detailed definition of Virtual Reality and all the relevant terms used in this paper, including immersion and interactivity. A short historical overview of previous forms of immersive cinema and an outline of the 'Innovation curve' puts the current developments into a broader context. Furthermore, the chapter includes a short introduction of social Virtual Reality and the idea of experiences connected with immersion and interactivity.

Because the technology's current hardware and its limitations dictate content production to a certain extent, chapter 3 gives a short overview of the most important aspects, including a comparison between computer-tethered and mobile Virtual Reality systems.

Chapter 4 presents some Virtual Reality experiences created for the newly pushed consumer market in recent years and shows the diversity in artistic forms as well as in forms of use of Virtual Reality experiences.

Chapter 5 describes Virtual Reality experiences incorporating interactivity. Possibly, these are examples of a new emerging form of VR entertainment content, which might merge aspects of gaming and film industry production. Different projects described in the chapter show attempts of combining mechanics of filmic storytelling as well as of games and social Virtual Reality. *Notes on Blindness* and *The Unknown Photographer* are two awarded Virtual Reality experiences, which are introduced in more detail in chapter 5.

In a further step, chapter 6 introduces some production workflows and differences between conventional video production and content production for VR. Furthermore, current and possible future challenges in content production are highlighted in this chapter.

Chapter 7 takes a detailed look at the Virtual Reality market, focusing on distribution forms and forms of revenue for content producers. This chapter also explains network businesses and the current state of innovation in the VR market and evaluates competition forces in this rising market segment.

Chapter 8 gives a conclusion and a short outlook on possible future developments.

1.3 Methodology | Research Outline

Besides an extensive literature and internet research, several expert interviews helped gain insight into the field of research during writing this paper. Following the method of using expert interviews as exploratory tool, as defined by Bogner and Menz, prepared questions that varied for each expert served as a guidance tool.²⁹ The interviewees derive their expertise from different areas. David Attali works in the video content production, Christopher Jeckl and Loïc Suty have expertise in computer-generated Virtual Reality content production and Guillaume Fortier works in hardware and software development. With Alexander Knetig, chief editor of ARTE Creative, as the innovative branch of one of the major European TV broadcasters, this paper gains additional expertise, especially regarding TV and its changing media landscape as well as in the sector of distribution in general. Frédéric Peltier's expertise stems from the gaming industry and his position at Ubisoft, one of the biggest game developers.

An empiric study was conducted in the form of an online-survey from 10th of January until 11th of February 2017. The survey was available in three languages, English, German and French, via a public online link. 265 forms were filled out and subsequently evaluated. The full survey and its results can be found in Appendices G-J.³⁰

²⁹ Bogner/Menz (2009) p. 46-48. | Bogner and Menz differentiate between three methods of expert interviews: the exploratory, the systematizing and the theory-generating one. The conducted expert interviews did not follow a strict pattern and questions varied due to the different experiences and fields of the interviewees. This method honours the diversity of the experts and avoids putting uneven parameters into comparison.

³⁰ Appendices G-J, pp. 208-246.

2 Definition Virtual Reality

Even though Virtual Reality dates to first trials in the late 1960s³¹, it is new to a broader consumer market in its current form. General knowledge about Virtual Reality is rising, especially among younger people. The study conducted within the framework of this paper shows that 96% answered positively to the question “Have you heard of Virtual Reality before?”.³²

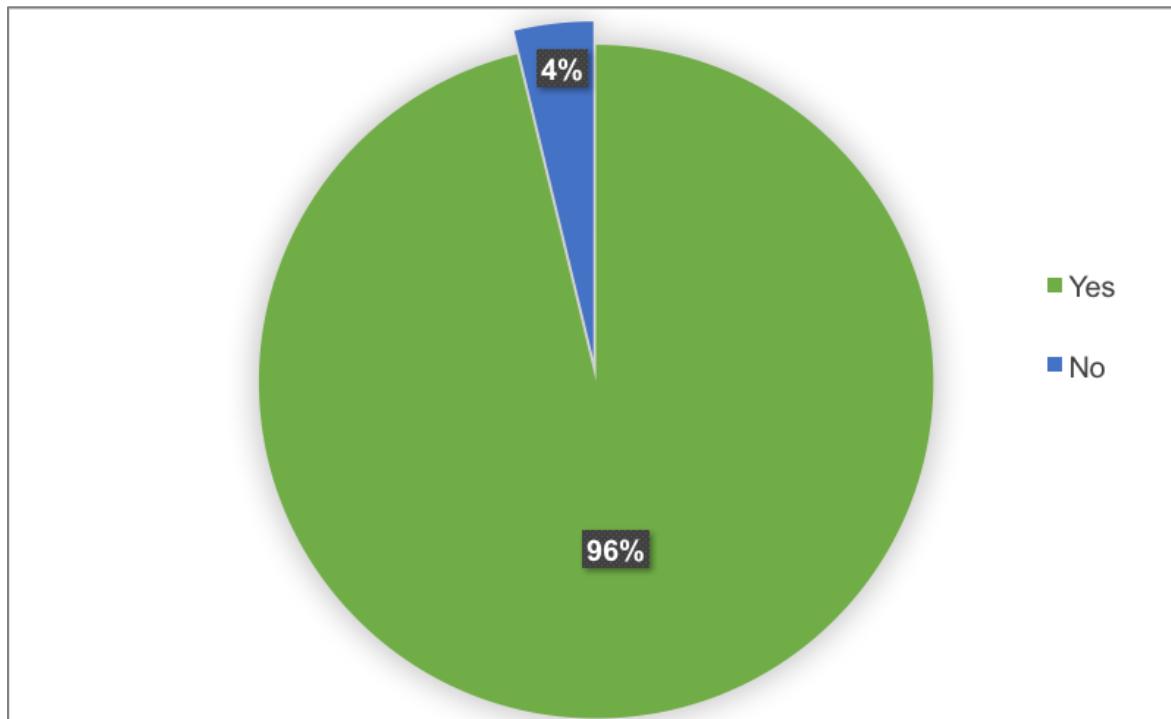


Illustration 1: Familiarity of the term ‘Virtual Reality’ among internet-using population [Survey 2017]³³

Because Virtual Reality is, in this sense, a new field of research and its development is highly dependent on the fast-moving changes in hardware, there is no unified definition.³⁴ On a technical standpoint, Virtual Reality can be defined as a computer-generated environment “that can simulate physical presence in virtual worlds by engaging human sensory experiences”³⁵ and “that can be experienced and interacted with as if that environment were real”³⁶.

³¹ See chapter 2.5 Immersive Film | Historical Roots.

³² Appendices G-J, pp. 208-246.

³³ Appendices G-J, pp. 208-246.

³⁴ Dörner/Broll/Grimm/Jung (2016) p.12; Heuer/Rupert-Kruse (2015) p. 77.

³⁵ Amin/Gromala/Tong/Shaw (2016) p. 269.

³⁶ Jerald (2015) p. 9 | This definition also includes the user experience.

A Virtual Reality system is a computer system, consisting of hardware and software, which can realize the presentation of a virtual world.³⁷ The virtual world is displayed in the form of “three-dimensional, stereoscopic, interactive computer graphics”³⁸. Four components are necessary to create the illusion of the virtual environment:

- Stereoscopic displays³⁹ – images with three-dimensional depth information
- Motion tracking hardware to detect the user’s body’s/ head’s movements
- Input devices like game controllers or hand- and body-tracking sensors
- Desktop or mobile platforms to provide operating systems including hardware and software.⁴⁰

The definition of a perfect Virtual Reality system ranges even further; an ideal Virtual Reality system allows the user “to physically walk around objects and touch those objects as if they were real”⁴¹. To be able to allow the user to move around in the virtual environment, the VR system must be able to perform real-time rendering matching the input of the user through his/her movements.⁴² The possibility of touching objects in a Virtual Reality is still far from technological standards. Despite the theoretical possibility of Virtual Reality incorporating haptic senses, current virtual reality experiences are mostly targeting vision with additional sound information.⁴³

2.1 Pre-rendered versus Real-time Virtual Reality Experiences

A recurring component of any definition of Virtual Reality is the idea that to convey a perfect immersive virtual world, the user must be able to perceive it ‘from inside’ while being cut off from the real environment.⁴⁴ In short: "Virtual Reality has one goal: to convince you that you are somewhere else"⁴⁵. 360-degree reception of the

³⁷ Dörner et al. (2016) p. 7.

³⁸ Amin et al. (2016) p. 269.

³⁹ A Virtual Reality headset uses the human eyes’ ability to see stereoscopically; it manipulates the reception process through displaying two slightly different images, which creates perception of depth information. Dörner et al. (2016) pp. 36-39.

⁴⁰ Parisi (2016) pp. 2-3.

⁴¹ Jerald (2015) p. 9.

⁴² Osarek (2016b) p. 19; Neubauer (2016b) pp. 38-39.

⁴³ Kent (2011) p. 465. | See also chapter 3.3 Touch and Haptic Systems.

⁴⁴ Dörner et al. (2016) pp. 16-17.

⁴⁵ Parisi (2016) p. 2.

audio-visual illusion surrounding the user makes it possible for her/him to fully immersive her/himself.⁴⁶

	Cinematic VR	Hybrid Forms	CG VR
Content	360° Live-Action Footage / 360° Animated Footage	Computer-Generated Content	
Tracking	2 degrees of Freedom	6 degrees of Freedom	
Rendering	Pre-rendered	Real-time	
Interaction	Content not interactive	Possibility of High Level of Interaction	
Dimensions	2D / 3D	3D	

Illustration 2: Differences of cinematic and computer-generated VR

360-degree live action video viewed in a VR system is pre-rendered and therefore, it is not possible to move physically inside the environment of a 360-degree video. This opposes the definition of an ideal VR system allowing the user to move physically within the virtual world.⁴⁷ Consequently, the question whether 360-degree live action footage in a Virtual Reality system qualifies as ‘true Virtual Reality content’ can be raised. However, as explained in chapter 2.1 and 2.2, 360-degree pre-rendered VR content can be understood as part of the Virtual Reality spectrum due to its 360-degree reception within a VR system.

2.1.1 Computer-generated, Real-time Rendered Virtual Reality Content

In real-time rendered VR content, the user has six possible degrees of movement due to positional and rotational tracking.⁴⁸ At present, these kinds of experiences are produced with the help of game engines, and therefore pose a high degree of complexity in the creation process.⁴⁹ Real-time rendered Virtual Reality content is often described as the ‘true Virtual Reality’:

"True virtual environments are artificially created without capturing any content from the real world. The goal of virtual environments is to completely engage a user in an experience so that she feels as if she

⁴⁶ Lemle/Bomkamp/Klein Williams/Cutbirth (2015) p. 25.

⁴⁷ Neubauer (2016b) p. 38.

⁴⁸ Osarek (2016b) p. 19.

⁴⁹ Osarek (2016b) p. 19.

is present in another world such that the real is temporarily forgotten, while minimizing any adverse effects."⁵⁰

As of present, only computer-generated content can reach the "inherent freedom of audience to move around, to peek at the underside of things, to linger and appreciate the details, to preserve the chain of persuasion for all the things that make up that world"⁵¹.

2.1.2 Cinematic Virtual Reality Content

With the rising market diffusion of VR headsets, the already existing form of 360-degree video has recently gained popularity.⁵² Facebook and YouTube started supporting 360-degree videos in 2015.⁵³ Recently, a whole class of Virtual Reality experiences based on 360-degree video with a resolution of 360 x 180⁵⁴ has been emerging - as described before, these are panoramic movies in which the viewer can look around in a full circle. The 360-degree video content can be either computer graphics or live-action movie footage captured with special cameras.⁵⁵ There are 2D 360-degree video cameras, as well as more expensive 3D 360-degree cameras, so the cinematic VR category can consist of two-dimensional as well as three-dimensional content. Despite allowing the user to look around in a circle of 360 degrees, cinematic VR is sometimes called 'passive Virtual Reality'.⁵⁶

Efforts are being made to overcome the limitations of 360-degree footage – one of it is conducted by the company Lytro, which is working on a light field VR capture technology to record 360-degree video with depth information allowing six degrees of freedom with a possible resolution of over 6k per eye.⁵⁷ Other competing companies are working on this technique, such as Uncorporeal and JauntVR.⁵⁸ However, these technologies currently still hold limitations and have high production costs - they are discussed in more detail in chapter 6.5.1 Volumetric Virtual Reality.

⁵⁰ Jerald (2015) p. 30.

⁵¹ Kelly (2016a) p. 85.

⁵² Izdebski/Legkov (2016) pp. 64-65.

⁵³ Dredge (2015) online.

⁵⁴ Osarek (2016b) p. 19.

⁵⁵ Osarek (2016b) p. 19.

⁵⁶ Bruns (2016) p. 15.

⁵⁷ James (2017c) online.

⁵⁸ Watercutter (2016) online; Takahashi (2016) online; Scholz (2016) p. 46.

2.1.3 Hybrid Forms

Hybrid solutions may enable pre-rendered movie footage with more degrees of freedom to move.⁵⁹ One option is to have pre-computed 3D footage with six degrees of movement by pre-rendering the scene "from any possible point in space and [then] retrieve the correct two images at runtime while tracking the user's head position and rotation"⁶⁰. Nozon is working on a solution called PresenZ that enables pre-rendered footage to be room-scale VR.⁶¹ Taking another approach, recently there have been Virtual Reality experiences with 3D 360-degree footage with positional tracking, making them more responsive than conventional cinematic VR. One of it is an experience released by PlayStation VR called the *Joshua Bell VR Experience*, in which the world-class violinist plays a classical piece.⁶² Still a costly and timely endeavor, in this case stereoscopic 4K video was recorded and then the digital video was deconstructed while isolating each element of the scene into 3D models to recreate the video sequence in 3D.⁶³

2.2 The Reality-Virtuality Continuum | Augmented and Mixed Reality

The vocabulary around Virtual Reality and various other forms of artificial realities has been used in different ways to explain various concepts. All these concepts are a gradient of a fusion of virtual content with real content, from 100% real and 0% virtual to the exact opposite, with a middle ground of infinite possibilities. This understanding follows Milgram's conception of the so-called 'Reality-Virtuality continuum'⁶⁴ and has been picked up repeatedly.⁶⁵ The Reality-Virtuality continuum does not only consist of computer-generated images in a virtual environment. It also includes video footage in a Virtual Reality system or computer-generated content as an overlay onto the real environment: "VR is a relatively new medium and the vast space of artificial realities that could be

⁵⁹ Osarek (2016b) p. 19.

⁶⁰ Osarek (2016b) p. 19.

⁶¹ Osarek (2016b) p. 19.

⁶² Lang (2017c) online.

⁶³ Carbotte (2017) online.

⁶⁴ Milgram/Takemura/Utsumi/Kishino (1994) p. 283; Milgram/Colquhoun (1999) pp. 1-9; Jerald (2015) p. 30; Dörner et al. (2016) p. 246; Billinghurst/Clark/Lee (2014) p. 81; Mehler-Bicher/Reiß/Steiger (2011) p. 10; Wang (2011) p. 494.

⁶⁵ Jerald (2015) pp. 29-30; Dörner et al. (2016) p. 246.

created is largely unexplored.⁶⁶ Currently, it is customary to make a distinction between the terms Virtual Reality, Augmented Reality and Mixed Reality (also called Blended Reality).⁶⁷

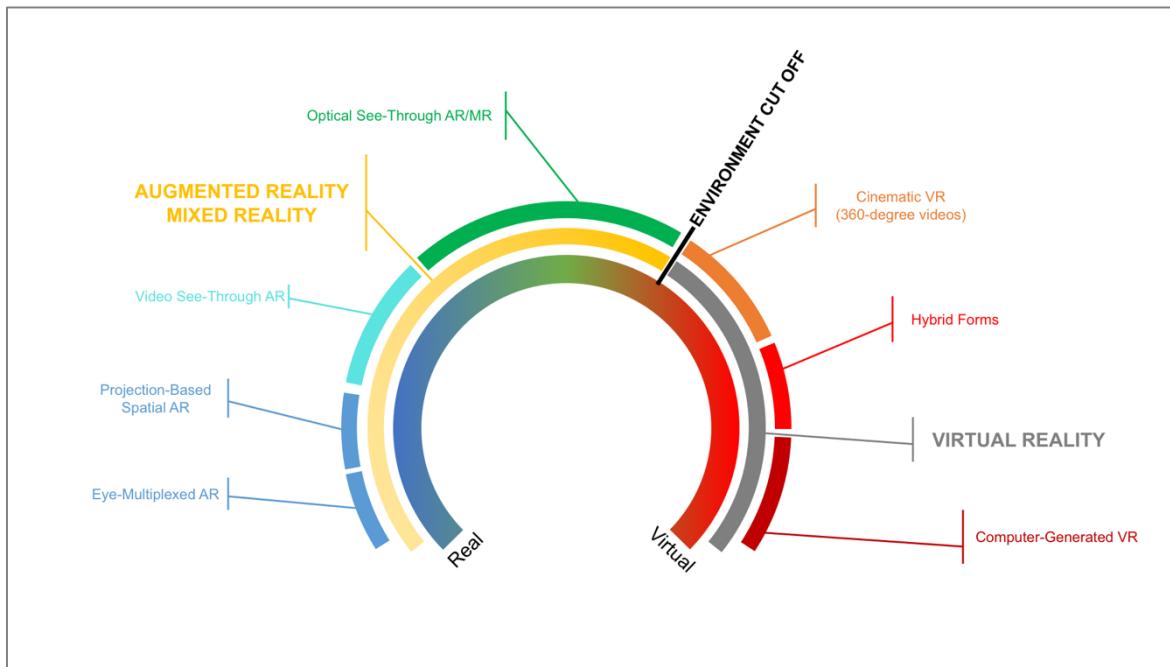


Illustration 3: The Reality-Virtuality continuum [adapted from Milgram (1999) p. 3, Billinghurst et al. (2014) p. 81 and Jerald (2015) p. 30]

While in Virtual Reality, as stated above, the virtual environment is 'replacing' the real world to provide a complete immersive experience, the term Augmented Reality has been used to describe adding a layer of digital content onto the existing environment without blocking it from the user's perception.⁶⁸ Following Azuma's widely used definition,⁶⁹ in Augmented Reality the real environment is combined with virtual content that is ideally interactive in real time and that is registered in three dimensions.⁷⁰

There are different categories of Augmented Reality: video-based AR-displays, optical see-through AR displays, projection based AR displays and eye

⁶⁶ Jerald (2015) p. 56.

⁶⁷ Osarek (2016b) pp. 12-13.

⁶⁸ Osarek (2016b) pp. 12-13; Jerald (2015) p. 9; Augmented Reality: Dörner et al. (2016) p. 20. | Note that there is no unified definition for Augmented Reality either. Mehler-Bicher et al. (2011) p. 9.

⁶⁹ E.g.: Wang (2011) p. 495; Tönnis (2010) pp. 1-2; Schart/Tschanz (2015) p. 22; Mehler-Bicher et al. (2011) p. 10.

⁷⁰ Azuma (1997) p. 356; Dörner et al. (2016) pp. 241-242, 245.

multiplexed AR displays.⁷¹ In video see-through Augmented Reality, a real-time video is overlaid with virtual objects or information.⁷² The output device can be a smartphone, for example. In optical see-through Augmented Reality, a semi-transparent output-device is required as the user sees the real environment while virtual content is optically layered on top of the real environment in the output-device.⁷³ There is also spatial Augmented Reality⁷⁴ or the so-called projection based AR⁷⁵, which has virtual content projected onto real objects. Eye-multiplexed AR displays “let users combine the views of the two worlds mentally in their minds”⁷⁶.

Definitions of Augmented Reality and Mixed Reality are converging and the term Mixed Reality has been used in different ways. In Milgram's Reality-Virtuality continuum, Mixed Reality encompasses all the forms from Augmented Reality up to Augmented Virtuality – the latter being adjacent to Virtual Reality environments.⁷⁷ Another definition of Mixed Reality is that it places artificial information and objects into 3D space in real time with maintaining position to the real objects.⁷⁸ In a similar understanding, the term Mixed Reality has been used to refer to new technologies using light field techniques in combination with semi-transparent displays to project three-dimensional objects onto the real environment in a manner of creating virtual content that is indistinguishable from real objects.⁷⁹ This currently popularly used way of understanding Mixed Reality corresponds with the definition of optical see-through Augmented Reality and the (possible) ability of Augmented Reality to “anchor virtual content in the real world

⁷¹ Billinghurst et al. (2014) pp. 128-139. | For a more detailed classification see Milgram et al. (1994) pp. 285-286.

⁷² Dörner et al. (2016) p. 248.

⁷³ Dörner et al. (2016) pp. 248-249.

⁷⁴ Dörner et al. (2016) p. 249.

⁷⁵ Billinghurst et al. (2014) pp. 136-137.

⁷⁶ Billinghurst et al. (2014) p. 138. | Spatial and eye-multiplexed Augmented Reality are very close to the Reality-side of the spectrum and are therefore usually not referred to when talking about Augmented Reality in a general sense.

⁷⁷ Milgram et al. (1994) p. 283 and Milgram/Colquhoun (1999) pp. 8-9. | Jerald locates 360-degree footage within the category of ‚Augmented Virtuality‘, which he defines as follows: „Augmented virtuality (AV) is the result of capturing real-world content and bringing that content into VR.“ Jerald (2015) p. 30.

⁷⁸ Osarek (2016b) p. 13.

⁷⁹ Kelly (2016a) pp. 76-77.

such that it appears to be a part of the physical environment"⁸⁰. Therefore, following Azuma's more broadly phrased definition of Augmented Reality, Mixed Reality can be understood as a variety of (see-through) Augmented Reality. Augmented and Virtual Reality will likely converge in the future, for example in hardware, as the technology of HMDs will evolve to allow see-through devices to also fully blend out the environment.⁸¹

2.3 Interactivity as Integral Part of Virtual Reality

A Virtual Reality system is by its definition and by its technical construction interactive. It requires the input/tracking of the user, the application, the rendering and the output to the user.⁸² The rendered images in the application are responsive to the user's moves:

"Communication between the human and system is achieved via hardware devices. These devices serve as input and/or output. A transfer function, as it relates to interaction, is a conversion from human output to digital input or from digital output to human input. [...] This forms a cycle of input/output that continuously occurs for as long as the VR experience lasts."⁸³

Thus, interactivity is an integral part of any Virtual Reality system; when the user makes an input - due to tracking of the user's body's position and orientation, images are generated in the output device depending on the user's point of view.⁸⁴ Tracking is the process of registering the user's pose and position while adjusting the output picture to this new acquired pose and position.⁸⁵ To display a believable image, the system has to run in real-time, meaning it has to generate a minimum of images per second in order to create an impression of continuous and natural movements in the images of the virtual world.⁸⁶ As of current standard, a minimum of 60 frames per second is required to display real-time rendering of the Virtual

⁸⁰ Billinghurst et al. (2014) p. 103.

⁸¹ Jerald (2015) p. 484; Jeckl (2017) Appendix F, p. 192.

⁸² Jerald (2015) p. 31.

⁸³ Jerald (2015) pp. 30-31.

⁸⁴ Dörner et al. (2016) pp. 13, 195-196.

⁸⁵ Billinghurst et al. (2014) p. 104. | There are various forms of tracking, such as magnetic tracking, vision based tracking, infrared tracking, visible light tracking and fiducial tracking. Billinghurst et al. (2014) pp. 103-125; Schart/Tschanz (2015) pp. 39-43.

⁸⁶ Dörner et al. (2016) p. 6; Heuer/Rupert-Kruse (2015) p. 79.

Reality system.⁸⁷ The higher the frame rate, the smoother the movements in the virtual environment are displayed.⁸⁸ If the stream of images fails to adjust immediately, the term latency is used.⁸⁹ "Latency is the time a system takes to respond to a user's action, the true time from the start of the movement to the time a pixel resulting from that movement responds."⁹⁰ If an application displays with a low frame rate, it contributes to latency.⁹¹

In the system's ability to react to the user's input lies one of the great differences between VR and conventional filmmaking. With the possibility of the viewer to direct her/his gaze anywhere in the scene, fundamentals of filmmaking change. In this sense, the viewer becomes more a participant than a viewer. The involvement of the user is a crucial element of Virtual Reality applications and definitions.⁹² As described above, the whole technology is embedded in a notion of interactivity.

In a next step, there are further possibilities of interaction in Virtual Reality experiences. These might transform the conventional concepts of leaning back (passive reception) and leaning forward (active reception). Possibly, there might be increasing interactivity in Virtual Reality experiences in the future.⁹³ While the idea of presence in Virtual Reality might be the initial selling factor,⁹⁴ it has been suggested, "VR's enduring benefits will spring from interactivity"⁹⁵.

2.4 Immersion | Immersive Virtual Reality

In Virtual Reality, the viewer is not only included in the experience as an active participator, but she/he is also supposed to immerse in the artificial environment.⁹⁶ To a certain extent, digital games offer the user the possibility to immerse in a

⁸⁷ Dörner et al. (2016) p. 7. | To provide an immersive experience, a minimum of 75 and sometimes even 90 frames per second has been set. Chung (2016) online; Hern (2016) online.

⁸⁸ Heuer/Rupert-Kruse (2015) p. 80.

⁸⁹ Dörner et al. (2016) pp. 195-198. | Latency can arise at various points during the operation of the system; for example, while the input tracking process, during transport of data within the system, during simulation of the virtual world, while rendering of the output and/or during the output process itself. Latency of the whole system is called 'end-to-end latency'. Dörner et al. (2016) pp. 198-200.

⁹⁰ Jerald (2015) p. 183.

⁹¹ Jerald (2015) p. 204.

⁹² Heuer/Rupert-Kruse (2015) p. 79.

⁹³ Kelly (2016b) p. 217.

⁹⁴ Kelly (2016b) p. 217.

⁹⁵ Kelly (2016b) p. 217.

⁹⁶ Leslie (2016) p. 190.

fantasy world - the player enters a virtual world, which she/he would not experience in life.⁹⁷ These virtual worlds offer storytelling possibilities, which are fundamentally different to narrative structures in more traditional media.⁹⁸ At first glance, VR might offer the possibility for even more immersion.⁹⁹ Virtual Reality brings the viewer to "a place visited rather than [...] perceived"¹⁰⁰. This phenomenon is often referred to as immersion and/or presence and the terms recur as an integral part of definitions and descriptions of VR, however they are not always used synonymously.¹⁰¹

What is immersion? One definition is that "immersive technology refers to technology that blurs the line between a physical world and digital or simulated world, thereby creating a sense of immersion"¹⁰². The so-called willing suspension of disbelief described by Samuel T. Coleridge refers to the fact that the user can experience the virtual environment as if it were real and reacts to it despite knowing it is just an illusion.¹⁰³ Jerald defines immersion as follows:

"Immersion is the objective degree to which a VR system and application projects stimuli onto the sensory receptors of users in a way that is extensive, matching, surrounding, vivid, interactive, and plot informing."¹⁰⁴

Following this understanding, immersion is a technical term, which indicates to what degree the sensory reception of the user is addressed by the experience through one or more output devices.¹⁰⁵ For a possible intensive immersive experience, the sensory reception should be isolated from the real environment as much as possible, with the output devices surrounding the user fully instead of just allowing a small field of view.¹⁰⁶ Moreover, the output device should provide a high display quality in terms of color and resolution.¹⁰⁷ In technical specifications, based

⁹⁷ Lochner (2014) p. 10.

⁹⁸ Lochner (2014) p. 11.

⁹⁹ Lemle et al. (2015) p. 26.

¹⁰⁰ Jerald (2015) p. 46.

¹⁰¹ Dörner et al. (2016) pp. 13-14.

¹⁰² Kent (2011) p. 521.

¹⁰³ Dörner et al. (2016) p. 8.

¹⁰⁴ Jerald (2015) p. 45.

¹⁰⁵ Dörner et al. (2016) p. 14.

¹⁰⁶ Dörner et al. (2016) p. 14.

¹⁰⁷ Dörner et al. (2016) p. 14.

on the current human's perception, this means: a field of view greater than 110 degrees, resolution higher than 1080p, a frame rate higher than 75 fps, motion-to-photon latency below 20 milliseconds and pixel persistence below 2 milliseconds.¹⁰⁸ Because there are so many factors involved, immersion is a gradual constant, which is provided more or less by different displays and applications.¹⁰⁹

In contrast, the term presence specifies the subjective sensation of the user during reception: "How the user subjectively experiences the immersion is known as presence."¹¹⁰ In other words, immersion signifies the objective, quantifiable characteristics and stimuli.¹¹¹ Presence refers to

"an internal psychological and physiological state of the user; an awareness in the moment of being immersed in a virtual world while having a temporary amnesia or agnosia of the real world and the technical medium of the experience"¹¹².

The term presence therefore describes the mental aspect of the reception.¹¹³ Both, immersion and presence are connected in the sense that the user is likely to feel a heightened form of presence if the system allows more immersion.¹¹⁴ For example, presence is increasing when the display allows a wider field of view, if head tracking is activated and when the user can move around physically.¹¹⁵

Besides immersion and presence, the term involvement describes the degree of interest or attention of the user during the simulation.¹¹⁶ Involvement is - analogous to the suspension of disbelief - mostly generated by the quality of the content shown in the Virtual Reality experience.¹¹⁷

¹⁰⁸ Chung (2016) online.

¹⁰⁹ Desktop-systems are sometimes called 'non-immersive' VR systems. Dörner et al. (2016) p. 14.

¹¹⁰ Jerald (2015) p. 46.

¹¹¹ Jerald (2015) p. 46.

¹¹² Jerald (2015) p. 46.

¹¹³ Dörner et al. (2016) p. 18.

¹¹⁴ Dörner et al. (2016) p. 46.

¹¹⁵ Dörner et al. (2016) p. 46.

¹¹⁶ Dörner et al. (2016) p. 19.

¹¹⁷ Dörner et al. (2016) p. 19.

As mentioned before, presence is one of the biggest selling points in the current Virtual Reality market.¹¹⁸ Likewise, many content creators mention the importance of immersion and presence as a factor in content creation:¹¹⁹

“For the first time, we can construct or record—and then share—fundamental human experiences, using technology that stimulates our senses in a manner so closely approximating lived experience that our lizard brain interprets it as real (which, by the way, is what “presence” is).”¹²⁰

Canadian VR filmmakers Félix Lajeunesse and Paul Raphaël state that presence does not come by the nature of the format but needs to be cultivated in the creation process of content.¹²¹

2.5 Immersive Film | Historical Roots

Making cinema more immersive has been an ongoing ambition throughout its entire history. In the second half of the 1920s, the building of atmospheric theaters aimed at providing immersive spaces that surrounded and engaged the spectators through all senses.¹²² In the 1950s, there was a general trend of enhancing the sensory qualities of cinema by inventions like wider screens, stereoscopic sound and other features.¹²³

360-degree art came into shape in the form of panoramic murals in the 1860s.¹²⁴ Assumingly, the first visual VR-like 360° display was showcased in 1895 in San Francisco.¹²⁵ The installation titled *Haunted Swing* allowed around 40 people to experience the combination of movement of the swing as well as movement of the surrounding room, creating a sense of self-motion.¹²⁶

In 1962, Morton Heilig patented the so-called *Sensorama Simulator*,¹²⁷ a single cinematic seat displaying five films with "stereoscopic color views with a wide field

¹¹⁸ Kelly (2016b) pp. 216-217.

¹¹⁹ Milk (2016) online; Jon Favreau in an interview with Jonathan Nafarrete, Nafarrete (2016a) online.

¹²⁰ Milk (2016) online.

¹²¹ Bye (2016a) online.

¹²² Bruno (2016) p. 159.

¹²³ Turi (2014) online.

¹²⁴ Kent (2011) p. 466.

¹²⁵ Jerald (2015) p. 16.

¹²⁶ Jerald (2015) p. 16.

¹²⁷ Kent (2011) p. 466; Turi (2014) online.

of view, stereo sound, seat tilting, vibrations, smell and wind"¹²⁸. The Sensorama is one of the first attempts at providing a multi-sensory experience.¹²⁹ In the film *Motorcycle* a first-person viewpoint video shot from a motorcycle is accompanied by vent and chemical smell distributed by the seat.¹³⁰ "His [Heilig's] ideas for adding layers of sensory stimuli to augment a simple cinema presentation led the way towards today's "virtual reality" experiences."¹³¹

The term Virtual Reality appeared first 1938 in French as 'la réalité virtuelle' in Antonin Arnaud's book *The Theatre and Its Double*.¹³² In 1965, Ivan Sutherland laid the foundation for Virtual Reality in its current form with the publication of his paper *The Ultimate Display* long before computers or mobile phones were invented.¹³³ In 1966, Sutherland patented a Head-Mounted Display,¹³⁴ which forms the basis for the current most common way of reception for Virtual Reality content. This head-mounted display enabled to view simulated, stereoscopic environments.¹³⁵

In the 1980s, NASA was researching a way to build a multi-sensory workstation to simulate a virtual space station.¹³⁶ In the early 1990s, research in Virtual Reality progressed rapidly - the first commercial VR systems appeared on the market.¹³⁷ In the early 2000s, the invention of electromagnetic as well as ultrasound tracking systems reduced the price of Virtual Reality systems.¹³⁸

Additionally, the mobile phone revolution triggered the possibility of making Virtual Reality accessible to mainstream consumers by decreasing costs of small high-resolution screens.¹³⁹ To achieve the results of today's Google Cardboard with an inserted smartphone would have required costs of about one million US\$ in

¹²⁸ Jerald (2015) p. 21.

¹²⁹ Lemle et al. (2015) p. 26.

¹³⁰ Turi (2014) online.

¹³¹ Turi (2014) online. | The seat even included an ultraviolet light for sanitizing purposes.

¹³² Kent (2011) p. 466.

¹³³ Dörner et al. (2016) p. 19.

¹³⁴ Mehler-Bicher et al. (2011) p. 13; Bruns (2016) pp. 18-19.

¹³⁵ Dörner et al. (2016) p. 19.

¹³⁶ Dörner et al. (2016) p. 20.

¹³⁷ Dörner et al. (2016) p. 20.

¹³⁸ Dörner et al. (2016) p. 20.

¹³⁹ Kelly (2016a) p. 78.

1990.¹⁴⁰ Nevertheless, despite current technological developments, the initial predictions of market potential that were set very high have gradually decreased.¹⁴¹ In its early phase, Virtual Reality has been mainly sold to innovators as a technical marvel,¹⁴² as mentioned before. The novelty aspect of the technology will wear off eventually¹⁴³ and for casual consumers there must be a benefit for adoption of the technology.¹⁴⁴ Rogers described the progress of an innovation's successful democratization and adoption as the so-called 'Innovation curve', which is presented in the following chapter.¹⁴⁵

2.6 The 'Innovation Curve'

Technological change has accelerated in speed within the last century.¹⁴⁶ Likewise, the diffusion of innovations has undergone increased pace.¹⁴⁷ Rogers defines diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas"¹⁴⁸. Diffusion is also "a kind of social change, defined as a process by which alteration occurs in the structure and function of a social system"¹⁴⁹. Rogers sees four main elements in the diffusion of innovations; those are

- The innovation
- Communication
- Time; and,
- The social system.¹⁵⁰

¹⁴⁰ Kelly (2016a) p. 78.

¹⁴¹ Osarek (2016b) p. 15.

¹⁴² Jerald (2015) p. 473.

¹⁴³ Hines (2016) online.

¹⁴⁴ Schmalstieg/Höllerer (2016) p. 411.

¹⁴⁵ Innovation "involves the conversion of new knowledge into a new product, process or service and the putting of this new product, process or service into actual use". Besides product innovation, there is also process innovation. Johnson et al. (2015) pp. 184, 186-187.

¹⁴⁶ Rothaermel (2013) p. 13.

¹⁴⁷ Rothaermel (2013) p. 13. | It took 84 years until 50% of US citizens owned a car, but only 10 years for the internet to reach this rate of diffusion.

¹⁴⁸ Rogers (2003) p. 5.

¹⁴⁹ Rogers (2003) p. 6.

¹⁵⁰ Rogers (2003) pp. 11-13.

Therefore, diffusion is “the process by which (1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system”¹⁵¹. A successful adoption potentiates over time in the shape of an S-curve.¹⁵² An initial slow adoption is usually leading to a potential, faster increase of diffusion.¹⁵³

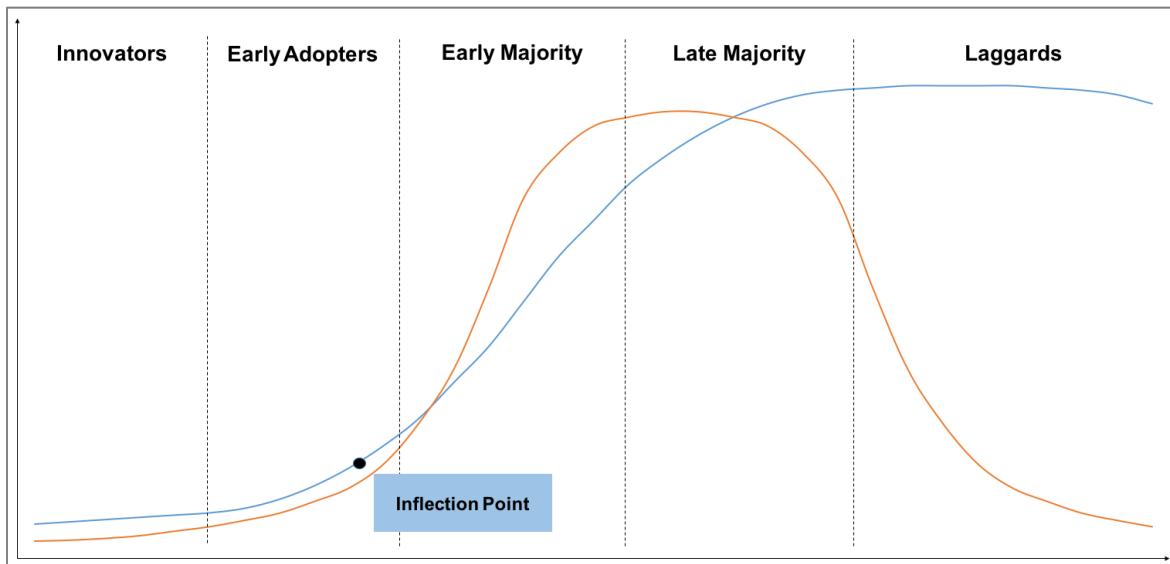


Illustration 4: S-curve (blue), inflection point and adoption curve (orange) [adapted from Rogers (2003) pp. 11, 281]

The tipping point when the diffusion of an innovation suddenly undergoes an exponential increase is called the inflection point.¹⁵⁴ At this stage, an early majority of buyers joins the circle of early adopters.¹⁵⁵ The so-called S-curve rises until it reaches a plateau of demand, when broad adoption has spread.¹⁵⁶ Following Rogers understanding, there is a 2.5 percentage of innovators, followed by early adopters (13.5%) and an early majority (34%).¹⁵⁷ The adoption curve shows an increasing amount of adopters, which finally decreases when the innovation has reached broader diffusion.

¹⁵¹ Rogers (2003) p. 11.

¹⁵² Rogers (2003) pp. 11, 210-211; Johnson et al. (2015) pp. 190-192.

¹⁵³ Johnson et al. (2015) p. 191.

¹⁵⁴ Rogers (2003) p. 211.

¹⁵⁵ Rogers (2003) p. 281.

¹⁵⁶ Johnson et al. (2015) pp. 191-192.

¹⁵⁷ Rogers (2003) pp. 280-281.

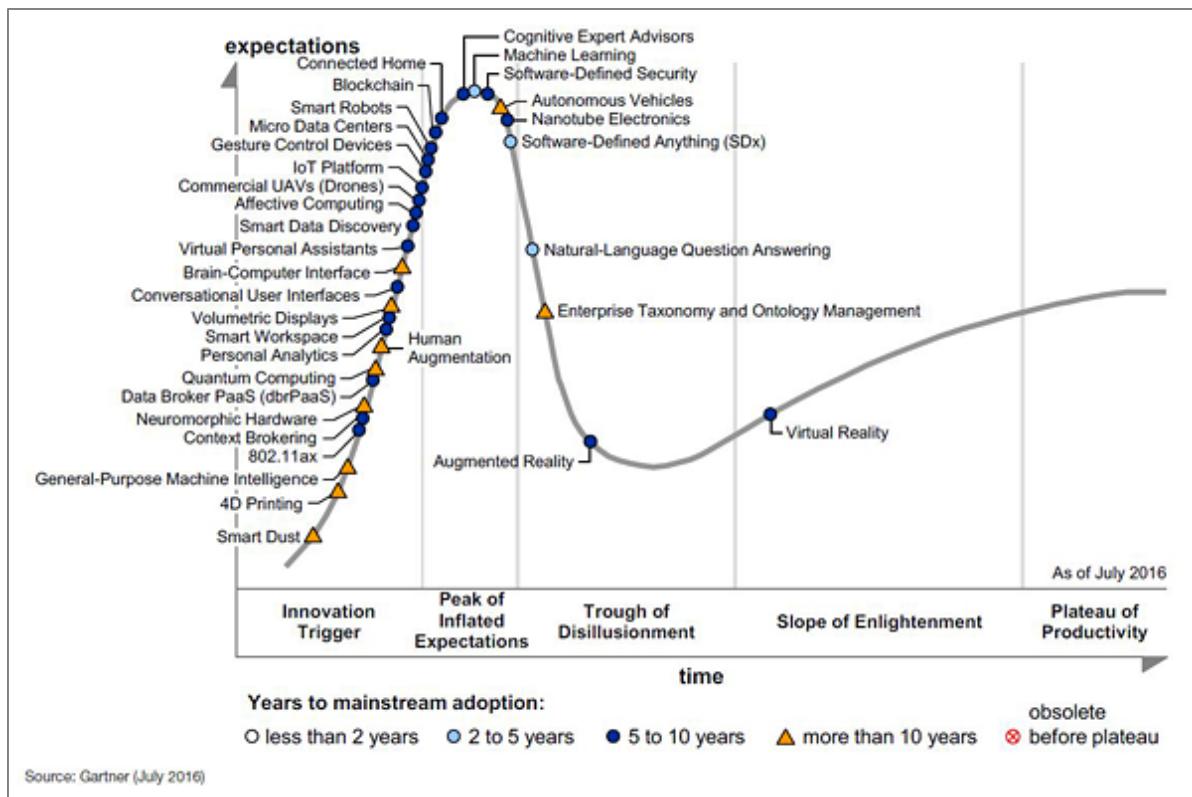


Illustration 5: Gartner Hype Cycle, July 2016 [Source: Gartner (2016) online]

The Gartner-Hype-Cycle predicts a 5 to 10-year span until mainstream adoption of Virtual Reality takes place, as of July 2016.¹⁵⁸

2.7 Age of Experience

Following the idea that we are moving from an 'age of information' towards an 'age of experience', consuming/buying and sharing experiences gains importance in all sectors.¹⁵⁹ Likewise, with artificial intelligence, the internet might transform from 'an internet of information' to 'an internet of experiences'.¹⁶⁰ Feeling a sense of presence and immersion in artificial reality is "one of [its] great promises [...] – either you get teleported to magical places or magical things get teleported to you"¹⁶¹ This selling point promotes a new level of immersion in cinema, as attempted during the late 1920s and the 1950s.¹⁶² "Experience is the new currency in VR and MR."¹⁶³ The experiential value becomes a major factor in VR

¹⁵⁸ Gartner (2016) online | Experts estimate a similar time span for the diffusion of VR/AR. Jeckl (2017) Appendix F, p. 192.

¹⁵⁹ Wadhera (2016) online.

¹⁶⁰ Kelly (2016a) p. 78.

¹⁶¹ Kelly (2016a) p. 76.

¹⁶² See chapter 2.5 Immersive Film | Historical Roots.

¹⁶³ Kelly (2016a) p. 78.

marketing,¹⁶⁴ and might transform the understanding of cinema as entertainment form: “[...] going to the movies will soon involve *into* the movies.”¹⁶⁵

“Experiences that no humans have had: exploring Mars; living as a lobster; experience a close-up of our own beating heart, live. [...] you haven’t experienced it, felt it below your intellect, had it lodge in your being in a way that you can call your own.”¹⁶⁶

Through the combination of presence and experiencing virtual places, the traditional ‘viewer’ in cinema is replaced by an ‘embodied visitor’.¹⁶⁷ VR experiences do play with the notion that “the user has a body within the virtual world”¹⁶⁸. In a VR music video titled *Chocolate*, the user embodies a metallic robot with wobbly fingers. The experience starts in front of a mirror, where the user sees her-/himself embodying the robot.¹⁶⁹ The illusion continues throughout the experience as the user sees her/his robotic arms as if they were her/his own.¹⁷⁰

2.8 Social Virtual Reality

The idea of living through an experience also finds itself in Social Virtual Reality. One of the big benefits of online gaming is its possibility of social interaction. For Virtual Reality, some experts see high potential for entertainment content that allows users to meet in a virtual environment.¹⁷¹ Despite high hopes in this market sector, Google Daydream did not offer any video applications with social/multiplayer functionality upon release.¹⁷² There are developments made in this area though.¹⁷³ Oculus’ application *Toybox*, released in December 2016, allows two users to interact by moving around and sharing toys.¹⁷⁴ With the release of PlayStation VR, various games required the help of a team, as for

¹⁶⁴ Izdebski/Legkov (2016) p. 65.

¹⁶⁵ Watercutter (2015) p. 84.

¹⁶⁶ Kelly (2016a) p. 79.

¹⁶⁷ Murray (2016) online.

¹⁶⁸ Jerald (2015) p. 47. | Jerald defines this as 'self-embodiment'. See also chapter 6.1.5 Character-Embodiment.

¹⁶⁹ Lang (2017o) online.

¹⁷⁰ Aaron Koblin in an interview with Kent Bye, Bye (2017a) online; Lang (2017o) online. | The real-time rendered experience allows minor interactivity such as choosing the direction of where to fire some kittens.

¹⁷¹ Izdebski/Legkov (2016) pp. 64-65; Kelly (2016a) p. 85.

¹⁷² Lang (2016a) online.

¹⁷³ Robertson (2016b) online.

¹⁷⁴ James (2016a) online.

example the VR games *Keep Talking and Nobody Explodes* or *Monster Escape*.¹⁷⁵ In these experiences, the team members do not wear a headset but can still participate in a group to play with a user wearing the VR headset.¹⁷⁶ Another social VR project is the Virtual Reality platform *Sansar*, which is due to launch in spring 2017. The underlying idea of this platform is offering possibilities for creators to build virtual worlds that serve users and customers.¹⁷⁷ Facebook has a team working on prototypes for social VR, which were presented at the Oculus Connect in 2016.¹⁷⁸ There are already some pioneering examples of interactive film Virtual Reality experiences, which utilize social interaction within the virtual environment to tell stories.¹⁷⁹ Therefore, it can be predicted that social VR might gain in importance for media content producers in the future.

¹⁷⁵ Leitner (2016) p. 14. | In *Keep Talking and Nobody Explodes*, the player wearing the VR headset disarms a bomb that only she/he can see while the other players follow an instruction manual to support the player.

¹⁷⁶ Leitner (2016) p. 14.

¹⁷⁷ Lang (2017t) online.

¹⁷⁸ Robertson (2016b) online.

¹⁷⁹ See chapter 5.4 Other Innovative Interactive Virtual Reality Experiences.

3 Reception and Interaction Hardware

Rapid technology improvements characterize the current Virtual Reality hardware market.¹⁸⁰ In this phase, new components, hardware and supplementing products constantly enter the market. Hardware producers currently push for the consumer market and therefore for the in-home entertainment sector.¹⁸¹

3.1 Head-mounted Virtual Reality Displays

Head-mounted displays (HMDs) are emerging as the most common platform to view Virtual Reality content.¹⁸² There are different kinds of HMDs; direct-view HMDs, video HMDs, see-through HMDs and interactive HMDs.¹⁸³ Direct-view displays cut the user off from the surroundings of the real environment.¹⁸⁴ Video-HMDs have an additional front camera to display objects, which are located within the viewing direction of the user.¹⁸⁵ See-through HMDs qualify for Augmented/Mixed Reality as they enable the user to view the real world without any latency. An interactive HMD can be any of the previously mentioned headset-technologies with an additional input device, allowing users to interact with the virtual displayed information directly.¹⁸⁶

As described in chapter 2.1, Virtual Reality system HMDs cut off the viewer from the environment and are sometimes called "immersive displays"¹⁸⁷. The field of view¹⁸⁸ of the head-mounted display plays a role in ensuring immersion; the bigger the field of view, the more the viewer can possibly be immersed in the virtual environment.¹⁸⁹ Currently, there are still drawbacks in today's high-quality Virtual Reality HMDs. Besides a complicated set up,¹⁹⁰ they are tethered to a

¹⁸⁰ Kelly (2016a) p. 83.

¹⁸¹ James (2016b) online.

¹⁸² Lemle et al. (2015) p. 27.

¹⁸³ Dörner et al. (2016) pp. 142-153.

¹⁸⁴ Dörner et al. (2016) pp. 147-148.

¹⁸⁵ Dörner et al. (2016) pp. 149-150.

¹⁸⁶ Dörner et al. (2016) p. 151.

¹⁸⁷ Dörner et al. (2016) p. 14.

¹⁸⁸ The field of view is the horizontal and vertical degree, taken from the user's eyes, in which the virtual environment is displayed. Dörner et al. (2016) p. 143.

¹⁸⁹ Dörner et al. (2016) p. 143.

¹⁹⁰ Eadicicco (2017) online.

computer.¹⁹¹ In viewing experiences like *The Unknown Photographer*, creative hang-ups of cables above the user help decrease the physical restrictions the cables bring. Ways to make Virtual Reality wireless are being researched and developed. A device called MoVR shall enable multi-player cordless gameplay within one room in the future.¹⁹² An Australian start-up called Immersive Robotics is working on a HMD that is wireless and displays 4K per eye, requiring the user to wear a belt with a battery powered receiving box.¹⁹³ Intel is working on a wireless headset called Project Alloy – it “combines inside-out tracking technology with a design that houses all the requisite processing power internally, eliminating the need to be tethered to a powerful, expensive computer”¹⁹⁴. It also features a wider field of view and a more powerful processor with enhanced integrated graphics.¹⁹⁵ Facebook and Microsoft are already developing wireless headsets in conjunction with HP, Dell and Lenovo.¹⁹⁶ The Microsoft HoloLens does not have wires due to its technology containing all the processors, optics and the battery inside the visor.¹⁹⁷ Predictions state wireless data transfer will be a standard feature in PC-powered headsets by 2018.¹⁹⁸ Changes in hardware might also influence content production, as described in more detail in chapter 6.5.2 Further Challenges.

3.2 Controlling Hardware

In today's Virtual Reality HMDs systems, consoles - originally designed for video games¹⁹⁹ - are used as input-devices for the VR system. Google Daydream headset has a controller analogue to the Wii-Controller with an ergonomic design.²⁰⁰ Oculus released the 'Touch', which is a hand-controller to allow the user to give inputs into the system. A review praised it for its precise tracking

¹⁹¹ Kelly (2016a) p. 82. | In 2016, the HTC Vive, the Oculus Rift and the PlayStation VR were the major computer-tethered headsets on the market. The Samsung Gear VR, one of the first major mobile headsets, was designed in cooperation with Oculus.

¹⁹² Barrett (2016) online.

¹⁹³ James (2016e) online.

¹⁹⁴ Eadicicco (2017) online.

¹⁹⁵ Lang (2017h) online.

¹⁹⁶ Eadicicco (2017) online.

¹⁹⁷ Kelly (2016a) p. 82.

¹⁹⁸ Hayden (2017a) online.

¹⁹⁹ Lochner (2014) p. 141.

²⁰⁰ Storms (2016) online.

performance and natural ergonomics.²⁰¹ Sony is releasing a PlayStation VR aim controller, which will allow free movement of the user in first-person-shooter games.²⁰² However, a game controller does not enable every possible kind of interaction - like for example walking or touching/grabbing objects. Therefore, efforts are put into developing supplement devices for input controllers. There are also advances into technology recognizing the body's movements without any controllers, for example the so-called technique of the leap-sensor.²⁰³ It uses infrared to recognize the arm's movement within space - albeit in a limited range of space.²⁰⁴

3.3 Touch and Haptic Systems

Assuming touch is one of the essential trinities of Virtual Reality,²⁰⁵ touch/ hand gloves systems may turn out to be necessary supplement products in the future. Touch will require real-time rendered Virtual Reality experiences and systems. Currently, gloves tracking the position of the user's hands are not consumer-ready.²⁰⁶ In the future, most Virtual Reality, except for completely passive experiences, "will enable users to interact with their hands"²⁰⁷. There are also efforts being put into developing haptic systems that can be combined with VR headsets - one of it is NullSpace's haptic Suit called 'Hardlight' which contains 16 haptic pads to deliver feedback to the user's chest, back, arms and shoulders.²⁰⁸

3.4 Technological Issues

Nowadays, remaining technological issues prevent a full immersive depiction of the virtual environment. Among these are errors in the visual depiction of lights and shadows as well as image blur.²⁰⁹ Furthermore, disturbing factors can be errors in the display; if an object approaches the corner of the display, the illusion

²⁰¹ Lang (2016d) online. | Additionally, Oculus brought out Replacement Rift Accessories; those include a Remote Control, as well as a 4 Meter Headset Cable and the so-called 'Oculus Rift Fit', which is a frame to enhance wearing comfort of the headset. Lang (2017a) online.

²⁰² Brennan (2017f) online.

²⁰³ Jeckl (2017) Appendix F, pp. 206-207.

²⁰⁴ Colgan (2014) online.

²⁰⁵ Kelly (2016a) p. 80. | Images, sound and touch are defined to be equally important in a Virtual Reality system.

²⁰⁶ Kelly (2016a) p. 80.

²⁰⁷ Jerald (2015) p. 483.

²⁰⁸ James(b) (2017) online.

²⁰⁹ Dörner et al. (2016) pp. 51-52.

can break because of inconsistent depth-information - this is called frame cancellation or stereoscopic window violation.²¹⁰ When the stereoscopic illusion of the virtual world breaks, the viewer sees two images, rather than one image with depth information.²¹¹

Furthermore, motion sickness is still an ongoing issue and "perhaps the greatest challenge of VR"²¹². Motion sickness can occur when "visual body motion does not match physical motion in a reasonable manner"²¹³. Consequently, it is assumed that motion sickness decreases if the actual/ real-world movements of the user go in line with the user's movements in the virtual environment.²¹⁴ In a test of the Institute immersive Media (IFIM) in Kiel, an expert remained in a virtual environment for the duration of 24 hours.²¹⁵ Physical simulation side effects such as nausea, eye fatigue and disorientation increased steadily over the test period.²¹⁶ It amplified while performing extensive motion within the virtual environment, it decreased after keeping a more stable position.²¹⁷

To make the matter more complex, VR sickness is difficult to measure due to its multiple symptoms and variables.²¹⁸ A possible major contributor to motion sickness is the Virtual Reality system's latency between physical motion and visual feedback in the visual world.²¹⁹ Content creators are working on methods how to reduce motion sickness subjectively - Ubisoft's game *Eagle Flight*, for example, causes limited motion sickness despite its high-speed gameplay.²²⁰ Through the

²¹⁰ Dörner et al. (2016) p. 50.

²¹¹ Dörner et al. (2016) p. 46. | The phenomenon is called 'diplopia'. To avoid double images in stereoscopic viewing in a virtual system, objects should be placed within -25% to +60% of the distance between the viewer and the virtual display. Dörner et al. (2016) p. 49.

²¹² Jerald (2015) p. 159; Peltier (2017) Appendix D, pp. 172-175.

²¹³ Jerald (2015) p. 48.

²¹⁴ Dörner et al. (2016) p. 56.

²¹⁵ Steinicke/Bruder (2015) pp. 13-16. | The test person wore an Oculus Rift Headset for two hours without taking it off and had a 10 minute-break every second hour within the 24-hour time span of the experiment.

²¹⁶ Steinicke/Bruder (2015) p. 20.

²¹⁷ Steinicke/Bruder (2015) p. 21.

²¹⁸ Jerald (2015) p. 195.

²¹⁹ Jerald (2015) p. 183; Neubauer (2016b) p. 40; Steinicke/Bruder (2015) p. 22. | Therefore, latency should be minimized as much as possible when creating Virtual Reality experiences.

²²⁰ James (2016c) online.

possible broader diffusion of VR, viewing habits might also evolve, and therefore motion sickness might be of lesser concern for content creators in the future.²²¹

3.5 Mobile versus Computer-tethered Virtual Reality Systems

Besides computer-tethered headsets, there are mobile headsets, which are cheaper than the former. This makes entry barriers to mobile VR for consumers lower.²²² Mobile Virtual Reality systems have high potential to enjoy growing popularity quickly due to its indispensable component of hardware – the phone itself.²²³ Potentially, a market of over two billion mobile users globally opens up to mobile Virtual Reality.²²⁴ Due to the current level of smartphone ownership and the lower costs of mobile VR headsets, mobile-based Virtual Reality is much more accessible than the current high-end computer-tethered systems.²²⁵ Publicly funded media content providers like ARTE follow a strategy of trying to reach the biggest possible audience by distributing mostly mobile VR experiences.²²⁶

Despite broader accessibility, the technical standards are currently still lower in mobile VR systems than in the high-end computer-tethered ones. Mobile phones do not perform with the same standard as high-quality graphic cards of computers, making mobile applications more pixelated.²²⁷ In addition, the field of view of the mobile VR headsets is usually smaller - likely resulting in a decrease of immersion.²²⁸ However, in recent years the mobile industry has profited from intensive technology improvements that are put into effect in rapid time spans. GPU-performance (the ‘Graphics Processing Unit’ of the mobile phone) is increasing 20 to 30% each year, enhancing the quality of graphics of phones

²²¹ Vecchioli (2016) online.

²²² Peltier (2017) Appendix D, p. 171.

²²³ Sinclair (2016) online.

²²⁴ Bradshaw (2016) online; Peltier (2017) Appendix D, pp. 171-172.

²²⁵ Suty (2017) Appendix B, p. 141; Knetig (2017) Appendix C, p.160; Peltier (2017) Appendix D, pp. 171-172.

²²⁶ Knetig (2017) Appendix C, p.160. | ARTE has also produced experiences for high-end headsets; one example is the much-awarded *Notes on Blindness*. The experience was originally produced and released for the Oculus Rift and it was later released as a more limited experience on the ARTE360 app.

²²⁷ Neubauer (2016b) p. 38.

²²⁸ Dörner et al. (2016) p. 143. | See chapter 2.4 Immersion | Immersive Virtual Reality.

drastically.²²⁹ Hence, mobile VR's market potential will increase rapidly with the constant improvements in hardware technology.

Currently, content creators still face limitations in mobile VR. Due to their six-axis sensors, mobile phones detect movement in space, but cannot translate where in space the user is in a virtual environment.²³⁰ Thus, mobile phones only perform rotational tracking – the head movement can be detected and adjusted along the x-axis, but does not support movement within space, like leaning forward or backward.²³¹ If the user's movements do not translate accurately to the output of the VR system, motion sickness is more likely to occur.²³² As a result, most mobile games for VR currently do not involve gameplay that has the user control the character movement.²³³

Content creators are hoping for tracking in all degrees of movement to become available on mobile headsets.²³⁴ One of the first experiments pointing in this direction is an academic project at Utah State University, which installed the SteamVR tracking system²³⁵ on the Samsung Gear VR, a mobile headset.²³⁶ It is likely that the fast-moving technological advances will solve many obstacles that still hold for mobile VR. Currently, content producers choose whether to produce for mobile VR systems or computer-tethered ones.²³⁷ Many content creators follow a strategy of releasing a high-quality version and a degraded one for less-capable devices. However, this approach might result in additional work steps and therefore additional budget requirements.²³⁸

²²⁹ Peltier (2017) Appendix D, p. 172.

²³⁰ Peltier (2017) Appendix D, pp. 171-172.

²³¹ Brennan (2017h) online.

²³² Peltier (2017) Appendix D, pp. 171-173.

²³³ Peltier (2017) Appendix D, pp. 172-173.

²³⁴ Peltier (2017) Appendix D, p. 172.

²³⁵ The SteamVR tracking system is used in conjunction with high-end, computer-tethered headsets to track movements of the user within a room-scale environment.

²³⁶ Brennan (2017h) online.

²³⁷ The different choice in distribution also requires different workflows. See chapter 6.3 Production of Conventional Movie Content versus Production of 360-Degree Video Content and 6.4 Production of Computer-generated Content.

²³⁸ The gaming industry is used to this kind of practice due to its history of producing for different consoles and output devices. Peltier (2017) Appendix D, pp. 180-181.

4 Current Developments in Virtual Reality Film Experiences

“How [do] people watch a movie when they’re surrounded by it?”²³⁹ In Virtual Reality, with images projected on a 360-degree sphere, one major difference to conventional filmmaking is the way of reception. Peter Jackson, famous movie director of films such as *The Lord of the Rings* Trilogy and *The Hobbit* movies, “sees artificial reality as virgin territory for telling stories and creating new worlds”²⁴⁰. Some first forays into the storytelling in Virtual Reality produced between 2014 and 2017 shall be described in chapter 4.

4.1 Virtual Reality Experiences as Adjunct Product of Another Media Format

The first filmic Virtual Reality experiences appeared more in the shape of demos than full films or narrative experiences – many of them being marketing offshoots of a studio movie, live-event footage or branded experiences.²⁴¹ As for now, big budget VR experiences are often “adjunct marketing experiences for existing media properties”²⁴², confirms Adam Levin, CEO of the Virtual Reality Foundation.

Besides VR experiences tied to the TV series *The Walking Dead* and *Mr. Robot*²⁴³, a 360-degree video displays the opening animated credit sequence of the TV show *Game of Thrones*.²⁴⁴ The video gained 1.7 million views within the first three hours after publishing.²⁴⁵ While this trend certainly helps VR content to gain traction due to the popularity of the TV show,²⁴⁶ the clip mainly functions to promote the TV show.²⁴⁷ VR experiences accompany the marketing campaign for big Hollywood movies such as *Star Wars: The Force Awakens*, *Assassin’s Creed*

²³⁹ Watercutter (2015) p. 84.

²⁴⁰ Kelly (2016a) pp. 83-84.

²⁴¹ Zeitchik (2015) online.

²⁴² Adam Levin qtd. in Ohanesian (2015) online.

²⁴³ Bishop describes the *Mr. Robot* VR experience as a "legitimate storytelling experience that captures the atmosphere and sensibilities of the show and brings it into an entirely new medium". See Bishop (2016) online.

²⁴⁴ Spangler (2016) online; Ohanesian (2016) online.

²⁴⁵ Spangler (2016) online.

²⁴⁶ Season 6 of the show is HBO’s most viewed TV show up to date. Spangler (2016) online.

²⁴⁷ The clip is only 2.5 minutes long and therefore follows the short form of most Virtual Reality pieces. See the following subchapter 4.2 Short Form Format.

and *The Hobbit*.²⁴⁸ A Virtual Reality experience that has been announced is based on the dystopian sci-fi *Planet of the Apes* franchise.²⁴⁹

The Martian Experience followed the Hollywood blockbuster *The Martian* and was released in November 2016 for an initial price of US\$19.99.²⁵⁰ In the experience, the user embodies the movie's main character Mark Watney and performs tasks to ensure his survival and rescue on Mars.²⁵¹ Thus, the experience has a level of interactivity, changing between passages of passive cinematic experience and active video-game adventure.²⁵²

As in the case of *The Martian Experience*, if the adjunct Virtual Reality product to the traditional media is released after the main product, “studios face a paradox: how to draft off the best-known content without having it feel like old news”²⁵³. With the recent movie *Ghost In the Shell*, the release of VR bonuses side by side with the movie is becoming an increasingly regular occurrence. For big budget movies, the trend will probably move towards using Virtual Reality experiences as an advertisement vector like the movie trailer format.

It has been suggested that in the future VR experiences should provide more than bonus material to current shows, films and other media formats.²⁵⁴ With modalities based on games and film production, VR bears potential for forms of narration native to the medium,²⁵⁵ - possibly offering an experience distinct from both the categories of games and traditional cinematic movies.²⁵⁶ For VR to evolve and for the technology to be successful on a long-lasting basis, unique experiences with

²⁴⁸ Zeitchik (2016b) online; Ohanesian (2016) online; Peltier (2017) Appendix D, p. 175.

²⁴⁹ Giardina (2017) online. | The *Planet of the Apes* Virtual Reality experience is produced by Within in a new partnership with FoxNext and Annapurna Pictures (which produced the titles *Life of Us* and *The Protectors*) and will be directed by Chris Milk. Hayden (2017b) online.

²⁵⁰ Ewalt (2016) online. | Besides *The Martian Experience*, the Fox Innovation Lab, established by 20th Century Fox, also released a VR experience in 2015 titled *Wild*, following the film with Reese Witherspoon.

²⁵¹ Ewalt (2016) online.

²⁵² Zeitchik (2016b) online. | The experience lasts approximately 25 minutes (depending on some of the user' choices) and starts with a scene of Mark Watney removing shrapnel from his spacesuit.

²⁵³ Zeitchik (2016b) online.

²⁵⁴ Ohanesian (2015) online; Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

²⁵⁵ Ding (2016) online.

²⁵⁶ Zeitchik (2016b) online. | See chapter 5 Interactive Film Experiences | Merging of Games and Film Genre in Virtual Reality.

stories well-suited for the medium need to be created.²⁵⁷ Likewise, compelling narratives will need to be created to win audience on a long-lasting basis.²⁵⁸ One possible emerging format is the one of interactive narrative Virtual Reality experiences. Some pioneering works displaying prime examples of this format are discussed in chapter 5.

4.2 Short Form Format

Due to technological limitations and due to viewer acceptance, early Virtual Reality experiences are of short duration. In early cinema, movies were of short duration and depicted ordinary processes of people's daily lives. At this time, the main attraction of cinema was the novelty of moving images.²⁵⁹ Likewise, when short clips on YouTube and Facebook came into fashion, the expression 'internet-cinema of attractions' appeared.²⁶⁰ Contrary to viewing habits in other media forms, attention spans of media audience on these platforms are particularly short.²⁶¹ An early internet image format, the GIF, a loop of series of still frames, has been compared to the early cinema of attractions - regarding its parallel low cultural respectability and its non-narrative forms.²⁶²

Criticism has been raised at the short duration of most cinematic VR experiences.²⁶³ Additionally, some of the early Virtual Reality experiences emphasize the effect of being spectacular rather than involving the user emotionally.²⁶⁴ For instance, one of the first stereoscopic VR experiences - *Strangers with Patrick Watson* - resembled the style of a music video.²⁶⁵ It has been predicted that "beyond gaming, VR video entertainment will remain short form until demand for VR headsets increases"²⁶⁶. However, the viewer acceptance of longer experiences is already rising: "Just a few months ago, many would have argued that 15 minutes is the upper limit for a VR experience. "Allumette" runs a

²⁵⁷ Eric Darnell in an interview with Kent Bye, Bye (2017e) online; Suty (2017) Appendix B, p. 148.

²⁵⁸ Heuer/Rupert-Kruse (2015) p. 87.

²⁵⁹ Gunning (2016) p. 142.

²⁶⁰ Heuer/Rupert-Kruse (2015) pp. 87-88.

²⁶¹ Knetig (2017) Appendix C, p.157.

²⁶² Droitcour (2016) p. 207.

²⁶³ Böhm (2016) online.

²⁶⁴ Heuer/Rupert-Kruse (2015) p. 87.

²⁶⁵ Bye (2016a) online.

²⁶⁶ Boland (2015) online.

full 20 minutes, but doesn't feel a minute too long.”²⁶⁷ *Allumette* places a special focus on the story of the experience - it is about a girl lighting up magical matches in the dark to stay warm while each match unlocks a memory of the girl, gradually displaying the story why she ended up by herself.²⁶⁸

One of the first Virtual Reality films to void the short form format entirely is the feature-film length VR 360-degree film called *Jesus VR*, which premiered at the Venice Film Festival in 2016 as a 40-minute-cutdown.²⁶⁹ The piece received bad reviews due to its camerawork, acting and technology issues such as overheating headsets.²⁷⁰ Additionally, it did not convey a "feeling up-close-and-personal to real 3D characters"²⁷¹. Like in all pre-rendered 360-degree video content, the camera point is fixed and the experience only allows rotational head tracking.²⁷² Little cutting was utilized in the experience and while generally, mostly wide shots were used, there is a point-of-view shot of Jesus Christ, which raised moral criticism.²⁷³

One possible way to forego the limitations of the current technology and create longer-lasting experiences is to produce series. This follows the general recent trend towards more series-based formats in cinema and TV.²⁷⁴ One attempt of a VR series format is *Invisible* - a five-part science-fiction thriller directed by Doug Liman²⁷⁵ and written by Melissa Wallack²⁷⁶ with a duration of six minutes per episode.²⁷⁷ The story follows a young woman, who receives a high inheritance and

²⁶⁷ Roettgers (2016a) online. | The experience was released 2016 and is available on the PlayStation VR, the HTC Vive and the Oculus Rift.

²⁶⁸ Roettgers (2016a) online.

²⁶⁹ Bradshaw (2016) online; Nordine (2016) online; Anderson (2016) online. | The producers are targeting to reach a broader audience via mobile VR.

²⁷⁰ Bradshaw (2016) online; Anderson (2016) online.

²⁷¹ Anderson (2016) online.

²⁷² Bradshaw (2016) online.

²⁷³ Bradshaw (2016) online.

²⁷⁴ See also chapter 7.8 Shifting Viewer Habits.

²⁷⁵ Doug Liman directed the films *The Bourne Identity* film (2002) as well as *Mr. and Mrs. Smith*.

²⁷⁶ Melissa Wallack is the writer of the script of *Dallas Buyers Club*.

²⁷⁷ Macaulay (2016) online; Moore (2016) online. | The experience was sponsored by Lexus and is available on Samsung VR or through the Jaunt VR app on IOS, Android, Gear VR, Oculus Rift and HTC Vive. After having done tests a few months prior to the shooting, the project had twenty shooting days, with production meetings in-between to evaluate the already filmed footage.

who subsequently dives into family intrigues.²⁷⁸ The last season's cliffhanger is pointing into the direction of a possible continuation of the series.²⁷⁹

4.3 Virtual Reality Documentaries

Many early Virtual Reality experiences are high-level quality 360-degree video documentaries, such as several chapters of *Expedition Antarctica* or *Polar Sea 360°*, which were featured on the mobile application ARTE360. Besides ARTE, another pioneer in this segment is National Geographic. In cooperation with National Geographic, the duo Félix Lajeunesse and Paul Raphaël created a 12-minute VR piece titled *Through the Ages: President Obama Celebrates America's National Parks*, which was produced to honor the 100th birthday of US' National Parks Service.²⁸⁰ To create an effect of showing the timelessness of national parks, the creators adapted their camera to capture time-lapse sequences in 360-degree video.²⁸¹

Subsequently in 2016, National Geographic Channel produced a VR documentary titled *The Protectors: Walk in the Ranger's Shoes*, directed by Oscar-winning Kathryn Bigelow.²⁸² The experience showcases a day in a national park in the Democratic Republic of Congo and its rangers protecting endangered African elephants.²⁸³ Kathryn Bigelow described the creation process for 360-degree video under these circumstances: "[...] the opportunity to experience the physical space with an emotional connection to the subject matter, the immediacy of that connection, really connects you to the stories told by the park rangers."²⁸⁴

4.4 Animated Virtual Reality Experiences

The Rose and I is among the first computer-generated animation Virtual Reality experiences²⁸⁵ and premiered January 2016 at the 'New Frontier section' of

²⁷⁸ Macaulay (2016) online; Moore (2016) online.

²⁷⁹ Macaulay (2016) online; Moore (2016) online.

²⁸⁰ James (2016d) online. | Additionally, the project was produced in partnership with Oculus Studio.

²⁸¹ Bye (2016a) online; James (2016d) online.

²⁸² Petski (2016) online; Gaudiosi (2016) online.

²⁸³ Petski (2016) online.

²⁸⁴ Kathryn Bigelow in an interview with John Gaudiosi, Gaudiosi (2017) online.

²⁸⁵ Computer-generated images have been used since the 1970s; the first fully computer-generated film - Pixar's *Toy Story* - was produced in 1995. See Lochner (2014) pp. 28-29, 39. Note: Examples of VR experiences in this category are both pre-rendered and real-time rendered experiences.

Sundance Film Festival.²⁸⁶ It is inspired by the character of *The Little Prince*, who lives on a deserted asteroid and happens to find a single rose, which catches his curiosity.²⁸⁷ The version presented at Sundance was viewable on HTC Vive - it allows the user to walk, however, it does not support any other form of interactivity.²⁸⁸

Additionally, a version titled *Rosebud* was made for the mobile headset Gear VR. In *Rosebud*, the user can teleport with the controllers of the Gear VR.²⁸⁹ This way the creators wanted to make sure interactivity was possible for the user, even on the mobile VR device.²⁹⁰ A reviewer pointed out the impact the diverging technological approach had on the content of the two experiences:

“The difference between actually, physically walking through a virtual space vs. rearranging set pieces for a better view speaks to different “tiers” of experiencing VR — a technological challenge that can have some tangible impact over how a story is presented.”²⁹¹

Lost and *Henry*, Oculus Story Studio’s two first VR experiences, both follow conventional narrative and storytelling techniques.²⁹² *Henry* tells a story with the conventional order of beginning, middle and end.²⁹³ This might have been well-intended to broaden the possible audience: "By having a foot in the old world, we want to bring in new people who didn't even know they wanted VR,"²⁹⁴ Saschka Unseld, creator of *Henry* stated. Nevertheless, interactivity was inserted in the form of so-called 'discoverables': if the user directs her/his gaze long enough into one direction, a ladybug crawls out and engages.²⁹⁵ Oculus Story Studio's *Henry* won an Emmy in 2016 in the interactive section, becoming the first original Virtual Reality production to receive this award.²⁹⁶

²⁸⁶ Miller (2016) online; Chung (2016) online.

²⁸⁷ Miller (2016) online.

²⁸⁸ Miller (2016) online.

²⁸⁹ Miller (2016) online.

²⁹⁰ Chung (2016) online.

²⁹¹ Miller (2016) online.

²⁹² Bishop (2017) online.

²⁹³ Zeitchik (2015) online.

²⁹⁴ Saschka Unseld qtd. in Zeitchik (2016a) online.

²⁹⁵ Zeitchik (2015) online.

²⁹⁶ Robertson (2016c) online. | *Henry* and the previously mentioned examples in this chapter oppose the trend of virtual reality experiences being spin-off projects from existing movies, TV shows or other media formats.

A sophisticated piece is Oculus Story Studio's third project *Dear Angelica*, which was directed by Saschka Unseld and which premiered at Sundance Film Festival in January 2017.²⁹⁷ It runs under fifteen minutes and has little interactivity in the sense that it does not require the user's input to continue the story.²⁹⁸ Nevertheless or maybe precisely because of that, with its poetic visuals, the experience displays a novel form of creating narratives in VR.²⁹⁹ Director Saschka Unseld admits that while *Henry* could be viewed as a conventional film, *Dear Angelica* takes the medium a step further as it would not work well on a 2D screen.³⁰⁰ It "doesn't feel like a translation of flatscreen media"³⁰¹. In *Dear Angelica*, a young woman voiced by Mae Whitman watches old films on a VCR to remember her mother Angelica, who was a film star.³⁰² While the spoken memories unfold in the form of written text in space, the experience shows Angelica in various of her previous movie roles. These poetic visuals surround the user completely.³⁰³

The 3D animations of the VR experience *Dear Angelica* were made directly within the VR technology with a tool called *Quill*.³⁰⁴ *Quill* and a similar application by Google called *Tilt Brush* both provide illustrators with tools to create in 3D space within a virtual environment.³⁰⁵ A special effect used in the experience makes the visuals seemingly unfold stroke by stroke, as if painted real-time.³⁰⁶

"[...] The team [...] opted to try to tell their story through moods. To do that, Quilez [who designed the application Quill] put a function in Quill called "draw order," which recorded the lines Allsbrook [the illustrator] drew and the speed with which she drew them so that the action viewers watched was the creation of the pictures in Angelica's daughter Jessica's memories. "It should feel like a lucid dream in that

²⁹⁷ The experience is also available as a free download on the Oculus Rift store.

²⁹⁸ Robertson (2017a) online. | In the project's early development stage, the content producers had considered to allow the viewer to influence the story by using Touch controllers, but the idea was dismissed. Watercutter (2017) online.

²⁹⁹ Robertson (2017a) online.

³⁰⁰ Bishop (2017) online; Zeitchik (2017) online.

³⁰¹ Robertson (2016d) online.

³⁰² Watercutter (2017) online.

³⁰³ Robertson (2017a) online.

³⁰⁴ Watercutter (2017) online; Zeitchik (2017) online. | The application is available for sale to anyone with an Oculus Rift and its Touch controller.

³⁰⁵ Nafarrete (2016b) online.

³⁰⁶ Bishop (2017) online.

way that things appear and disappear in a nearly effortless way,”³⁰⁷ Unseld says.

Thus, the power of fiction is doubled-questioned by the piece, which also themes cinema as an art form and how it might create memories that the user might not actually have lived through or which she/he might have romanticized through the passage of time.

“The long, looping lines of artist Wesley Allsbrook wrap around the viewer to create three-dimensional illustrated scenes that you can move around, behind, and within. As the story unfolds, Jessica begins writing letters to her departed mother, thinking back to the memories they shared and the roles she saw her play during the course of her career. And just as the brush strokes unfurl in real time, they vanish as well, calling to mind the ephemeral nature of memories and the relationships we build with our loved ones.”³⁰⁸

Dear Angelica utilizes storytelling within space:³⁰⁹ Besides the drawings which unfold and disappear in space, the filmmakers make use of scaling as a story element; when daughter Jessica remembers her mother’s death, Angelica’s image disappears as a shrinking figure like a memory in space and time.³¹⁰

Another 360-degree animated short film titled *Pearl* received an Academy Award Nomination in the category of animated shorts, making it the first computer-generated VR film/experience in history to compete for an Oscar.³¹¹ *Pearl* is a coming-of-age story about a single father and his daughter, with the viewer being seated as an unnoticed observer in a car’s passenger seat, where all the action takes place.³¹² In a montage like style, the film switches quickly from scene to scene, observing the young girl’s growth and adolescence and provoking emotional response when it finally comes to bringing her now-aged father back into her life.

³⁰⁷ Watercutter (2017) online.

³⁰⁸ Bishop (2017) online.

³⁰⁹ See chapter 6.1.2 Storytelling in Space.

³¹⁰ Bishop (2017) online.

³¹¹ Hayden (2017e) online.

³¹² Hayden (2017e) online.

4.5 Virtual Reality Journalism

With a historical long trial of attempts to ensure viewers with both agency and higher degrees of presence in a story,³¹³ VR's promise of being able to place the audience into a story seems to find a match in journalism. The goal is to "bring readers as close to stories as possible"³¹⁴. With decreasing market shares on classical news, journalism is also trying to find new revenue options.³¹⁵

The production company RYOT won an Academy Award Nomination for the 360-degree documentary *Body Team 12* shot in Liberia during the 2014 Ebola crisis.³¹⁶ In 2015, the New York Times supplied subscribers with complimentary Google Cardboards and launched the platform NYT VR.³¹⁷ In the following year, a new initiative called *The Daily 360* launched, promoting the release of a 360-degree video every day.³¹⁸ Furthermore, The New York Times co-produced many 360-degree videos, such as the project *The Displaced*, which features three children living in civil crises areas (Ukraine, Syria and South Sudan) and displays the common fate of displaced children all over the world.³¹⁹

Other journalistic Virtual Reality experiences have been used to raise donations for charity organizations. *The Source* introduces 13-year old Selam, who lives in a small Ethiopian village. Selam and her family receive access to clean water for the first time when a team of workers drill a well. In December 2015, the VR experience was shown to an audience of 400 people in the Metropolitan Museum of Art in New York.³²⁰ The charity organization managed to raise US\$2.4 million during that event.³²¹ Another 360-degree video titled *Clouds over Sidra* reportedly helped UNICEF to raise US\$3.8 billion.³²² *Clouds Over Sidra* displays a day in the life of a 12-year old refugee in the Za'atari Refugee Camp, which was hosting over

³¹³ Aronson-Rath/Milward/Owen/Pitt (2016) online.

³¹⁴ Pontes/Da Silva (2016) online.

³¹⁵ Scholz (2016) p. 40.

³¹⁶ Swant (2016) online.

³¹⁷ Pontes/Da Silva (2016) online. | *The New York Times* states to be constantly working on improving the performance on their online apps while also working on exploring new fields such as spatial audio as well as stereo images and video.

³¹⁸ Pontes/Da Silva (2016) online.

³¹⁹ Scholz (2016) pp. 41-42.

³²⁰ Swant (2016) online.

³²¹ Swant (2016) online.

³²² Swant (2016) online. | The experience was produced by United Nations VR and directed by Chris Milk in 2014. Bye (2017d) online.

80,000 Syrian refugees at the time of shooting.³²³ The content creators were granted access to the camp for a time span of only 48 hours, adding a further challenge to this production process.³²⁴

Journalistic experiences are more likely to be live-action video by its nature. Nevertheless, there have been attempts to create computer-generated VR content in this area. One example is Nonny de la Peña's *Project Syria*, which was created in 2014 for the World Economic Forum and is about child refugees.³²⁵ When it was later launched on SteamVR - one of the major platforms for Virtual Reality content (for both games and films) - some user reviews criticized it for being too political.³²⁶ In this context, the question if Virtual Reality was an empathy machine that could be misused has been raised.³²⁷ Alexander Knetig, chief editor of ARTE Creative, questions the format of journalistic Virtual Reality experiences in terms of its benefits.³²⁸ Albeit VR might have the chance to show reality in a non-biased way,³²⁹ a critical fine line between empathy and inhibition might persist, especially when it comes to showing war zones.³³⁰

Other challenges in VR journalism are mediumship, relevance and timeliness.³³¹ The challenge of relevance at its right time comes with the technological challenges that might cause longer production cycles.³³² Furthermore, especially for journalistic pieces, interruption by advertisement is unacceptable.³³³ This circumstance combined with high production costs makes ensuring revenue in journalistic VR difficult.³³⁴

³²³ Bye (2017d) online.

³²⁴ Gabo Arora in an interview with Kent Bye, Bye (2017d) online.

³²⁵ Crecente (2016) online.

³²⁶ Crecente (2016) online.

³²⁷ Gabo Arora in an interview with Kent Bye, Bye (2017d) online.

³²⁸ Knetig (2017) Appendix C, pp. 152-153.

³²⁹ Attali (2016) Appendix A, p. 139.

³³⁰ Scholz (2016) p. 45.

³³¹ Scholz (2016) p. 43.

³³² Scholz (2016) p. 44.

³³³ Scholz (2016) p. 46.

³³⁴ One way of saving costs in production of journalistic VR pieces is to incorporate existing two-dimensional footage. See Scholz (2016) p. 43.

4.6 Live-Events

Experts agree on the high potential of viewing live-events in VR.³³⁵ Sitting in the first row of big TV events or being inside the cockpit of a Formula1 race promises a novel experience for the user.³³⁶ In the sector of live concerts, the musicians Paul McCartney and Jack White initiated early pioneering projects.³³⁷

In cooperation with ARTE Concert, ARTE Creative also sets a special focus on music events in VR. The ARTE360 VR experience *Elisir D'Amore 360° Opera* was recorded before it was released, however ARTE is evaluating the potential of live-broadcast in this sector.³³⁸

Technical barriers still hold for live broadcasting in Virtual Reality. NextVR, a pioneering VR production company, did its first live-broadcast in cooperation with CNN: In 2015, the first democratic US debate was not only broadcast on TV, but it could also be watched as a live-VR experience on the Samsung Gear VR headset.³³⁹ For a duration of two hours, four different point of views were shown – VR users could also see the TV cameras in some of those viewing points.³⁴⁰ To show the debate as if the user was present in the audience at the location of the debate was part of the concept behind the Virtual Reality live experience.³⁴¹ While in political TV discussions, it is customary to cut to the person who is talking, being able to see all the candidates in VR simultaneously gives new insights to the audience.³⁴² NextVR is also working on integrating graphics, social media and broadcasters into the stream to enhance the user experience.³⁴³ NextVR has a live-broadcasting VR truck which is designed to be 'plug and play' and "deliver a multi-camera, live stereoscopic VR experience complete with fully mixed 3D VR audio"³⁴⁴.

³³⁵ Attali (2016) Appendix A, p. 138; Parisi (2016) p. 9; Suty (2017) Appendix B, p. 142; Knetig (2017) Appendix C, pp. 166-167.

³³⁶ Bruns (2016) p. 32.

³³⁷ Parisi (2016) p. 9.

³³⁸ Knetig (2017) Appendix C, pp. 166-167.

³³⁹ Pierce (2015) online. | The software was provided by Oculus.

³⁴⁰ Pierce (2015) online.

³⁴¹ Pierce (2015) online.

³⁴² Pierce (2015) online.

³⁴³ Pierce (2015) online.

³⁴⁴ Hamedy (2016) online.

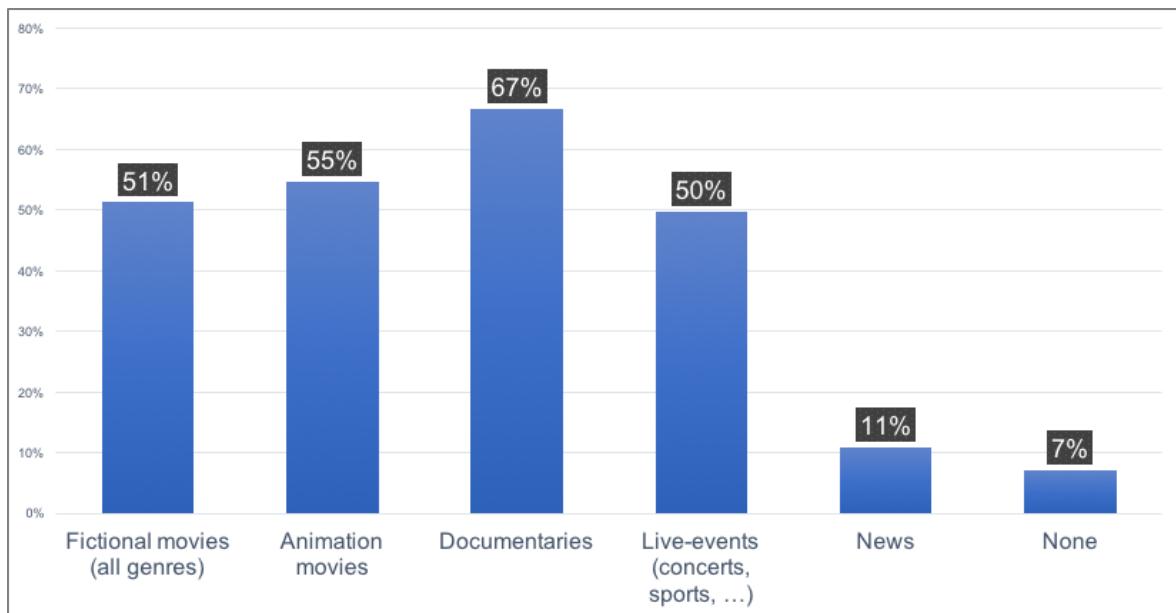


Illustration 6: Interest in classical movie/TV formats in a Virtual Reality system as stated by consumers [Survey 2017]³⁴⁵

In the survey conducted early 2017, out of classical movie/TV formats to view in a Virtual Reality system, the category live-events including concerts and sports received a relatively high rating. On the contrary, the news category turns out to be of least interest, while documentaries and animation movies take the lead. Besides these classical formats, Virtual Reality enables development of further narrative forms - for instance interactive Virtual Reality experiences, which are described in the following chapter.

³⁴⁵ Appendices G-J, pp. 208-246.

5 Interactive Film Experiences | Merging of Games and Film Genre in Virtual Reality

As introduced in the first chapter of this paper, games seem predestined to become a major segment of the VR industry. The marketed idea of ‘immersing oneself’ and of ‘being inside the virtual environment’ seems to find its perfect appliance for the gaming industry - the gaming experience might even be enhanced by Virtual Reality technology.³⁴⁶ Thus, some successful video games have been adapted to be compatible with Virtual Reality systems.³⁴⁷ Many of the games made for Virtual Reality are first-person-perspective like in conventional first-person-shooters.³⁴⁸ The Virtual Reality medium is well-suited to provide a participatory first-person-perspective and that might explain why games have taken over a big sector of the Virtual Reality industry.³⁴⁹

Games have become increasingly cinematic,³⁵⁰ perhaps promoting to some extent the perception of games as a form of art.³⁵¹ With Virtual Reality, the development might take different turns: cinema might be gamified.³⁵² Like in games, in Virtual Reality the user becomes an active participant. It has been suggested that in Virtual Reality, not only technically but also aesthetically, film and games merge and that the division currently drawn between those formats might become blurrier.³⁵³

Besides games, 360-degree video and social content, Izbedski and Legkov define a fourth category, which they call ‘experiences’³⁵⁴:

“[...] while very similar to games from an artistic point of view – both are based on animations and 3D real time rendering – the design

³⁴⁶ Heuer/Rupert-Kruse (2015) p. 81.

³⁴⁷ Heuer/Rupert-Kruse (2015) p. 81. | Heuer and Rupert-Kruse mention the following videogames: *Alien: Isolation*, *The Elder Scrolls V: Skyrim*, *Outlast* and *Antichamber*. However, it should be noted, however, that for *The Elder Scrolls V: Skyrim* and *Antichamber* the user can utilise a software called ‘vorpX’ to convert the video content to make it compatible for VR. Therefore, these games are not originally produced for Virtual Reality. Another famous example of a successful videogame released for VR is *Resident Evil 7*. Lang (2017d) online.

³⁴⁸ Heuer/Rupert-Kruse (2015) p. 81.

³⁴⁹ Ohanesian (2015) online.

³⁵⁰ Lochner (2014) p. 33.

³⁵¹ Melissinos (2016) online.

³⁵² Vecchioli (2016) online.

³⁵³ Suty (2017) Appendix B, p. 142; Saschka Unseld in an interview with Kent Bye, Bye (2016b) online.

³⁵⁴ Izdebski/Legkov (2016) pp. 64-65.

rules and framework differ: experiences do not need goal, scoring, etc., but rather focus on experiential values, such as storytelling or relaxation”³⁵⁵.

This entertainment category seems to be tailored to the medium Virtual Reality and merges the film and gaming industry, not only in its way of creating content but also in terms of aesthetics.

5.1 Interactivity in Games and Films

The lack of interactivity in some early VR experiences has been criticized.³⁵⁶ The VR technology bears, by nature,³⁵⁷ the possibility to incorporate the viewer: Doug Liman sees his role as VR filmmaker in curating and creating the experience, while giving the viewer some (if at least limited) control in her/his viewing experience.³⁵⁸ In interactive forms of entertainment, a dialogue between the medium and the audience is held in.³⁵⁹ Interactivity can therefore be understood as “communication that occurs between a user and the VR-application that is mediated through the use of input and output devices”³⁶⁰.

Interactivity is not limited to giving control to the user over her/his own position. It also includes the user's interaction with elements or characters of the virtual environment and her/his ability to influence the story. Interactivity has foremost been pushed to new forms of storytelling and entertainment by the advent of digital games.³⁶¹ The film and TV industries have been experimenting with making content interactive, however no format reached full success up to date - this might result from the fact that film and TV are linear formats by their nature.³⁶²

In virtual worlds, a player can often direct her/his own avatar³⁶³ and interact with virtual characters as well with other player's avatars.³⁶⁴ Under these circumstances, constructing suspenseful story arcs is a challenge for the author/

³⁵⁵ Izdebski/Legkov (2016) pp. 64-65.

³⁵⁶ Böhm (2016) online.

³⁵⁷ See chapter 2.3 Interactivity as Integral Part of Virtual Reality.

³⁵⁸ Doug Liman in an interview with Scott Macaulay, Macaulay (2016) online.

³⁵⁹ Lochner (2014) p. 143.

³⁶⁰ Jerald (2015) p. 277.

³⁶¹ Lochner (2014) p. 9.

³⁶² Lochner (2014) p. 219.

³⁶³ An avatar is an animated figure embodying the user.

³⁶⁴ Lochner (2014) p. 31.

game designer.³⁶⁵ There are various approaches to constructing stories with interactivity. A static story path or top-down approach follows pre-rendered video sequences, which are combined with interactive scenes, in which different means of changing the story are offered.³⁶⁶ In dynamic interactivity, also called bottom-up approach, there is a broader range of possibilities given to the player. Therefore, it is more difficult to guarantee a dramatic story construction and a suspenseful story arc.³⁶⁷

In video games, the player's motivation to participate is linked to multiple elements, such as the gameplay, the challenge, the visuals or the game design - above all it is driven by fulfilling the game's assignment(s).³⁶⁸ Usually, in interactive movies, the user is not given an assignment; nevertheless, the user has to be engaged by the content through different means.³⁶⁹ One way is to combine the challenge of a game and the empathy of a movie to create a circumstance, in which the user would take on a compassionate act like helping a character in a particular scene.³⁷⁰ This way, the user becomes a character in the experience.³⁷¹ In the Virtual Reality experience *ASTEROIDS!*, one of the alien-characters asks for the user's help to save its friend's life.³⁷²

Content producers now experiment with this approach and incorporate interaction between characters and users.³⁷³ The real-time rendered, interactive VR experience *Gnomes & Goblins*, directed by Jon Favreau³⁷⁴ displays this technique.³⁷⁵ While the user can grab things such as fruits from trees, using HTC Vive's hand-controllers, the user mostly interacts with the goblin. The user's

³⁶⁵ Lochner (2014) p. 163.

³⁶⁶ Lochner (2014) pp. 144, 169.

³⁶⁷ Lochner (2014) p. 148; Ryan (2015) p. 239. | These two approaches can be mixed within one experience. Ryan (2015) pp. 240-241.

³⁶⁸ Lochner (2014) pp. 48-49.

³⁶⁹ Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

³⁷⁰ Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

³⁷¹ Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

³⁷² Eric Darnell in an interview with Kent Bye, Bye (2017e) online. | This experience is based on a controlled story arc without branched stories.

³⁷³ Saschka Unseld in an interview with Kent Bye, Bye (2016b) online.

³⁷⁴ Jon Favreau directed Hollywood films such as *Iron Man* and *The Jungle Book*.

³⁷⁵ Feltham (2016a) online. | The experience was produced in cooperation with Reality One and Wevr; the latter produced the VR experience called *theBlu*. See chapter 7.9.2.10 Wevr Transport.

actions affect the relationship to the goblin, who accompanies the user throughout the entire experience.³⁷⁶ Therefore, the story varies for each user.³⁷⁷ Jon Favreau states: “It was hard because we wanted the character to act differently based on how fast you approached him, how respectful you were, how much trust you gain.”³⁷⁸ The user can also move within room-scale.³⁷⁹ While the experience premiered as a 10-minute preview version, the creators wish to continue this format: “Ultimately, the goal is to create a world that a user can explore for hours with a central character whose reactions feed off of theirs.”³⁸⁰ From *Henry to Gnomes & Goblins*, a general trend of increased use of interactivity in VR experiences is displayed.³⁸¹ The two projects *Notes on Blindness* and *The Unknown Photographer* further explore the principle of interactivity.

5.2 **Notes on Blindness: Into Darkness**

“Making use of game technology, animation and sound design”³⁸² *Notes on Blindness* leads the user through the increasing blindness of the writer and theologian John Hull, who documented this journey in 16 hours of audio recordings starting in 1983.³⁸³ *Notes on Blindness* consists of six chapters, which are accompanied on the sound level with the real-life audio recordings. The computer-generated real-time VR experience incorporates interactivity, for example in the form of the user having to find and put various articles in a kitchen into line of sight. A feature film sharing its title with the Virtual Reality experience was produced after the concept for the interactive Virtual Reality had already been laid out.³⁸⁴ The feature film is a hybrid between documentary and fiction, in which the actors lip-synced the recorded testimonies of John Hull and his family.³⁸⁵

³⁷⁶ Feltham (2016a) online.

³⁷⁷ Nafarrete (2016a) online.

³⁷⁸ Jon Favreau qtd. in Ohanesian (2016) online.

³⁷⁹ Nafarrete (2016a) online.

³⁸⁰ Jon Favreau qtd. in Ohanesian (2016) online.

³⁸¹ Murray (2016) online.

³⁸² Idfa Doclab (2016) online. | The creators Amaury La Burthe, Peter Middleton and James Spinney, Arnaud Colinart have expertise in game production.

³⁸³ Idfa Doclab (2016) online; D'Aprile (2016) online.

³⁸⁴ Knetig (2017) Appendix C, p. 163.

³⁸⁵ Kermode (2016) online.

In the Virtual Reality experience, the viewer sees a contour-shape-like imitation of life. Together with the sound design and the audio recordings, these visuals form an overall impression of the state of blindness. In this sense, the experience has a meta-linguistic level,³⁸⁶ putting the user into a virtual world in which only shades of people and figures and objects are seen, showing a parallel to what John Hull might have lived through. Given the project's topic, sound is particularly important in this experience.³⁸⁷ John Hull's audio diaries describe "his evolving appreciation of 'the breadth and depth of [the] three-dimensional world that is revealed by sound', the awakening of an acoustic perception of space"³⁸⁸. Thus, in this experience, storytelling in space was done mainly on the sound level with the creation of a binaural spatial sound map. It is this "panorama of music and information"³⁸⁹ rather than visuals that helps the user to navigate within the experience. The creators made a paradigm of connecting every element appearing in the scenes to a sound activity.³⁹⁰ The high-end version of this experience uses binaural sound recording³⁹¹, and there is also a downgraded version for mobile VR.³⁹² The project's story setting and the creative design makes *Notes on Blindness* "a prime example of how to harness the unique qualities of VR"³⁹³. *Notes on Blindness* "is an effective way to give the viewers a sense of what it's like to rely on your other senses to orient yourself"³⁹⁴ and as one reviewer put it, is "a brilliant example of just how this technology can expand our senses and awareness of concepts that, for most of us, are completely foreign"³⁹⁵.

5.3 *The Unknown Photographer*

Like *Dear Angelica*, the Virtual Reality experience *The Unknown Photographer* takes on the broad theme of memories - however in a different way. *The Unknown Photographer* is an interactive hybrid fictional-documentary experience. In its

³⁸⁶ Knetig (2017) Appendix C, p. 165.

³⁸⁷ Butet-Roch (2017) online.

³⁸⁸ Nytimes (2016) online.

³⁸⁹ Nytimes (2016) online.

³⁹⁰ D'Aprile (2016) online.

³⁹¹ For binaural sound see chapter 6.1.3 Spatialized Audio.

³⁹² Knetig (2017) Appendix C, p. 165.

³⁹³ Butet-Roch (2017) online.

³⁹⁴ Butet-Roch (2017) online.

³⁹⁵ D'Aprile (2016) online.

virtual environment, the user walks through a virtual museum, seeing life-size photos of World War I, which are "placed in a computer-generated, abstract and surreal landscape"³⁹⁶. As the experience is real-time rendered, it allows the user to choose her/his own individual pace to go through the experience.³⁹⁷ Because the experience allows the user to walk, potential motion sickness had to be considered in the production phase; through a trial and error process, some movements like falling were ruled out.³⁹⁸

The project has a long history ahead of it; in 1974 a photobook was found in an abandoned house in Quebec, which was passed on to the filmmaker and photographer Bertrand Carrière.³⁹⁹ Carrière started a quest to find out about the origins of the photobook and its owner, a person named Fletcher Moses, however the identity of the photographer could not be clarified.⁴⁰⁰ Based on this story, a documentary was made. The NFB [the National Film Board of Canada] approached Turbulent - a Montreal based production company - to develop an interactive web-documentary based on the story.⁴⁰¹ Experiments with the Oculus at Turbulent's office showed that the topic and the museum-like experience would be suitable for the VR format – the NFB met the idea with enthusiasm and supported the change in project type.⁴⁰²

To convey the uncertainty of the origins of the photos, a fictional text was written for the Virtual Reality experience, questioning memories in general as well. The voice-over text accompanies the experience while the historic photos shown in the experience do not have captions, leaving them open for interpretation – "they have a paradoxical presence, at once ghostly and monumental, with multiple meanings"⁴⁰³. The uncertainty of the memories of *The Unknown Photographer* is furthermore displayed by three different narrative lines in the experience, which are triggered randomly.⁴⁰⁴ The experience also questions the power of images on

³⁹⁶ Idfa Doclab (2015) online.

³⁹⁷ Suty (2017) Appendix B, p. 142.

³⁹⁸ Suty (2017) Appendix B, p. 144. | The initial testing phase took 1-2 months. Throughout the entire production phase, which took 6 to 9 months altogether, testing was continued.

³⁹⁹ Wissot (2016) online.

⁴⁰⁰ Suty (2017) Appendix B, pp. 140, 146.

⁴⁰¹ Suty (2017) Appendix B, p.140.

⁴⁰² Suty (2017) Appendix B, p. 140.

⁴⁰³ Loïc Suty in an interview with Lauren Wissot, Wissot (2016) online.

⁴⁰⁴ Suty (2017) Appendix B, p. 146.

a broader level: "The most impressive aspect of this project isn't the grisly images (nowhere are they really explicit), but the questions these evoke, and the sense of being submerged in the inevitable."⁴⁰⁵

While the experience was also funded by the Canadian Media Fund, the CMF, the NFB coproduced the experience and partly dealt with media relations and distribution strategies, one of which was the festival circuit.⁴⁰⁶ The Unknown Photographer was shown at various festivals, among others at Power to the Pixel in London, at the RIDM in Montreal, the IDFA in Amsterdam, the All Access Manitoba and Sundance 2016.⁴⁰⁷ Currently, Turbulent is trying to evaluate other forms of distribution, primarily the launch of a public version for the current high-end headsets HTC Vive and Oculus.⁴⁰⁸

5.4 Other Innovative Interactive Virtual Reality Experiences

Another foray into the format of interactive Virtual Reality experiences is the project *Life of Us*, which premiered along other projects mentioned in this paper at 2017's Sundance Film Festival.⁴⁰⁹ It is the first time the company Within, which had established itself early in cinematic Virtual Reality, produced a real-time rendered project. Furthermore, it was developed together with Spike Jonze,⁴¹⁰ director of various Hollywood films such *Being John Malkovich* and *Her*. In the experience, the user embodies different characters and lives through the evolution of human life.⁴¹¹ The experience has a narrative story plot and allows interactivity in various ways, such as throwing objects around or controlling figures as well as interacting with another person who has joined the experience.⁴¹² By incorporating communication with another user, this experience also touches the principles of social VR.

⁴⁰⁵ Idfa Doclab (2015) online.

⁴⁰⁶ Loïc Suty in an interview with Lauren Wissot, Wissot (2016) online.

⁴⁰⁷ Loïc Suty in an interview with Lauren Wissot, Wissot (2016) online.

⁴⁰⁸ Suty (2017) Appendix B, p. 141.

⁴⁰⁹ ASTEROIDS!, Chocolate, Dear Angelica and Melting Ice also premiered at 2017's Sundance Filmfestival.

⁴¹⁰ Hayden (2017b) online.

⁴¹¹ Aaron Koblin in an interview with Kent Bye, Bye (2017a) online. | The experience also performs voice modulation for depicting the different characters.

⁴¹² Bye (2017a) online.

ASTEROIDS!, the sequel continuation of *INVASION!*, from Baobab Studios is a real-time rendered computer-generated VR experience with interactive elements. The content creators keep control of the overall story arc with characters reacting to the user's interaction, even if the user decides to not take any actions.⁴¹³ The Virtual Reality experience even struck a movie deal, making a character world designed for VR converge into the cinematic movie world.⁴¹⁴

Other interactive experiences like the project *Irrational Exuberance* do not follow a predetermined story path.⁴¹⁵ This experience displays interactivity with the user operating the Vive controllers to clear away debris in an outer space setting.⁴¹⁶ Despite forays into this medium of interactive, real-time rendered Virtual Reality experiences, in which gaming and movie industry converge, some experts question the general marketability of this advancing form.⁴¹⁷ Content creators now address the question whether interactivity stands in a conflict with storytelling and immersion by combining these elements.⁴¹⁸ Saschka Unseld from Oculus Story Studio states that, contrary to initial beliefs, agency and presence do not necessarily conflict each other.⁴¹⁹ He suggests that truly new forms of narrative can be found in Virtual Reality and that once the boundaries of the categories films and games fade, both - interactive experiences as well as fully passive ones - will co-exist.⁴²⁰

⁴¹³ Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

⁴¹⁴ Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

⁴¹⁵ Ding (2016) online.

⁴¹⁶ Robertson (2016d) online.

⁴¹⁷ Knetig (2017) Appendix C, pp. 161-162; Peltier (2017) Appendix D, pp. 177-178. | On the contrary, other experts including Christopher Jeckl consider the potential of computer-generated interactive content to be high. Jeckl (2017) Appendix F, pp. 190-191.

⁴¹⁸ Eric Darnell in an interview with Kent Bye, Bye (2017e) online.

⁴¹⁹ Saschka Unseld in an interview with Kent Bye, Bye (2016b) online.

⁴²⁰ Saschka Unseld in an interview with Kent Bye, Bye (2016b) online.

6 Production of Virtual Reality Content

While Virtual Reality experiences “blend aspects of film, stage performances, and the interactivity of gaming,”⁴²¹ creating engaging VR content requires not only a sophisticated combination of these elements but also finding ways of expression that are native to the format.⁴²² Likewise, workflows that are more native to the format will need to be established. Currently, production processes lean on the common workflows from movie and game production, although they include additional complexity due to an increased number of work steps.

6.1 A 'Revolution of Film Grammar'?

Virtual Reality production with live-action 360-degree video includes addressing the issue of how to effectively capture the story in 360 degrees without the film team being seen on the images.⁴²³ Besides difficulties in the production process, it also means the opening of the so-called fourth wall for the audience; the viewers can turn around in all directions along their own axis.⁴²⁴ Thus, scenes need to be planned in all directions.⁴²⁵ This requires re-consideration of some aspects of common techniques in the creation of media content for the new medium.

It was stated that the current grammar of film, which has evolved since the beginning of the invention of cinema, cannot be applied to Virtual Reality content creation.⁴²⁶ Some novel rules that were established for VR content creation dictate not to use fast cuts or fast movements of camera or focus pulls.⁴²⁷ Likewise, in game creation, similar dictations were established: self-induced movement of the players is problematic, especially in non-flight-view experiences. On the contrary, the game *Eagle Flight* seems to induce relatively low motion sickness thanks to the bird-eye-view of the players. One way to facilitate a change in the user's position is teleporting.⁴²⁸ In a fast-paced first-person combat VR game titled *Raw*

⁴²¹ Moynihan (2016) online.

⁴²² See chapter 4.1 Virtual Reality Experiences as Adjunct Product of Another Media Format.

⁴²³ Lemle et al. (2015) p. 35.

⁴²⁴ As described before, this is a requirement for any Virtual Reality system. See chapter 2.1 Pre-rendered versus Real-time Virtual Reality Experiences.

⁴²⁵ Anderson-Moore (2016) online. | One way of doing this, is to split up the screen into six quadrants (front, right, behind, left, up and down).

⁴²⁶ Kelly (2016a) p. 85.

⁴²⁷ Chocano (2014) online.

⁴²⁸ Peltier (2017) Appendix D, p. 173.

Data teleporting is used in a way of having the user glide to her/his chosen spot quickly.⁴²⁹

6.1.1 Reducing Adverse Effects

Many of the techniques used in early Virtual Reality experiences seem to come out of the necessity to reduce adverse effects. In gaming, motion sickness can be reduced by integrating real world stabilized cues. For example, in the game *Eve:Valkyrie*, a stabilized cockpit serves as a visual rest frame.⁴³⁰ When the viewer perceives to be manipulating the world in motion as an object from a stationary vantage point, she/he does not necessarily expect the vestibular system to be stimulated.⁴³¹ Furthermore, accelerations from non-moving to moving positions can be problematic. "Minimizing accelerations and rotations is especially important for passive motion where the user is not actively controlling the viewpoint (e.g., immersive film where the capture point is moving)."⁴³²

On the other hand, room scale walking in a VR environment might turn out impracticable for in-home entertainment purposes. Some experts say teleporting might become a common form of user movement, possibly with further recognition of arm-swing.⁴³³ Another interesting use of interaction for gaming and cinematic VR experiences might be picking up objects, like already exhibited in the game *Batman: Arkham VR*.

In 2014, Virtual Reality film was perceived as "an intriguing hybrid of Brechtian in-the-round theatrical stuff and game design"⁴³⁴. To overcome motion sickness, many early VR film experiences display slow tracking instead of intensive cutting.⁴³⁵ Contrary to conventional TV standards, the cutting pace of the example of a political debate mentioned earlier in this paper, was slow.⁴³⁶ Longer takes might also result from the need to establish an emotional connection with the viewer to create presence.⁴³⁷ By establishing slower paced scenes, content

⁴²⁹ Hayden (2017f) online.

⁴³⁰ Jerald (2015) p. 208.

⁴³¹ Jerald (2015) p. 209.

⁴³² Jerald (2015) p. 210.

⁴³³ Jeckl (2017) Appendix F, p. 206.

⁴³⁴ Chocano (2014) online.

⁴³⁵ Franklin-Wallis (2016) online.

⁴³⁶ Pierce (2015) online; See chapter 4.6 Live-Events.

⁴³⁷ Bye (2016a) online.

creators ensure the viewer grasps all the details of a scene. In the Virtual Reality experience *Henry*, the content creators decided to extend the dramatic moment, at a critical plot point when the lonesome hedgehog Henry accidentally spikes one of the balloons that are keeping him company during the celebration of his birthday.⁴³⁸

6.1.2 Storytelling in Space

When working with longer scenes without cuts, one other way to exercise modulations is to let scenes evolve rhythmically in space.⁴³⁹ The VR experience *KÀ: The Battle Within*, produced by Felix and Paul Studios, shows a performance of Cirque du Soleil in a 360-degree environment.⁴⁴⁰ The idea of this piece is that the viewer is able to move along with the acrobats through space.⁴⁴¹ In the case of *KÀ*, the creators started with a more intimate setting, and then gradually had more and more performers join until the scene builds up into an epic performance of many characters.⁴⁴² The creators of *KÀ* describe the use of modulation to be more suitable than editing scenes:

"You have a 360-degree sphere; if you can organically attract someone's attention somewhere else and at the same time change the nature of the shot, I think that is a much more rewarding modulation than just cutting."⁴⁴³

With a full circle of images around the viewer, composing in space gains importance over other aesthetic conventions.⁴⁴⁴ Creation of scenes within space also includes scaling; in *Dear Angelica* different placing of characters in the virtual environment suggests different relationship between characters.⁴⁴⁵ In this sense, storytelling in Virtual Reality is much about storytelling within space.⁴⁴⁶ "Scale is a very powerful tool in VR and, in the sense that you can be small and go places or

⁴³⁸ Zeitchik (2015) online.

⁴³⁹ Bye (2016a) online.

⁴⁴⁰ Bye (2016a) online.

⁴⁴¹ Bye (2016a) online.

⁴⁴² Bye (2016a) online.

⁴⁴³ Félix Lajeunesse and Paul Raphaël in an interview with Kent Bye, Bye (2016a) online.

⁴⁴⁴ Knetig (2017) Appendix C, pp. 153-154.

⁴⁴⁵ Saschka Unseld in an interview with Kent Bye, Bye (2016b) online.

⁴⁴⁶ Knetig (2017) Appendix C, pp. 153-154.

be big and feel powerful, it affects the experience tremendously,”⁴⁴⁷ Jon Favreau says.

As described before, the VR experience *Notes on Blindness* utilizes storytelling in space on a sound level with spatialized audio. Three-dimensional audio cues are used to direct the user’s gaze to look towards a specific direction.⁴⁴⁸ Thus, sound design becomes particularly important in VR content creation and is therefore described in more detail in the next chapter.⁴⁴⁹

6.1.3 Spatialized Audio

In the production of game content, spatialized audio is a common technique. Sometimes even the gameplay depends on it – primarily in (competitive) first-person-shooter games. In *Rainbow6: Siege* or *Counter Strike: Go* for example, the invisible opponent can be located by the sound of footsteps. For the film industry, the use of spatialized audio as a narrative component seems to have a revival through the introduction of Virtual Reality. With the advent of 360-degree video the already existing form of binaural audio recording⁴⁵⁰ with its concept to match the natural shape and position of the ears also gained interest in content production.⁴⁵¹ In binaural audio recording, sound is recorded with two microphones positioned like the ears of a human head. Spatialized audio can also be created with specific software or game engine plug-ins like F-Mode 3D for Unity.⁴⁵²

Jaunt VR ensures binaural audio format for all their experiences and Chris Milk (co-founder of the VR content production company Within) points out the importance of three-dimensional audio.⁴⁵³ Out of the 35 Virtual Reality projects the TV broadcaster ARTE had funded by the beginning of 2017, five used binaural audio.⁴⁵⁴ Hardware is also moving towards the integration of three-dimensional

⁴⁴⁷ Jon Favreau qtd. in Ohanesian (2016) online.

⁴⁴⁸ Attali (2016) Appendix A, p. 134; Lalwani (2015) online; Jerald (2015) p. 148. | During a Beck concert in February 2013, Chris Milk shot a 360-degree video with binaural audio.

⁴⁴⁹ Experts have pointed out that sound makes up at least 50% of a Virtual Reality experience’s quality. Attali (2016) Appendix A, p. 136.

⁴⁵⁰ Binaural recording was already used in the late 18th century in the so-called ‘Theatrophone’ to broadcast a Paris Opera show. Lalwani (2015) online.

⁴⁵¹ Lalwani (2015) online.

⁴⁵² This method was used in the creation of the VR experience *The Unknown Photographer*. Suty (2017) Appendix B, p. 144.

⁴⁵³ Lalwani (2015) online.

⁴⁵⁴ Knetig (2017) Appendix C, p. 166.

sound; for example, the Oculus' Crescent Bay headset contains the binaural technology with its head tracking.⁴⁵⁵ The company Valve launched an open-source SDK kit, which supports development of audio cues with spatial information, especially for real-time rendered, interactive applications.⁴⁵⁶ The binaural audio format is an mpeg codec called HE-AAC, which is supported by all android and iOS-mobile devices, which means it is available on mobile VR.⁴⁵⁷

6.1.4 Other Attention Cues

Besides audio, the attention of the viewers might be directed by other clues.⁴⁵⁸ In traditional filmmaking, visual focus shifts are used to direct the viewer's gaze. Despite theoretically doable, Virtual Reality still holds "considerable technical and practical barriers to producing the effect in-camera"⁴⁵⁹. Most of the current cameras and camera rigs used for Virtual Reality have fixed, deep depths of field, making it impossible to blur parts of the image without extensive post-production work.⁴⁶⁰

Attention⁴⁶¹ cannot only be directed by audio and focus, but also by the narrative itself: Félix Lajeunesse and Paul Raphaël state that instead of aiming to direct the viewer's attention, they create an experience with a dominating element that drives the user's interest.⁴⁶² As with any storytelling medium, a captivating narrative is the key to grasp the viewer's attention. The importance of a compelling story line and a strong connection to the character has been pointed out repeatedly, for example by Doug Liman, creator of the VR series *Invisible*:

"The key is, you have to have a story and characters that are compelling so that you want to look and find them. Even if you are looking in the wrong direction, you are desperately trying to look in the right direction because you care about the story and the

⁴⁵⁵ Lalwani (2015) online.

⁴⁵⁶ Lang (2017n) online. The Steam Audio SDK will be available for Unity as well as for Unreal Engine and supports Windows, Linux, MacOS and Android and is not restricted to a specific VR system / headset technology.

⁴⁵⁷ Neubauer (2016b) p. 40.

⁴⁵⁸ Jon Favreau in an interview with Jonathan Nafarrete, Nafarrete (2016a) online.

⁴⁵⁹ Aronson-Rath et al. (2016) online.

⁴⁶⁰ Aronson-Rath et al. (2016) online. | In the described example a Go-Pro Rig was used.

⁴⁶¹ Attention is "the process of taking notice or concentrating on some entity while ignoring other perceivable information". Jerald (2015) p. 146.

⁴⁶² Bye (2016a) online. | Furthermore, Félix Lajeunesse and Paul Raphaël state that even if the viewer decides to direct her/his attention somewhere else, the experience should be compelling so that the viewer gets emotionally connected regardless of which view she/he is choosing.

characters. That is so much more important in VR. In film, I can make you care, I can shoot a giant close-up. I can manipulate you into caring. I don't have that option in VR. I don't want to keep harping back to the script, but if from the very foundation you didn't care about these characters and what was happening, you wouldn't feel compelled to care about them in the world and find them. You have to create a world that people watching will be so drawn into that they'll then do the work to find the story. What's important are short scenes that get right to the heart of it, with plenty of conflict and drama and visually compelling environments."⁴⁶³

6.1.5 Character-Embodiment

While in traditional cinema, it is uncommon to exhibit the first-person-view extensively, video games make extensive use of this narrative technique. The team of Visionary VR understands inhabiting and playing another character as one of many exciting tools of VR content creation.⁴⁶⁴ As mentioned earlier, in the VR experience *Chocolate*, the user becomes a robot.⁴⁶⁵ In *I, Philip*, a hybrid of 360-degree video footage combined with computer-generated scenes, the viewer sees the experience through the eyes of an android.⁴⁶⁶ While this technique is practiced regularly, users are becoming accustomed to viewing experiences that do not display character-embodiment.⁴⁶⁷

6.1.6 The Uncanny Valley

In creating computer-generated content for Virtual Reality, like in the content creation for animation movies or cartoons, artificial worlds and characters need to be carefully constructed not to fall into the so-called 'uncanny valley'. The uncanny valley-phenomenon was first described by Masahiro Mori in 1970.⁴⁶⁸ Jerald explains the phenomenon as follows:

"Although our sense of familiarity with simulated characters representing real characters increases as we get closer to reality, this is only up to a point. If reality is approached, but not attained, some of our reactions shift from empathy to revulsion."⁴⁶⁹

⁴⁶³ Doug Liman in an interview with Scott Macaulay, Macaulay (2016) online.

⁴⁶⁴ Ohanesian (2016) online.

⁴⁶⁵ See chapter 2.7 Age of Experience.

⁴⁶⁶ *I, Philip* was produced by ARTE. See chapter 7.6 Content-Production Industry.

⁴⁶⁷ Suty (2017) Appendix B, p. 145.

⁴⁶⁸ Lochner (2014) p. 40.

⁴⁶⁹ Jerald (2015) p. 49.

Consequently, for virtual reality this means that presence does not require photorealism, but that more important "presence-inducing cues [...] [are] responsiveness of the system, character motion, and depth cues."⁴⁷⁰

6.2 Aesthetic and Technical Changes in VR Content Production

Not all filmmakers follow the rules that have been established for early Virtual Reality experiences. The creators of *Invisible* have defied some of those early rules and followed more mainstream movie-techniques; they used split-screens, cuts to different angles and unusual perspectives.⁴⁷¹ This might result from the fact that the series' genre is a thriller, so perhaps the effect of jarring the audience was intended.

However, other Virtual Reality experiences also display quicker scene changes; in *Pearl* a montage depicts different moments over a period of many years. In this example, the standpoint of the user stays stable as the user is placed on the passenger seat of a car, while the scenes switch and show the passage of time.

The recently released music video of Gorillaz for their new song *Saturnz Barz* displays some innovative forms of "novel animation techniques and camera positions"⁴⁷². Cuts are made in a more music video kind of style and consequently in a faster pace, with creative transitions reaching from flash-to-white to seemingly breaking walls and other transitions between computer-generated scenes that flow with the rhythm of the song.

Saschka Unseld from Oculus Story Studio points out that initial artistic conventions in Virtual Reality films should be reconsidered; he concludes that it is possible to utilize character movement and editing, for example.⁴⁷³ Following this idea, it can be argued that changes in artistic creation from conventional video production to Virtual Reality production might not be as grave as initially anticipated, at least in some areas of production. The same possibly applies to the production of computer-generated content. Christopher Jeckl, VR content producer, states that the breaking of rules, like placing flying objects within the 80-cm personal space of the user, makes room for interesting effects. As the following chapters show,

⁴⁷⁰ Jerald (2015) p. 50.

⁴⁷¹ Moore (2016) online.

⁴⁷² Brennan (2017j) online.

⁴⁷³ Saschka Unseld in an interview with Kent Bye, Bye (2016b) online.

technical changes from conventional video and game production to VR content production are possibly higher than the aesthetic ones, influencing production workflows and therefore time and costs.

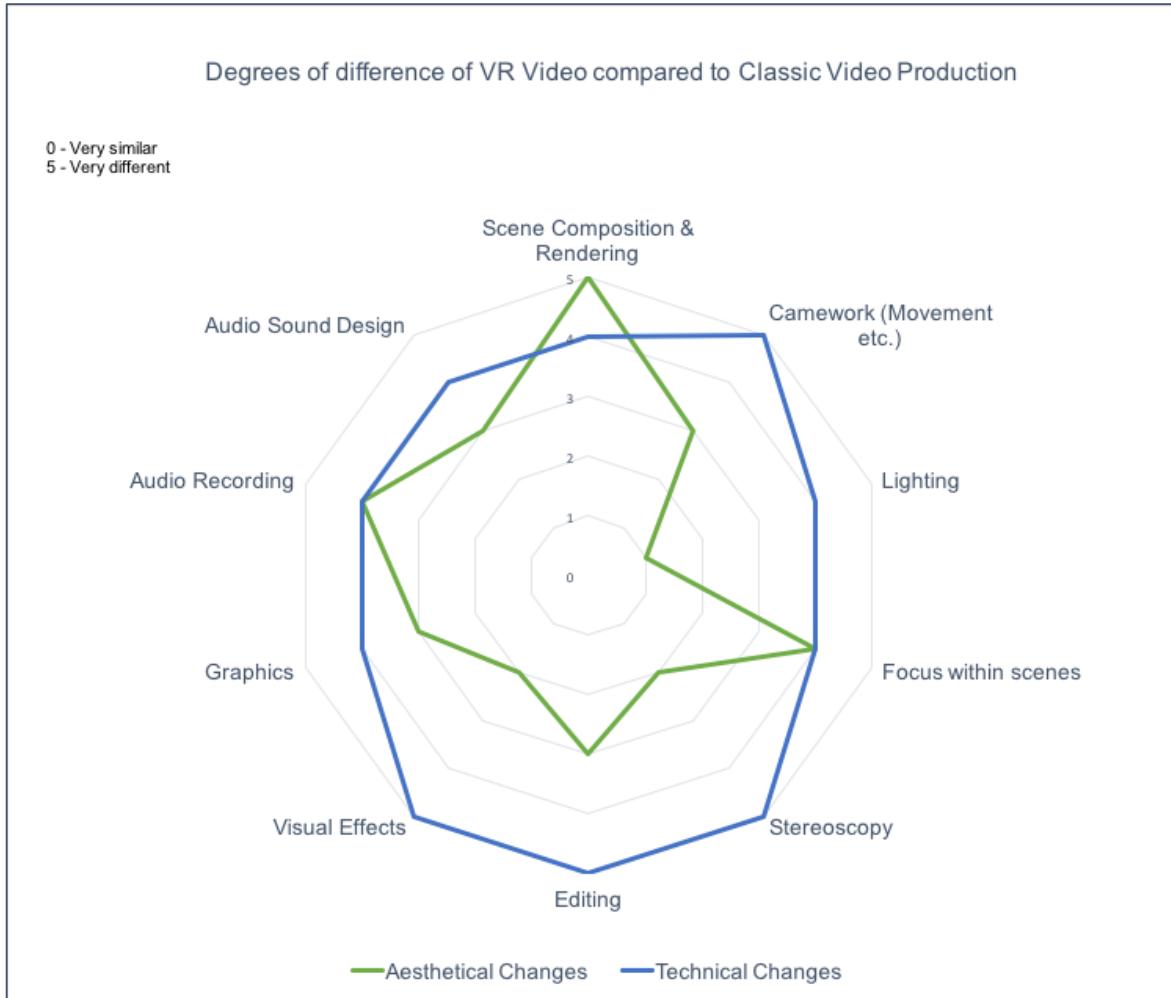


Illustration 7: Degrees in aesthetic and technical changes between classic video production and cinematic Virtual Reality production

If the spatialized audio technique is used, audio recording and sound design differ from usual video content production, especially if a Game Engine plug-in is used.⁴⁷⁴ On a technical standpoint, post-production in terms of editing and visual effects currently differs from conventional video production. However, it possibly does less so in aesthetic terms.⁴⁷⁵ Focus pulling of camera images also varies from classic video creation because of the technical limitations described above.⁴⁷⁶ Lighting, camerawork and scene composition require careful construction due to

⁴⁷⁴ See chapter 6.1.3 Spatialized Audio.

⁴⁷⁵ For post-production workflow of 360-degree video footage see chapter 6.3 Production of Conventional Movie Content versus Production of 360-Degree Video Content.

⁴⁷⁶ See chapter 6.1.4 Other Attention Cues.

the 360-degree sphere, which is, as stated before, one major challenge in content production for Virtual Reality.⁴⁷⁷

6.3 Production of Conventional Movie Content versus Production of 360-Degree Video Content

In producing content for Virtual Reality content, several layers of work need to be added to classical post-production, which is depicted on the left in the illustration below. These additional steps in workflow currently require more time and therefore cumulate more costs.⁴⁷⁸

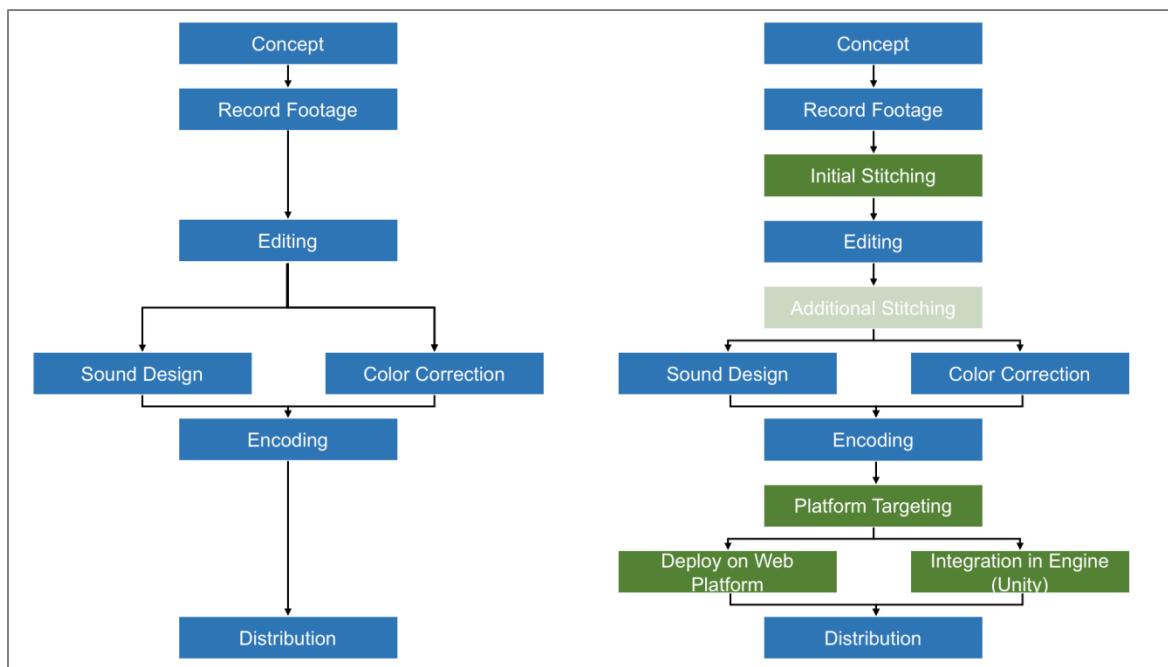


Illustration 8: Production workflow of conventional video content versus production workflow of cinematic VR content

Before being able to edit 360-degree footage, the videos from the different cameras recording the footage currently must be stitched into a panorama. Software programs can take over this work step. However, many of them, especially software coming with lower-end cameras, do not work flawlessly yet. If stitching is done manually, it is likely that an initial stitching will be done before editing and then an additional stitching step will be added to refine the stitching work after picture lock. Sound design and color correction is followed by additional work steps to encode the 360-degree footage for distribution on mobile or computer-tethered Virtual Reality - that differs from conventional video production.

⁴⁷⁷ See chapter 6.1 A 'Revolution of Film Grammar'?

⁴⁷⁸ Scholz (2016) p. 45. | The additional work steps are depicted in green in Illustration 8, 9 and 10.

6.4 Production of Computer-generated Content

The workflow of pre-rendered animation video production for VR follows the same principles as the one used for conventional animation movie creation, with additional steps for distribution on Virtual Reality systems.

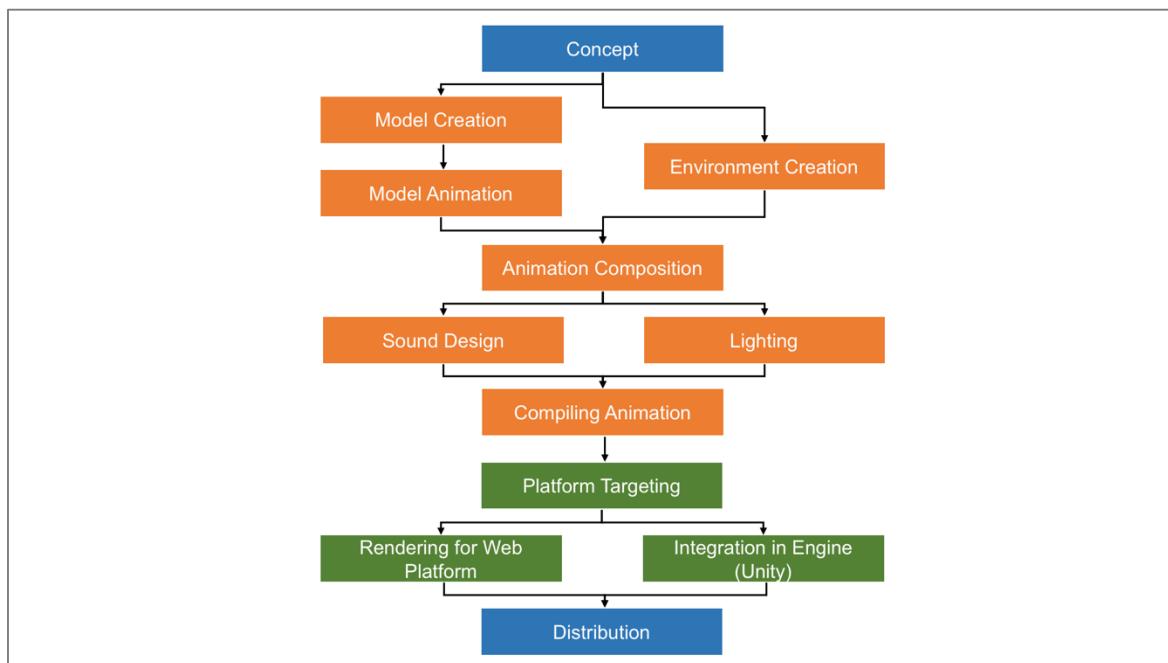


Illustration 9: Production workflow of pre-rendered animation VR video content

Unless VR content is designed solely as an audio-visual experience, it will likely be created within a game engine - opening the possibility to turn it into a real-time rendered experience.

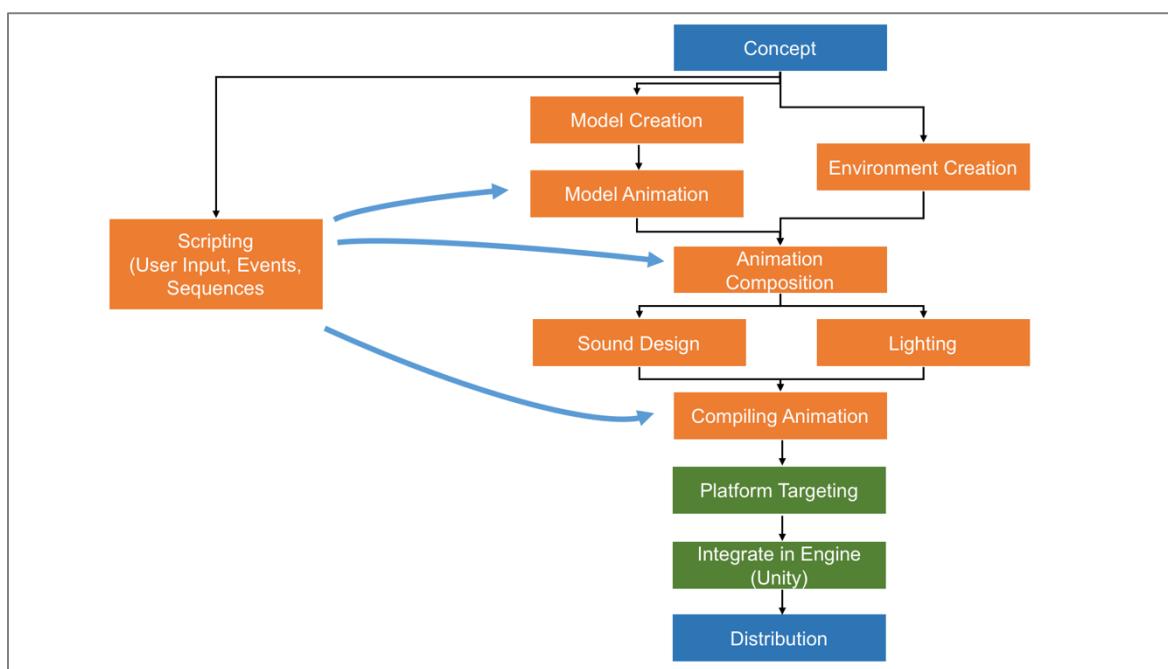


Illustration 10: Production workflow of computer-generated VR content

The creation of computer-generated real-time rendered content for Virtual Reality follows the general workflows of game-production. In both cases, production involves the building of content inside a 3D-engine. Hence, on a technical basis, workflows between the two industries merge immensely. Consequently, two major game engines, ‘Unity’ and ‘Epic’ have already announced development support for Google’s Daydream platform.⁴⁷⁹

Cinema traditionally focuses on high quality visuals and storytelling, while gaming production also considers other aspects like the gameplay or the mechanics. The integration of filmic content into a game engine ensures the possibility of real-time rendering for cinema. However, the technology still requires extensive processing time, making this workflow generally costlier than producing classic 360-degree video content.⁴⁸⁰

6.5 Changing Workflows

Just as the forms of narration in Virtual Reality are likely to evolve, the workflows will evolve as well. Constant innovation in hardware fuels workflows to mature.⁴⁸¹ Many early Virtual Reality experiences have been created using a game engine, designing the three-dimensional content with two-dimensional tools.⁴⁸² To improve this aspect of the production, two of the most used game engines, Unity and Unreal have announced to release versions that will allow users to create VR content inside a three-dimensional virtual environment – utilizing two-dimensional menus to make the transition easier.⁴⁸³ Unity launched an In-VR Game Editor in December 2016, with Unity interfaces presented in workspaces that the content creator can teleport around with in the virtual environment.⁴⁸⁴ Adobe Premiere, one of the most widely used editing programs will launch with an in-VR Video editor, too.⁴⁸⁵

⁴⁷⁹ Faulkner (2017) online. | Google Daydream is discussed in detail in chapters 7.5 Virtual Reality Headsets and 7.9.2.4 Google Daydream.

⁴⁸⁰ Jeckl (2017) Appendix F, p. 200.

⁴⁸¹ Goeldi (2016) online.

⁴⁸² Kelly (2016a) p. 87.

⁴⁸³ Kelly (2016a) p. 87.

⁴⁸⁴ Lang (2016g) online.

⁴⁸⁵ James (2016f) online.

New VR applications like *Quill* and *Tilt Brush* are going to provide new ways to create content within a three-dimensional virtual space and translate it from there into a moving environment. *Quill* has an easy-to-use interface that pops up like a virtual tablet to navigate with one hand.⁴⁸⁶ With the release of the *Tilt Brush Toolkit*, Google is making it possible to import creations done via *Tilt Brush* into Unity to use them in games, animations and other interactive VR content.⁴⁸⁷ Further artistic experiments are made in this field; designer Dong Yoon Park recreated a Star Wars battleship scene inside Virtual Reality with *Tilt Brush*, exploring the idea of creating volumetric objects in space with dots, lines and surfaces.⁴⁸⁸ Another application launched by Oculus is *Oculus Medium*, which is a digital free-form creation sculpting tool.⁴⁸⁹ In the future, ways to do modelling in three-dimensional space are likely to be developed further.⁴⁹⁰

With the release of *Dear Angelica*, Oculus Story Studio announced to develop the possibility of sequential storytelling in *Quill*, “taking it from something that can be used to create single illustrations, into one that can be used to make self-contained VR comics, complete with audio”⁴⁹¹. Following *Dear Angelica*, Oculus Story Studio is about to release a new project titled *Talking with Ghosts*, which was also created with *Quill*.⁴⁹² Further exploring VR content creation with the application, the experience consists of four illustrative comic VR films.⁴⁹³

New tools are regularly released to facilitate content creation in cinematic Virtual Reality. Nokia launched the 'OZO Player SDK', which helps to create VR applications with video playback.⁴⁹⁴ The SDK works with all kinds of 360-degree video (not only footage from the OZO)⁴⁹⁵ and can perform playback in any of the

⁴⁸⁶ Lang(u) (2016) online.

⁴⁸⁷ Gartenberg (2017) online.

⁴⁸⁸ James (2017b) online.

⁴⁸⁹ Lang (2016e) online.

⁴⁹⁰ Aaron Koblin in an interview with Kent Bye, (2017a) online.

⁴⁹¹ Bishop (2017) online.

⁴⁹² James (2017a) online. | *Talking with Ghosts* premieres April 21st, 2017 at the Tribeca Film festival.

⁴⁹³ James (2017a) online.

⁴⁹⁴ Lang (2016i) online. | The SDK is free of charge with a watermark and Nokia is offering case-by-case licensing options.

⁴⁹⁵ The playback engine supports 360-degree mono/3D and 180-degree 3D footage. Lang (2016i) online.

major VR systems.⁴⁹⁶ In a further step, it is foreseeable that Virtual Reality hardware and/or software might influence traditional filmmaking in the future. For the creation of visual effects for 2016's *Star Wars Rogue One*, the director used SteamVR controllers to choose the angle on VFX-shots before the final animation and the lighting/shading and rendering of shots was done.⁴⁹⁷

6.5.1 Volumetric Virtual Reality

Volumetric Virtual Reality is currently developed by various companies using different techniques. It bears the potential to revolutionize live-action 360-degree footage, ideally enabling the production of real-time rendered 360-degree video with six degrees of freedom, voiding current parameters of VR, as depicted in the following illustration.⁴⁹⁸

	Current Cinematic VR	Upcoming Volumetric 360° VR	CG VR
Content	360° Live-Action Footage / 360° Animated Footage	360° Post-Processed Live-Action Footage	Computer-Generated Content
Tracking	2 degrees of Freedom	6 degrees of Freedom	
Rendering	Pre-rendered	Real-time	
Interaction	Content not interactive	Possibility of High Level of Interaction	
Dimensions	2D / 3D	3D	

Illustration 11: Live-action footage in current 360-degree video versus upcoming volumetric VR

The company 8i, which was founded in 2014 and had raised US\$14.8 million to build a media platform around volumetric VR,⁴⁹⁹ showed its first volumetric captured project #100humans at Sundance 2016.⁵⁰⁰ It consists of four chapters, each part introducing a different character. 8i's technology captures video from

⁴⁹⁶ Lang (2016i) online.

⁴⁹⁷ James (2017d) online.

⁴⁹⁸ See also chapter 2.1.3 Hybrid Forms.

⁴⁹⁹ Terdiman (2015) online.

⁵⁰⁰ Watercutter (2016) online.

multiple off-the-shelf cameras and has the video streams transform into 3D holograms, displaying real-life objects in a virtual environment.⁵⁰¹

Jaunt VR and Lytro Immerge are working on light field cameras, which produce 3D live-action video, however currently still at high cost.⁵⁰² In 2016, the company Lytro received a ‘series D’ funding sum of over US\$60 million for developing their light field VR capture.⁵⁰³ Currently, Lytro is working on a 360-degree video capture system that records one angle and then can be rotated, filming the different angles individually.⁵⁰⁴ Lytro’s and Jaunt’s system, both consist of several rings of cameras and sensors that capture videos of a scene combined with a software setup to blend them together.⁵⁰⁵ Jaunt Neo allows capturing video in low-light conditions and also supports time-lapse capture and high-frame rate recording, which is necessary for high-end Virtual Reality experiences.⁵⁰⁶

Contrary to the trend to have all scene elements in focus, light-field techniques allow to choose the focus of the scene after recording.⁵⁰⁷ Allowing focus shifts will open different possibilities in content production of filmic VR experiences, also changing current conventions and workflows. However, there is still a lot of data to be processed even with a downscaled version of the light-field captured experience, which makes it difficult to display the light field captured video flawlessly in a headset as it requires heavy computing power to render.⁵⁰⁸ Once the issues have been solved, these techniques have the potential to reduce time and work in post-production, for example by eliminating the process of stitching.⁵⁰⁹

Another technique was presented by the company HypeVR. Ideally, this technique will allow room-scale movement within live-action captured footage by capturing the volumetric data of the scene. The scenes are recorded with a static rig of twelve 6K – RED Cameras which capture 60 frames per second. In conjunction

⁵⁰¹ Gasking (2016) online; Terdiman (2015) online.

⁵⁰² Scholz (2016) p. 46.

⁵⁰³ James (2017c) online.

⁵⁰⁴ James (2017c) online.

⁵⁰⁵ Robertson (2015) online.

⁵⁰⁶ Johnson (2015) online.

⁵⁰⁷ Robertson (2015) online. | As mentioned earlier, there are currently technical and practical barriers to produce the out-of-focus effect in camera for Virtual Reality experiences. Aronson-Rath et al. (2016) online; See also chapter 6.1.4 Other Attention Cues.

⁵⁰⁸ James (2017c) online.

⁵⁰⁹ Takahashi (2016) online.

with these, the rig uses a LiDAR sensor that captures the scene's depth on a map by pointing a laser at objects to determine their distance to the camera.⁵¹⁰ The retrieved data is combined with the video captured from the twelve cameras to create 60 volumetric frames per second of the scene, which create the volumetric video.⁵¹¹ The data size for 30 seconds of footage has been reduced from an initial 5.4 terabytes down to 2GB, but still poses a need for faster consumer internet connections and better compression.⁵¹² Due to the single point of view of the laser-capture-method, the back of the objects is not captured.⁵¹³ The missing data still requires time-intensive workarounds as the process of complementing the scene has to be done manually.⁵¹⁴ Thus, currently this technique still has limitations with regard to production and distribution.⁵¹⁵

Facebook recently announced the launch of two volumetric video cameras, an advancement in the 'Surround360' series.⁵¹⁶ These cameras, called the x24 and the x6, promise to achieve the same as the previously mentioned cameras - 360-degree live-action video with depth information and six degrees of freedom.⁵¹⁷ Facebook is licensing this camera design to a number of commercial partners and announced a product for later in the year 2017.⁵¹⁸ To ensure post-production handling in existing visual effects software, Facebook is also cooperating with a number of post-production and VFX studios to "help build out workflows and toolchains"⁵¹⁹. Depending on prices of the released product, this camera could have an enormous changing effect on the VR industry and its production techniques and possibilities.

6.5.2 Further Challenges

The fast-moving pace of VR technology presents yet another challenge; to produce content which is at the pulse of time, exploiting all the possibilities of

⁵¹⁰ Lang (2017r) online.

⁵¹¹ Lang (2017r) online.

⁵¹² Lang (2017r) online.

⁵¹³ Lang (2017r) online.

⁵¹⁴ Lang (2017r) online.

⁵¹⁵ Lang (2017r) online.

⁵¹⁶ Hayden (2017g) online.

⁵¹⁷ Hayden (2017g) online. | The names x24 and x6 indicate the number of on-board sensors.

⁵¹⁸ Hayden (2017g) online.

⁵¹⁹ Hayden (2017g) online.

current hardware while using innovative and creative storytelling and production ideas. Saschka Unseld has made it a rule to keep the full production time for a Virtual Reality project down to one year or one and a half years at the maximum, in order not to risk losing relevancy.⁵²⁰ With developments to release wireless headsets for example, content creation is likely to be influenced – the freedom of movement makes room for creation of less limited content.⁵²¹ Older content, created for the more restricted headsets, might turn to be out of fashion.

Another challenge for content creation might be the introduction of eye-tracking to a broader range of Virtual Reality systems. Oculus is already working on including eye-tracking as a feature of the newest headset.⁵²² Moreover, third-party software can be used to add eye-tracking to existing VR technology.⁵²³ Eye-tracking in Virtual Reality utilizes optical tracking, using landmarks inside the eye to track changes in a reflecting infrared light off the surface of the viewer's eye.⁵²⁴ Eye tracking makes 'foveated' rendering possible: it renders the field of focus of the eye in high clarity while blurring the other parts of the virtual environment.⁵²⁵ While 'foveated' eye-tracking is likely to be released on the market soon, a more interactive usage of eye-tracking poses further challenges.⁵²⁶

Eye-tracking will change current artistic and technical workflows. It is one of many challenges and chances that might arise for content production in the coming years. In equal measure, innovations like eye-tracking and its 'foveated' rendering also bring about technological advances that play in favour of the positive development of the technology; the focus on a particular part of the image reduces the overall level of detail of the images, lowering the volume of data to be processed.⁵²⁷ Thus, once implemented, eye-tracking might solve issues currently posed by the massive amount of data that requires rendering for a high quality experience in mobile Virtual Reality systems.

⁵²⁰ Watercutter (2017) online.

⁵²¹ Eadicicco (2017) online.

⁵²² Ternovyi (2016) online.

⁵²³ Ternovyi (2016) online.

⁵²⁴ Ternovyi (2016) online.

⁵²⁵ Ternovyi (2016) online.

⁵²⁶ Lang (2017u) online.

⁵²⁷ Jeckl (2017) Appendix F, pp. 206-207.

7 The Virtual Reality Market

When asked about future VR trends and their own desire how to use VR experiences, consumers give an overall lead to the gaming and movie industries.⁵²⁸ It has been stated that early adopters, who would spend a lot of money on Virtual Reality systems, are likely to be gamers.⁵²⁹ This paper's survey supports this statement: out of people already possessing a Virtual Reality headset, 60% stated to be playing video games.⁵³⁰ The gaming industry itself is currently targeting 'hard-core gamers' - rather than a casual consumer mass.⁵³¹ The examples of VR video content described in this paper present a growing, nevertheless still rather small niche of VR content production. Considering all this, how is the Virtual Reality technology relevant for the film and TV industries? The following subchapters evaluate aspects of the Virtual Reality market, such as general funding volume in the industry, funding possibilities for content producers and ways of distribution.

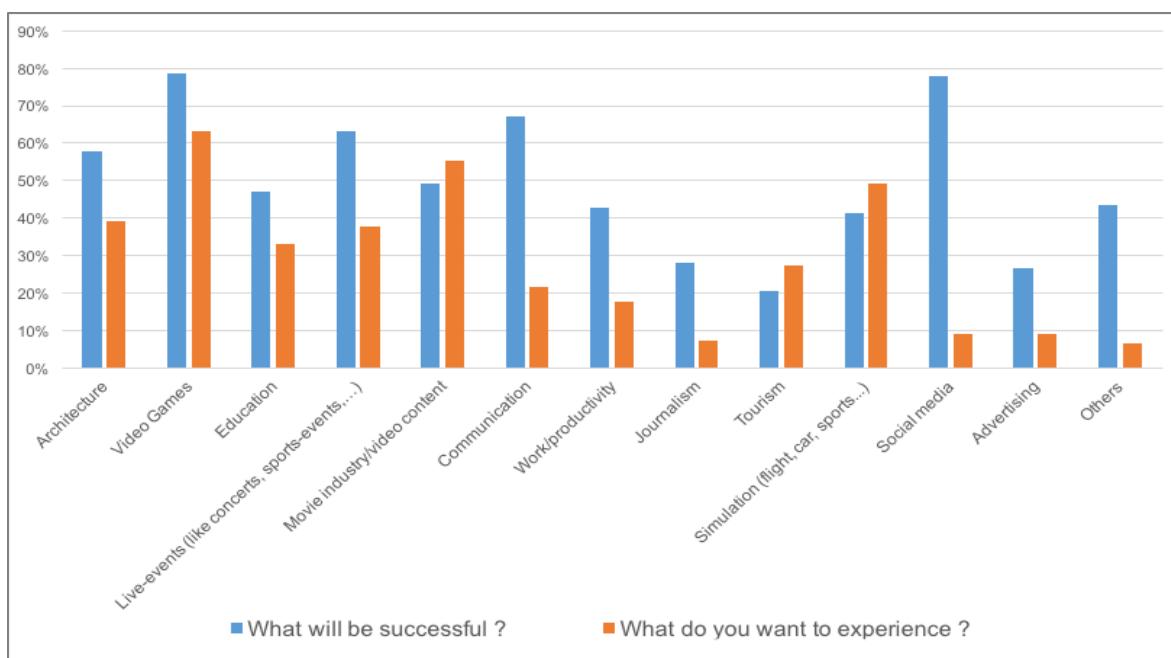


Illustration 12: Possible future trends in Virtual Reality as estimated by consumers [Survey 2017]⁵³²

⁵²⁸ This assumption is made based on the survey conducted during writing this paper. A stark contrast in the fields of social media and communication appeared; consumers estimate Virtual Reality to be well established in these sectors, but do not desire to use it for these purposes.

⁵²⁹ Gabe Newell qtd. in Brennan (2017b) online.

⁵³⁰ Appendix G, p. 217.

⁵³¹ Peltier (2017) Appendix D, p. 176.

⁵³² Appendices G-J, pp. 208-246.

7.1 Funding Volume in the VR/AR Market

In all areas of Virtual Reality development, funding was ramped up in the year 2016, with a total of US\$1.8 billion in the industries of VR/AR.⁵³³ This trend is going to persist in 2017, likely with a focus shift towards funding content production studios, location-based VR, gaming, non-gaming entertainment and live VR broadcasts.⁵³⁴ 85% of investments taken in 2016 were so-called Series A investments, implying an early development stage of the funded projects.⁵³⁵

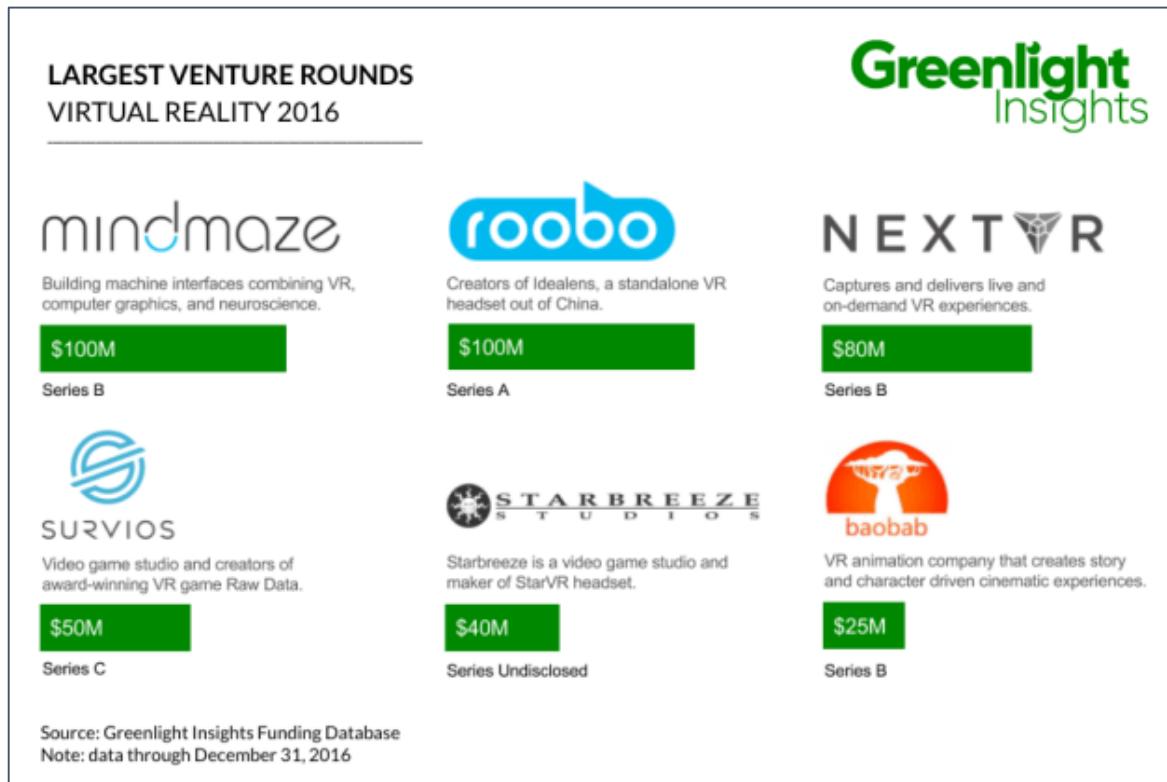


Illustration 13: Largest investments in the VR sector in 2016⁵³⁶

Content production has not only been funded in the gaming sector - for example with a US\$6 million funding series for Sweden based Resolution Games by Google Ventures and other backers in 2015.⁵³⁷ In June 2016, the content distribution and production studio Within received a US\$12.4 million ‘series A’ funding from established media companies such as 21st Century Fox, Annapurna Pictures, Legendary Pictures and Vide Media.⁵³⁸ Penrose Studios, the makers of

⁵³³ Dawson (2017) online.

⁵³⁴ Dawson (2017) online.

⁵³⁵ Dawson (2017) online.

⁵³⁶ Dawson (2017) online.

⁵³⁷ Peterson (2015) online.

⁵³⁸ Hayden (2017b) online. | There is a more detailed description of Within in chapter 7.9.2.9.

Allumette and *The Rose and I*, received a US\$8.5 million investment in March 2016.⁵³⁹ In the same year, Baobab Studios, which produced the Virtual Reality experiences *INVASION!* and its sequel *ASTEROIDS!*, received a US\$25 million investment.⁵⁴⁰ IMAX also invested US\$50 million in 2016 to fund ‘premium’ high-quality content production, as stated.⁵⁴¹ These investments show a general trend of desire for advancements in the fields of Virtual and Augmented Reality and simultaneously induce positive indirect effects for other industry participants.

7.2 Innovation Process | First and Second-Mover Advantages

As mentioned in chapter 3,⁵⁴² the Virtual Reality market is in a state of constant product innovation due to its early diffusion phase. Developing industries usually prioritize product innovation, while in more established markets the focus is rather set on process innovation.⁵⁴³ Driving product innovation can bring some of the following so-called first-mover advantages:

- To be able to use the first-hand experience with the innovation to develop greater expertise than later entrants.
- To be able to scale for mass production faster than later entrants when diffusion spreads.
- To have first-hand access on scarce raw materials, skilled personnel and/or components.
- To be able to bind customers to product(s) and to make it difficult for later entrants to make consumers switch to their product(s).⁵⁴⁴

Nevertheless, later competitors might also enjoy advantages, such as being able to use technological and other advances in innovations at lesser expense than the initial pioneering companies.⁵⁴⁵ The cost of imitation is only about 65% of the

⁵³⁹ Böhm (2016) online.

⁵⁴⁰ Hayden (2016a) online. | This funding was supported by Horizons Ventures, Twentieth Century Fox, Evolution Media Partners (backed by TPG and CAA), China’s Shanghai Media Group, Youku Global Media Fund and LDV Partners.

⁵⁴¹ Brennan (2016) online.

⁵⁴² See chapter 3 Reception and Interaction Hardware.

⁵⁴³ Johnson et al. (2015) pp. 186-187. | On the contrary, the Blue Ocean Theory, which is described in chapter 7.4, aims to find new product niches within a developed industry.

⁵⁴⁴ Johnson et al. (2015) p. 193. | In case of Virtual Reality, this may apply for hardware, software and content producers.

⁵⁴⁵ Johnson et al. (2015) p. 193.

original cost of innovation.⁵⁴⁶ From an economic standpoint, an advised position to pursue may be the one of the ‘fast second’.⁵⁴⁷

“A fast second (or ‘fast follower’) strategy involves being one of the first to imitate the original innovator. Thus, fast second companies may not literally be the second company into the market, but they dominate the second generation of competitors.”⁵⁴⁸

An innovation that revolutionizes a whole industry is called disruptive: it “creates substantial growth by offering a new performance trajectory that, even if initially inferior to the performance of existing technologies, has the potential to become markedly superior”⁵⁴⁹. Virtual Reality may have the potential to disrupt the current way of viewing video content, communication and possibly other aspects of life. For incumbents - existing players in the film/video and TV industry - it is therefore essential to keep an open mind and eye on new technologies. Moves into the direction of Virtual Reality made by big TV stations like CNN, ARTE and Hollywood Studios attest to that. New value-creation for consumers is the key to making profitable business with innovative technologies - this topic is discussed in more detail in chapter 7.7.⁵⁵⁰

7.3 Five Forces Framework | Competitive Markets

One way of determining a market’s attractiveness and therefore its potential, is to analyze its possible current and future competition forces.⁵⁵¹ Porter defines five forces within a market:

- Threat of entry,
- Threat of substitutes,
- Power of buyers,
- Power of suppliers and
- Extent of rivalry among existing competitors.⁵⁵²

⁵⁴⁶ Johnson et al. (2015) p. 193.

⁵⁴⁷ Johnson et al. (2015) pp. 193-194.

⁵⁴⁸ Johnson et al. (2015) p. 194.

⁵⁴⁹ Johnson et al. (2015) p. 195.

⁵⁵⁰ For value creation see chapter 7.7 Platform Businesses and their Network Effects.

⁵⁵¹ Johnson et al. (2015) p. 28.

⁵⁵² Porter (2008) pp. 8-21; Johnson et al. (2015) pp. 28-33; Rothaermel (2013) pp. 64-70.

An attractive industry “is one that offers good profit potential”⁵⁵³; if all five factors are high, the industry is not interesting to compete in and the competing companies do not enjoy attractive returns.⁵⁵⁴

Competitive rivals are bidding for the same group of customers with similar products/ and or services (competitive rivalry).⁵⁵⁵ For an industry to be attractive, it poses high barriers for new entrants (threat of entry).⁵⁵⁶ “It is the threat of entry, not whether it actually occurs, that holds down profitability.”⁵⁵⁷ Substitutes have a different nature than the offered product or service, however they target the same circle of customers (threat of substitutes).⁵⁵⁸ If power of buyers is high, they can demand lower prices or product or service improvements that result in lower profits (power of buyers).⁵⁵⁹ Conversely, power of suppliers rises if there is a limited number of suppliers, if switching to another supplier involves high costs or if suppliers can undercut intermediaries and therefore supply customers directly (power of suppliers).⁵⁶⁰ If suppliers are not solely dependent on one industry, they have increased power as well.⁵⁶¹

Complementary products and services can affect profitability of an industry as they can influence the five forces.⁵⁶² As mentioned before, supplement technologies and products to make Virtual Reality truly interactive were absent when the first headsets came out.⁵⁶³ Oculus had even delayed the release of its Touch hand-controller to provide additional time for the developers to produce compatible content, while simultaneously using this time to improve tracking performance and range as well as ergonomics.⁵⁶⁴ An increasing number of products will also enhance the possible range of diversity in VR content. Hence, technological

⁵⁵³ Johnson et al. (2015) p. 28.

⁵⁵⁴ Rogers (2008) p. 3; Johnson et al. (2015) p. 28.

⁵⁵⁵ Johnson et al. (2015) p. 28.

⁵⁵⁶ Johnson et al. (2015) p. 31.

⁵⁵⁷ Porter (2008) p. 8.

⁵⁵⁸ Johnson et al. (2015) p. 32.

⁵⁵⁹ Johnson et al. (2015) p. 32.

⁵⁶⁰ Johnson et al. (2015) p. 33.

⁵⁶¹ Porter (2008) pp. 13-14.

⁵⁶² Porter (2008) p. 23.

⁵⁶³ See chapter 3 Reception and Interaction Hardware.

⁵⁶⁴ Lang (2016b) online.

innovation can reshape rivalry.⁵⁶⁵ Constant technological innovation characterizes current Virtual Reality industry, most of all in VR system technology, however also in the sector of cameras, platforms and subsequently, in the production of content. Google and Facebook are likely to continue their heavy investments into Virtual Reality, with Google pushing the mobile sector (with Daydream) as well as the high-end professional systems (by funding companies like Magic Leap).

Even though Porter points out the importance to consider an industry's analysis and its shifting forces on a time horizon,⁵⁶⁶ the analysis of the Five Forces runs the risk of providing only a singular temporal depiction of an industry's potential.⁵⁶⁷ To consider an industry's dynamics that change over time, the Five Forces model can be put in relation to the industry life cycle and Rogers' understanding of the innovation diffusion.

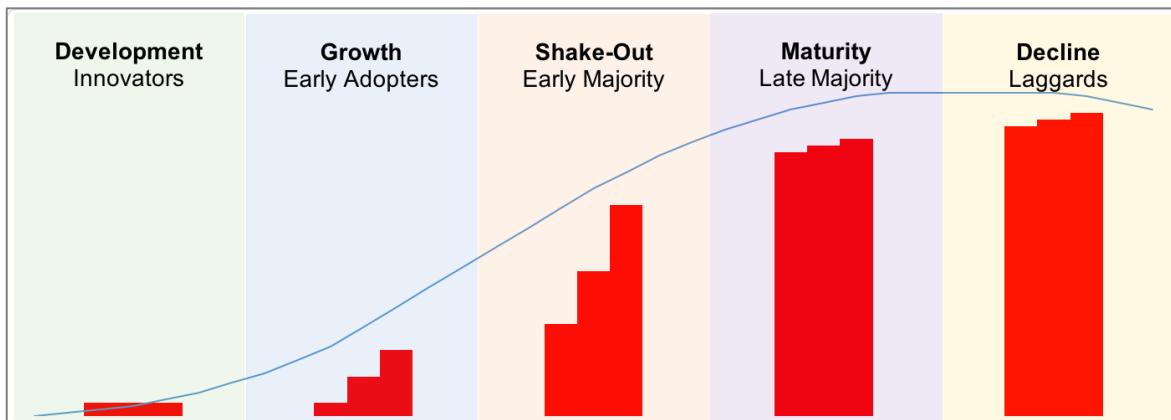


Illustration 14: Rivalry forces in developing industries regarding Rogers' S-curve of adoption and increasing competition forces within an industry (red) [adapted from Johnson et al. (2015) p. 35]

In the development stage, there is low rivalry due to high differentiation within an industry.⁵⁶⁸ The growth stage is characterized by low entry barriers with relatively weak buyers and growth potential.⁵⁶⁹ The following phase, called shake-out, is characterized by increasing rivalry with slower growth, followed by the maturity stage with higher entry barriers but standard products and a low growth rate.⁵⁷⁰ If an industry has reached a stage of low growth, the competitors are often roughly

⁵⁶⁵ Porter (2008) p. 26.

⁵⁶⁶ Porter (2008) pp. 5, 22, 24-26.

⁵⁶⁷ Rothaermel (2013) p. 71.

⁵⁶⁸ Johnson et al. (2015) pp. 34-35.

⁵⁶⁹ Johnson et al. (2015) pp. 34-35.

⁵⁷⁰ Johnson et al. (2015) pp. 34-35.

the same size - if there are many competitors, rivalry in an industry is high.⁵⁷¹ In the final industry life cycle stage there is usually extreme rivalry with intense price competition.⁵⁷²

Another dynamic factor to consider is 'industry convergence' over time, which often arises through technological advances and results in formerly unrelated industries serving the same customer need.⁵⁷³ The media industry has been exceedingly prone to changes caused by advances in the IT, as well as the telecommunications and the digital media industry.⁵⁷⁴ This progress is likely to continue with everything the technologies of artificial realities will bring about, even if they might emerge in different forms as currently commonly pictured. To operate profitably within constantly evolving markets, businesses need to venture into uncontested market space.⁵⁷⁵ This is the key idea of the so-called Blue-Ocean Theory, which is described in the following chapter.

7.4 Blue Ocean Theory

The Blue Ocean theory follows the understanding that for reaching profitability competitors shall find differentiated positions in the marketplace and venture into uncontested markets.⁵⁷⁶ A so-called value innovator company analyses critical success factors and focuses on setting priority on the aspects in which other companies are not well placed.⁵⁷⁷ By creating and capturing new demand in a market, competition is minimized in these new market spaces, called 'Blue Oceans' or 'strategic gaps'.⁵⁷⁸ The contrary is the 'Red Ocean strategy', which has companies compete in existing industry fields.⁵⁷⁹ Hence, there is high competition within Red Ocean markets, whereas in Blue Oceans profitability is reached by creating and enhancing consumer demand.⁵⁸⁰ Driving innovation like Microsoft

⁵⁷¹ Rothaermel (2013) p. 69.

⁵⁷² Johnson et al. (2015) pp. 34-35.

⁵⁷³ Rothaermel (2013) p. 73.

⁵⁷⁴ Rothaermel (2013) p. 73.

⁵⁷⁵ Kim/Mauborgne (2005) pp. 4-7.

⁵⁷⁶ Johnson et al. (2015) pp. 39, 41.

⁵⁷⁷ Johnson et al. (2015) pp. 40-41.

⁵⁷⁸ Kim/Mauborgne (2005) p. 17; Johnson et al. (2015) p. 41.

⁵⁷⁹ Johnson et al. (2015) p. 41.

⁵⁸⁰ Kim/Mauborgne (2005) p. 4.

with ‘Surface’⁵⁸¹ or Google and Facebook with Virtual/Augmented Reality, is one way to push forward into Blue Oceans markets. The approach targets pursuing low costs while still offering benefits and creating value for the user by differentiation within the market.⁵⁸² The four-action framework helps to define existing and possible new factors within an industry:

- Elimination – Which existing factors in the industry need to be eliminated?
- Reduction – Which factors need to be reduced?
- Raise – Which factors need to be raised?
- Creation – Which new factors should be created?⁵⁸³

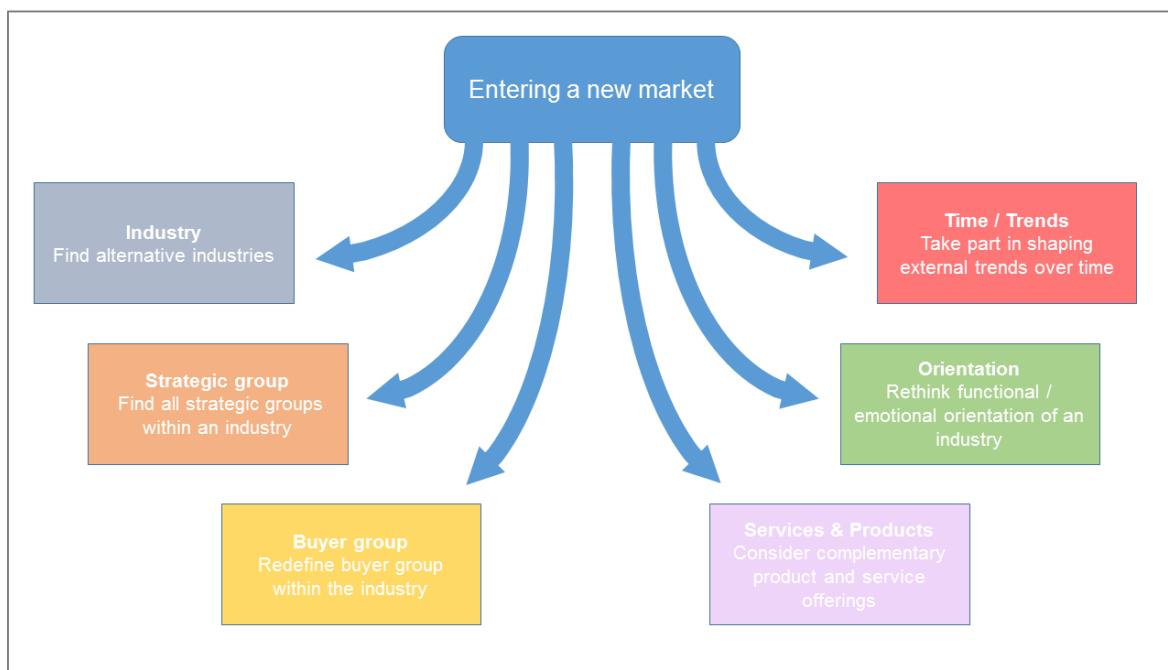


Illustration 15: The six-paths framework [adapted from Kim/Mauborgne (2005) p. 73]

To venture into uncontested new markets, the six paths framework helps to redefine the industry, the strategic group, the buyer group, complementary services and products, the industry’s functional-emotional orientation/appeal to consumers and trends over time.⁵⁸⁴ Alternative products shall provide different functions and forms but might be for the same purpose.⁵⁸⁵ In an analysis of the console market, it was suggested that Nintendo, which had lost market share due

⁵⁸¹ Mainelli (2015) online.

⁵⁸² Kim/Mauborgne (2005) pp. 11-17.

⁵⁸³ Kim/Mauborgne (2005) pp. 26-27.

⁵⁸⁴ Kim/Mauborgne (2005) p. 73.

⁵⁸⁵ Kim/Mauborgne (2005) p. 73.

to an increasing mobile gaming market, would need to expand into Blue Ocean territory by entering the Virtual Reality industry.⁵⁸⁶ Nintendo scheduled to bring out the newly designed ‘Switch’ console, a home and portable console, in 2017.⁵⁸⁷ Although the company has expressed a general interest in Virtual Reality, technological issues still remain.⁵⁸⁸

7.5 Virtual Reality Headsets

Based on the survey conducted for this paper, it can be observed that the adoption rate is representative of a rather small market. Generally, a low percentage of people already own a headset or are planning to buy one – in the survey this percentage amounted to a total of 18% of people.

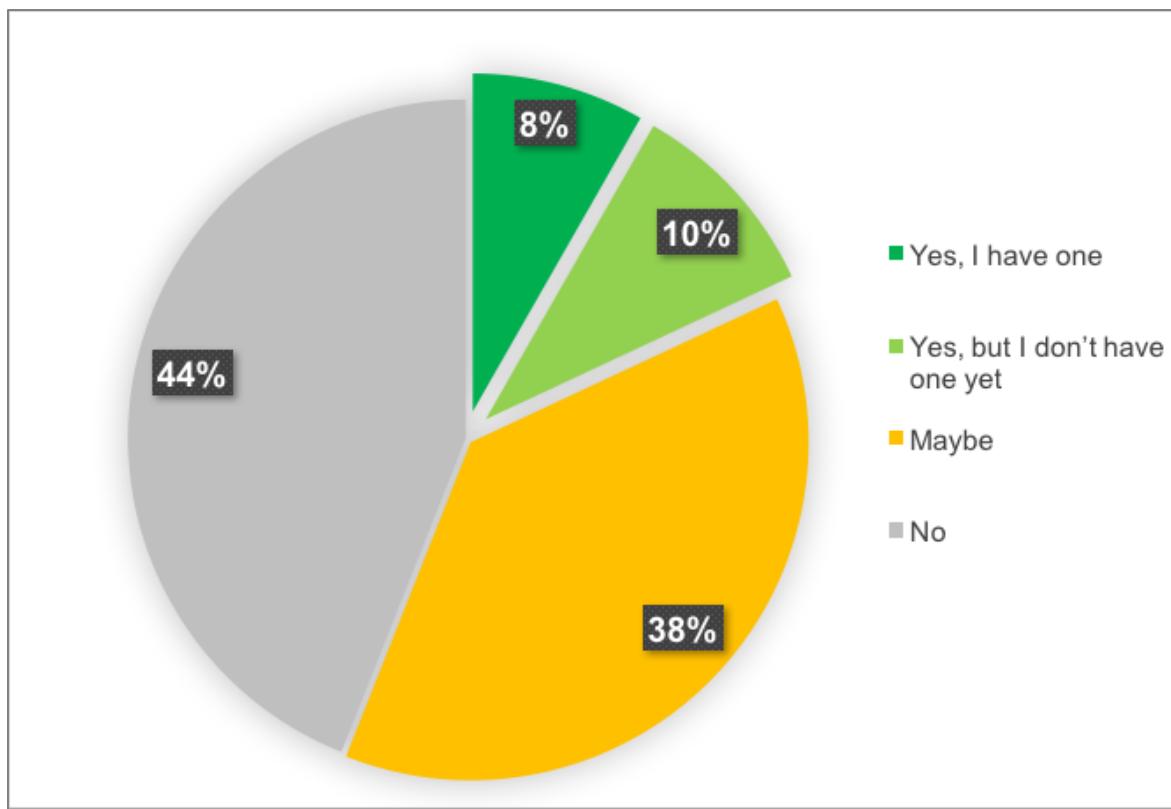


Illustration 16: Consumer study results "Are you planning to own a Virtual Reality headset for home usage?" [Survey 2017]⁵⁸⁹

Constant technology improvement and innovation is fueling the current hardware industry. Upon release, the costly HTC Vive was the only headset to provide the feature called the 'play area': by allowing the user to walk around in a virtual

⁵⁸⁶ Nielson (2014) online.

⁵⁸⁷ Brennan (2017c) online.

⁵⁸⁸ Brennan (2017c) online.

⁵⁸⁹ Appendices G-J, pp. 208-246.

environment in a 15x15 feet field, it was offering the most immersive VR experience on the market.⁵⁹⁰ Oculus Rift added this feature with an additional tracking hardware launched at the same time as the Touch controller. Furthermore, HTC Vive announced a change of strategy in their hardware development. In the future, there will be a consumer as well as a business VR system headset; the latter including dedicated support, enhanced warranty and bulk buying options.⁵⁹¹ This professional headset of HTC Vive is developed with a focus on manageability as well as on range and comfort of use.⁵⁹² For high-quality headsets, the price level is still high for consumers and according to predictions, it will remain relatively high due to the necessary technological advances.⁵⁹³ Following the release of the Oculus Rift and the HTC Vive, Sony launched its VR-headset for PlayStation 4 as a second-mover - competing with a lower price⁵⁹⁴ than the two first premium headsets. It did so for an already existing customer group: the VR headset is tethered to the PlayStation 4.⁵⁹⁵ In February 2017, Sony released its first official sales figures – up to date 915.000 PlayStation VR headsets had been sold.⁵⁹⁶

High technological costs and patent acquisition costs cause relatively high entry barriers for hardware manufacturers. Nevertheless, numerous companies are venturing into this field. Examples are Magic Leap, working on a Mixed-Reality technology,⁵⁹⁷ Meta developing a more affordable Augmented Reality headset⁵⁹⁸ and the kick-started funded FOVE headset with its full eye-tracking capable technology.⁵⁹⁹ On the contrary, Apple is still holding back on releasing any VR/AR

⁵⁹⁰ Eadicicco/Peckham (2016) online. | Besides that, the HTC Vive was praised for its accurate and fluid motion controllers.

⁵⁹¹ Lang(n) (2017) online.

⁵⁹² Lang(n) (2017) online.

⁵⁹³ Brennan (2017b) online.

⁵⁹⁴ End of 2016, the HTC Vive sold at US\$799, the Oculus Rift at US\$599 with an additional US\$199 for the Touch Controllers and the PlayStation VR at US\$499 (including camera and controllers). Matney (2016) online.

⁵⁹⁵ Kuchera (2016) online.

⁵⁹⁶ Lang (2017s) online.

⁵⁹⁷ Kelly (2016a) pp. 76-78.

⁵⁹⁸ Hempel (2016) p. 58.

⁵⁹⁹ Ternovyi (2016) online.

device, following a strategy to enter an innovative market only when it is rather established.⁶⁰⁰

In the mobile-area entry barriers are relatively low, for both consumers and manufacturers. That trend was set with the release of the Google Cardboard in 2014,⁶⁰¹ which sold for around US\$20 at release.⁶⁰² Google announced that over ten million of their Cardboard headsets had been shipped by beginning of 2017.⁶⁰³ Sales also benefited from brands using Cardboard experiences for promotion and distributing the low-cost headset free of charge.⁶⁰⁴ Reportedly, a total of 88 million headsets like the Cardboard and similar headsets were sold in 2016.⁶⁰⁵ By January 2017, the first mass-distributed mobile headset, the Samsung Gear VR surpassed the five million mark of sold units.⁶⁰⁶ Baofeng supposedly sold over one million units of a US\$30 headset in the first quarter of 2016.⁶⁰⁷ The most successful mobile headset in China sells for US\$10 (US\$20 on Amazon outside of China) at a rate of 101,644 units a month, making China the potential leader in business volume in low-cost mobile VR.⁶⁰⁸ Thus, the mobile VR headset technology is more likely to be adopted faster by a broader consumer market.⁶⁰⁹

Trying to provide an ultimately different experience than the Cardboard and an even more immersive experience than the earlier Samsung Gear VR,⁶¹⁰ Google is now releasing the Daydream headset. It sells for US\$79, £69, or AU\$119.⁶¹¹ Hence, Daydream is clearly targeting entry-level VR,⁶¹² simultaneously offering a more affordable Virtual Reality mobile system of good quality.⁶¹³ Google

⁶⁰⁰ Hayden (2017d) online. | The patenting of AR devices shows the company's active research and development in this field.

⁶⁰¹ Brennan (2017e) online.

⁶⁰² Kuchera (2016) online.

⁶⁰³ Robertson (2017c) online.

⁶⁰⁴ Mirt (2017) online.

⁶⁰⁵ Mirt (2017) online.

⁶⁰⁶ Brennan (2017d) online.

⁶⁰⁷ Mirt (2017) online.

⁶⁰⁸ Mirt (2017) online.

⁶⁰⁹ See chapter 3.5 Mobile versus Computer-tethered Virtual Reality Systems.

⁶¹⁰ Faulkner (2017) online.

⁶¹¹ Faulkner (2017) online; Storms (2016) online.

⁶¹² Mainelli (2016) online.

⁶¹³ Storms (2016) online.

Daydream is already aiming for latency under 20ms,⁶¹⁴ potentially making mobile VR more competitive with the current high-quality headsets.

Google has not patented the formula for the headset and has rolled out the screen-less reference design, which enables other mobile phone manufacturers to create suitable Daydream headsets for their phones.⁶¹⁵ By opening the possibility to manufacturers to obtain the Daydream-certified label,⁶¹⁶ Google is pushing its Daydream software platform on which all these headsets will be running on – this will also bind consumers to this platform. The Daydream-certified label will ensure a standard for content and hardware producers alike.⁶¹⁷ Samsung, Alcatel, Asus, HTC, LG, Xiaomi, ZTE and Huawei have announced to manufacture Daydream-ready phones, headsets and controllers.⁶¹⁸ Huawei already displayed the first Google Daydream headset in early 2017; it combines the Gear VR's and the Daydream's technology - running on the Daydream software platform.⁶¹⁹

Another step into the direction of high-quality, affordable VR is Facebook's announcement of a wireless standalone prototype VR headset, which combines the Samsung Gear VR technology with the one of the Oculus Rift.⁶²⁰ With growing accessibility of content through mobile VR, the audience size increases. Unsurprisingly, the TV station ARTE targets mobile VR users with its ARTE360 app rather than the smaller group of early adopters, owners of high-end Virtual Reality systems.⁶²¹ ARTE360 is also cooperating with Daydream.⁶²²

While Google is disclosing the Daydream's reference design, Microsoft is trying to push innovation with their fully autonomously computed Augmented Reality headset HoloLens.⁶²³ To do so, Microsoft is providing access to the Windows Holographic framework, which is a platform running on Windows 10 with its primary interaction model, its own “perception” application program interfaces (so-

⁶¹⁴ Chokkattu (2017) online.

⁶¹⁵ Mainelli (2016) online; Faulkner (2017) online.

⁶¹⁶ Peltier (2017) Appendix D, p. 182.

⁶¹⁷ Peltier (2017) Appendix D, pp. 182-183.

⁶¹⁸ Faulkner (2017) online.

⁶¹⁹ He (2017) online.

⁶²⁰ Seifert (2016) online. | This headset will resemble the design of the Oculus Rift without wires and will include built-in ear pads.

⁶²¹ Knetig (2017) Appendix C, p. 160.

⁶²² Knetig (2017) Appendix C, p. 159.

⁶²³ Mainelli (2016) online.

called APIs⁶²⁴) and access to Xbox Live services.⁶²⁵ This framework of codes will help developers to produce content for any device running on Microsoft's operating system. This strategy targets fueling content production running on Microsoft's operating system, if demand rises.

In early 2017, 24% of game developers taking part in the annual GDC conference were currently developing content for Valve and the HTC Vive, followed by 23% developing for Oculus Rift, and 13% for PlayStation VR.⁶²⁶ While only 8% were currently developing for Google Daydream, 17% stated to be interested to do so in the future.⁶²⁷

Regarding content production, it needs to be considered that many people still view 360-degrees videos through an internet browser, rather than on a VR headset and with premium headphones.⁶²⁸ In its stage of innovation, the VR technology is steadily evolving and its usage is only gradually reaching its full potential.⁶²⁹ Hence, this circumstance also influences content production and its possible audience. In equal measure, users wear Virtual Reality headsets to watch two-dimensional video content, like on the Netflix app inside the virtual environment.⁶³⁰ Possibly, a new way of watching cinema might arise in this area - maybe in the form of a further advancement in the evolution of 3D cinema.⁶³¹

7.6 Content-Production Industry

Opinions on whether producing Virtual Reality content is a costly matter differ. This might arise from the fact that producing high-quality Virtual Reality content is an expensive endeavor,⁶³² while producing low-end Virtual Reality content can be done rather economically. Generally, 360-degree content can be produced at lower costs than computer-generated Virtual Reality content.⁶³³ High-end live-

⁶²⁴ API “is a set of routines, protocols and tools for building software. [...] A good API makes it easier to develop a program by providing all the building blocks. A programmer then puts the blocks together.” See Beal (n.d.) online.

⁶²⁵ Mainelli (2016) online.

⁶²⁶ Lang (2017b) online.

⁶²⁷ Lang (2017b) online.

⁶²⁸ Knetig (2017) Appendix C, p. 152.

⁶²⁹ Knetig (2017) Appendix C, p. 167.

⁶³⁰ Knetig (2017) Appendix C, p. 167; Jeckl (2017) Appendix F, p. 194.

⁶³¹ Jeckl (2017) Appendix F, pp. 189, 192-193, 199.

⁶³² Osarek (2016a) p. 33; Scholz (2016) p. 45.

⁶³³ Attali (2016) Appendix A, p. 135.

action Virtual Reality content combined with computer-generated elements has a longer production cycle than a classical video production and therefore is more cost demanding.⁶³⁴ Currently, it is likely that high-quality VR experiences - particularly in the journalistic area - do not provide direct cost recovery from viewers or advertisers.⁶³⁵ The estimated cost of a Virtual Reality documentary production was around US\$100,000 to US\$500,000 USD in 2015.⁶³⁶ The estimation stated a 25% increase of budget in comparison to the production of the same documentary as a regular TV product.⁶³⁷ The 9-minute 360-degree video *The Source* was produced by Vrse.works and Frontline with a budget of US\$100,000 with the entire production process handled in-house.⁶³⁸ The computer-generated experience *Notes on Blindness* was produced with a budget of 400.000€, of which 130.000€ were funded by ARTE.⁶³⁹ *I, Philip*, a hybrid between cinematic and computer-generated content, runs for 14 minutes and was produced for a total budget of 550.000€. Shorter experiences like *The Temptation of Saint Anthony* by Hieronymous Bosch⁶⁴⁰ had a budget of around 40.000€.⁶⁴¹

For big game producers like Ubisoft creating content for Virtual Reality currently still poses a financial risk.⁶⁴² High-end gaming VR productions would require the budget of a big Triple A-videogame in the range of up to 2 million€, while revenue of Virtual Reality games cannot be well-predicted due to the novelty of the market.⁶⁴³ In addition, until recently, hardware manufacturers had been disguising their sales figures,⁶⁴⁴ making sale predictions even more difficult. Sony recently made the step to announce their number of sold units in early 2017, as mentioned in the previous chapter 7.5.⁶⁴⁵

⁶³⁴ Aronson-Rath (2016) online.

⁶³⁵ Aronson-Rath (2016) online.

⁶³⁶ Collis (n.d.) online.

⁶³⁷ Collis (n.d.) online.

⁶³⁸ Collis (n.d.) online; Swant (2016) online.

⁶³⁹ Knetig (2017) Appendix C, p. 165.

⁶⁴⁰ This experience is entirely computer-generated.

⁶⁴¹ Knetig (2017) Appendix C, p. 165.

⁶⁴² Peltier (2017) Appendix D, p. 175.

⁶⁴³ Peltier (2017) Appendix D, p. 175.

⁶⁴⁴ Peltier (2017) Appendix D, pp. 175-176, 179.

⁶⁴⁵ See chapter 7.5 Virtual Reality Headsets.

In 2016, Chris Milk, one of the pioneers of cinematic VR, stated that Virtual Reality content was still limited.⁶⁴⁶ Experts agree upon this circumstance,⁶⁴⁷ which gives this industry the potential to boom – on one condition though: only if there is an audience emerging out of the diffusion of hardware. That circumstance is mirrored by the New York Times' move to distribute complimentary Google Cardboard to its subscribers.⁶⁴⁸

While the art of developing truly immersive content is still in the trial-and-error stage, some companies and studios are already leading the field.⁶⁴⁹ Theoretically, most existing production companies for both live action and computer-generated content should be able to transition to VR production.⁶⁵⁰ CEO Neville Spiteri of the content studio Wevr states: "The hardware is ahead of the content today. So if you're an early pioneer developing compelling experiences, you're going to be able to win over an audience and monetize it."⁶⁵¹ Hence, there might be a large number of firms entering this market segment in the future - consequently resulting in increased competition.

Keeping up with workflows and technical standards does not only require trained personnel (or putting costs into training staff) but also investment into the newest hardware and software components. The capital required to do this might not be easily recouped,⁶⁵² at least not in the current Virtual Reality content market.

Despite the needed funds for a professional production and technological expertise, entry barriers to producing content are currently relatively low - that makes the factor of threat of entry high and therefore competitiveness in this sector is fueled.⁶⁵³ As described above, from a technological and financial standpoint it is easier to produce 360-degree videos,⁶⁵⁴ therefore entry barriers are even lower and competition is increasing fast. For computer-generated content, higher production costs make entry barriers higher. Especially in this area, well-

⁶⁴⁶ Milk (2016) online.

⁶⁴⁷ See for example Heuer/Rupert-Kruse (2015) p. 88.

⁶⁴⁸ Kuchera (2016) online.

⁶⁴⁹ Heitlinger (2016) online.

⁶⁵⁰ Heitlinger (2016) online.

⁶⁵¹ Neville Spiteri qtd. in Volpe (2016b) online.

⁶⁵² Scholz (2016) p. 46.

⁶⁵³ See also Heitlinger (2016) online.

⁶⁵⁴ Goeldi (2016) online.

trained technicians and developers might be a rare resource. In content production, as well as in platforms,⁶⁵⁵ there is a high possibility of differentiation, therefore it is possible to set a certain focus in content production – and possibly venture into Blue Ocean markets.

7.6.1 Branded Virtual Reality Content | Virtual Reality in B2B

A possible financing option for content producers is the commercial based model, providing Virtual Reality experiences for brands.⁶⁵⁶ Virtual and Augmented Reality open a new platform for advertising and marketing; content producers emphasize its ability to promote brand experiences.⁶⁵⁷ Early tests showed that engagement rates doubled with the use of 360-degree video compared to traditional video advertising.⁶⁵⁸ "Void of the production constraints of 30 second TV spots, 360-degree video opens up new avenues for deeply immersive advertising that invites the consumer in to engage with a personalized brand experience."⁶⁵⁹ In this market segment, content producers enjoy higher certainty to recoup their expenses of production in the current state of the Virtual Reality industry.⁶⁶⁰

At present, brands are trying to use VR's novelty factor to promote their products.⁶⁶¹ In the introduction to this paper it has been pointed out that Rolls-Royce uses the format of 360-degree video to advertise an innovative experience both in the product as well as the advertisement. Currently, the advertising business favors 360-degree video content over computer-generated content: "Virtual Reality's younger, cheaper cousin — 360-degree video — is an increasingly popular gizmo in the marketer's toolbox."⁶⁶² Behind many of these experiences lies the idea of bringing the user to unusual places - the range reaches from a closed-to-public fashion walk of a famous brand to the factories of Rolls-Royce.⁶⁶³ FIA Formula E Championship released a 360-degree making-of-

⁶⁵⁵ For content platforms see chapter 7.9.2 Content Platforms.

⁶⁵⁶ Attali (2016) Appendix A, p. 136.

⁶⁵⁷ Stenger (2016) online; Sloane (2016) online.

⁶⁵⁸ Goeldi (2016) online.

⁶⁵⁹ Goeldi (2016) online.

⁶⁶⁰ Attali (2016) Appendix A, pp. 136-137.

⁶⁶¹ Attali (2016) Appendix A, p. 136.

⁶⁶² Caffyn (2016) online.

⁶⁶³ Caffyn (2016) online.

video of a stunt showing a dangerous backflip over a racing car.⁶⁶⁴ Faraday revealed its first prototype electric car in the medium of 360-degree video to display the novelty of the product in every aspect.⁶⁶⁵ Other brands experimenting with 360-degree video include Nestlé, Coca-Cola and Volvo.⁶⁶⁶ Volvo mirrors the 3D navigation technique with the nature of 360-degree video content. "*Your world isn't flat. Your map shouldn't be either. Built-in 3D Navigation. This is our standard.*"⁶⁶⁷ is written in a three-dimensional font, which is placed inside the images of the landscape the Volvo is driving through.

Because of the slow spreading of Virtual Reality into the private consumer market, it has been suggested that the technology should be pushed into the enterprise workflow.⁶⁶⁸ In the same way, the smartphone has transformed from being a gimmick into an indispensable part of any enterprise workflow.⁶⁶⁹ Virtual Reality content producers are also pushing into the direction of the B2B-area. In this case, companies often supply headsets to highlight products, certain objects or services.⁶⁷⁰ Like advertising, this area is a more secure way of financing VR content production.

7.6.2 Switching Costs and Cross-Platform Experiences

In the current state of early adoption of Virtual Reality, recouping over viewers directly in terms of sold applications, still poses financial risks on content producers. At its release in October 2016, the PlayStation VR had around 25 experiences available – with a price range of eight to sixty Euros.⁶⁷¹ Additionally, content like *Playroom VR* and the interactive film *Allumette* were available free of charge.⁶⁷² By early 2017, only 30 VR apps had made over US\$250,000 through

⁶⁶⁴ Caffyn (2016) online.

⁶⁶⁵ Sloane (2016) online.

⁶⁶⁶ Goeldi (2016) online.

⁶⁶⁷ YouTube (2016, May 02) [<https://www.youtube.com/watch?v=Pb4c6azXO3E>].

⁶⁶⁸ Lang (2016c) online.

⁶⁶⁹ Lang (2016c) online.

⁶⁷⁰ Jeckl (2016) online.

⁶⁷¹ Leitner (2016) p. 14.

⁶⁷² Leitner (2016) p. 14.

distribution on Steam,⁶⁷³ crushing the early optimistic figures set by some indie VR titles like *Job Simulator*.⁶⁷⁴

Consumers still have low switching costs when it comes to Virtual Reality content. In contrast, switching costs for the industry participants are currently high only when it comes to switching headsets, especially regarding the computer-tethered, high-quality ones. In this context, making applications cross-platform is of interest for content producers. In the gaming industry, there are first moves to make multiplayer VR games available across all headset platforms. By the end of 2016, following *Eve:Valkyrie*, Ubisoft's *Eagle Flight* was converted to allow all players of the current three major computer-tethered headset VR systems to join each other for a conjunctive gameplay.⁶⁷⁵ This move enhances the range of the possible player base and therefore it improves the gameplay experience.⁶⁷⁶

Obstacles are remaining for content producers with different headset technologies on the market. Making an application compatible for various VR systems causes additional steps in the content production. If executed badly, conversions can fail. The game *Robinson: The Journey*, which was originally released on PlayStation VR, launched on SteamVR without Official Vive Support and users without a compatible gamepad were not able to play the game.⁶⁷⁷ At the beginning of 2017, Google started offering the VR app *Tilt Brush* to Facebook's Oculus Rift and Gear VR⁶⁷⁸ - pointing to a general trend of cross-platform applications.

7.6.3 360-Degree Cameras

For professional content producers, 360-degree camera manufacturers or hirers can represent powerful suppliers. As with any other sector in the VR industry, growth for both professional and amateur cameras will depend on the general adoption of VR by a broader group of consumers. So far, only a few companies provide professional equipment - examples are the Nokia's OZO or the Jaunt VR. The OZO is one spherical camera with eight synchronized sensors with an

⁶⁷³ Brennan (2017b) online.

⁶⁷⁴ Hayden (2017c) online.

⁶⁷⁵ Fahey (2016) online.

⁶⁷⁶ Fahey (2016) online.

⁶⁷⁷ Lang (2017f) online.

⁶⁷⁸ Lang (2017i) online. | *Tilt Brush* was launched for the Oculus Rift at the same time as Oculus launched its application *Quill*.

accompanying standalone computer with software for live stitching and preview.⁶⁷⁹ Sony Pictures and Disney struck deals with Nokia to use their OZO for content production.⁶⁸⁰ For professional production, there are also custom camera rigs, combining for example RED cameras or a Black Magic rig.⁶⁸¹ In the medium price range, besides the 360Freedom, there is the GoPro Omni (for US\$5000) that combines six HERO4 Black cameras.⁶⁸²

Similar to the content market, the camera market for Virtual Reality is likely to scatter into professional, prosumer and consumer fields.⁶⁸³ On the lower priced consumer market, various manufacturers are pushing into the field; Kodak's SP360 and the Ricoh Theta S were early competitors.⁶⁸⁴ There is also the 360Fly, the Samsung Gear 360, the Orah, the Vuze, the Kodak Pixpro and the Lucidcam 180 Stereo.⁶⁸⁵ The choice in low-cost 360-degree cameras will likely expand due to emerging manufacturers from China.⁶⁸⁶ Professional content creators can consider using low priced 360-degrees cameras for pre-visualization, scouting and preproduction and planning in general.⁶⁸⁷ The broader availability of entry-level 360-degree camera also pushes production of consumer-produced content. On top of that, developments like Facebook's newly announced volumetric Surround360 cameras might boost the quantity of higher-quality consumer-produced content.⁶⁸⁸

7.6.4 Consumer-produced Content

As described earlier, 360-degree video content has emerged as a new medium for private and professional purposes.⁶⁸⁹ Facebook has offered 360-degree video support since 2015, one year after acquiring Oculus Rift.⁶⁹⁰

⁶⁷⁹ Rhodes (2016) online. | The OZO can record up to 6K resolution and costs US\$45.000 to buy and US\$3000 per day to rent, as of early 2017.

⁶⁸⁰ Hayden (2016c) online.

⁶⁸¹ Rhodes (2016) online.

⁶⁸² Rhodes (2016) online.

⁶⁸³ Heitlinger (2016) online.

⁶⁸⁴ Burns (2016) online.

⁶⁸⁵ Rhodes (2016) online.

⁶⁸⁶ Heitlinger (2016) online.

⁶⁸⁷ Rhodes (2016) online.

⁶⁸⁸ See chapter 6.5.1 Volumetric Virtual Reality.

⁶⁸⁹ Izdebski/Legkov (2016) pp. 64-65.

⁶⁹⁰ Raymundo (2016) online.

Besides Google/YouTube, the social network has actively pushed production of user-generated content. Both platform businesses are investing in streaming solutions to ensure flawless publishing and distribution services.⁶⁹¹

"YouTube and Facebook, by far the dominant platforms for online video, are both clearly determined to expand this dominance into the next wave of online video: 360-degree virtual reality content."⁶⁹²

It can be argued that consumer-produced content poses challenges for professional content production. On the other hand, the popularity and marketing power of networks like YouTube and Facebook can give room for distribution of professional content. Facebook and Google are also striking deals with professional content producers to "make compelling 360 video available on their respective platforms. For instance, Facebook successfully distributed a 360-degree trailer for the new *Star Wars* movie and more recently the intro sequence for *Game of Thrones*".⁶⁹³ Google has collaborated with MTV, Discovery and the New York Times and invested in its own VR studio.⁶⁹⁴

These circumstances make these social network platforms an interesting distribution channel for consumers, but also for professional content, like for ARTE.⁶⁹⁵ Consumer-market and professional market on these platforms do not necessarily oppose each other, but can also cross-fertilize one another in the way that more active users who view and produce consumer content also means more potential audience for professional content creators on that same platform. These kinds of network effects driven by platform businesses are described in the following chapter.

7.7 Platform Businesses and their Network Effects

It has been suggested that the adoption of the internet was partly caused by the democratization of content creation within it, for example through platforms like *WordPress*.⁶⁹⁶ "By enabling everyone to create content, the web benefited from

⁶⁹¹ Goeldi (2016) online.

⁶⁹² Goeldi (2016) online.

⁶⁹³ Goeldi (2016) online.

⁶⁹⁴ Goeldi (2016) online.

⁶⁹⁵ Knetig (2017) Appendix C, pp. 155-157.

⁶⁹⁶ Mahajan (2016a) online. | *WordPress* offers the user to create websites without having to possess any technical knowledge and now makes up around 25% of the internet.

network effects; starting a flywheel that attracted consumers and creators alike.⁶⁹⁷ It is maybe what the creators of *Sansar* are striving for: the underlying idea is to operate a virtual place where different parties of a market can meet.⁶⁹⁸ This follows the business model of a matchmaker or a so-called network orchestrator, which is described in the following two subchapters.

7.7.1 Frictionless Access of Content

In the early days of consumer market Virtual Reality, the access to content was induced with rather high friction. Friction would potentially slow down the diffusion of an innovation: "the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption"⁶⁹⁹.

Currently, installations, loading times and other technical issues do not make for a frictionless experience of VR content.⁷⁰⁰ Access to content should be as frictionless as possible. Until recently, the operations linked to mobile VR - purchasing, starting, switching apps - required to remove the phone from the headset regularly. With the release of the Daydream headset, friction of this kind was reduced. Purchases can be made within the Daydream experience, reducing friction to make in-app purchases and therefore increasing chances that customers will return investment costs of content production.⁷⁰¹

The frictionless access and entry to a network or platform is vital to its potential growth.⁷⁰² Efforts are made within the Virtual Reality industry to reduce friction through various products. Initially, Virtual Reality experiences needed to be downloaded first before the user could view or use them. WebVR enables streaming Virtual Reality content, making content available through a web browser - this way it offers one possibility of decreasing friction during access of content.⁷⁰³ Through WebVR, Virtual Reality content and non-VR content can be combined within a single website.⁷⁰⁴ Second Life and VRTV are also working on ways to

⁶⁹⁷ Mahajan (2016a) online.

⁶⁹⁸ Lang (2017q) online.

⁶⁹⁹ Rogers (2003) p. 257.

⁷⁰⁰ Attali (2016) Appendix A, p. 138.

⁷⁰¹ Peltier (2017) Appendix D, pp. 177-178.

⁷⁰² Parker/Van Alstyne/Choudary (2016) pp. 24-26.

⁷⁰³ Huls (2017) online.

⁷⁰⁴ Mahajan (2016b) online.

make it possible to stream VR content.⁷⁰⁵ Matchmaker businesses attempt to add value to consumers, often by reducing friction within processes in market transactions.⁷⁰⁶

7.7.2 The Matchmaker Business Model

The internet has made it possible to reduce friction in many business exchanges and consequently, internet-platforms businesses have emerged.⁷⁰⁷ In conjunction with faster broadband communication networks, computer chips, operating systems and various other technological advances, certain businesses have profited from being able to reduce transaction costs and friction even more.⁷⁰⁸

The matchmaker business model is old⁷⁰⁹ but has recently been very successful and is now shaping some of the biggest companies in the world. It exists alongside the asset-builder, the service provider and the technology creator business model.⁷¹⁰ Matchmaker companies are also called multi-sided platforms, because these companies operate physical or virtual places where members of a market group get together and exchange goods or services.⁷¹¹ In other words, “they facilitate direct interactions between different types of customers”⁷¹² and enable value-creating interactions by connecting two or more types of customers to interact with each other on attractive terms.⁷¹³

Famous examples of these companies are Apple⁷¹⁴, Google, Microsoft⁷¹⁵, Alibaba and Amazon, besides others like Uber and Airbnb.⁷¹⁶ These platform companies rely on demand-side economies of scale, rather than on supply-side economies of

⁷⁰⁵ Mahajan (2016b) online.

⁷⁰⁶ Evans/Schmalensee (2016) p. 36.

⁷⁰⁷ Evans/Schmalensee (2016) p. 19.

⁷⁰⁸ Evans/Schmalensee (2016) pp. 19, 39-44, 198-199, 202-203.

⁷⁰⁹ Evans/Schmalensee (2016) pp. 198-201. | The principle of matchmaker businesses can be dated back to the Ancient Greek time.

⁷¹⁰ Parker et al. (2016) pp. 32-33.

⁷¹¹ Evans/Schmalensee (2016) p. 1.

⁷¹² Evans/Schmalensee (2016) p. 15.

⁷¹³ Evans/Schmalensee (2016) pp. 15, 18-19; Parker et al. (2016) p. 5.

⁷¹⁴ Apple operates a two-sided platform with app developers on one side and consumers on the other side. Evans/Schmalensee (2016) p. 35.

⁷¹⁵ Microsoft operates a three-sided platform business, with app developers, consumers and computer manufacturers. Evans/Schmalensee (2016) p. 35.

⁷¹⁶ Evans/Schmalensee (2016) pp. 1, 8.

scale.⁷¹⁷ In matchmaker businesses, the different customer sides need to be balanced – that can go as far as paying one side of customers for their services (or letting them use the platform without charging any fees) in order to reach this state of balance.⁷¹⁸ Another way to achieve balance of customer sides is to promote 'side switching' by encouraging one side of users to join the other side of market participation.⁷¹⁹

When starting a platform business, coordination problems might occur: one side of customers does not enter the market without the other side of customers and vice-versa - this vicious circle is also called the 'chicken-and-egg problem'.⁷²⁰ Matchmaker platforms must find ways to attract one side of customers before a critical mass of customers of the other side joins the market place. The chicken-and-egg problem applies to some extent to the current state the Virtual Reality; content producers are not willing to take too much risk producing content for VR while simultaneously consumers are not willing to buy hardware if there is no compelling content available to consume with the hardware. Hardware manufacturers try to overcome this issue by funding content production and by exclusivity deals, as described in chapters 7.1 and 7.9.2.1.⁷²¹

7.8 Shifting Viewer Habits

Like competition within markets, a company's strategy requires constant adaption to changing industry factors. In value creation for a media audience, another transforming factor is shifting viewer habits. The transformation of communication and media technologies has not only entailed the rise and expansion of companies based on the matchmaker business model, it has also gradually influenced viewing habits of the media audience.

On-demand video-subscription services such as Hulu, Netflix and Amazon Prime have increasingly become successful and are competing for viewers. The availability of content plays a major role here, with an increasing number of original

⁷¹⁷ Parker et al. (2016) pp. 32-33.

⁷¹⁸ Evans/Schmalensee (2016) pp. 15, 35.

⁷¹⁹ Parker et al. (2016) p. 26; Evans/Schmalensee (2016) p. 25.

⁷²⁰ Evans/Schmalensee (2016) pp. 70-73.

⁷²¹ See chapters 7.1. Funding Volume in the VR/AR Market and 7.9.2.1 Exclusive Headset-Platform Deals for Content Creators.

formats in recent years.⁷²² Additionally, premium content from big studios is competed for; in December 2016, Hulu announced it landed an exclusive deal with Disney to add more than 50 of their films to its content library.⁷²³ Following a global expansion strategy, Netflix only opened its streaming service to European countries like France and Germany in 2014.⁷²⁴ It now holds 47% of revenue outside of the US, with 93.80 million subscribers altogether at the end of 2016.⁷²⁵

As previously explained, the internet has not only brought about online-streaming services and therefore shifted viewing habits, it has also popularized short forms of entertainment.⁷²⁶ On-demand TV and streaming TV have given rise to formats with continuity - especially formats with elements of character and plot growth and development.⁷²⁷ Meanwhile, Hollywood cinema with its superhero or genre franchises is also moving towards more episodic formats.⁷²⁸

RTL Co-CEO Guillaume de Posch acknowledged a higher fragmentation of content and is therefore targeting a strategy of the so-called ‘Total Video’ to focus on “producing, aggregating and monetizing content on all platforms and devices”⁷²⁹. To serve differentiated viewing habits of today's population, the TV station ARTE follows a strategy of serving various channels of distribution.⁷³⁰

7.9 Forms of Distribution

For every content producer, the question of distribution arises. Commercial-based produced content usually recoups costs with an additional revenue margin, so that is why this model is currently a less risky option for content producers, as

⁷²² Emarketer (2016) online. | The subscription services have increasingly offered original content, promoting their platforms with it. On the other hand, the number of original scripted shows in traditional TV increased as well within the last eight years.

⁷²³ Hall (2016) online. | Interestingly, these services are pushing into live TV streaming now; Hulu announced the launch of a live service in 2017, while Netflix is offering offline playback support and AT&T launching DirecTV Now offers both live TV streaming as well as on-demand content.

⁷²⁴ Shaw (2014) online.

⁷²⁵ Statista (2017) online.

⁷²⁶ See chapter 4.2 Short Form Format.

⁷²⁷ Droitcour (2016) p. 207.

⁷²⁸ Droitcour (2016) p. 207.

⁷²⁹ RTL Group (2016) online.

⁷³⁰ Knetig (2017) Appendix C, pp. 150-151. | Distribution on many different distribution channels poses a further challenge on TV stations; traditionally only quotas of linear TV are considered for funding budgets. This system is slowly being reformed now.

mentioned in chapter 7.6.1.⁷³¹ For the studio model, in which artistic pieces are distributed directly to viewers, the question arises: Is there an audience and how is it reached?

Distribution models for Virtual Reality experiences are still broadly undefined and unclear.⁷³² What is agreed on is that for Virtual Reality to spread, content needs to be accessible.⁷³³ While in linear TV the audience flow can be well-predicted and productions are created for certain slots in the program, distribution over the internet is much less structured.⁷³⁴ With a broad range of different technologies and platforms, reaching media audience becomes a challenge, which can be met by setting a focus on marketing efforts.⁷³⁵

7.9.1 Virtual Reality in Traditional Movie Theatres and Similar Venues

One way of reaching an audience for filmic Virtual Reality experiences is to show them in traditional cinemas or similar venues. One of the first permanent Virtual Reality movie theaters opened in 2016 in Amsterdam.⁷³⁶ In a lightened room there are swivel chairs, each equipped with a Gear VR headset and headphones.⁷³⁷ At launch, the ticket entry for a package of Virtual Reality films of 35 minutes duration in total was €12.50.⁷³⁸ In Paris, the French cinema operator mk2 opened a Virtual Reality screening venue with 12 pods for visitors at its location Bibliothèque Paris.⁷³⁹ Currently, these venues can profit from the technology's novelty factor. "With the VR Cinema, it feels like the talking point is designed to be more about the technology and the experience, rather than the movie."⁷⁴⁰ It is especially interesting for people who have not had a chance to try any (high-end) Virtual Reality system.⁷⁴¹

⁷³¹ See chapter 7.6.1 Branded Virtual Reality Content | Virtual Reality in B2B.

⁷³² Zeitchik (2017) online.

⁷³³ Huls (2016) online.

⁷³⁴ Knetig (2017) Appendix C, p.164.

⁷³⁵ Knetig (2017) Appendix C, pp. 164-165.

⁷³⁶ Sawers (2016) online.

⁷³⁷ Sawers (2016) online.

⁷³⁸ Sawers (2016) online.

⁷³⁹ Graham (2016) online. | Ticket prices at launch were 12€ for 20 minutes or 20€ for 40 minutes.

⁷⁴⁰ Sawers (2016) online.

⁷⁴¹ See also Nelson (2017) online.

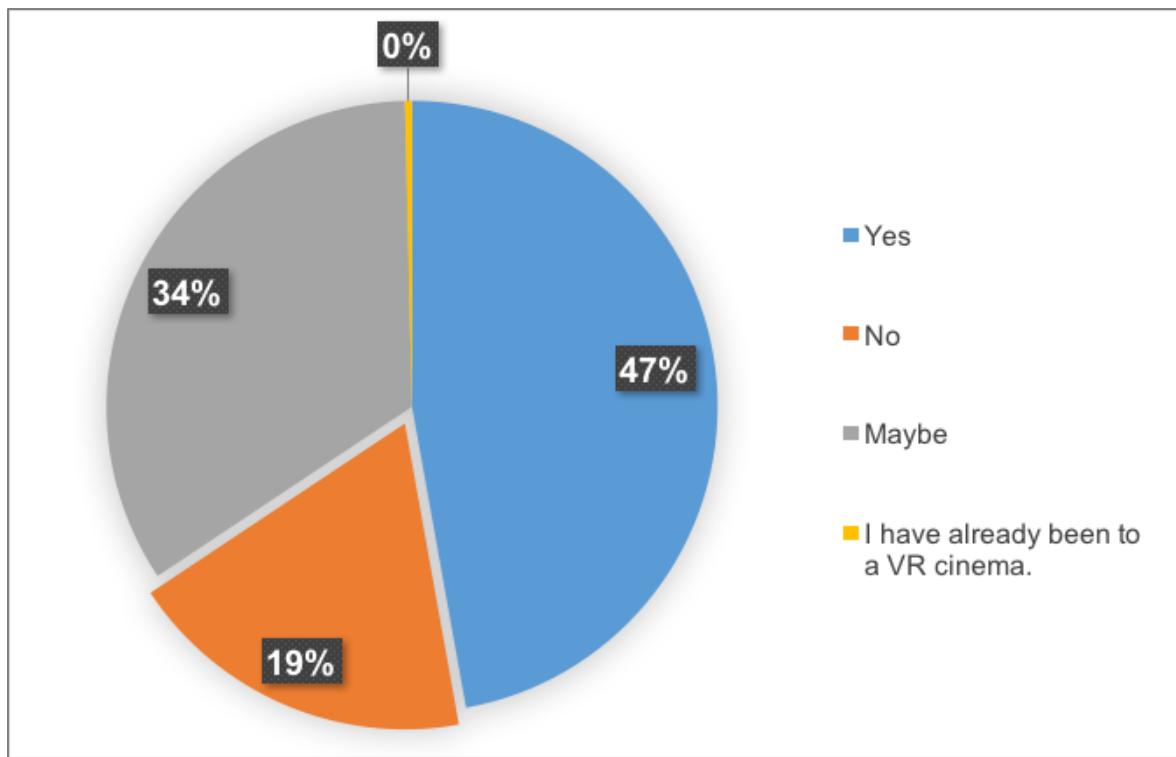


Illustration 17: General interest in visiting a VR cinema [Survey 2017]⁷⁴²

The survey results conducted for this paper show a total of 81% of respondents possibly interested in visiting a VR cinema. With a potentially rather big audience, this distribution channel might help cumulate revenue at this stage of diffusion of the VR technology.

7.9.1.1 ‘Experience Centers’

Early 2017, IMAX opened their flagship location of the first so-called ‘IMAX VR Experience Centre’ in Los Angeles, planned to be followed by five more locations.⁷⁴³ Like Virtual Reality cinemas, IMAX follows the 'pay-to-play' business model.⁷⁴⁴ The center is equipped with StarVR Headsets, which have a wider field of view than the headsets already out on the market: the Oculus Rift and the HTC Vive currently allow for a 110-degree field of view, whereas the StarVR headset provides a 210-degree field of view.⁷⁴⁵ In the VR cinema, there are 14 room-scale cabins to accommodate for various VR experiences.⁷⁴⁶ At launch in Los Angeles,

⁷⁴² Appendices G-J, pp. 208-246.

⁷⁴³ Nelson (2017) online; Naferette (2017) online. | At launch, tickets sold for US\$7 for a 5-minute experience and for US\$10 for a 12-minute experience.

⁷⁴⁴ Nelson (2017) online.

⁷⁴⁵ Carman (2016) online. | The Star VR headset is currently not for sale on the consumer-market.

⁷⁴⁶ Nelson (2017) online; Nafarrete (2017) online.

single and multiplayer content was offered, one of it being Ubisoft's game *Eagle Flight*.⁷⁴⁷ The experiences compatible for the StarVR headset are currently limited.⁷⁴⁸ This is probably why IMAX has committed to a US\$50 million US dollar investment to create premium content in the near future.⁷⁴⁹ Two factors will ensure ongoing interest in the venue: exciting content that is exclusive and/or time-limited and a better viewing experience than the in-home-entertainment equivalent, a model similar to conventional cinema nowadays.⁷⁵⁰ The Star VR headset with its wide angle viewing is already providing an enhanced viewing experience compared with other Virtual Reality headsets on the market. IMAX is pushing forward location-based VR - new centers are going to be opened in the United Kingdom in a partnership with 'ODEON & UCI Cinema' as well as in Shanghai.⁷⁵¹

7.9.1.2 Full Domes

Contrary to conventional cinemas, the screen in a full dome surrounds the viewers on all sides and above (though not on the ground) in the shape of a dome. 360-degree planetariums are nowadays used for science centres and museums, universities as well as mobile planetariums for conferences, film festivals and exhibitions.⁷⁵² Furthermore, they are used for all kinds of interactive media – such as multi-user gaming experiences, video jockey events, as well as pre-rendered full dome-productions and live-tours through the universe or the human brain in real-time.⁷⁵³ 360-degree video content of any kind can be displayed in a full dome without the need of Virtual Reality headsets.

7.9.1.3 Film Festivals

Due to its pioneering state as a storytelling medium, as for current state of the art, distribution of Virtual Reality content via festivals seems to have become one of the most common ways to present artistic Virtual Reality experiences. The Venice Film Festival, one of the major film festivals, was the first one to dedicate a full

⁷⁴⁷ Nafarrete (2017) online.

⁷⁴⁸ Nelson (2017) online.

⁷⁴⁹ Nelson (2017) online; See also chapter 7.1 Funding Volume in the VR/AR Market.

⁷⁵⁰ Nelson (2017) online.

⁷⁵¹ Nafarrete (2017) online.

⁷⁵² Beyer (2015) p. 53.

⁷⁵³ Beyer (2015) p. 54.

room to VR experiences in 2016.⁷⁵⁴ In the same year, Tribeca Film Festival (TFF) announced showing VR content.⁷⁵⁵ Sundance Film Festival 2017 divided VR experiences into the categories ‘mobile VR’, ‘tethered VR’ and ‘art’, though it has been suggested that - with an increasing amount of content - further distinctions between journalistic, interactive and narrative content will need to be made.⁷⁵⁶

7.9.2 Content Platforms

Hardware manufacturers of Virtual Reality headsets provide content via their respective platforms. It is currently difficult to access this platform specific content with a headset from another manufacturer. In the year 2016, Samsung hardware could access content via Samsung VR, while HTC Vive had content provided over ViveHome, Viveport and SteamVR. SteamVR is available to all Oculus Rift users; besides the Oculus Store which could also be accessed by Samsung Gear VR.⁷⁵⁷ This situation does not allow frictionless access to all Virtual Reality content - it might be partly caused by hardware producers’ strategies to push their own technology by offering exclusive and limited content - described in the following chapter.

7.9.2.1 Exclusive Headset-Platform Deals for Content Creators

Sometimes referred to as the chicken-and-egg problem, as described above,⁷⁵⁸ is the circumstance that creators will not produce hardware-bound content for a limited customer base while at the same time consumers will not buy any hardware if compelling content is scarce.⁷⁵⁹ Specific to this current state of technology, hardware manufacturers are investing technical and monetary resources into content production in an attempt to enhance demand for the Virtual Reality headsets by building up exclusive content libraries.⁷⁶⁰

Oculus is focusing on this business strategy by investing US\$500 million in exclusive content production for their Oculus Touch system - notably a lot of this

⁷⁵⁴ Anderson (2016) online.

⁷⁵⁵ Nelson (2016) online.

⁷⁵⁶ Zeitchik (2017) online.

⁷⁵⁷ Lamkin (2016) online.

⁷⁵⁸ See chapter 7.7 Platform Businesses and their Network Effects.

⁷⁵⁹ Lang (2016h) online.

⁷⁶⁰ Boland (2015) online.

amount goes into games creation.⁷⁶¹ Oculus had timed exclusivity on gaming titles like *Eagle Flight*, releasing the experience on the Oculus platform about half a month before the other platforms. Sony has followed the same strategy launching PlayStation VR exclusive experiences.⁷⁶² Content producers profit from these deals not only in terms of direct payments but also in terms of additional publicity by being part of the official marketing campaign of a hardware manufacturer.⁷⁶³ Oculus is estimating that once the hardware is established, the second or third generation of content creation will not require funding any longer.⁷⁶⁴ Content producers often develop content that is compatible with different platforms, possibly with enhanced features for the currently more elite platforms/Virtual Reality systems.⁷⁶⁵

In regards to content platforms, which are ultimately “the glue of VR”⁷⁶⁶, technical barriers to entry in this market segment are low.⁷⁶⁷ As a growing number of players is pushing into this field, competition is increasing. One way to establish a successful platform is to serve differentiated areas and to create new, innovative market segments.⁷⁶⁸ A few examples of content platforms are described in the following subchapters.

7.9.2.2 YouTube

YouTube360 and a platform called Vrideo were both launched in March 2015.⁷⁶⁹ While Vrideo was shut down in late 2016, YouTube360 now has almost 2 million subscribers to its channel.⁷⁷⁰ YouTube, being a successful matchmaker company, figured out how to operate on the internet like traditional media enterprises, to attract both viewers and advertisers and on top of that, receive the content displayed on their website without having to invest in it.⁷⁷¹ With a possible range of

⁷⁶¹ Lang (2016h) online. | Game creation is pushed due to fact that gamers are targeted as early adopters, as mentioned in chapter 1 Introduction.

⁷⁶² Lang (2016h) online.

⁷⁶³ Peltier (2017) Appendix D, pp. 181-182.

⁷⁶⁴ Lang (2016h) online.

⁷⁶⁵ Peltier (2017) Appendix D, pp. 181-182.

⁷⁶⁶ Heitlinger (2016) online.

⁷⁶⁷ Heitlinger (2016) online.

⁷⁶⁸ Heitlinger (2016) online.

⁷⁶⁹ Popper (2016) online; Roettgers (2016b) online.

⁷⁷⁰ Korolov (2016) online; Roettgers (2016b) online.

⁷⁷¹ Evans/Schmalensee (2016) pp. 202-203.

a billion users and vast capabilities to process video efficiently, YouTube offers many advantages for distribution of content. As of January 2016, over 350.000 hours of 360-degree videos have been watched on YouTube.⁷⁷² The music video of the Gorillaz, *Saturnz Barz*, received over 3 million views within 48 hours, making it one of the most successful 360-degrees videos up to date.⁷⁷³

7.9.2.3 Facebook

Besides YouTube, the other big player in social media and 360-degree video content is Facebook, as described in chapter 7.6.4 Consumer-produced Content. Google and Facebook, both operating multi-sided businesses, "each touch more than one-seventh of the world's population"⁷⁷⁴ and seem to be the leading platforms for accessing 360-degree video content – the survey results confirm this circumstance.

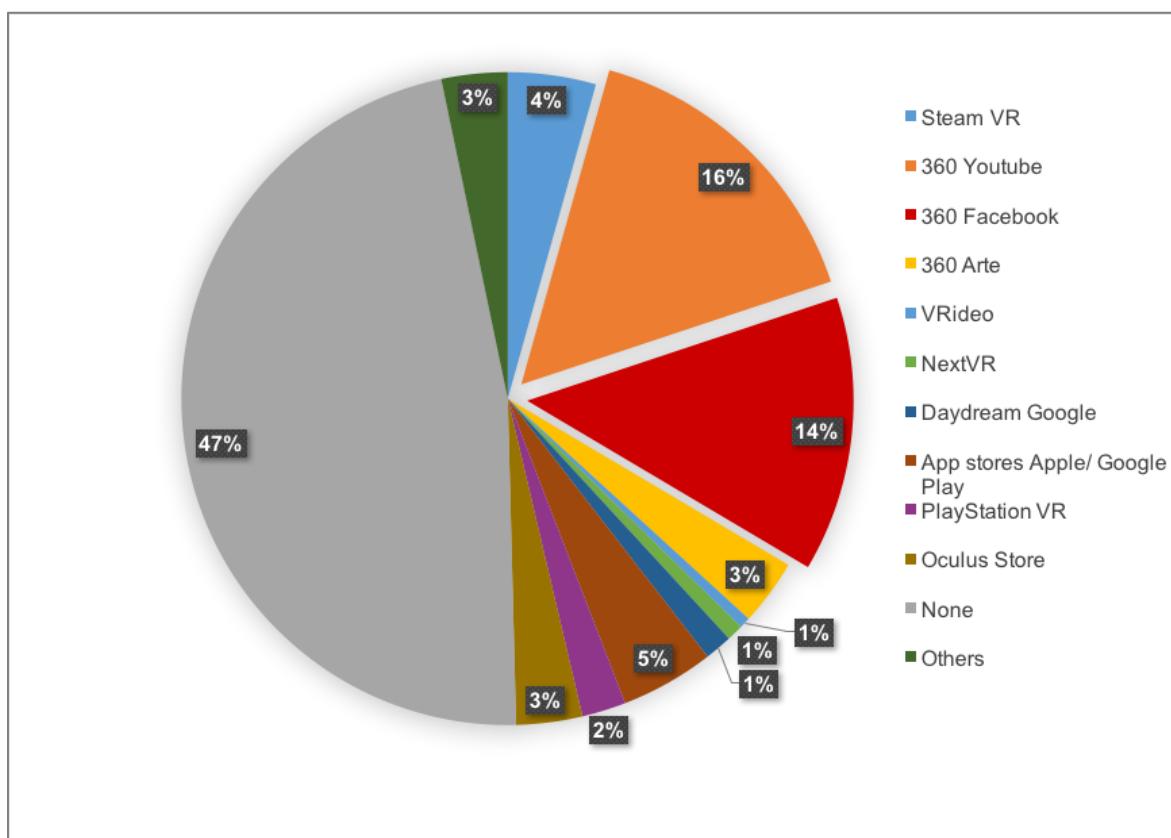


Illustration 18: Partition of platforms for accessing 360-degree video content [Survey 2017]⁷⁷⁵

⁷⁷² Bavor (2016) online. | To be able to upload 360-degree content to YouTube, an app must be downloaded to inject the 360-degree video's metadata manually.

⁷⁷³ Brennan (2017j) online.

⁷⁷⁴ Parker et al. (2016) p. 33.

⁷⁷⁵ Appendices G-J, pp. 208-246.

For Virtual Reality content on YouTube and Facebook, currently it seems that both user-generated and professional VR content will co-exist on one platform.⁷⁷⁶ Facebook is particularly pushing its 360-degree content in their algorithms and CEO Mark Zuckerberg has scheduled to put another US\$3 billion investment in making Virtual Reality more accessible over the coming years.⁷⁷⁷ Meanwhile, ARTE's most successful VR videos have accumulated 600.000 to 3 million views on Facebook while they were viewed 10.000 to 30.000 times on ARTE's own app.⁷⁷⁸

7.9.2.4 Google Daydream

With Daydream, Google is following a strategy of making mobile Virtual Reality a potential market with vast accessibility and broad-range. It already did so successfully with the Google Cardboard: from June 2014 to December 2015, the Cardboard app from Google Play was installed over 25 million times.⁷⁷⁹ Besides the headset technology, Google Daydream is primarily a content platform. Despite the currently still limited number of compatible phones, Daydream is expanding its platform by granting access to Google Play - as well as to other services; Netflix VR, HBO NOW VR, Hulu VR, the New York Times, NextVR, Jaunt VR, Littlestar and Within, to name a few.⁷⁸⁰ Google Daydream also cleverly leverages people's existing Google accounts, so the customer has a seamless transition to the Virtual Reality platform.⁷⁸¹

From the start, Google has used YouTube's access through the Cardboard app to supply consumers with an abundance of content.⁷⁸² The Hulu Virtual Reality app was the first one to offer the possibility to let up to three users meet to watch the Hulu videos together with the Gear VR headset – combining socializing and video

⁷⁷⁶ This co-existence might lead to problems, which can cause the platform-business to fizzle. A company called Brightcove had originally focused on gathering premium content on its platform – the premium media businesses did not support Brightcove to build up a consumer-generated content part of the site and because Brightcove could not secure significant traffic in that area, it failed to establish itself as consumer-destination site. Evans/Schmalensee (2016) pp. 82-83.

⁷⁷⁷ Eadicicco (2017) online.

⁷⁷⁸ These viewing numbers are estimates from early 2017. Knetig (2017) Appendix C, p. 156.

⁷⁷⁹ Bavor (2016) online.

⁷⁸⁰ Faulkner (2017) online; Lang (2016a) online. | The Daydream platform was planned to support 51 applications by the end of 2016. Hayden (2016b) online.

⁷⁸¹ Storms (2016) online.

⁷⁸² Henderson/Hall (2017) online. | Early 2017, Daydream was still the only platform accessing the official YouTube VR app, however it was recently joined by PlayStation VR platform. Lang (2016a) online; Lang (2017l) online.

viewing in the virtual environment.⁷⁸³ Google is also introducing a new premium VR video content application called Sky VR.⁷⁸⁴

In January 2017, Daydream's key requirements were released for content development, enabling all developers and not only the initially selected partners to create content for Google's new platform.⁷⁸⁵ Major game producers such as Ubisoft, have also announced a partnership with Daydream.⁷⁸⁶ Ubisoft is developing one of their biggest free-to-play IP's *Hungry Shark* for launch on the Daydream platform.⁷⁸⁷ The team at Turbulent, which created *The Unknown Photographer*, is now working to bring out its next Virtual Reality experience on the Daydream platform.⁷⁸⁸ This growing interest in Daydream is mirrored by the numbers of the 2017's Game Developer Conference as 18% of developers stated their intent to develop for the platform, as described in chapter 7.5.⁷⁸⁹

7.9.2.5 ARTE360

Various TV stations and news empires, such as CNN, BBC, ARTE, ZDF, The New York Times, USA Today and The Guardian have initiated VR content and/or 360-degree video distribution apps. ARTE established its ARTE360 in 2015 and is aligning its strategy into the direction of a global market that seems to be especially strong in Asia, according to chief editor of ARTE Creative, Alexander Knetig.⁷⁹⁰ Despite the TV station's orientation towards a French and a German audience, the ARTE360 app had been downloaded 52% in English by early 2017.⁷⁹¹ ARTE's marketing budget for Virtual Reality will be increased in the year 2017, setting a focus on distribution, necessary to the nature of on-demand content.⁷⁹²

⁷⁸³ Lang (2017e) online. | Subscribers can view regular Hulu video content, while for viewing a collection of 360-degree video content no subscription fee is required.

⁷⁸⁴ Brennan (2017e) online; Knetig (2017) Appendix C, p. 159.

⁷⁸⁵ Matney (2017a) online.

⁷⁸⁶ Peltier (2017) Appendix D, p. 169.

⁷⁸⁷ Peltier (2017) Appendix D, p. 169-170.

⁷⁸⁸ Suty (2017) Appendix B, p. 148.

⁷⁸⁹ Lang (2017b) online. | See chapter 7.5 Virtual Reality Headsets.

⁷⁹⁰ Knetig (2017) Appendix C, pp. 151, 160-161. | ARTE usually follows a call for entry-system to invite artists to apply for project funding. See Knetig (2017) Appendix C, p. 163.

⁷⁹¹ Knetig (2017) Appendix C, p. 160.

⁷⁹² Knetig (2017) Appendix C, p. 164.

A 'heat map' launched in November 2016 gives additional feedback about the users' direction of looking and therefore their interests.⁷⁹³ Some of the early experiences on the ARTE360 application have counterpart products in the form of conventional film/video, which are broadcast on the station's TV channel. The feature film *Notes on Blindness*, produced along the VR experience, gained praise.⁷⁹⁴ Several TV documentaries are tied to VR experiences, like *Life to Come* or *The Temptation of Saint Anthony by Hieronymous Bosch*. In addition to being adjunct products to bigger media formats,⁷⁹⁵ these projects also function on a standalone basis and can be understood in terms of forming a bridge between older and newer technologies, possibly targeting different spectra of audience.

7.9.2.6 CNNVR

CNNVR sets its priority on Virtual Reality journalism and news; it has recently announced to bring out weekly 360-degree videos and Virtual Reality live experiences.⁷⁹⁶ CNN's Head of VR, Ed Thomas, advertises CNN's focus on Virtual Reality with the promise "to place the user in hard-to-reach places, or making them feel like an active participant within a news story"⁷⁹⁷. CNN's goal is to reach a daily production cycle with teams placed in New York, Atlanta, London, Hong Kong, San Francisco, Dubai, Johannesburg, Tokyo and Beijing.⁷⁹⁸

7.9.2.7 LIFE VR

The recent relaunch of LIFE as a content portal for VR is an example of following the Blue Ocean strategy. The publishing brand, owned by Time, Inc., had ceased regular publication in 2000 and relaunched as the host of VR content for several publishing brands like the TIME, People, Sports Illustrated, Real Simple, Essence, Southern Living and InStyle.⁷⁹⁹ The platform is available on iOS and Android mobile as well as on desktop.⁸⁰⁰

⁷⁹³ Knetig (2017) Appendix C, p. 155.

⁷⁹⁴ Kermode (2016) online.

⁷⁹⁵ See chapter 4.1 Virtual Reality Experiences as Adjunct Product of Another Media Format.

⁷⁹⁶ Brennan (2017g) online. | CNNVR is available on Google Daydream, the Samsung VR app and the Oculus Video app.

⁷⁹⁷ Ed Thomas qt. in Brennan (2017g) online.

⁷⁹⁸ Brennan (2017g) online.

⁷⁹⁹ Lutero (2016) online.

⁸⁰⁰ Lutero (2016) online.

The first three VR experiences launched on the platform were all produced in collaboration with outside partners, including the studios Wevr, VR Playhouse and Framestone.⁸⁰¹ All early experiences on the LIFE VR platform were compatible with Google Cardboard. This influences the shape of the content; first it pushes for shorter experiences because of the limited wearing comfort of the cheap mobile headsets and secondly interactivity is made nearly impossible for this way of viewing.⁸⁰² The idea behind this strategy was to offer content as easily accessible as possible – in the future it is planned to have VR experiences with a limited version for lower-quality headsets and a version including all features for headsets like the HTC Vive.⁸⁰³ As mentioned earlier, this practice has been pursued regularly - for instance, the experience *The Rose and I* is offered as a walkable and as a static version, in which the user can navigate via the mobile headset controllers.⁸⁰⁴

7.9.2.8 SteamVR

SteamVR is probably the most popular source for computer-tethered VR content; by early 2017 it offered over a thousand VR experiences of all kinds.⁸⁰⁵ In contrast to many other content platforms, SteamVR managed to elude the chicken-and-egg puzzle from the start: Steam, one of the biggest gaming distribution platforms in general, already had a very vivid and active customer base situated strongly in the gaming sector. By adding a Virtual Reality section to their platform, SteamVR could leverage from their existing customer base (which were likely to be part of the early adopters' circle), making it interesting for developers to produce content for SteamVR. To expand their content library, SteamVR teamed up with companies like the producing studio Within. Thus, Within's content can be accessed through SteamVR, besides other filmic Virtual Reality experiences - making the platform relevant for gaming and for video content.

Furthermore, Valve, the company behind Steam, cooperated with HTC on the design of the HTC Vive VR headset. Valve announced the production of three full

⁸⁰¹ Robertson (2016a) online.

⁸⁰² Robertson (2016a) online.

⁸⁰³ Robertson (2016a) online. | For the 75th anniversary of the attack on Pearl Harbor an experience available only on HTC Vive was released through LIFE VR. At release, it was available for \$10 on the HTC's VR app store. See Lang (2016f) online.

⁸⁰⁴ Miller (2016) online; See chapter 4.4 Animated Virtual Reality Experiences.

⁸⁰⁵ Brennan (2017b) online.

Virtual Reality games early 2017,⁸⁰⁶ and recently released a tracking hardware.⁸⁰⁷ Reportedly, 500 companies have signed up to develop content with the SteamVR tracking technology.⁸⁰⁸ Additionally, the SteamVR Tracking Hardware Development Kit (HDK) is available to third parties; it is a royalty-free-system so the Hardware Kit can be embedded into third-party products.⁸⁰⁹ The Software Development Kit (SDK) is made available online without charge.⁸¹⁰

Recently, SteamVR has released a site licensing model, allowing venues to show SteamVR content in VR-enabled cybercafés.⁸¹¹ Thus, it follows a similar strategy like HTC Vive's platform 'Viveport', which supports the opening of so-called 'offline experience centers' (especially in China).⁸¹²

7.9.2.9 Within

The company Within, which is producing and hosting VR content, was the first one to launch an all-accessible website in early 2017. It is based on the WebVR technology⁸¹³ providing a video player directly in the internet browser.⁸¹⁴ The website of Within also supports navigation with a Daydream headset and controller, therefore offering content to all users equipped with any device from a monitor to a high-quality headset.⁸¹⁵ Under the leadership of its founder Chris Milk, Within has formed a partnership with FoxNext, the film and television business of 21st Century Fox.⁸¹⁶ This partnership shows an increased interest of big media empires in the VR sector. Besides that, The New York Times, Vice Media, NBC

⁸⁰⁶ Robertson (2017b) online.

⁸⁰⁷ Lang (2017k) online. | The updated version of the tracking system of early 2017 sells for a lower price and has optimized design with a single-rotor design instead of a dual-rotor, making it smaller, lighter and quieter. It also has lower power usage, better tracking and a better field of view.

⁸⁰⁸ Lang (2017j) online. | A previously mandatory introductory course for software developers is not required any more, making entry barriers to produce content for the tracking system lower.

⁸⁰⁹ Lang (2017p) online.

⁸¹⁰ Lang (2017p) online.

⁸¹¹ James (2016g) online.

⁸¹² James (2016g) online.

⁸¹³ Firefox, Google, Oculus and Microsoft support WebVR's development. Lang (2017g) online.

⁸¹⁴ Lang (2017g) online.

⁸¹⁵ Lang (2017g) online.

⁸¹⁶ Giardina (2017) online.

and the United Nations are among the clients of Within.⁸¹⁷ Some of the projects created by Within have been discussed in this paper.⁸¹⁸

7.9.2.10 Wevr Transport

When preorders of HTC Vive started shipping in 2016, the content studio Wevr launched a content platform called Transport.⁸¹⁹ The platform enables content creators to upload their content, which is then curated carefully by Wevr to show solely VR experiences of high-quality.⁸²⁰ It can be deducted that the platform makers are aiming to follow Netflix's strategy of a working platform with high-quality content and creative producers as well as active users.⁸²¹

One of the first experiences produced by Wevr was *theBlu: Whale Encounter*. It allows the user to explore an undersea world VR at their own pace - this is made possible by modes like slowing down the experience with photo capture as well as an ambient mode that removes time limits.⁸²² Moreover, it was one of the first experiences using the room-scale VR technology.⁸²³ Together with two more episodes of *theBlu*, it was sold as a Season One bundle for US\$9.99 at launch.

Another experience available at launch of the Transport platform was *Irrational Exuberance*⁸²⁴ - pointing to a concept of displaying mainly interactive computer-generating content for VR. Wevr CEO Neville Spiteri describes the platform like this: "It's actually a purpose-built, high-performance, cross-platform software engine that allows real-time video and computer graphics to be blended together. That's based on an open VR medium format."⁸²⁵

⁸¹⁷ Gonzalez (2016) online.

⁸¹⁸ See chapters 4.5 Virtual Reality Journalism and 5.4 Other Innovative Interactive Virtual Reality Experiences.

⁸¹⁹ Volpe (2016a) online.

⁸²⁰ Huls (2017) online.

⁸²¹ Huls (2017) online.

⁸²² Feltham (2016b) online; Volpe (2016a) online.

⁸²³ Feltham (2016b) online.

⁸²⁴ Volpe (2016a) online. | *Theblu: Whale Encounter*, *Irrational Exuberance* and *Crown* were available free of charge at launch of the platform. For *Irrational Exuberance* see chapter 5.4 Other Innovative Interactive Virtual Reality Experiences.

⁸²⁵ Neville Spiteri qtd. in Volpe (2016b) online.

7.9.2.11 Windows Holographic

Microsoft pitches its ‘Windows Holographic’ platform to provide everything from basic Virtual Reality to advanced Augmented Reality while running on a broad range of different types of hardware.⁸²⁶ Thus, it could be deducted that Microsoft is already pointing in the direction of a possible merging of Virtual Reality and Augmented/ Mixed Reality.

7.9.3 Subscription-based Content Platforms

Up to date, all platforms have offered the possibility to purchase content, some content (often filmic Virtual Reality experiences rather than games) is even available free of charge. This form of distribution follows the ‘premium business model’, in which users pay for each experience.⁸²⁷ Nowadays, many platform-businesses operate on a subscription business model – they charge an access or usage fee.⁸²⁸ Viveport, the content platform of HTC Vive, is the first one to venture into the market of the subscription-based-model by starting a monthly US\$6.99 fee for accessing five VR applications on their portal.⁸²⁹ Predictions say that this way, Viveport might have “a chance to leapfrog other content companies like Amazon, Netflix, Facebook, and Google’s YouTube to bring the subscription business model to VR content”⁸³⁰. In the future, Viveport is planning to open its portal to other VR systems such as the Oculus, making it a cross-platform content supplier.

Monetization over subscription fees might still be risky due to the market size of the VR industry. Survey results of the study conducted in early 2017 show that consumers are not willing to pay for a subscription for accessing Virtual Reality content, at least not at the current stage. 45% of respondents negated the question ‘Would you consider paying a subscription for viewing VR content like Netflix or similar video services?’ and 42% were unsure about it.

⁸²⁶ Mainelli (2016) online.

⁸²⁷ Peltier (2017) Appendix D, p. 178; Sinclair (2016) online.

⁸²⁸ Evans/Schmalensee (2016) pp. 94-95. | For example, *OpenTable* is charging restaurants a monthly fee, while credit card operators are charging cardholders an access fee.

⁸²⁹ Bye (2017f) online. | Viveport and SteamVR both serve as HTC Vive’s content platform. While Viveport is mostly offering cinematic and educational content for HTC Vive, SteamVR’s focus is on the gaming sector.

⁸³⁰ Bye (2017f) online.

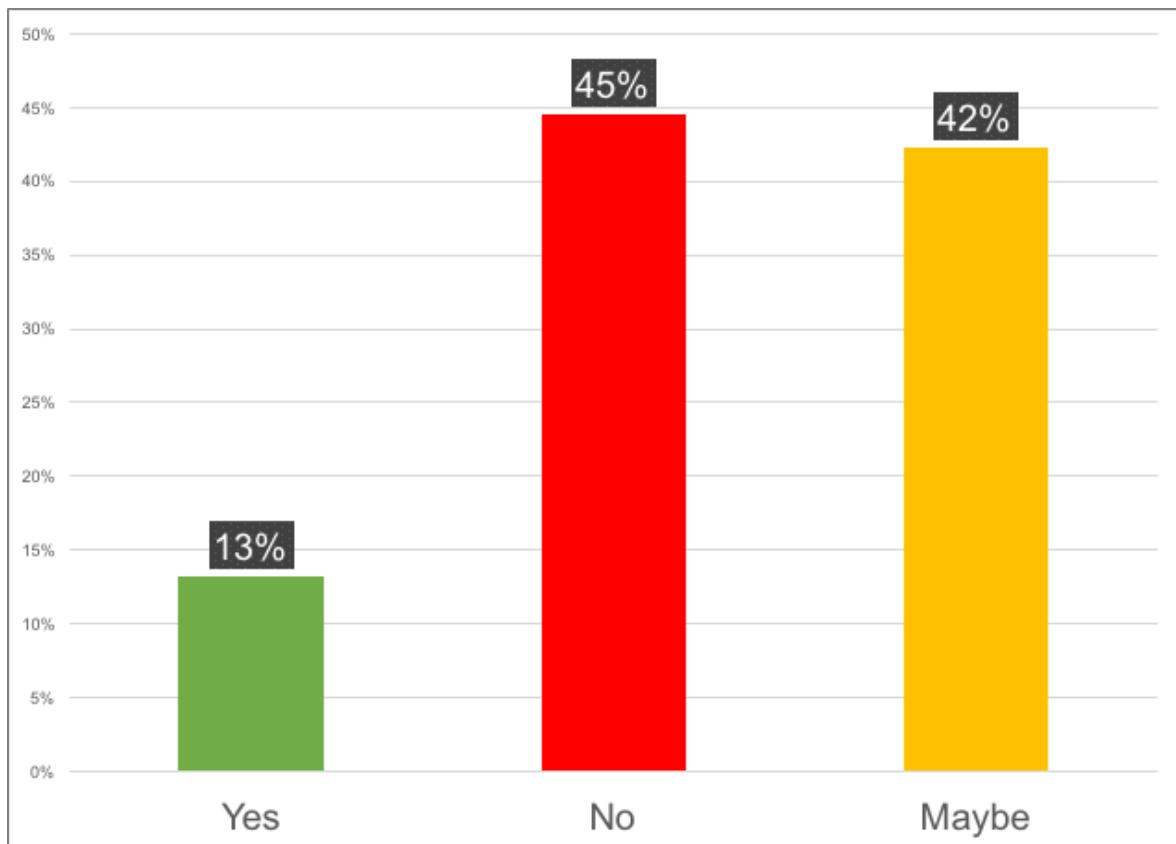


Illustration 19: General willingness to pay subscriptions for obtaining Virtual Reality content [Survey 2017]⁸³¹

The biggest challenge in the current Virtual Reality industry is still the gradually growing market size of the Virtual Reality in-home sector – a growing number of viewers need to be ready to pay for watching a VR film or a VR experience before producers can receive revenues over subscription- and premium-based-business models.⁸³²

7.9.4 Virtual Reality and the Free-to-play Model

As mentioned in the previous chapter, many Virtual Reality games and some Virtual Reality experiences, like for example *The Martian*, are currently sold as premium content – that means that the user pays for accessing the content initially.⁸³³ This business model seems to ensure quick return of investment, especially in a market with many unknown factors and variables - such as its further development and the size of the possible audience. However, with the

⁸³¹ Appendices G-J, pp. 208-246.

⁸³² Attali (2016) Appendix A, p. 137.

⁸³³ Peltier (2017) Appendix D, p. 178.

emergence of mobile Virtual Reality, another business model should be considered - the free-to-play business model.

The mobile market in the gaming industry is currently rising, from a 24% market share in 2015 to a forecast of 34% market share in 2019.⁸³⁴ Mobile gaming has disrupted the console game market, resulting in a constant decrease of sales in consoles since 2008.⁸³⁵ Considering the current popularity of free-to-play games on the mobile market, following question arises: How does the free-to-play model affect expectations about Virtual Reality content, especially for mobile VR?

In the free-to-play model - as the name says - the user does not have to pay a subscription fee to play a game or download an experience. During the game, the user may have various possibilities of making purchases, which can be virtual goods such as aesthetics, costumes, status, more time or short-term power-ups.⁸³⁶ Even though only 1 to 20 percent of players do make purchases, the business model proves to be quite lucrative if successful. A switch to the free-to-play model brought a five-fold increase in revenue for the title *Dungeons & Dragons Online* and a three-fold increase for the title *Lord of the Rings Online*,⁸³⁷ and supposedly a twelve-fold revenue for the relaunch of *Team Fortress 2* in 2011.⁸³⁸ The successful free-to-play game *League of Legends* reached an amount of 100 million monthly active players globally in 2016.⁸³⁹

In the free-to-play model, producers can regulate game mechanics to offer different prices for players with converging levels of willingness to pay for additional content.⁸⁴⁰ It seems that the model brings a win-win situation to consumers and producers;⁸⁴¹ gamers can test games without having to spend money initially and can decide about any purchases at a later point while

⁸³⁴ Newzoo (2016) online.

⁸³⁵ Statista (2016) online.

⁸³⁶ Lovell (2011) online; Alha/Koskinen/Paavilainen/Hamari/Kinnunen (2014) online. | Short-term power-ups in video games are bonuses usually increasing the capacity of the user's character.

⁸³⁷ Lovell (2011) online.

⁸³⁸ Alha et al. (2014) online.

⁸³⁹ Volk (2016) online.

⁸⁴⁰ Alha et al. (2014) online.

⁸⁴¹ Criticism has been raised towards this business model. Producers have been blamed to utilize aggressive monetization strategies, which make it more a pay-to-win model and they are blamed to aim more at short-term profits than long-term engagement of the player. Alha et al. (2014) online.

producers get more players to try their games, reaching a bigger audience.⁸⁴² Given this circumstance, the model is also dependent on a broad player bases.⁸⁴³ Thus, in the current state of Virtual Reality's innovation process without a mass adoption on the consumer market, Tommy Palm, CEO of Resolution Games,⁸⁴⁴ states the model is currently not profitable in Virtual Reality.⁸⁴⁵ He points out that this business-model will only become profitable during a later phase of the innovation diffusion.⁸⁴⁶ Contrary to Tommy Palm, the chief executive from Immersv, Mihir Shah, stated in 2016 that the general model of micro-transactions was highly profitable and that it is already spreading into VR.⁸⁴⁷

Iimmersv launched a Virtual Reality ad platform in March 2016 to help game studios to add video trailers to their free-to-play VR games; it turned out that currently 80% of people watching the ads finish seeing them – this makes nearly double the completion rate of video ads in mobile games, as of current standard.⁸⁴⁸ The ads either are 360-degree videos or are played on a virtual 2D screen.⁸⁴⁹

Consumer expectations for mobile gaming, even if it is Virtual Reality mobile, is likely to tend towards the free-to-play model.⁸⁵⁰ Considering this circumstance, another possible business model would be the 'try-and-buy' one, in which users can play the first few levels of a game and then have to pass a paywall to access higher levels or further content.⁸⁵¹ Generally, in VR's current innovation phase with targeting more serious gamers, the 'free-to-play' business model might be less interesting because this audience group is traditionally not focused on free-to-play games.⁸⁵² It is foreseeable that the free-to-play business model will be more

⁸⁴² Lovell (2011) online. | In the UK, the game *Dungeon Keeper* was ruled not to be permitted to be advertised as free of charge due to the likely requirement for a player to have to make in-app purchases to be able to advance in the game. Pereira (2014) online.

⁸⁴³ Sinclair (2016) online.

⁸⁴⁴ Resolution Games produced *Solitaire Jester* for VR in 2015 and the game *Bait!* in 2016, which were both free-to-play. Sinclair (2016) online.

⁸⁴⁵ Sinclair (2016) online.

⁸⁴⁶ Sinclair (2016) online.

⁸⁴⁷ Grubb (2016) online.

⁸⁴⁸ Grubb (2016) online.

⁸⁴⁹ Grubb (2016) online.

⁸⁵⁰ Grubb (2016) online.

⁸⁵¹ Peltier (2017) Appendix D, pp. 179-180.

⁸⁵² Peltier (2017) Appendix D, p. 178.

profitable when Virtual Reality applications and systems expand in market share and when a mass consumer audience wants to access (mobile) Virtual Reality content.

7.10 Global Market

In terms of media content distribution nowadays, especially when it comes to Virtual Reality content, it is crucial to operate on a global market. Netflix displayed this strategy successfully, taking market shares of local TV stations, DVD rentals and local streaming and Video on Demand services.⁸⁵³ Likewise, the Virtual Reality technology is distributed globally – this also changes the possible diffusion of VR as the innovation-decision process is taking place faster.⁸⁵⁴

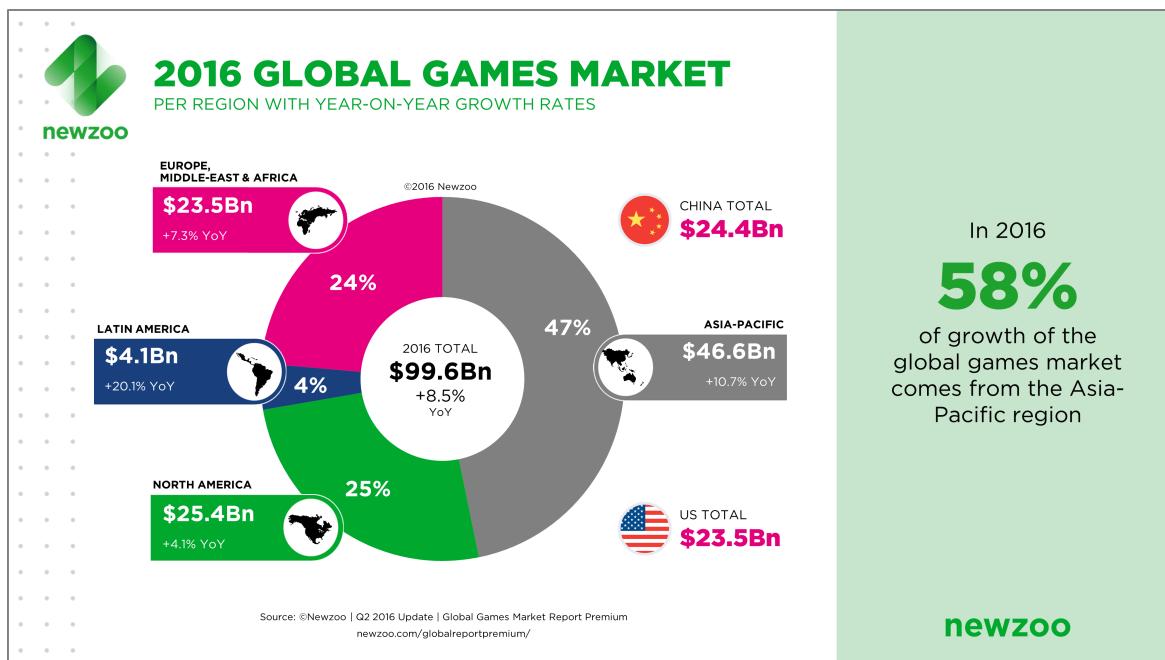


Illustration 20: 2016 Global games market [Source: Newzoo (2016) online⁸⁵⁵]

For the Virtual Reality market, there seems to be a focus set on the Asian market. In 2016, 58% of growth of the global games market came from the Asia-Pacific Region, making it an emerging media market for the gaming industry.⁸⁵⁶ It is reported that in China heavy investments are flowing into developing Virtual

⁸⁵³ See chapter 7.8 Shifting Viewer Habits.

⁸⁵⁴ Rogers (2003) pp. 215-216. | Rogers gives the example of the free email service 'Hotmail', which managed to expand to serve 12 million users within eighteen months. Rogers (2003) p. 216.

⁸⁵⁵ Newzoo (2016) online.

⁸⁵⁶ Newzoo (2016) online.

Reality and Artificial Intelligence.⁸⁵⁷ A lot of hardware is originating from China, including 360-degree cameras and headsets, though most are still below current international technological standards.⁸⁵⁸ With further investments, this might change.

A high interest within consumers into the technological adoption of VR might push the market in Asia.⁸⁵⁹ Consequently, there is also a growing number of VR arcade operations running pay-to-play HTC Vive setups in China.⁸⁶⁰ HTC Vive is pushing to open a hundred VR cafés in China in 2017,⁸⁶¹ possibly opening markets not only for the games sector, but also for the film/video industry.

7.11 Virtual Reality Analytics

With the advent of the new medium Virtual Reality, possibilities of using analytics are also explored and employed. In Virtual Reality analytics, a 3D attention map can show which part of the content users pay attention to.⁸⁶² The resulting analysis could be used by production studios and distributors to improve the quality of focus points within experiences.

Mood analysis can be derived from voice information of the VR user, eye tracking, object tracking, measurement of environmental data, information from pulse/temperature measurements as well as from electromagnetic spectra like infrared or ultraviolet.⁸⁶³ User information from Virtual Reality experiences combined with other data from profiles such as health-tracking, pulse meters or voice mood analysis can give rise to possibilities for an 'attractive' advertising space.⁸⁶⁴ With the launch of Google's application *Tilt Brush* via Facebook's Oculus platform, it is unclear if and how the user's movements are being recorded. As of early 2017, Google has not disclosed their privacy policy for VR applications.⁸⁶⁵ With Facebook's privacy policies it is already possible to capture and store

⁸⁵⁷ Bye (2017b) online.

⁸⁵⁸ Bye (2017b) online.

⁸⁵⁹ Bye (2017b) online.

⁸⁶⁰ Lang (2017m) online.

⁸⁶¹ James (2016g) online.

⁸⁶² Jerald (2015) p. 150. | Applications like ARTE 360 are using heat-maps to know where users direct their gaze.

⁸⁶³ Osarek (2016b) pp. 20-23.

⁸⁶⁴ Osarek (2016b) p. 13-14; Scholz (2016) pp. 46-47.

⁸⁶⁵ Bye (2017c) online.

physical movements of users, which can be tied back to the users' Facebook profiles.⁸⁶⁶

Besides targeted advertising, the derived information could be used to "redirect your attention, to compile a history of your interests, to persuade you subliminally, to quantify your actions for self-improvement [or] to personalize the next scene"⁸⁶⁷ or it could be sold to other parties.⁸⁶⁸ This kind of analytics stands for a new level of personal in-depth-analysis that will require a responsible usage from all involved parties,⁸⁶⁹ and in this sense will also take part in shaping the technology's future.

⁸⁶⁶ Bye (2017c) online.

⁸⁶⁷ Kelly (2016a) p. 86.

⁸⁶⁸ Scholz (2016) p. 48; Kelly (2016a) p. 86.

⁸⁶⁹ Osarek (2016b) p. 25.

8 Conclusion and Outlook

"It's too early to know what virtual reality is or what it will be."⁸⁷⁰ Heavy investments - a total of US\$1.8 billion in the year 2016 - flow into the VR/AR sector, pointing to a potential growth of this industry. Regarding the film, video and TV industries, Virtual Reality is still a niche market, with existing media companies venturing into new market segments, into so-called 'Blue Oceans'. Even in the gaming sector, big titles are only gradually being produced. This stems partly from the circumstance that to fulfill the high expectations concerning graphics and gameplay quality, high financial means are necessary.⁸⁷¹ Since out of the three early high-quality VR systems, only PlayStation announced an amount of 915.000 sold units by early 2017,⁸⁷² the market size for high-quality VR systems is still incalculable and therefore forecast sales figures of content are difficult to estimate. Between 23% and 24% of professional game developers are currently creating content for the two most expensive computer-tethered VR systems, the Oculus Rift and the HTC Vive,⁸⁷³ which enable immersive features such as the play area.

In contrast to this, low cost mobile headsets like the Cardboard and similar designs reportedly reached a distribution figure of 88 million in 2016,⁸⁷⁴ paving the way to VR's adoption by a broad range of consumers. Due to the fast-moving technological advances and lower costs, mobile VR systems are likely to become more prevalent and will be a driving factor in the technology's diffusion.⁸⁷⁵

Innovative headsets might soon help to overcome the current limitations of mobile VR technology, above all the restriction of movement, consequently permitting new possibilities and forms of content creation. Likewise, technological advances like the recently announced Facebook camera system 'Surround360' promise to reduce the inherent constraints that live-action 360-degree footage currently holds in comparison to real-time rendered computer-generated VR content. On the one hand, advances like this one and other innovations such as eye-tracking, bring

⁸⁷⁰ Kelly (2016a) p. 112.

⁸⁷¹ Peltier (2017) Appendix D, p. 175; Jeckl (2017) Appendix F, pp. 191, 200; Neubauer (2016a) p. 4; Neubauer (2016b) p. 41.

⁸⁷² Lang (2017s) online.

⁸⁷³ Lang (2017b) online.

⁸⁷⁴ Mirt (2017) online.

⁸⁷⁵ Peterson (2015) online; Peltier (2017) Appendix D, p. 171, Jeckl (2017) Appendix F, p. 192.

changes to the artistic shape of the content as well as to production workflows. Resulting from the technology's innovation stage, production processes currently lean on the traditional ones of the video and the gaming industries. These will gradually be taken over by more native ways of creating content within the VR environment as demonstrated by Oculus' use of the application *Quill* for the project *Dear Angelica*.

Experts agree on the fact that the diffusion of Virtual Reality requires access to compelling content. Content platforms play an important role in the in-home entertainment sector as all content is distributed over the internet. In current online content distribution, different business models are being evaluated. In the gaming sector, it is likely that with an increasing market diffusion, the free-to-play and the try-and-buy business model will gain the lead over the currently most commonly used premium sales form. While narrative VR experiences are partly offered following the same strategy, many are launched free of charge. This results from the fact that many narrative experiences are used for promotion of any kind - the range reaching from VR experiences as an adjunct product to another media format to fully branded advertising material. To promote their hardware, manufacturers of VR systems also dedicate funds to content production. Some VR distributors strive to build up compelling content libraries to attract sponsors for their platforms. To a certain extent, even VR content platforms of TV stations and news empires could be perceived as an attempt to promote their respective media brand names. The latest addition to the various distribution forms is the launch of the first subscription based platform.

Following the principles established by YouTube and Facebook, the currently most prevalent video-distribution internet platforms, consumer-generated content will fuel the diffusion of the technology. These two internet platforms are actively pushing the emergence of VR as a new mass consumer market phenomenon, leveraging on their existing audience base.

In professional Virtual Reality content production, a clearer understanding of codes and consumer exigencies will be reached. Artistic norms of content production will evolve with the advance of workflows and early conventions are already regularly broken by pioneers in innovative VR experiences. The idea to make the cinema and the gaming experience more immersive underlies the whole marketing of Virtual Reality. Immersion as well as interactivity both offer possibilities of new

forms of narratives, merging artistic norms of the film/video industry with those of the gaming industry. Thus, it can be deducted that interactivity will play an ongoing role in the emerging of Virtual Reality. Future advanced forms of Virtual Reality, such as those incorporating haptics or touch components will carry the constant innovation process, giving rise to more chances and challenges and ultimately, more variety in content.

Giving an outlook, the merging of the technologies of all artificial realities may be considered. While Virtual Reality has already been launched on the mass-market sale, Augmented Reality hardware is still in development stage.⁸⁷⁶ However, once it has reached sufficient maturation, it will also be introduced to a consumer market. Digi-Capital forecasts that Augmented Reality will have surpassed VR with a total of US\$120 billion business volume over only US\$30 billion business volume in the VR industry by the year 2020.⁸⁷⁷ This prediction might encompass the fact that Augmented Reality technologies are likely to target the business sector more than the entertainment sector, at least in its innovation phase. It has also been suggested that the diffusion of Virtual Reality can only take place if its use for non-entertainment appliances is pushed.⁸⁷⁸ The idea behind this is that if Virtual Reality offers value besides entertainment, like the computer during its early innovation phase, the target group of consumers will increase and current price levels become a smaller issue.⁸⁷⁹ However, the entertainment sector is already pushing into the AR market too - Disney for example is readjusting its previous strategy of pioneering VR towards a focus on AR technology.⁸⁸⁰

Especially in the professional field, Virtual Reality is likely to merge with Augmented and Mixed Reality in the future. As stated earlier, hardware of Virtual and Augmented Reality is going to be combined, thus decreasing boundaries that are currently drawn between these two technologies.⁸⁸¹ Particularly in combined

⁸⁷⁶ Taguiam (2017) online; Rutkin (2016) online. | Others have argued that VR and AR will exist simultaneously for different purposes, rooting VR more in the entertainment area. Charara (2016) online.

⁸⁷⁷ Digi-Capital (2015) online.

⁸⁷⁸ Izdebski/Legkov (2016) p. 69.

⁸⁷⁹ Izdebski/Legkov (2016) p. 70.

⁸⁸⁰ Brennan (2017i) online.

⁸⁸¹ Jerald (2015) p. 484; Jeckl (2017) Appendix F, p. 192.

forms, Virtual and Augmented Reality would have the potential to become powerful forms of media.⁸⁸²

On a more farsighted outlook, technology is gradually moving towards immersion and interactivity and is becoming more human-centric "as the evolution of technology becomes more adaptive, contextual and fluid within the workplace, at home, and interacting with businesses and other people"⁸⁸³. It is likely that in the future interactivity in the shape of reactive technologies will play an important role in everyday life.⁸⁸⁴ With a young generation being particularly excited about the new forms of artificial realities, it could be predicted that only within the time span of a generation these forms will establish themselves as indispensable part of life.⁸⁸⁵ The future will bring about advancements of media formats, usages and media audience viewing habits and will offer ground for new paths of innovation and market fields.

⁸⁸² Jeckl (2017) Appendix F, p. 205.

⁸⁸³ Gartner (2016) online.

⁸⁸⁴ Kelly (2016b) pp. 217, 223, 229-236.

⁸⁸⁵ Jeckl (2017) Appendix F, p. 201.

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10 Appendices

Appendix A: Expert Interview David Attali | 2016-Nov-09 | Hong Kong

David Attali is a French director, artist, entrepreneur and producer based in Hong Kong for the past 20 years. Some of his works include a series *Cinema Conversations* featuring Catherine Deneuve, Jacques Audiard, Jean Pierre Jeunet, Gaspar Noé, Jalil Lespert, Isabelle Huppert and Christophe Lambert, a mini doc *FH the Unknown stories*, which has collected over 200 k views on YouTube and the short film *Itch*, which is currently on the festival circuit. Besides numerous being a producer on numerous commercial and broadcast projects, he is also the co-author of the feature documentary *Game Fever*.

B.E.: Which projects are you currently working on?

D.A.: We have been working on getting our VR project *The Rooftoper* funded, possibly by ARTE. I know ARTE is investing and financing VR projects and they have invested into delivery technique. For the delivery technique, it's an American German company, which has a way to decode and stream VR in an app, and ARTE bought the license from this company and it is currently one of the best streaming options for mobile. ARTE has launched an app called ARTE 360, they purchase 360-degree material, and it works well over 4G. This opens the possibility to show content on a platform, which is a major broadcaster.

B.E.: Can you tell a little bit about what *The Rooftoper* will be about?

D.A.: *The Rooftoper* is a 5-7 minutes' immersive film and it's made as a scripted documentary. It follows the steps of an urban explorer in Hong Kong, it's meant to be a series as well, and the idea is to make you feel that you are there with two general objectives. One is a feeling of hyper presence and the second is to create a feeling of connection and empathy with this character of *The Rooftoper*. The 'rooftoper' is a young woman and she became relatively famous for taking exciting pictures of herself on rooftops. The idea behind is that we have basically explored most of the earth and now we are finding new ways to explore. There is this movement of urban exploration with different kind of ways of exploring; one of it is

'rooftopping'. It is basically breathing altitude in an urban environment and landscape - breathing fear, breathing what is forbidden to do and basically going where you are not allowed to go.

B.E.: As I understand that will be filmed with 360-degree cameras and so that will be pre-rendered VR?

D.A.: I have been studying how to direct and how put together something that is interesting in 360-degree, but my main question was that a lot of what is made today for 360 is made for thrills or for impressions and for sensation, and that's not what I want to do. Something that I want to do is more connected with the human aspect of the film and of course using the context of urbanity as a backdrop and this backdrop supports the intention of the film. Moreover, the intention of the film is to find out more about who this girl is and to use this context of urban exploration as a vehicle to understand a more complex portrait of youth in the city. The main character is 22 years old and she is a Hong Kong citizen, who was born in China and part of the post-80s generation, the millennials. So, that's a 360-immersive film that aims to give you a sense of hyper presence and empathy for this character, but that has also a textual input and textual objective that is to make understand better what the context of the city is as we have now lots of chances with the political environment. We had the yellow umbrella movement; we have a changing culture that is trying to find more creative ways to make a living or to find a new identity. We would take this girl in an extremely exciting context to talk about what the city and its identity is today. We have about 7 – 10 scenes and most of these scenes are meant to give you a feeling of the city and to make you connect with the girl. The sound will play an important role, as the film would start with voices of people telling about their fears, with audio all around you.

B.E.: Would you use binaural audio in this project?

D.A.: It would not be binaural but 'ambisonic'. As we open the film on a busy street, you are the camera. The camera is you, you are a presence, you are a person in this crowd. You are part of the extreme crowd experience. The sound is supposed to be shifting towards the main character. [...] David tells more about the structure of the first scene, which is removed here for purposes of confidentiality.] In 360-degree, you cannot just shift focus like in traditional film so you must use other means, like audio, to shift focus. When I wrote the script, I struggled slightly with the question of how to write this script? How do you write a 360-degree immersive film experience?

B.E.: It is very interesting what you have said so far. I am wondering whether you have also considered doing a computer-generated VR experience or is that not of interest for you?

D.A.: I find it interesting, however it is much more expensive and much more complex to do. Maybe it is not, that is debatable. The big advantage of computer-generated VR is that it gives you freedom of movement and interaction as well. So, it is something different, but of all the things I have tried I never felt so inspired than by the immersive films.

B.E.: You have told me before you admire the good quality seen in Chris Milk's Virtual Reality projects?

D.A.: That is the most interesting projects in VR/360-degree for me so far. So, *The Rooftoper* is meant to be something like that in terms of image and production quality. We would follow the girl from the crowds of the streets to the roofs of Hong Kong, gradually higher and higher, until you get to the night and you fly over the city.

B.E.: Regarding image quality, have you already chosen on which 360-degree camera to work with on this project?

D.A.: Yes, we have it all laid out, but the problem is that the camera I want is not available on the market. I bought a camera that has never appeared, I waited a year for my camera, but it never arrived, it was an interesting 4K camera that had global shutter that gives me consistent exposure for all the 8 lenses that are being used. The camera was called 'Sphericam', but it was never delivered. So far, for me, the best camera is the 'Jaunt' Camera, and Jaunt is not available unless you have a lot of money.

B.E.: How much are the estimated costs for *The Rooftoper*?

D.A.: We have estimated the costs for *The Rooftoper* to be around 1 million HKD. We are thinking of applying for funding here in Hong Kong art development, as well as at the CNC – The Centre national du cinéma et de l'image animée.

B.E.: Could you say the costs for a VR project is so and so much percentage higher than for a conventional video project, what is your estimation on that?

D.A.: You can do cheap stuff, a lot of people do cheap stuff, but the aim that I have set for myself is to do something truly immersive. To do something truly immersive, you have to have a good quality image, good stitching, you need to have everything balanced and especially, you need to have a very good sound engineer

- because I believe that sound is more than 50%. There is this project, but also the bigger project of having a studio. The problem with this is, that there is so far very little market for these kinds of projects. I was very excited last year, seeing VR emerge and a lot of things have been delivered. A lot of devices have been delivered, but truth in the matter is, I don't really see people adopting it, do they? I think, it is strong, it has a special purpose, but for film so far, if there is a market? It's very narrow.

B.E.: A market for immersive film production?

D.A.: In a way, there is a market for immersive film experiences like that, I believe. I went to SVVR [Silicon Valley Virtual Reality] and I met all the market leaders including Palmer Luckey. Currently somewhere there is money to be made with VR. There are two models. The first one is the one we probably can do here, if we have the resources - which is commercial based model where you provide interesting VR experience for brands.

B.E.: That would mean VR/360-degree movies, which are produced for advertising purposes?

D.A.: Yes, because there is an incentive, there is the newness factor, and that is more important for the people who watch these things. To use this as branding object is quite powerful, and in this case people get to see it which is maybe not as much as people watching ads in cinema or on TV, or social media... That's one thing and there is distributional social media, Facebook, YouTube, app stores, VRideos ... and we have many of those platforms. The question is; however, do they really make the numbers? I am wondering about that. It is possible to create things for brands that people get to see, and quite a few quality brands have been doing this already for quite a while.

B.E.: Can you name a few examples?

D.A.: Lexus and Northface do it as well as many others... Film studios do it too - there is an experience called *The Martian*.

B.E.: *The Martian* VR project was done after the movie had been released though, how do they finance this?

D.A.: There is money behind these studios. The other model is to go more the Hollywood studio thing, so in that area CG creation is very interesting. It is very expensive to do. You have the Oculus Studio, which has made 3 films.

B.E.: Like *Henry*...

D.A.: Yes, and Oculus Studio is completely financed by Facebook, so they have the budget. Basically, you got the money to get the best people to do something and of course, they are doing great stuff. Furthermore, there are some other companies like ‘Penrose Productions’ who have done VR projects like *Allumette* and *The Rose and I*, which is very well done. For the studio model, there is the question: Is there a box office yet?

B.E.: So the biggest challenge, in your opinion, is that question or the cost factor?

D.A.: Basically, the biggest challenge is getting an audience. You need to have an audience; you need to have people to be ready to pay to watch a film in the VR headset.

B.E.: The selling of PlayStation VR seems to be working well..

D.A.: Yes for gaming, selling VR currently works. For film/video, I am not so sure...

B.E.: It is a big question mark. How can this field increase its market?

D.A.: The HTC Vive has sold one hundred thousand pieces which is better than the Oculus Rift. So, if Oculus is double that, that means your audience are currently 300 thousand people and 80% of those are gamers, so that's a very small community. Now we are in the first year, so you cannot expect everyone to be equipped.

What seems to be working is the new cinema VR halls, there is the HTC Vive room in Shenzhen now and they have something like that in London too. There is a lot of VR experiences in the MIPCOM. The industry is doing stuff, but whether the audience gets it, is still a question. I don't really see anyone using the VR headsets.

B.E.: I read that at the Venice film festival 2016 the first long-feature film VR film was premiered however a review said, that the room was badly-arranged with people pumping into each other viewing the film and turning on their chairs, so that destroyed the proper experience. So currently for filmmakers the best way to get their VR/ 360-degree videos funded is to go for the advertisement financed option?

D.A.: Yes, definitely, all options are possible to do and there are interesting experiences in all forms. The burning of Galaxy phones has been a set-back for the market. I think one of the most interesting models for now is the Live streaming, for example to show the NBA, the most successful company is ‘NEXTVR’. It is a heavily funded start up, and they are very good. ‘Second Life’ is doing things in VR too...

B.E.: Where do you see the highest potential for the audience here?

D.A.: It is to be there without being there, it takes you to the NBA, to a concert, etc. That's live and immersive. Streaming is good - right now there is a model to watch live performances in cinema. People pay 200 HKD to see the MET opera in cinema. I bet that people who are ready to pay for that, would also be willing to pay for a Live 360-degree experience. With live streaming in cinema you can have one thousand viewers instead of one hundred viewers, with VR you may have 2 million people. I am thinking of events like the US open, a Coldplay concert. CNN is doing

Live-VR too.

B.E.: Is the technology already up the standard to have a good immersive experience for live-events?

D.A.: It is getting there, because they are building the infrastructure.

B.E.: Thinking of the consumer cameras like the Ricoh Theta, etc... How do you stand towards these?

D.A.: The Ricoh Theta's quality is not good enough, in my opinion. Even the NBA online streaming doesn't feel like HD yet; however, it says if you use the app on the phone it's a better image quality.

B.E.: At Austrian Airlines in Vienna, a short 360-degree video clip was made to promote business class upgrades. Unfortunately, the handling of the Gear VR is not very practical as the customer has to press three buttons before being able to view the video in 360 degrees and it's not very easy to handle the headset.

D.A.: There is a lot to do in VR in terms of friction. In all these internet startups, the idea behind is to bring value to the customer. One goal here is to remove friction for the customer to access value of the product. Currently, there is still a lot of friction in VR and it's not a smooth experience to get to it usually. Even in the VR galleries – as you mentioned before the Festival VR screening. There is also a lot of things, for example the hygiene. At the conference where I was this year, there were masks available for all headset-users. The headsets are also still uncomfortable in a way; I would not want to wear it for more than one hour.

On the other hand, there are interesting things as mentioned the live-events before, and the series *Invisible* sponsored by 'Lexus'. Did you watch *Clouds over Sidra*?

B.E.: Yes, I did. Some people say that VR journalism is kind of bending the rules of conventional journalism. Some say it might influence the audience. How do you

see this matter?

D.A.: I don't see the point in this discussion, because why would it be a problem to show you how something is? That is an amazing thing, if you can see what is going in Aleppo – that can change the world.

Appendix B: Expert Interview Loïc Suty | 2017-Jan-03 | Paris

Loïc Suty is an experience designer on experimental and convergent projects. He has been working for ‘Turbulent’, a Montreal-based media company, since 2013. He is the director of the Virtual Reality interactive experience *The Unknown Photographer*, which had its premiere at the New Frontier selection at Sundance Film Festival 2016.

B.E.: The project *The Unknown Photographer* originates from Bertrand Carrière’s documentary and the photobook that was found in an abandoned house in Quebec in 1974. Who had the initial idea to make a VR project out of that?

L.S.: At the beginning, Bertrand wanted to do a documentary with the NFB [National Film Board of Canada]. He started with his quest about the unknown photographer and met Guth Des Prez and other historians to try to figure out who this guy was. Then the NFB decided that they wanted to do a digital documentary, a Web-documentary about the story of the unknown photographer and they approached ‘Turbulent’ – the place where I work – to do something with that. The idea was a web documentary in the beginning and so the team at ‘Turbulent’ worked on a first version of the project and it turned out that it was not as good as we wanted. At the same time, we knew we didn’t know anything about the unknown photographer. It is a very blurry biography and so we decided to do something dramatically different from the web documentary approach, and we had a VR headset at the office and so we started to play with that in Unity. We found that the museum-like- experience worked very well with VR and the idea of the project so it became a VR project.

B.E.: As National Film Board of Canada had originally pictured to fund a web documentary, how was the change in the project concept perceived?

L.S.: The NFB was very enthusiastic about that. They saw some tests and were convinced from the start that the project really works well in VR and so they said: “It’s great. Let’s go this way.” They were happy about it and it is the first VR application made with the NFB so it was a great thing for them.

B.E.: Was the budget altered when the decision was taken to make it a VR project?

L.S.: I cannot say a lot about money, because it was Marc and Claire at the office

dealing with that issue and I was happy to not to have to deal with any money issues. The project was also funded by the CMF, the Canadian Media Found so the budget was bigger than initially, but Turbulent put a lot of money into the project to end the VR project. It was Marc, Claire, Fred and Benoit [at 'Turbulent'] who decided to inject money into that project to finish the VR project.

B.E.: I guess you already envisioned the festival participation of the project and you did receive a lot of prizes. Did the producers at Turbulent think of any other form of distribution?

L.S.: We are currently thinking about further possibilities of distribution and there have been a lot of talks with the NFB to know when to launch a public version. However, we have some work to do to make the version compatible for the new headsets – the new Oculus and the HTC Vive. The visual rendering is messed up with the new headsets, so there is a lot of work to do with that. Maybe the experience is going to be available as a download application on stores in March/April this year.

B.E.: So, it will be distributed on platforms like ITunes and alike?

L.S.: It will be the 'Oculus Share' and similar, because it's still going to be a computer based VR experience. It's not going to be a mobile experience, as the rendering is very heavy even on the computer and therefore, the experience is not quite made for mobile.

B.E.: Regarding this topic, just a general question - asking for your estimation - where do you see VR more likely to succeed – in the computer VR or on the mobile VR? What is your outlook on that?

L.S.: I am not really sure. It is sure that the mobile VR is more accessible and it's kind of cool for the live-action VR. So, for the 360-degree video clips, it's really a great thing. The computer-based VR is great for gaming. Here I am not referring to hardcore games but for CPU-demanding applications, so I don't know which is going to be the better one. It's going to be like the general division of games and mobile games. There is also the installation issue, so if it is going to be more the HTC based or the computer-based experiences - I cannot estimate what the market will be like.

B.E.: What do you think currently is the most useful use of VR?

L.S.: There is a lot of things. I guess the documentary field is great in VR, but it is currently not as profound as it could be. It's not always bringing that much, but it's an interesting field.

B.E.: Do you refer here more to the documentaries about places and such or more the journalistic kind of experiences, like *The Displaced* distributed by the New York Times?

L.S.: The journalistic experiences can be more interesting than the documentary kind style ones, because there is the live-event aspect. It's really great to have a 360-degree video when there are people in the street somewhere for anything and you can really see what's happening. The journalism is going to be a big thing for that. Same goes for sports...

B.E.: Do you think live-sports VR/ 360-degree video has potential to be successful?

L.S.: I think that is going to be successful, because nowadays we are in the 360-degree video mode, and soon it will be a 3D recreating of what's happening and you will be able to be in the head of each player [of a football match for example]. And there might be a lot of other things.

B.E.: Currently, there is a division between VR and 360-degree video... Do you think that it will merge as well a little bit?

L.S.: I guess that's going to happen, yes. I am not a real technical specialist, and my field is rather games than cinema and video. However, I guess there is going to be a lot of new cameras coming out, there is going to be 3D cameras too. I guess you will be able to film your surrounding in 3D, it's going to change the 360-degree video versus 3D thing. Everything is going to become "3D-ish".

B.E.: For *The Unknown Photographer* you went for the computer-generated method. Your idea, I guess, worked only with the computer-generated workflow...

L.S.: We could have done some animation based thing and have the rendering in Gear VR - that could have worked as well. But we wanted to have a real walk in the experience, and to have this doom-like thing, or quake-like thing. You are going through corridors and you are discovering the pictures at your own pace and we needed the computer-based thing to do that and the 3D thing to do that, and we were aware from the beginning that we were building a doom without a gun and we wanted to have this walking through space, so 3D was key to the experience.

B.E.: And I guess it was key that the experience is interactive and that the user can take his/her time within the experience?

L.S.: Exactly and that the user can stay in front of a picture if he/she wants or anything. There is a couple of different places where you might want to stay a little while and that was important to leave the user to do whatever he/she wants to do in the

experience.

B.E.: Do you think the interactive form will march forward and that there will be a market for these experiences?

L.S.: I see that there are a lot of great experiences and that there are a lot of games that work very well in VR. I don't know if there is going to be a huge market for interactive forms, but I just see that there are a few very interesting examples. In games, there is the first-person-shooter concept, which is interesting but on the other hand you have the motion sickness happening. There is the PlayStation VR that is coming out. I guess there is going to be a lot of pop-up-shooter-like games [so-called rail-shooter games] and other typically VR games like playing golf. That might be something cool because you are staying in one place. There is couple of spaceship shooters which are great for people who are not motion sick, like *Eve:Valkyrie*. And there is *The Vanishing of Ethan Carter*. It is a video game which has been adapted to VR. Its surrounding is great and so it's great to walk around in this experience.

B.E.: Regarding motion sickness, did you consider this issue when you did *The Unknown Photographer*?

L.S.: Yeah, from the beginning we knew that we had an issue and we tried and tested as much as we could. We tried jumping, falling and we found out falling doesn't work, so in the experience you are moving gently. About 5% of the people get motion sick from the experience. Overall it's far less motion-sickness generating than other experiences. At the time when we produced the experience, the HTC was not out yet. So, I guess if we did it now, we certainly would have taken another direction. We are trying new things now for the public version, but we are not entirely ready yet. That's the great thing about the HTC Vive, because you are physically walking in the experience, so you are not motion sick and it opens lots of possibilities.

B.E.: So, the user would be moving within a small area?

L.S.: Yes, I have seen there is a new way of doing things with the HTC Vive which is you point and shoot and then you tele-transport to another area where you can walk in. It's becoming one of the common things with moving. But there might also be a lot of other options things too.

B.E.: Could you tell me more about the production phase of *The Unknown Photographer*?

L.S.: It took 6-9 months, and 3-4 people were working on the project during that time. We had the previous research ready so that was an advantage for us. The photos were already classified, so it was the VR part solely which took 6 months, plus 3 months of fine tuning.

B.E.: The video documentary was already finished at that time?

L.S.: The editing of the documentary took place during the phase of VR production, so Bertrand finished it just before the summer 2015.

B.E.: Can you tell me what were the big steps in the VR creation process?

L.S.: We started from the beginning with Unity because it was the only game engine available for free at that time. Unreal was not free yet. We started to prototype with Unity and we started to use the built-in FPSController. We did a lot of small experiences in Unity, without any programmer in the beginning just to try and see what's happening when you are walking in a place which is that dimension or another with the headset on.

B.E.: How long did this testing phase take you?

L.S.: The first testing phase took us around 1-2 months, but it was all along the production phase that we constantly tried new things. Testing and having small iterations is key in VR; especially at that time when we were doing it as the field was entirely new. There wasn't any of the google advices out so we were just experiencing like: 'Ok, if I am moving fast, that's bad. If I am falling, that's very bad.' I fell in the experience when trying something with stairs and stairs are very bad too. When you fall for the first time in VR, you want to throw up immediately. And we also had to try the sound thing, because we worked with 'F Mode' which is a plugin on Unity. We could have used 'Wwise' as well, but 'F Mode' was free, so we decided to use that. We did all the 3D modelling at the end with 'Blender'. The developer is keen on 3D modelling; he was used to work in 'Maya', however during the process he switched to 'Blender', because it's free and powerful and we were trying to use a lot of free software. The community is great for 'Blender': on the second chapter, where you have the cubes flying, I wanted to have a special math figure; there is always a university working on something like that for 'Blender' and so we just had to input their plugin. It's great when you have this kind of community with a software.

B.E.: You mentioned the sound - could you tell a little about the binaural/dynamic sound? At what stage in the production process did you decide to go for that technology?

L.S.: The sound is not binaural. It is 3D spatialized with the ‘F Mode’ 3D sound [plug-in of Unity/game engine]. We tried a couple of binaural plug-ins during the production phase, but it crashed often. I did the sound design and I would have loved to have the binaural rendering, but unfortunately we had to cut it out. It turned out that it did not change that much the experience for many users. Nevertheless, it was interesting to work on the sound for this experience because there is the inner voice, which sounds like a radio voice. It worked with the VR concept to have an inner voice talking to you in the headset. It was obvious during the first tests that that worked well. And the music was already made for the web documentary stage of the project. It was made by François Lafontaine, who is a Montreal based musician and the tracks he did for the experience suited very well. The music is slow and well-paced, so I just kept this music and grabbed the themes and with that I built the sound field for the experience.

B.E.: The sound field brings me to my next question... I am wondering about “immersion in VR” regarding your project. Immersion is what VR is advertised with. In your experience, you put some digital deer running by with the idea of the Brechtian breaking of the plot. What was your approach regarding this topic?

L.S.: Yes, everyone is going for that idea that ‘yes, it’s immersive’, but even radio is immersive if you listen carefully and a cinema experience can be very immersive. And a bad VR experience is not immersive. I guess many people want to see a recreation of reality because it’s virtual reality. That was the same case at the beginning of cinema too, as well as with photography so that is why many people think that, if you do not have a body in the experience, it is a problem. I see now that people are getting used to not having a body in VR. That is contrary to the belief that says that if you don’t have a body in the VR experience, the user feels like a ghost. People are getting used to not having a body in the VR experience and it is not going to be a problem in a couple of months/ years. So overall, I think immersion is important, but it’s just a parameter. About regarding the digital deer in the experience: the recreating of reality is not necessarily the only thing to be done in VR. At the beginning of our tests, we had a few people saying: “Once it’s going to be finished, it’s going to feel like war.” And we felt like war is always going to be much more terrible and you will never experience war in a headset, just sitting in a chair. Therefore, we really kept the 3D kind of look and we put the deer inside to make it clear, that this is not war. It’s just a recreation of some pictures of war, but not war itself. I have a problem with heroic depictions of war, so I really wanted to avoid creating one.

B.E.: I guess that already explains one of my further questions, why you decided to go for a hybrid of fiction and documentary...?

L.S.: Yes, indeed and the fictional part also came in because we did not have the outcome of who Fletcher Moses was and we have three different narrative lines in the experience. Every time one of three possible texts are spoken it's chosen randomly. We wanted have something like that even though the user isn't aware of that because we didn't have something unique to say so there are three possibilities. So, it gives us the opportunity to say it could have been like that or like that or anything.

B.E.: So the audio is triggered completely randomly...

L.S.: Yes, we tried to suit it for example to a user running fast to show another psychology of the narrator than for another user, but it happened to turn out that it did not really change a lot and that the random thing was a bit more interesting because you have more radical changes. We could have done it with another approach but we went for the randomly triggered audio. We questioned ourselves about whether or how to be clear about the three different narrators to the user and we chose to hide it. We decided to hide and so you don't have three buttons where you can choose which narrator you want to hear.

B.E.: So is it possible that one user misses entirely one version of the narrator?

L.S.: Every time you go through the experience you just hear one version of each text. The conclusion is really three variations of the text, like different views of the text in each node. The node means that in each text, you have different slices and you go through a trigger and you have a first text and the user stays in this area for some time and then the other part of the text is launched when he/she crosses the other trigger. There are around 10-15 triggers in each part. The music is triggered like that too, so there are changes in text and music. There are also special music triggers.

B.E.: A more general question again... What does people attract about VR? What's your outlook on that?

L.S.: Err... Porn, I heard that it's working for that field and usually anything that is working for that industry, works for any other industry. Then of course there is gaming and social meetings in VR. On the other hand, thinking about it more, everyone was saying "VR is for gaming", but I am not so sure it is mainly for gaming. I guess people like to experience VR and it's maybe much more about the cinematic thing to experience new ways of telling stories and the 360-degree

videos.

B.E.: So even more than gaming - are you hinting at that?

L.S.: That might merge somewhere, because you also have a lot of film like games like *Fireworks* or *The Vanishing of Ethan Carter* and *Life is Strange*. There are many narrative games that are getting close to a cinematic experience. Maybe the line is going to be blurrier in the future than nowadays.

B.E.: I guess the game industry has already gone into that direction with games that are very visuals-driven and cinematic. I am thinking here about the puzzle games - that could work well in VR maybe?

L.S.: I am not sure about the market, but there is a lot of great games, like *I expect you to die*. It was launched at the very beginning when Oculus was brought out and in my opinion it works very well. That could be very filmic as well, the story could be more worked.

Regarding the market of gamers and interactive cinematic VR experiences, we have presented *The Unknown Photographer* at the MIGS/ Montreal International Games Summit a couple of weeks ago and that was the first time we had a lot of gamers trying the experience and what was interesting was, that they knew immediately what the experience was about. We had a lot of people saying in the past that gamers would be frustrated because they don't have a gun or anything alike. Everyone at the summit realized it was just a wandering experience of the photographer's inner mind and seeing photos, and that's it. They did not complain in the lines of that it was not a game, but they just knew what the experience was about once they tried it.

B.E.: So, the general feedback there was positive?

L.S.: Yes, very much so. It was great to have all the gamers and seeing they are not just people who want to shoot. They really liked the experience; they knew it was a semi-historical documentary while trying it. I don't know if gamers are going to try *The Unknown Photographer* and would be saying that it is great, and I feel they wouldn't just oppose it by saying it is not a game. In either case, I think people are going to be interested in being inside a place. That will rely on finding new ways to tell stories with the cinematic VR. I hope the VR experiences that are going to be produced will not just be the gadget side thing of movies or TV series and that are going to be some true stories be made only for VR.

B.E.: Are you referring to something like the *Games of Thrones* VR experience?

L.S.: I think that's maybe the mistake we have made in the cinema and TV industry and for the web that you always have a lot of complementary things which are not that interesting, which are just gadgets. I would like to see unique experiences to be done – something alike *Star Wars*, that you have a real storyline dedicated to VR that would be great; something that the user can only experience in VR.

B.E.: Is Turbulent currently working on new VR projects?

L.S.: We are, however it is expensive to do VR so we are currently in the financing process as well. We are working on a musical project and we want to head towards the 360-degree video concept with it. There have been many great experiences in music, especially Arte made a great 360-degree video of a few bands. That is really a great 360-degree music experience. We are trying to do something else than everybody else, we are thinking about doing something that is alike the experience of *The Unknown Photographer*, like a game like experience with music. The user would be wondering through a special place to discover different kind of music, a world of an artist in a 'The Unknown Photographer- state of mind'.

B.E.: I assume therefore the experience will be created in a computer-generated environment?

L.S.: Yes, we are trying to do this experience for Gear VR too and we are planning to do a Daydream version as well. We are at the beginning of the production phase, so far it kind of works on the computer version.

B.E.: Daydream sounds a bit like it's going to be the next big thing...?

L.S.: Yes, definitely and right now for me that is a developer issue... I guess you already have phones, which are compatible with Daydream. Romaine [at Turbulent] is working on that. We are sure that this is going to be a huge platform within a couple of months, so you must be ready to be compatible for that. Maybe after that, it's going to be Apple. Currently we do not know much about what they are doing, but they are trying things and I guess they are kind of waiting for others to kill each other and then come out with something better. Therefore, Daydream is something we are aiming for right now. We also have a couple of prototypes to push a bit further; we are currently testing many things in a kind of workshop-manner.

B.E.: You mentioned the funding process of the new project before. What other options are there of funding, could you tell a little more about this matter?

L.S.: We are currently talking to the ‘SODEC — Société de développement des entreprises culturelles’. It is another great way to fund VR projects, connected to other Quebecois institutes of music industry for our musical project. We are also talking to Radio Canada, as well as to other people just to see if this kind of experience could be interesting. There is going to be non-VR as well so you can use it on your computer without headset. We are working on picture this world’s artist without the experience looking too much like a game or 3D-ish. In addition, we are going to have binaural audio on this project because it is going to be great to have songs that are spatialized in a place where you can walk and where you can get close to an instrument and so on. We are also playing with virtual screens and maybe to mix 2D footage with 3D footage, we are once again in the prototyping phase, which we are doing in a workshop like manner like with *The Unknown Photographer*.

B.E.: Do you know any other companies in Canada, which are doing the same kind of prototyping for VR?

L.S.: Yes, there is the Canadian company ‘Dpt’, they did a VR experience called *Deprogrammed*. There is lot of gaming companies in Montreal as well, there is ‘Minority Media Inc’. They did a time-machine VR application, which is very interesting and I guess they are working on something else as well.

B.E.: Are you cooperating with other companies?

L.S.: We are cooperating with other companies to produce 360-degree footage, you need to know well how to do the stitching and the post-production process, we are no experts on that, and there are some companies, which already are. Everything else, we are doing inside ‘Turbulent’ and we are trying to teach our own staff new things in VR to progress further in the field.

Appendix C: Expert Interview Alexander Knetig | 2017-Jan-04 | Strasbourg

Alexander Knetig is the editor in chief of ARTE Creative section of European-funded public service European TV broadcaster ARTE since 2015. In his position, he is, amongst many other things, in charge of the production overlook and marketing of various Virtual Reality projects co-produced by ARTE as well as shaping the general direction of content-offers of ARTE Creative.

B.E.: Als Eingangsfrage: welche Ziele hat sich Arte Creative gesetzt und bzw. welche Pläne hat Arte auf dem Gebiet von Virtual Reality?

A.K.: ARTE CREATIVE existiert schon länger, wurde vor 5 Jahren von meinem Vorgänger gegründet und war eine Zeitlang wirklich sehr spezifisch auf experimentelle, junge Kunst ausgerichtet. Wir haben das vor eineinhalb Jahren erweitert, als ich hergekommen bin, um daraus einfach die junge Kulturplattform von ARTE zu machen - ein bisschen über Kunst hinaus, ein bisschen Richtung Popkultur und nicht nur die Hochkultur drin zu haben. Um durchaus alles, was im deutschen Kulturverständnis Kunst ist dabei zu haben. Das werden wir in den nächsten Monaten noch erweitern und uns noch mehr für gesellschaftliche und journalistische Themen interessieren. Darüber hinaus möchten wir auch an der Fiktion arbeiten und Creative Thinking in der Wissenschaft betreiben.

B.E.: Zu diesem Thema habe ich gerade vorhin den Beitrag von Barack Obama auf der Homepage von Arte Creative gesehen.

A.K.: Genau in diese Richtung möchten wir noch mehr gehen und die Idee von dieser jungen Kulturplattform oder einfach dem jüngeren oder dem zeitgenössischen Angebot von ARTE ist es eben einen weiteren Schritt zu tun in Richtung Welt von heute; auch formell und eben nicht mehr die Distinktion zu machen zwischen: Es gibt TV und es gibt Web, sondern einfach alles ist digital, auch TV ist digital. Es gibt einfach nur verschiedene Distributionsvektoren im digitalen Bereich, einer davon nennen wir lineares TV, ein anderer ist Mediathek, ein anderer Facebook, ein anderer Twitter, und noch ein weiterer YouTube usw. Und in diese Richtung entwickeln wir uns auch im Virtual-Reality- Bereich, weil wir denken, dass es sich hier nochmal um ein neues, eigenständiges Medium handelt. Wir versuchen gerade auch unsere Teams so auszurichten, dass wir uns eben nicht nur an die digitale Welt anpassen – wenn wir dies nicht schon lange gemacht haben, sind wir

sowieso ‚tot‘ – sondern einfach nur versuchen, Strukturen zu erschaffen, mit denen man sich permanent anpassen kann, weil mit Facebook/ YouTube ist es natürlich nicht vorbei. Alle 4 bis 5 Jahre kommt ein neues Medium hinzu, als letztes mit Snapchat. Danach kommt ‚conversational Facebook Messenger‘, wahrscheinlich Contents direkt produziert für Interfaces, die sprachbasiert sind – Domotics, all diese Sachen. Für uns ist VR einfach ein Teil dessen, weil wir heute auch nicht wissen, was VR werden wird. Für manche ist VR ja längst nicht nur ein Distributionsvektor für Inhalte, sondern die Zukunft der Kommunikation, die Zukunft der Medizin, aber das wissen wir heute einfach noch nicht und wir wissen nicht, wie schnell oder wie langsam dies passiert. Heute sehen wir es einfach als eine Plattform für Inhalte – eine unter vielen. Aber wir sehen natürlich folgendes: der beste Indikator dafür sind die Investitionen, die in diesem Bereich getätigt werden und es gibt kaum einen Bereich heutzutage, wo so viele Investitionen getätigt werden, europaweit und vor allem weltweit – sowohl in Asien als auch in Nordamerika. Und deswegen schauen wir einfach mal. Zurzeit ist wirklich das unsere Strategie: für alle diese Distributionswege nicht zu sagen, wir haben ein Leitmedium Fernsehen, wonach wir ein wenig darum herumbauen, sondern jedem Medium seinem Inhalt zu geben – thematisch schon einmal. Wir wissen, dass wir auf YouTube 25-Jährige erreichen, die sich für andere Themen interessieren als der ARTE-Journal Zuseher, der durchschnittlich 65 Jahre alt ist. Das heißt, jedes Mal das schon thematisch auszurichten, da hilft uns CREATIVE sehr viel weiter, weil wenn wir Fernsehen machen würden, würden wir Inhalte für die 65-Jährigen machen und wir brauchen einfach den Webseiten-Bereich bei uns heute. Und es ist eben nicht das gleiche, das auch für YouTube zu machen, auch formell, weil was auf YouTube funktioniert, funktioniert nicht unbedingt im Fernsehen und umgekehrt. Und auch in Hinsicht auf VR, wo es eben nicht nur darum geht, nur schöne 360-Grad Videos zu produzieren, sondern auch konzeptionell und narrativ völlig andere Wege zu gehen.

B.E.: Auf der ARTE 360 App habt ihr sehr viele verschiedene Inhalte, versucht man hier schon die verschiedenen Publikumsgruppen anzusprechen? Was ist hier der Hintergrund für die diversen Inhalte?

A.K.: Die drei Gedanken dahinter sind (die App existiert seit einem Jahr, seit Dezember 2015) zunächst mal, dass, wenn wir schon eine App machen, dann brauchen wir viele Inhalte, um einen Showcase für 3 oder 4 Premium-Inhalte zu machen. Da würde es nicht sinnvoll sein, dafür eine eigene App zu machen. Der zweite Gedanke dahinter ist ein thematischer: ein Versuch in allen Bereichen und dementsprechend auch in allen Altersgruppen präsent zu sein - von denen, die

sich für schöne Bilder vom Mont Blanc interessieren bis hin zu Phillip K. Dick Fans, die eine experimentelle ‚Fiction‘ sehen wollen, bis hin zu Leuten, die meiner Meinung nach eher aus dem Videospielbereich kommen, die sich für *Notes on Blindness* interessieren. Also da ist natürlich der Gedanke, verschiedene Publika abzuholen. Und der dritte und wichtigste Teil - Du meintest gerade wir haben viele Inhalte, das war sehr diplomatisch ausgedrückt - Meiner Meinung ist es einfach zu viel, weil es ist ein wenig profillos. Heute können wir uns das noch leisten, weil es nicht so viele gibt, die das machen. In 2-3 Jahren müssen wir mehr Profil reinbekommen, dann sind wir hoffentlich ein bisschen weiter bis dahin. Aber der dritte und eigentlich wichtigste Teil ist auch, einfach Sachen auszuprobieren wie: für welche Thematiken und Geschichten eignet sich das Medium ganz besonders. Da haben wir auch schon erste Erfahrungen sammeln können und wo wir einfach sehen, umso spektakulärer die Bilder, umso besser funktioniert es. Aber auch da bin ich mir nicht ganz sicher, weil auch da ist VR noch nicht ganz so gut, was die Qualität der Bilder anbelangt – so gut ist es noch nicht gerendert und so schön ist es einfach noch nicht.

B.E.: Die Qualität gerade am Mobile VR ist noch nicht ganz da...?

A.K.: Genau gerade am Mobile, sowohl von der Größe des Schirms als auch von der Qualität des Videos, das gerendert wird, als auch von technischen Möglichkeiten eines Mobiltelefons, so weit sind wir einfach noch lange nicht und die meisten Leute sehen es nicht auf einer Oculus Rift, die sehen die Inhalte auf einer Gear VR oder einem Cardboard und sogar da sind es nicht die meisten Leute; die meisten Leute sehen das 360-Grad Video auf Facebook in der Timeline direkt oder auf YouTube. Ich finde grundsätzlich, es ist ein Format, das sich relativ schlecht für Journalismus eignet.

B.E.: Du hast bereits in Wien am Media Innovation Day im Oktober erwähnt, dass du es relativ problematisch findest. Dennoch wird es trotzdem relativ viel gemacht...?

A.K.: Es wird relativ viel gemacht – die New York Times macht ja jetzt ihr tägliches 360-Grad Video und ich finde, umso dokumentarischer, umso besser. Umso mehr Reportage, desto mehr geht es in die Gadget-Richtung. Das kommt vielleicht auch daher, dass ich einen journalistischen Background habe und mein Hirn einfach so formatiert wurde, dass alles unnötige aus einer Story rausgenommen werden muss. Ich finde es eignet sich nicht so gut, weil dieses „immersive“, was man natürlich in VR hat, ist für viele Stories vielleicht nicht so wichtig, wie die Story selbst, also es bringt der Story nicht so viel. Ich warte nur darauf, eines Besseren belehrt zu werden. Ich bin sicher, es wird Stories geben, die das sehr gut machen

werden. Bisher finde ich es einerseits deontologisch problematisch und andererseits vor allem sehe ich den Mehrwert noch nicht ganz – damit meine ich im Reportage-Bereich, nicht im dokumentarischen Bereich.

B.E.: Ist es auch diese Empathie Frage, mit der hier im Reportage-Bereich gespielt wird?

A.K.: Ich denke, dass zweite Sache des Immersiven ist natürlich das Emotionelle und dieses Emotionelle ist nicht immer gut für Journalismus. Ich werde jetzt natürlich nicht auf irgendwelche Objektivitätsdiskussionen im Journalismus eingehen, das haben wir seit 20 Jahren hinter uns. Natürlich ist es klar, dass es einen Objektivitätsanspruch geben muss, aber sämtliches journalistisches Storytelling natürlich subjektiv ist. Aber das Emotion dabei sein muss, ist schon klar – das muss ja bei jeder Story dabei sein. Aber dadurch, dass das Emotionelle gerade so gut funktioniert in VR und in 360-Grad, ist es halt das, was meistens hervorgehoben wird.

B.E.: Mit Immersion wird Virtual Reality ja auch beworben.

A.K.: Ganz genau, es heißt, als wärst du mittendrin, sprich mit dem Protagonisten – all diese Sachen, das ist teilweise problematisch. Allerdings distributionell handelt es sich um einen riesigen Vorteil, wenn es sich um Fiktion handelt, wenn es sich um Videospiele handelt natürlich auch – immersiv und emotionell um einen richtigen Flow hinzubekommen und stundenlang da drinnen zu verbringen. Ich glaube, die ersten inhaltlichen Produkte, in denen die Leute mehr als 10 - 15 Minuten drinnen verbringen werden, das werden Videospiele sein. Das sieht man ja auch am Erfolg der PlayStation VR, die innerhalb von zwei Monaten Oculus und HTC Vive überholt hat. Das liegt jetzt natürlich nicht nur an der Stärke des Produkts, sondern auch am Marketplace, am Ökosystem, am Preis, dass es sich schon an Hardcore-user wendet, die noch dazu dreimal weniger dafür zahlen müssen als für die HTC Vive, weil die Playstation ja schon dafür zuhause sein muss - das liegt also an vielen Elementen. Ich glaube ein Element ist auch, dass, wofür dieses Medium wunderbar gemacht ist, weil dritter Punkt für mich – was ganz besonders stark ist in VR, ist für mich dieses ‚Storytelling im Raum‘. Das ist natürlich etwas, das wir von Videospiele kennen und was davor in keinem Medium existiert hat – nicht in Büchern, nicht in Filmen, aber was bei Videospiele ganz stark ist. Sobald du selbst bestimmen kannst, wo du hinschaust, braucht es ein anderes Storytelling als bei dem Storytelling mit einer Timeline, mit einer Cadrage. Das geht da nicht mehr und das heißt, die einzige Lösung, die wir dafür bisher gefunden haben, ist eben Storytelling im Raum statt Storytelling auf einer Timeline in der Zeit. Und

wenn wir es schaffen, Geschichten zu finden oder zu konzipieren, die diese drei Stärken bedienen, glaube ich, werden wir in den nächsten 2-3 Jahren wirklich sehr starke Inhalte schaffen können für das, was VR heute ist. Wenn man davon ausgeht, dass es eine Brückentechnologie ist und wir irgendwann keine Goggles mehr tragen werden, sondern von Snapchat-Spectacles über HoloLenses, wo wir dann eher im Mixed Reality Bereich sind, bis hin zu Implantaten im Auge, keine Ahnung. Dann muss man natürlich wieder etwas Anderes andenken, weil da würde natürlich gerade das Immersive stark wegfallen. Diese Immersion haben wir heute ganz stark, weil wir eine kleine Camera Obscura um unseren Kopf herum bauen. Jedes Mal, wenn wir diese aufsetzen – das allerdings gerade für die Demokratisierung der Technologie große Probleme darstellt. Aber ich glaube, das sind die drei Stärken, die man ausschöpfen muss und ich glaube, eben mein Skeptizismus im journalistischen Bereich röhrt daher, dass das drei Aspekte sind, die eine gute Story ausmachen aber nicht unbedingt im Journalismus. Und meine Obsession damit eher in Richtung dokumentarisch, also Autoren-doku, eher Richtung Fiktion, Videospiele zu denken und Videospiel auch daher röhrt, weil das alle drei Genres sind, die sehr gut mit diesen Stärken bedient werden können.

B.E.: In Bezug auf die fiktionalen Inhalte, hast du da eine Tendenz – eher zu 360-Grad Video oder zu computer-generierten Inhalten – hast du da eine Tendenz?

A.K.: Ich glaube beides ist möglich. *I, Philipp* hat uns gelehrt, dass man tatsächlich auch mit realen Aufnahmen etwas Sinnvolles machen kann. Der andere Vorteil ist natürlich, dass es verhältnismäßig billiger ist, als alles computer-animiert zu machen, vor allem eben, wenn man stark-immersive Bilder haben will. Weil dann muss es photorealistisch-immersiv sein, nicht wie sehr viele abstrakte, schöne Animationsfilme, die auch ihre eigene Immersion haben, aber eben nicht die photorealistische einer VR heutzutage. Ich denke schon, dass das durchaus eine Zukunft darstellen kann, man sieht ja auch immer wieder, dass hier Versuche gewagt werden in den letzten 4-5 Jahren. Da war *I, Philipp* ja absolut nicht die erste Produktion, sicher auch nicht die überzeugendste. Ich glaube, wir haben immer noch ein bisschen Angst vor der eigenen Courage; auch bei *I, Philipp* gehabt, unter anderem auch weil wir das ja in Sequenzen geteilt haben. Wieso haben wir das gemacht? Wenn wir sagen Storytelling im Raum, wieso machen wir dann einen Zeitcut mit fade in und fade out wie auf einer normalen Timeline? Das macht überhaupt keinen Sinn, wir sollten eigentlich im gleichen Raum sein. Es gibt einige Filme, die relativ schön in VR adaptiert werden können und eines der besten Beispiele finde ich hier *Birdman* von Alejandro Iñárritu.

B.E.: Also quasi als Vorbild für ein Projekt ohne sichtbaren Bildschnitte?

A.K.: Ja zum Beispiel, also ich stelle mir das so vor, dass man versucht 10 Minuten von *Birdman* in VR zu machen. Da sieht man gerade auch an diesem Beispiel, dass es gerade in dem Bereich des Making-Of, Backstage, das sehr immersiv sein könnte und viel besser als das klassische Making-Of, weil *Birdman* ja auch hinter den Kulissen spielt.

B.E.: Ihr habt ja auch ein Making-Of auf eurer ARTE 360 App...

A.K.: Ja das ist auch nicht ganz das Gelbe vom Ei, meiner Meinung nach. Aber ja, gerade mit Bruno Dumont, der da gefilmt wurde, es ist interessant. Aber es ist halt immer noch: ‚Erlebe es, als wärst du dort.‘ Und das ist ein Aspekt der Sache, aber ich finde, das hatten wir auch schon mal vor 20 Jahren. Also in der ersten VR oder im IMAX Kino, hatte man auch dieses Versprechen schon und es wurde damals eigentlich auch schon ziemlich gut eingelöst. Ich glaube man kann noch viel weiter gehen als das, nicht einfach nur zu sagen, ‚Fühle dich so, als würdest du die Kamera halten.‘ Ja eh, aber das ist dann wiederum auch ein Verfremdungseffekt, der das Ganze auch wieder weniger immersiv gestaltet, ich glaube, da haben wir noch nicht eine wirkliche Reife erreicht.

B.E.: Sieht man von den ‚views‘ her, sind das diese Inhalte, die du priorisieren würdest, die auch mehr Anklang finden?

A.K.: Also unsere statistische Auswertung lehrt uns heute mehrere Sachen: Wir haben mit unserer App leider erst seit 2 Monaten ein eigenständiges, statistisches Auswertungstool, das nennen wir die ‚Heat Map‘ und wo wir mit Eye Tracking arbeiten. Die ‚Heat Map‘ zeigt uns drei ganz starke Tendenzen: die erste ist, die meisten Leute interessieren sich noch nicht wirklich für die Interaktivität – und ich spreche hier nur von der leichten Interaktivität, dass wir den Kopf in alle Richtungen drehen - weil wir ganz stark sehen, die meisten Leute am Zentrum des Hauptbildes – also alles worum herumgestickt wird – da schauen die meisten Leute hin. Der zweite Aspekt ist: viele Leute fadisieren sich, weil der zweite wichtigste Punkt der Heat Map ist unten in der Mitte, weil sie einfach zu Beginn nach unten schauen und dann gar nichts mehr machen.

B.E.: Oder das Handy einfach irgendwo hinlegen oder so...

A.K.: Ganz genau. Und die dritte Sache ist, wenn wir es schaffen, dass die Leute sich irgendwo hindrehen, schaffen wir das mit Ton und nicht mit Bild, weil es viel natürlicher ist. Weil logischerweise, wenn etwas hors champ ist, dann hören wir es zuerst. Und dies ist natürlich einer der GROSSEN Stärken von VR, das ist das

natürliche aller Interfaces, noch vielmehr als Touch-Screen, nämlich einfach nur das zu machen, was man immer macht im Leben und da ist der Ton unglaublich wichtig. Das ist die dritte Lehre, die wir daraus ziehen. Die vierte Lehre ist, dass – rein statistisch - unsere App im VR Modus von nur ein paar Tausend Leuten genutzt wird, die meisten nutzen sie in 360-Grad, weil sie die Devices noch nicht zuhause haben und dass die Ratio – das gleiche Video distribuiert bei uns versus Facebook – 1 zu 500 ist ungefähr.

Unsere größten Erfolge sind bisher *I, Philipp* einerseits und andererseits im dokumentarischen Bereich *Notes on Blindness* und unsere ganzen Kunst-Dokus Shchukin, die Immersion in *Die Versuchungen des heiligen Antonius von Hieronymus Bosch* usw. – ich glaube auch, einfach weil ARTE damit assoziiert wird, d.h. man erwartet sich so etwas auf ARTE zu finden, vielmehr als eine durchgeknallte Web-Fiction im Kopf eines humanoiden Roboters mit dem Gesicht von Philip K. Dick. Und diese Erfolge sind heute 10.000 - 30.000 ‚videoviews‘ auf unserer App. Die gleichen Videos generieren auf Facebook 600.000 – 3 Millionen ‚views‘. Ich glaube das ist sehr wichtig, auch wenn man darüber spricht, was ist heute, was ist morgen? Wo priorisieren wir heute? Wo wissen wir, dass wir heute Aufmerksamkeit generieren überhaupt im Sinne von ‚Arte macht so etwas‘ und wo muss es hingehen? Unsere Gegenwart, also zumindest seit sechs Monaten und für die nächsten sechs Monate, liegt eindeutig für die distribuierten Medien – also Facebook und YouTube, also alle die ein 360-Grad Player haben. Man sieht ja jetzt auch auf Twitter mit den 360-Grad Live Videos, es beginnt langsam, aber Twitter wird immer minoritär bleiben, wenn es überhaupt in 2 bis 3 Jahren noch existiert. Weniger als ein Prozent unserer Visits (die Inhalte von ARTE Creative) kommt über Twitter, 38% kommen über Facebook. Damit sind gemeint eben die atomaren Inhalte, 90 % atomare Inhalte, nur 10% kommen über die Homepage, die meisten sehen unsere Homepage nie - was dementsprechend natürlich auch für die Betreuung des Teams ganz wichtig war für mich, weil ich ihnen irgendwann mal gesagt habe, dass die Homepage gut ist, wichtig als Visitenkarte, aber hört auf, euch mit der Hälfte eurer Zeit nur mit der Homepage zu beschäftigen. Verbringt 10% eurer Zeit damit und 90% damit, die user experience zwischen den Inhalten um die richtigen Empfehlungen zu bekommen. Und das statistisch für die Gegenwart wichtig ist, wie gesagt, dass wir auf Facebook und YouTube mit diesen Inhalten existieren.

- B.E.: Du hattest dies bereits in Wien erwähnt. Könntest du nochmals kurz die Algorithmen erwähnen, mit wieviel mehr Prozent derzeit ein 360-Grad Video auf Facebook gewertet wird?

A.K.: Also heute ist es so, dass wir eine Ratio haben, rein empirisch, Facebook kommuniziert nicht dazu, wir sehen einfach nur, sobald wir etwas online stellen, also abgeleitet aus den letzten 9 Monaten ungefähr, denn wir posten seit ca. diesem Zeitraum native 360-Grad Video auf Facebook und da ist die Ratio 1 zu 10 zwischen einem normalen Post und einem nativen Video, und 1 zu 5 zwischen einem nativen Video und einem nativen 360-Grad Video, das heißt 1 zu 50 zwischen einem normalen Post und einem 360-Grad Post mit einem nativen Inhalt.

B.E.: Wenn ARTE Creative versucht auf Facebook priorisiert unterwegs zu sein, da geht es auch um Image, etc..?

A.K.: Ja und nein, das ist wahrscheinlich einer der spannendsten Mediendebatten unserer Zeit, über Fake News oder was auch immer hinaus, es ist heute extrem schwierig zu sagen, was wir eigentlich messen sollten. Und das hat sehr viele verschiedene Implikationen, da kommt es sehr stark darauf an, was du eigentlich bist. Ob du ein öffentlich-rechtlicher Rundfunk bist, ob du ein privates Unternehmen bist, ob du ein privates Medien-Unternehmen bist, das eine starke Marke hat und zu einem Medienunternehmen werden möchte – z.B. Red Bull – usw., und das hängt halt völlig von der Situation ab. Allen gemein ist, und daran arbeiten wir zurzeit, dass wir natürlich nicht ein Facebook-Video, wo die durchschnittliche Verweildauer sieben Sekunden ist, genauso messen sollten, wie eine „videoview“ bei uns, wo die durchschnittliche Verweildauer 12 Minuten ist. Das ist qualitativ nicht das gleiche, aber wir sollten uns schon Gedanken machen, wie wir diese Facebook-videoviews messen, weil es ist nicht „Nichts“. Und du generierst extrem Aufmerksamkeit für deine Marke in diesen Medien. Wir überlegen uns gerade Quotienten einzuführen, oder einfach Koeffizienten, wo wir auch Facebook mitmessen können. Auch YouTube – YouTube ist vor allem bei einer durchschnittlichen Verweildauer von 6 Minuten eigentlich mittlerweile wirklich genuiner Bestandteil von dem, was wir machen und jetzt müssen wir uns wirklich überlegen, was wir überhaupt wie messen sollten. Vor allem auch gerade wenn du öffentlich-rechtlich bist, d.h. die Leute schon für die Inhalte bezahlt haben, bevor sie sie überhaupt gesehen haben, ist es ganz wichtig, dass sie sie sehen und du keine Werbung darum herum verkaufen willst. Da bin ich halt einfach dafür, so großzügig wie möglich zu sein – nur halt bis dahin, dass sich meine Marke nicht verliert und das ist heutzutage absolut nicht klar, wann das passiert. Was sicher ist, dass kein einziges Fernsehunternehmen, das halbwegs bei Verstand ist, sich in den nächsten 5 bis 10 Jahren erlauben wird können, nur eine Quote zu messen.

Nicht nur, weil die Quote heutzutage eine gerontophile Messlatte aus dem Altersheim ist, wenn man davon ausgeht, dass unser Durchschnittszuschauer ein Alter von 61 Jahren hat. Dass der öffentlich-rechtliche Sender in Deutschland zwischen 57 und 69 Jahren ist. Wir sind als ARTE der zweitjüngste öffentlich-rechtliche Sender in Deutschland.

B.E.: Ihr habt ja auch Catchup TV. Man geht damit ja auf das veränderte Sehverhalten von einem jüngeren Publikum ein.

A.K.: Ja nur, dass die Entscheidungen auf politischer Ebene nicht danach gefällt werden, sondern nur nach der Quote. Wir kommunizieren dazu, wieviele views es auf catch-up-TV gab, die Presse kommuniziert; unsere Geldgeber in Deutschland und das Kulturministerium in Frankreich schauen auf die Quote. Grundsätzlich ist das bei ARTE ein viel weniger wichtiger Aspekt als bei vielen anderen Sendern, weil wir ein Prestigeprojekt sind, d.h. auf das Markenimage kommt es mindestens genauso viel an. Aber gerade bei den Großen, ORF/ ZDF, große Anstalten wie der SWR, oder in Frankreich France Télévision, France 2, France 3 – da wird ausschließlich die Quote gemessen. Und die Quote ist eine Matrik, die über 40 Jahre alt ist aus einem reifen Medium, die aus einer Zeit stammen wo das Fernsehen das einzige dominierende Massenmedium war, d.h. es tatsächlich ein Prozentsatz der Bevölkerung war. Heute ist es kein Prozentsatz der Bevölkerung mehr, sondern einfach nur der Prozentsatz der alten Menschen, die sich ein Programm anschauen. Hier stellt sich die Frage, was dieser Wert für eine Legitimität hat. Alle strategischen Entscheidungen auf Führungsebene in großen Sendern werden noch darauf basiert. Das gute ist, dass unser Geschäftsführer ein bisschen ein anderes Kaliber ist – also er ist ein typischer Mann über 60, ganz typisch. Aber sein Profil ist ein wenig anderes, er ist vor 4 Jahren zu ARTE gekommen und es ist das erste Mal, dass er überhaupt für einen öffentlich-rechtlichen Sender arbeitet. Davor hat er ‚Allociné‘ erfunden und gegründet, davor hat er für ‚Canal+‘ 10 Jahre gearbeitet und davor war er 20 Jahre lang Videospielproduzent in den 70er Jahren und 80er Jahren für ‚Atari‘ und ‚Nintendo‘. Er hat einfach eine ganz andere Denkweise und gerade für Leute unserer Generation so spannend, weil das der Background ist, der uns fehlt. Man sieht wie die Zukunft aussieht, aber man weiß nicht, woher was kommt und er kommt aus dem Digitalbereich, was das ganze hier bedeutend vereinfacht, um gewisse Sachen schneller vorantreiben zu können. Nur so wird halt überall anders überhaupt nicht gedacht. Es gibt in den anderen Sendern keine Reflexionen dazu, ob die Quote überhaupt die richtige Messlatte ist. In den meisten öffentlich-rechtlichen Sendern wird noch nicht mal richtig gemessen. Ich hatte letztes Jahr

eine Konferenz vor 300 Leuten beim ZDF gehabt, die eine Einführung in die Web-Matrix haben wollten - ZDF, der markanteilmäßig größte Sender Deutschlands, mit einer riesigen Mediathek, also mit durchaus zukunftsträchtigen Initiativen. Aber über das Problem der Einschaltquote hinaus, ist das andere Problem, wie schaffen wir es zu vergleichen? Wir haben ja auch die absoluten Zahlen für Fernsehen – ist das das gleiche wie eine „videoview“ in unserer Mediathek? Ja, mehr oder weniger, auf YouTube? Nicht mehr so wirklich und auf Facebook sicher nicht, aber trotzdem produzieren wir für alle diese Vektoren und es macht Sinn für all diese Vektoren zu produzieren. Wie harmonisieren wir das? Das ist die große Herausforderung in den nächsten 2 – 3 Jahren, und diese Herausforderung ist für uns sogar nur eine halbe Herausforderung, weil wir es nur harmonisieren müssen. Für die privaten ist es harmonisieren und Geld damit verdienen. Also ich glaube, es wird einer der großen, großen Herausforderungen werden.

B.E.: Weil du über andere Fernsehanstalten gesprochen hast: teilweise gibt es ja auch schon andere Fernsehsender, die VR Apps haben, zum Beispiel der ZDF.

A.K.: Ja der ZDF verwendet unsere Technologie, diese haben sie von uns übernommen. Das scheint so wie CNN alles ausschließlich in die Richtung der 360-Grad Videos zu gehen...

Ich weiß, TerraX beim ZDF denkt darüber nach, richtig in den VR-Bereich einzusteigen. Das ZDF ist in Europa mit uns, das einzige Medium – also rein europäische Unternehmen – das gerade eine VR App für Daydream bastelt. Da gibt es schon Bestrebungen, aber dadurch, dass sie erst ein knappes Jahr nach uns gekommen sind, werden sie noch ein bisschen brauchen. Ich weiß bei France Télévision ist das derzeit komplett abgemeldet, weil da eine neue Direktion ist, die völlig andere Sorgen hat. Die BBC arbeitet natürlich an ihrer VR App und hat mit ‚Taster‘ ein Tool, was durchaus für das beta testing sehr interessant werden kann. Und für uns ganz besonders wichtig zurzeit, weil das für uns eigentlich die echte Konkurrenz ist: SKY- mit ihrer großen VR, unter anderem Sky Arts, die ganz groß (mehr als 3sat) ganz groß im ARTE Teich fischen mit genuin produzierten 360-Grad Videoprojekten. 3sat und ARTE sind eher komplementär, weil 3sat Österreich für Frankreich eintauscht, aber 3sat sehr viel auf Wiederholungen basiert ist, da wo ARTE auf alles was wir machen Exklusivität hat und es erst danach irgendwo anders ausgestrahlt wird und dementsprechend leben wir dann davon, dass die Leute wissen, das läuft auf ARTE und es kommt von ARTE. Gäbe es ARTE nicht, gäbe es den Programminhalt nicht.

B.E.: Ihr seid ja auch auf Daydream aktiv bzw. ist alles, was ARTE bisher im VR-

Bereich gemacht hat, ist für Mobile VR produziert worden. Ist das möglicherweise aus dem Grund so, dass der Markt für Mobile VR größer ist?

A.K.: Ganz genau. Es ist einfach nur eine sehr pragmatische Herangehensweise für ein öffentlich-rechtliches Unternehmen, das eben von Gebühren bezahlt wird und dementsprechend immer versuchen muss, ein Maximum an Leuten abzuholen, ein Maximum an Leuten mit einem gewissen Inhalt für eine gewisse Plattform. Auch im Fernsehen holen wir meiner Meinung nach das Maximum heraus für die Inhalte, die wir haben, weil die halt keine 30% Marktanteil haben können, weil es sehr spezifische, teilweise Nischen-Inhalte sind und dementsprechend sind wir ganz schnell ganz stark auf ‚Mobile‘ gegangen, auch weil die mobile-marketplaces/ die Stores vor allen anderen existiert haben. Oculus hat ja sehr lange eine unklare Linie gefahren, ob nur Video oder nur Game oder etwas dazwischen. Und das war am Ende für uns sehr schwierig, da überhaupt mithalten zu können, weil das halt doch Projekte sind, wo wir eineinhalb Jahre brauchen, in dem Moment, wo es durch die Gremien geht. Wir haben heutzutage bei unserer Programmkonferenz haben wir Leute, deren Hauptjob es ist, zu evaluieren, welche VR Inhalte überhaupt zu uns passen, das ist ja schon ein Erfolg. Aber es braucht eine Zeit, um produziert zu werden, um finanziert zu werden und dementsprechend, wenn wir dann Stores haben, die alle 6 Monate ihre gesamte Politik ändern, geht das nicht.

Wir haben einige Projekte experimentelle schon für Oculus produziert, aber das sind Projekte, die nicht in unserer App sind, wie z.B. Notes on Blindness. Für die Gear VR existiert es seit dieser Woche in der ARTE App, und eben als eigenständige Applikation für die Oculus. Und natürlich: auch das muss zusammenpassen, weil wir können nicht sagen, wir wollen es für viele Plattformen machen und wir machen es außerhalb ARTE. Die Haupt-App wurde vor einem Jahr initialisiert und ist seit sechs Monaten fertig, d.h. viele Projekte, die besonders innovativ sind, wurden parallel entwickelt – basieren nicht auf der gleichen Technologie. Das heißt, wir müssen mit allen Projekten, die von jetzt an getextet werden, eine gewisse Standardisierung reinbekommen, das dauert natürlich eine gewisse Zeit.

B.E.: Und mit Daydream geht man auch in Richtung eines globaleren Markts – ist das hier auch Hintergrund?

A.K.: Das ist ein wichtiger Aspekt für uns, den ich ganz vergessen habe, zu erwähnen. Die VR App ist zu 48% auf deutsch und französisch heruntergeladen und zu 52% auf englisch – für einen Markt außerhalb vom deutsch- und französischsprachigen

Europa, ganz stark in Asien. Unser Projektleiter für VR unternimmt Reisen nach Moskau, Peking, Seoul - wir sprechen auch mit Alibaba-Ablegern, aber das ist wirklich noch in der Anfangsphase. Das Gute ist, wir sind priorität auf Android und IOS unterwegs und über Android wird das ganze natürlich einfacher für den asiatischen Raum.

B.E.: Weil wir vorhin bereits über Interaktivität gesprochen haben: Wie siehst du hierzu das Potential? Du meintest, das wird noch nicht so wirklich angenommen?

A.K.: Schwierig, ich denke ja, aber unter dem, was sich die Leute unter Interaktivität vorstellen, nämlich Games, da ja. Man sieht ja auch sehr gut, die ersten Spiele, die exklusiv auf Playstation VR herausgekommen sind, die Orientierung von Oculus geht ganz stark dahin, HTC Vive natürlich. Ich meine, das ist ja eines der Hauptaugenmerke gewesen, wenn man das Haptische auch noch dabeihat, was du bei den anderen Goggles ja nicht hast bzw. nicht hattest. Dann macht es natürlich Sinn, im Gaming-Bereich nachzudenken – was Interaktivität betrifft, wird das ziemlich groß werden. Die Frage ist es, ob diese hybriden Formate, die wir so bei ARTE geschätzt haben, also die ganzen webdoku-mässigen Formate, d.h. eine gewisse Interaktivität für ein Storytelling, wo das Gameplay nicht unbedingt im Zentrum, sondern im Dienste einer Geschichte steht, was ja im Videospielbereich längst nicht immer der Fall ist. Es gibt ja zwei Schulen – die Gameplay-Schule und die Narrations-Schule im Videospielbereich. Manche argumentieren wiederum, doch die Geschichte ist sehr, sehr wichtig und das Gameplay, nicht nur die Geschichte, es gibt aber offensichtlich sehr viele Spiele, wo das Gameplay nur für sich steht und wo du keine Geschichte brauchst. Da muss man sich die Frage stellen, da habe ich keine genaue Einschätzung dazu. Ich würde sagen, zunächst erstmal in den nächsten ein bis zwei Jahren kommt dazu von uns kaum etwas. Wir haben jetzt einmal versucht, mit S.E.N.S VR ein Projekt mit einer leichten Interaktivität zu haben. Das Puzzlegame ist traditionell etwas, das man vor drei Jahren noch auf dem Tablet gemacht hat – wie *The Room*. Ähnliches kann man heutzutage definitiv für ‚Casual VR‘ ausprobieren, aber das ist das höchste der Gefühle zurzeit. Da sind wir konzeptionell einfach nicht gut genug, weil da die gesamte Industrie in den Kinderschuhen steckt. Es beginnt langsam, wir produzieren ja parallel dazu Videospiele für ARTE Creative und für die Stores – das sind dann eigenständige Apps, keine VR Videospiele, sondern normale Videospiele wie Puzzlegames, Explorationgames – vier pro Jahr, vor allem für mobile, aber nicht nur. Wir haben vor einem halben Jahr *Californium* gehabt - das ist ein Exploration Game für SteamVR, für PC – das ist einfacher, weil das Storytelling logischer click and shoot. Die meisten anderen sind eher im

Plattform-/ Puzzlegamebereich, auch eher mobile, weil da der Markt am größten ist. Aber nicht nur – seit dem Sommer haben wir auch ein erstes Spiel auf Playstation 4 und für die nächsten 12 Monate sind auch noch zwei neue Spiele für die Playstation 4 und auch noch eines für Xbox. [...] Was uns ganz stark interessiert ist Xbox, weil da zusätzlich noch eine Mediathek darauf ist, d.h. da gibt es eine Interaktivität zwischen der ARTE TV-Mediathek und den Videospielen. Das kann man auf der Playstation eher nicht haben, da aber eher die Indiegamer abholt und unsere Spiele sind eher Indie-Game-orientiert – die sind eher auf Playstation unterwegs, weil die die Exklusivität haben auf Titel wie *Last Of Us*, *Journey* usw., die zwar aufwendig produziert sind, aber noch immer noch sehr Indie – also sehr kunstvoll gestaltet sind. Und ja, das sind so die Entwicklungen, was die Interaktivität betrifft. Also Hybridformate sind eher schwierig, Videospiele ja. Ich glaube, es werden uns die Mittel fehlen und die Erfahrung, da direkt einzusteigen.

B.E.: Die zwei großen Schlagwörter von Virtual Reality – Immersion und Interaktivität – widersprechen sich die vielleicht auch manchmal?

A.K.: Für mich ist es ganz klar, dass für viele Arten von Inhalten Immersion und Interaktivität inkompatibel sind, unter anderem für klassisch audiovisuelles. Nicht nur für das, sondern es gibt genug Beispiele aus dem Theater- und Kinobereich, mit experimentellen interaktiven Theaterspielen und experimentellen interaktiven Kinofilmen, wo es nicht um Immersion geht, sondern um ganz etwas Anderes und deswegen ist es experimentell. Ein Medium darauf aufzubauen, ist schwierig, ich denke es kann durchaus interaktiv und immersiv zugehen, aber nennt sich halt Gameplay und Flow. Das ist das, wo es im wunderschönen Buch über Computerspiele, das letztes Jahr herausgekommen ist, darum geht, ja Videospiele sind Kunst aber sie selbst durchspielen die ganze Zeit. Wenn man richtig versunken ist, dass man die ganze Zeit einen permanenten Dialog mit sich selbst führt, da muss man erst mal schauen, das schafft man nicht mit linearem Inhalt, der ab und zu mal interaktiv ist – das ist ja Verfremdungseffekt, das ist das Gegenteil. Es muss eine permanente konstante Immersion sein, damit man nicht rausgerissen ist - quasi eine Immersion, die wie ein warmes Bad ist und nicht wie eine Kneippkur, die heiß/kalt abwechselt. Das ist gut für die Durchblutung, aber nicht sehr immersiv.

B.E.: Ich habe bemerkt, ihr habt auch einige Inhalte, die als TV Dokumentationen auf ARTE liefen und da gibt es eine VR experience dazu, wie zum Beispiel *Life to Come* oder das Projekt über Bosch Hieronymus. Ist das oft produktionstechnisch

oft parallel von Anfang an so konzipiert?

A.K.: Es kommt ganz darauf an, im Idealfall ja. Was man natürlich wissen muss, ich erzähle hier so, als wäre das alles in meinem Kopf entstanden. Das sind alles Projekte, die von kreativen Produzenten, die an uns herangetragen wurden. Die Ideen sind nicht von uns, wir sind nur die Bank, wir investieren.

B.E.: Das wäre eine nächste Frage, wie grundsätzlich die Förderungskriterien sind und wie hier vorgegangen wird?

A.K.: Noch ganz kurz, was die Inhalte betrifft: es kommt halt ganz auf die Produzenten an. Es kommt vor, dass die Produzenten von Anfang an sagen, sie wollen beides machen. Es kommt vor, dass die Produzenten einen Kinofilm machen wollen und die VR experience kommt danach. Und es gibt einige Beispiele, wie *Notes on Blindness*, wo das VR Projekt vor dem Fernsehprojekt konzipiert wurde. Das passiert im VR -, im Videospielbereich und im Webserienbereich. Und es soll ja eben in alle Richtungen gehen, weil sonst werden wir es nie schaffen, vorbereitet zu sein. Von der Produktion her bei ARTE, egal ob TV oder digital: nichts wird intern produziert, außer das ARTE-Journal. Egal ob Frankreich, Deutschland oder international, wir haben hier kein einziges Final Cut oder ähnliches. Das sind somit alles Produzenten von außen. Wir geben die großen strategischen Richtungen vor, machen einen Call for Entry, weil wir uns die und die Sache vorstellen, aber manchmal sind es einfach nur Projekte, die uns zugetragen werden und wir entscheiden dann, je nach Medium nach Ausgaben. Für Fernsehen ist es ein wenig klarer, weil hier ja für Slots produziert wird als bei VR Projekten. D.h. das sind alles außenstehende Produzenten, die Projekte zu uns tragen und wir davon meistens nur einen Teil finanzieren. Wir sehen unsere Produzenten als unabhängige Geschäftsleute an, die dann auch ihre gesamte Produktion kontrollieren. D.h. die entscheiden, was mit dem Geld gemacht wird, wir spielen dabei die ganze Zeit Inception. In Frankreich ist es ein sehr großzügiges, weites Fördersystem, in Deutschland gibt es das in der Form nicht – wenn dann nur regional und nicht national. Das ist dann sehr regional spezifisch, was dann für ARTE nicht so interessant ist meistens. Bei VR Projekten produzieren wir bei Projekten aus Deutschland 60-80% des Gesamtbudgets, auf französischer Seite nur 20-40% weil hier das Gesamtfördersystem und mittlerweile auch der Markt groß genug, dass wir nicht mehr als das finanzieren müssen und dabei trotzdem Mitspracherecht haben und der Rest dann refinanziert wird durch Förderungen, teilweise refinanziert durch Auswertungen, die der Produzent dann weiterverkaufen kann als Lizenz. Gerade im VR Bereich, noch viel mehr als im

Fernsehbereich, ist der Aspekt der internationalen Distribution sehr wichtig. Da versuchen wir auch vertraglich – die einzigen kreativen Leute, die wir hier im Haus haben, sind unsere Juristen – jede Grauzone für sämtliche Möglichkeiten um da etwas daraus zu machen. Je nachdem, weltweit oder eben nicht, was für den Produzenten oder für uns am sinnvollsten ist, wir wollen ja kein Geld verdienen. Wir wollen das beste Produkt, für das wenigste Geld für die glücklichsten Produzenten, weil wir wollen ja, dass die wieder zu uns kommen, weil sie immer noch da sind und nochmals ein Projekt mit uns machen. D.h. für uns, wir nehmen standardmäßig weltweit die Rechte. Wenn ein Produzent allerdings sagt, wartet, da hat mich HTC Vive angerufen, die wollen mein Projekt für den nordamerikanischen Raum haben, dann sagen wir – ok, für den nordamerikanischen Raum macht ihr was ihr wollt und treten ihnen die Rechte gratis ab. Das ist eines der Privilegien eines öffentlich-rechtlichen Senders, aber im Gegenzug dazu wie ‚Sky‘, die gerade sehr viel aufkaufen, koproduzieren wir. Das heißt, wir zahlen dann trotzdem mehr als die privaten, aber auch weil wir es uns leisten können und wir eben nicht diese ganzen anderen Obligationen haben.

B.E.: Zum Budget generell, steigt das Marketingbudget für 2017 im Vergleich zum vorigen Jahr an?

A.K.: Prinzipiell werden wir das Marketingbudget für VR dieses Jahr hochschrauben, weil wir generell das Marketingbudget gesamt hochschrauben werden aber auch weil wir noch so lächerlich klein sind. Und für mich ist Marketingbudget im digitalen Kontext Ausstrahlung. Du kannst ein Ding launchen, wenn kein Mensch weiß, dass es existiert, wird auch niemand kommen. Da ist ja nicht wie ein Audience Flow, wo du nach 20 Jahren Sendung, ziemlich gut sagen kannst, wie viele Leute da sind und so wie du gut sagen kannst, eine Sendung verdrängst du, wenn du sie in die dritte Prime nimmst – also nach Mitternacht. Oder wenn du es in der Prime ausstrahlst, gegen das Finale der Weltmeisterschaft. Das sind alles Aspekte, die du im digitalen Kontext nicht hast, weil hier alles on demand ist. Und gerade weil alles on demand ist und weil es alles im Überangebot gibt, ist der Marketing-Effort so unglaublich wichtig. Wir werden es also hochschrauben, die genauen Zahlen kann ich nicht verraten, wir werden im sechsstelligen Bereich sein. Das Budget für das Jahr wird immer erst Ende Jänner validiert, d.h. ich habe etwas beantragt, von dem ich gute Chancen habe, einen guten Teil davon zu bekommen. Was immer noch nichts ist, wenn man das vergleicht - das Marketingbudget für ein AAA-Spiel ist zwischen 20 und 40 Millionen Dollar. Und es gibt ja diesen industriellen Standard, für jeden Euro in der Produktion musst du einen Euro für die Distribution ausgeben. Wir sind heute bei einer Ratio von 1 zu 100 ungefähr- für 100 Euro

produziert, 1 Euro im Marketing. Wir versuchen umzuschichten, aber das Problem ist, umzuschichten bedeutet, dass das Geld irgendwo weggenommen wird. Die Idee kann ja auch nicht sein, einfach massiv Geld aus der Produktion wegzunehmen, denn die Produktion ist es ja, was als öffentlich-rechtliche Medienanstalt unsere gesellschaftliche Relevanz garantiert. Das wird auch eine große Herausforderung in der Zukunft, nicht nur in bezug auf VR, sondern allgemein – die Distribution.

B.E.: Wenn wir über Budget sprechen, kann man sagen wieviel Budget prozentuell in den VR-Teil und wieviel in den Spielfilm-Teil des Projekts *Notes on Blindness* gelaufen sind?

A.K.: Das sind zwei separate Produktionen. Der Spielfilm ist ein teurer Kinospieldfilm mit Reenactment usw. mit über einer Million Pfund Budget – als englische Produktion. Im VR-Bereich sind wir für ca. 20 Minuten Content bei ca. 400.000 €. Davon sind 130.000 € ARTE-Anteil. Also wir sind hier schon in einem ziemlich hohen Bereich. *I, Philip* wurde für 550.000 € für 14 Minuten und alles andere, was wir im VR Bereich gemacht haben, ist im fünfstelligen Bereich. *Hieronymus Bosch* kostete 40.000 €.

B.E.: *Notes On Blindness* wurde produktionstechnisch nehme ich an in Unity wie ein Game produziert?

Genau, die Produktion hat mit Game-Designern zusammengearbeitet und was ganz wichtig war, der Autor Aumaury La Burthe ist Tondesigner für Videospiele. Es ist also ganz stark auf Videospiel basiert.

B.E.: Der Ton in *Notes on Blindness* ist binaural?

A.K.: Ja, der ist binaural, aber wir haben eine downgrade-Version und die binaurale Version. Und für mich ist eines der stärksten Sachen von *Notes on Blindness*, weil es ja um die Entwicklung des Gehörs gegenüber dem Sehverlust geht, das ist ja ganz besonders metalinguistisch interessant. Für mich ist das Audiodesign eines der stärksten, nur leider ist es ein paar hundert Leuten vorbehalten, die die richtigen Devices und die richtig guten Kopfhörer haben, um das wirklich auch genießen zu können, d.h. damit gewinnst du Preise, aber damit machst du kein Marketing -noch nicht zumindest. Damit kann man durchaus Marketing machen, Ton wird immer wichtiger. Dolby Atmos beginnt im Wohnzimmer massiv zu existieren, all diese Sachen. Aber eben die Kombination von Ultra-High-Quality-Ton plus VR-Device, die ist schon einem sehr minoritären Publikum vorenthalten. Ich glaube, das wird ein sehr guter unique-selling-Point in den nächsten zwei bis

drei Jahren werden. Für *Notes On Blindess* im Oktober 2016 war es glaube ich noch ein bisschen früh. Wir haben es publiziert, aber eher in unserer b2b-Form. Insgesamt sind wir bei 5 binaural Projekten bei unseren insgesamt 35 VR Projekten – das sind *S.E.N.S VR*, *The Temptation of Saint Anthony By Hieronymous Bosch*, *Notes on Blindess, I, Philip* und das *Elisir D'Amore 360° Opera*.

B.E.: Zum Punkt des Donizetti und des Konzerts, würde mir noch kurz einfallen. Wie siehst du das, dass das 360-Grad Video für Live-Events wie Konzerte, Sport-Events, für euch als ARTE vielleicht weniger, aber generell wie siehst du da das Marktpotential?

A.K.: Außer für ARTE Concert, wo wir auch Live-Konzerte haben und wo wir auch zusammenarbeiten, wir beginnen jetzt schon, das ist ja erst seit 2 Wochen heraußen, mit Facebook 360-Grad Live zu arbeiten. Außer für Konzerte, ist es natürlich weniger interessant für uns, aber man kann es sich sehr gut vorstellen für Sport, für Reality-TV auch. Es sind zwei Bereiche, die wir bei uns überhaupt nicht haben. Ich würde das Marktpotential hier als hoch einstufen, aber für mich stellt sich da die Frage eher, in welchem Kontext das die Leute tatsächlich sehen werden. Ich glaube, das sind halt noch immer Events, die sehr stark mit klassischem Fernsehen verbunden sind, wo man halt immer noch einschaltet. Ich würde sagen heute ist es bei vielen Leuten immer noch Reality-Shows, Sport und Premium-Serien, weil man nicht will, dass dir jemand erzählt, wer rausgeschmissen wurde, wie das Match ausgegangen ist, oder das System des Spoilers am Montag in der Früh im Büro. Und das ist halt ein Kontext, der immer noch sehr „wohnzimmer-lastig“ ist. Da stellt sich für mich die Frage, was für Art von VR-Devices werden da die sinnvollsten sein. Oder geht es hier einfach nur um 360-Grad im Fernsehen, nur dafür fehlt uns halt die Smart-TV-Killer-App. Das Marktpotential ist groß, aber für mich ist es eine ganz große Interfacefrage, wie alles was derzeit mit Smart TV zu tun hat. Auch wenn ich denke, dass Smart TV das Potential hat, Fernsehen zu töten. Zurzeit ist Smart TV noch nicht sehr userfreundlich, deswegen denke ich auch eben für Live-Events, wo das eigentlich die logische Extension wäre, stellt sich halt die Frage, wie das Interface aussieht. Es gibt viele Möglichkeiten, es gibt die Möglichkeit einer Anbindung über z.B. die Alexa, es gibt die Möglichkeit einer Tablet-App und sehr viele mehr. Potential groß, aber eben die Frage, wie es dann genau aussieht.

B.E.: Für die Konzerte von ARTE wäre das dann eher 360-Grad Video oder Live?

A.K.: Wir experimentieren zurzeit, es muss halt immer noch gut rüberkommen. Zurzeit sind wir technologisch nicht entwickelt genug, um das richtig machen zu können.

Was wir heute in Facebook Live, oder 360 Facebook leisten können, schaffen wir heute nicht in 360 Live. Intern nicht und auch nicht mit den Produzenten, mit denen wir dafür bisher zusammenarbeiten. Ich bin mir sicher, in sechs Monaten sieht das alles wieder ganz anders aus und danach muss man die Strategie nochmals adaptieren.

B.E.: In Wien hast du die Netflix-App als meist-heruntergeladene VR App erwähnt...

A.K.: Ich denke, das ist ein wenig das Äquivalent zu unserer Heatmap und den Leuten, die einschlafen. Ich glaube man darf nie die Faulheit der Leute unterschätzen und da spreche über die intellektuelle Faulheit, um wieder etwas Neues zu lernen. Und ich glaube viele Leute, die sich diese Devices geholt haben, waren darauf gar nicht vorbereitet. Ich glaube das wird sich verändern, aber ich glaube das ist eine typische Sache von early adoption. Die ersten zwei drei Jahre einer jeden Technologie sind stark davon geprägt, dass nur die wenigsten sie auch so verwenden, also optimiert verwenden. Also wenn ich das jetzt mit anderen Technologien vergleichen würde, die in den letzten Jahren rausgekommen sind von Medien wie YouTube oder Facebook, die am Anfang auch sehr minoritär verwendet wurden, dann darf man diese early adopters nicht überschätzen. Die wenigsten davon wissen, wie man das optimiert verwendet und es gibt halt immer auch diese große Brücke zwischen einer Technologie und ihrem Potential und dem Moment, wo sie sich demokratisiert oder wieder verschwindet – 3D zum Beispiel als sehr schönes Beispiel.

B.E.: Oder sich in einer anderen Technologie wiederfindet, wie die Stereoskopie in VR...

A.K.: Genau, wo sich einfach das Device verliert und dass sich dementsprechend sich die Rezeption und damit auch die Narration verändern muss. Aber 3D ist halt eine schöne Lehre auch für VR: Wenn wir nicht die richtigen Inhalte haben, sondern nur entdecken, dass der Effekt mit der Verfolgungsjagd so super gut funktioniert, uns der gleiche Effekt in jedem Film existieren wird, dann wird es den Leuten auch irgendwann fad werden. Und für mich ist eigentlich das schönste Beispiel in dieser Richtung die Digitalfotografie: Diese wurde Anfang der 90er Jahre von Kodak erfunden, doch Kodak ist in Konkurs gegangen, denn es war zu früh. Das Potential war riesig, alle haben es gesehen, sie haben sich völlig übernommen und 10 Jahre später wären sie Marktführer gewesen, aber da war es schon zu spät. Für mich ist das sehr repräsentativ dafür, dass die Entwicklung einer Technologie und ihres Potentials nicht unbedingt der Moment ihrer Demokratisierung und der Moment, wo echt viele Inhalte entstehen. Und ich glaube im VR Bereich werden wir dann in die nächste Stufe vorstoßen, wenn es

nicht erste super-spannende Pilotprojekte gibt, sondern wenn die Autoren, die diese Pilotprojekte gemacht haben, ihr drittes, viertes, fünftes Projekt machen und dafür auch anerkannt werden. Dann werden wir in einer anderen Liga spielen und das wird noch ein bisschen brauchen. Das gute ist, dass offensichtlich sämtliche Investitionen weiterhin fließen und die „Contentproduktion“ dadurch dementsprechend rau gepuscht wird und so auch das Spreu vom Weizen getrennt werden kann und es einfach beginnt, Exzellenz zu geben. Und das ist eine erste Etappe, das ist etwas, was 3D in seiner zweiten Etappe (in ihrer 2010er Version) nie geschafft hat. Es gab die Explosion mit *Avatar*, und danach gab es auf einmal nur noch jedes Mal den gleichen Film und inhaltlich gab es schon einige interessante Ausnahmen, aber der Rest war halt jedes Mal das gleiche. Ich glaube, das kann bei VR völlig anders laufen.

Appendix D: Expert Interview Frédéric Peltier | 2017-Feb-17 | Paris

Frederic Peltier is a technology deployment director at Ubisoft for the mobile gaming sector. His expertise stems from his career in the mobile gaming development industry. Before working at Ubisoft, he was employed by Gameloft.

B.E.: You had mentioned you changed your position: what is it exactly that you are doing in your current position?

F.P.: Officially, I am technology deployment director, which is quite unusual for a position in the gaming industry. Usually teams or working with developers and there is someone above them who is technical director, which is someone coding and giving the right directions or where they want the projects to go. I am not doing that I am much more someone that is evangelizing teams trying to bring a new technology saying: Have you seen that? Do you think it is going to be worth working on it for a project? Do you believe that those new kinds of vibrations could work for your mobile game? So, this is much more what I am doing - which is close to a producer, kind of job, but related to technology. In mobile, it is evolving quite fast, which is not such a thing you have seen at Ubisoft in PC console they are working on hardware, which is lasting for five to seven years. So, whenever they are studying a new hardware they know what it is going to deliver and they are doing it for five or seven years. But on mobile that is not the case. You already have new hardware, new technology. For example, Apple is bringing out a new version of IOS bringing new features, so we have to see what we can do with that to bring new experiences to the customers.

B.E.: So you are still specialized in mobile games?

F.P.: I am only working at Ubi-mobile games, a specialized department within Ubisoft. We are 700 people among around 10.000, it's a bit less than one-tenth of the overall company.

B.E.: Has Ubisoft released any VR mobile stuff?

F.P.: No - we were expecting to release something, we have announced a partnership with Google on their Daydream initiative, which is a VR initiative which has been released in six countries I think quite now, not in France but in US, UK, Germany and Australia I think so a bunch of countries and Daydream is in 2017 to release

worldwide I think. So, we have been announcing a partnership with them, so have been working with them for a long time; they told us that this technology was coming, so we had studying VR for a long time with them but we have not released any titles. We have announced that one of our biggest IP *Hungry Shark* is coming to VR but we have not shown anything yet to public so it is about to come...

B.E.: It must already be in development...?

F.P.: Yes, it is already in development but we have not announced a fixed date because we want to release it whenever we feel it is mature enough to be played by people - we are not putting ourselves in the situation where we have announced a date and we must release it no matter what.

B.E.: I noticed that Ubisoft for the computer- tethered games it was also moved back, no? A few like the *Werewolves Within*...

F.P.: Yeah, *Werewolves Within* we released as well *Eagle Flight*, which I think was expected sooner in 2016 and at the end it was only at the end of the year, but that is something we have been doing for a long time at Ubisoft. We try to have release date in mind but if we were feeling that the experiences are not as rich as we were expecting, we take risks and we delay it. That is something that happened, it's a DNA of the company and we have been doing this for a long time even if it is sometimes quite painful when it comes to a company we stock options, we have a bourse. Every time we delay something, we know that the stocks are getting lower price, we do face the consequences and we do believe releasing at the right time is always the best.

B.E.: So that is a general policy of Ubisoft?

F.P.: Yes, we are always trying to anticipate something, that is also something part of Ubisoft DNA, we try to be there when a new technology is coming, we have been there with Nintendo, when the Wii hit markets, we were there with new innovative game plays, so when VR was announced we were interested in being part of the first key players and even if we were late with *Werewolves Within* and with *Eagle Flight*. You will be able to see that we were among the first of the big publishers, Activision, Electronic Arts, and Take-Two. We are among the five biggest publishers in the world and among these, we were among the first ones with something for VR. So even if we are late we are still among the first of the major players and this is something we tried to have in each new technology coming, so it was for the Wii, Wii You, for the Switch, we are working hard to be there with

Nintendo. The Nintendo switch has nothing to do with VR right now - it is maybe difficult for Nintendo to go to VR with that hardware because VR is something that requires lots of power, so I do not know how they will manage to do so with that device. And when it comes to mobile, mobile VR they managed to do make it happening because they put phones in headsets, but the Nintendo switch is so big so I don't see how they can feed it in the headset, but I may be wrong, but there is nothing announced yet.

B.E.: You are already talking about now mobile and the computer-tethered headsets - in which area do you see more potential?

F.P.: That is really difficult, as a personal feeling I still do believe that mobile VR will be the key for the future, for a simple reason: when it comes to costs, everyone is able to go to VR because he has a smartphone and when Oculus and HTC Vive gave their final retail price everyone was shocked but it would go to big prices like between 800€ to 1000€ and you have to had a computer which such a similar price. So, it is really a big step to enter into VR which is not the case with mobile. You just must have a Daydream, which is going to cost like 99€ or a Samsung Gear VR which is almost the same, plus your smartphone that you already have in pocket, so the entry-price is lower and we have seen with PlayStation VR that because they have set the price along four / five hundred they have a bigger market audience.

The price will be the first entry-point for having people going to VR. So I do believe that prices, smartphones, mobiles will be the best way to address mass market with VR. When it comes to wires, with computers, you have many wires, which you have to pay attention to, you will need a strong computer, you also have a camera and/or the satellites to be positioned, and you have to have a big room with two by two meters. It is quite not easy to set up something to enjoy VR easily when it comes to PC or console, but it is also the best experience.

The experience is better for two reasons: You have better graphics with a computer for sure, but also when it comes to motion sickness and feeling, you have a better feeling with PC headsets because with the sensors they are able to have they can do a better motion tracking, like translation with these technologies and this is not something you can have right now on mobile.

B.E.: Like less latency?

F.P.: It is not only latency; it's really that if you translate your head, you cannot have this move reflected in your game.

B.E.: With a mobile phone, you mean?

F.P.: Yeah because you don't have the sensors, you have the six-axis sensor that can see where your head is aiming at, but you don't know where your head is within the space, so if you don't move your head and fix something in front of you, if you just move your head on the x-axis (but don't tilt it), it works but you are not able to reflect it within a game, so the game camera will not move the same way as your head which provokes motion sickness. That's why when we are making games for mobiles we are trying to have experiences where people are not in control of the character movement. That's why we are seeing a lot of rail[shooter] experiences, where people are just in a wagon and they are just enjoying a ride or something, they are not in control what is happening with their body. If we are experiencing something like you move in a little room or something it won't work.

This is something you can do with HTC Vive because the headset is tracked by the game and they know where you are and you can reflect it in your game and it is ok and you are not feeling too sick, but that is not something that is right now possible in mobile, that - we know - is coming. We know there are lot of hardware manufacturers that are working on addressing motion sickness but also trying to address those differences between the PC VR, Console VR and the mobile VR. They are trying to see how they can improve for sure the graphic, so as I mentioned previously the console and pc are evolving at slow pace, even if it is going faster by every generation of console, but it is still something that is quite big with mobile we are seeing yearly technology improvements, GPUs are growing by 20 - 30 % every year, so you can expect rapid improvements that are going to reach skyrocket very soon. So, if you look in what NVIDIA for example is stating with their mobile GPU, they are saying that right now they are able offer X-Box 60, PS3 graphics within a mobile phone. So, in a couple of years maybe they will be able to offer PS4-graphic experiences on your mobile phone. So, little by little mobile is reaching what we can see on PC- and console, so this additional power will help mobile VR for sure.

B.E.: Originally, the idea of VR is like the HTC Vive allows the user to walk around - ideally without the wires. Then you mentioned the other advantages of the mobile VR – does Ubisoft put any priority on one of the two fields?

F.P.: There is no priority set on one of these, because we don't have any conflict within our studios to work on VR PC and VR mobile. We have dedicated mobile studios, which can address VR questions and VR projects and PC/Consoles ones able to work on VR. We are exchanging between us because something that is quite

essential when you are making a game is working on what we call the three C - which is a character, control and camera, are the three pillars of making a game that is entertaining, so you have to pay attention: is your camera fixed properly, is your character working ok and can the player feel he/she is represented within a fake world and the control - is your character easily controlled by the game part or the attached control, whatever you are using. So, the three C is fundamental of making a game. If you have issues with one of three pillars, then your game is not going to work and people won't play it because they are not satisfied with the way where the camera is and so on. When we discovered VR, we realized that the three C were completely reinvented, we had to make games differently as I mentioned previously. You cannot have people walking around as they want as you must make sure that as seen in lots of games that have been released so far we use a lot teleportation within games. So, games are in a fixed position, they are making actions, and then they are teleporting to somewhere else. We are not having them walking around to the next position. This was something that was decided as a key fundamental for VR games because it is creating motion sickness right now. Maybe when the technology will be much mature, in three, four, five years, and we will be able to get rid of motion sickness for good, because of better latency, because of whatever technology hardware accomplishment we will make, we will perceive things differently in game development, but this is not the case right now. Which is why when we had teams working on VR prototypes all their achievements were shared between mobile and PC-console because we wanted really to benefit from research and that is why we are trying to have common groups of people exchanging on mailing lists internally, but mixing different kind of developers coming from different universe.

B.E.: You mentioned motion in games – in *Eagle Flight* the user is moving too, why does it work in this game?

F.P.: Motion sickness is not very easy to - as far as I know scientists have not found a rule to pose of what creates motion sickness and why some people are more affected than others, but what we can see is that whenever you are going to have users to be able to feel they are really part of this experience, they are more prone to feel motion sickness. If they are able to identify themselves as the guy that is about to fall from a sky building they will have that high sensation, I feel it because I am scared of heights and when you are doing VR and they have demos and experiences in which you are on a skyscraping building and you are moving from one platform to another, I can see the streets far below and I am feeling like I am about to fall like in reality. And that is something you are not feeling when you are

doing *Eagle flight*. You could because you are in the sky and you can imagine that you fall, but in your head, you are like a bird, so it is all right to be moving.

B.E.: I guess it is the same for *Eve Valkyrie* - not a Ubisoft game - because you are flying, right?

F.P.: In that experience, you are in a space ship. Therefore, in your head, it is ok to have this kind of strange moves but it can still create motion sickness. I think Oculus graded it moderate because they have grades on how likely you are going to feel motion sick, so they are paying attention to that, so it's not only about latency but also about how hard you are putting your brain into such situations. So, this is not something you are experiencing when you are doing a VR movie, because you are in a seated position and you expect to see the big screen, you can see it at different angles but in the end your body remains seated and if you are experiencing it in your couch, it is ok for your brain. Generally, this is really tricky, that is part of the big challenges we are facing in VR in game development.

B.E.: To work around motion sickness seems to dominate the creation of content...

F.P.: I think that's because it is a revolutionary way of experiencing games but I have the feeling - that's personally though - I do believe that most of the market is feeling the same – that technology is almost ready, but not ready yet.

Oculus was expected, I think, in 2014, and they had to delay a few times their release date, because they were not happy with the screen because there was latency, because they were working on the external camera to get the position of the headset, because they were working on audio that is plugged within the headset and so on - lots of different reasons but also because they were getting feedback on the prototype that was called DK1 I think. People could get it through Kickstarter or buy ordering and we had lots of those DK1s to start prototyping on that and I think they got a lot of feedback around motion sickness which was really a major key super-force at that point. And even if they addressed that situation with new iterations with the DK2 and the real commercial device I think we still have a lot of room for improvements on that and I can't wait to see a new Oculus CES2 or whatever they call it but as right now the definition is not good enough for a screen that is so close to your eyes. You can see the pixel, so I think they will get rid of that at some point but right now to me, it is not the biggest major concern for us as game developers: It is not resolution, because bigger resolution will require a bigger 3D power so we will have issues with even a stronger PC as a requirement but it is more about how we can address latency, how we can trick, it will be I think something maybe it bit fancy, but it will be incredible to have the ear

tricked because part of our stabilization and feel of gravity is because of the ear, so if we have a way with a hardware device to trick those imitations maybe we will be able to address motion sickness. I think there is lots of ways to do it. So we are working on it and motion sickness is a big part of the problem because we feel that, or at least I feel that, hardware is not as strong as it could be, but I think that's normal when it comes to a new technology.... It is a bit expected but we know and there was an official statement by Oculus, I think from HTC Vive as well and from Sony PlayStation that were saying that they will only release their devices when it will be ok for motion sickness because they were really afraid of bad word of mouth and they wanted to avoid the public to be afraid of this technology. So, they really released the headsets when they thought it was ok, but I think there is still room for improvement.

B.E.: As you know, my paper is more about the video experiences in VR but also how it is touching the gaming industry. I read many articles and some said, VR is already well established in the gaming industry... You mentioned that the technology is not 100% there yet, do you feel that the gaming industry is nevertheless further in its innovation stage than the video industry when it comes to VR?

F.P.: We have an issue here because it is not to say we are better than the movie industry but when a film is made, so far in VR, it is just about displaying this movie within a 3D VR environment.

B.E.: You mean in a 360-degree video without being able to walk..?

F.P.: Yeah, exactly, so you know where your camera is, you have to create a new way of feeling things for sure, there will be lots of issues about, yeah we are making a new part only of the environment and we now need to fake the whole 360-degree environment for sure, but at least it is just about having this scene rendered. On our side, the issue is that the costs are becoming so high, we are almost reaching the cost of big Triple A movies, when you are taking an *Assassin's Creed* game, for Ubisoft is about 2 hundred million euros, it is about 1.500 people working more than 2 years on it so this is really huge and the market is so small.

B.E.: So, you are saying you have or you need the same kind of budget for a Virtual Reality production?

F.P.: People expect to have an *Assassin's Creed* -like great experience in VR, so have to figure out: Can you allocate that much people on that kind of amounts, on experiences that will only be entertaining like 20 to 40.000 people, I don't know. We don't have figures from Oculus, from Vive, from Sony on how good they are

selling their hardware, so we only can make guesses, estimations, we have Steam Spy - they are making some estimations on how many VR headsets are in a PC-industry. It is even harder on mobile, we have absolutely no figures from Google and Samsung, they are very silent about how they are performing, but what we can see: they are still trying, so that is why we are a bit in expectations. We don't want to be late, we are still working on it, we are releasing stuff, we are testing stuff but we are not allocating all Ubisoft studios for sure, not all of them are working on VR - it may happen that if it works, we will be there for sure, but right now it is very risky and that's why when I was saying we are among the first to be there in VR, we are also among the first to have announced something in VR. So it is not only about winning competition of being there first it is also being among the only ones that clearly announced making investment on this particular market, so we will see if it pays but it is quite risky, I am not in the movie industry but I do believe that this is also something that is quite challenging. Right now the main things I have seen are about making 360 commercial marketing video promotions on YouTube and stuff, but I have not seen lots of real movies announced in 360 because that's going to be also a big challenge.

We have been releasing as well some trailers in 360 for YouTube, we have been releasing, I think, a very interesting trailer for *Assassin's Creed Syndicate* last year on YouTube, so you can see the *Assassin's Creed* movie is slow motion and you are going to kill a target, but this was just to make the buzz, we haven't been releasing *Assassin's Creed* in VR and that is not something that is planned as far as I know.

B.E.: Well, and that's out of your field but outside from your perspective, so within the film industry which field would have the most potential in your opinion?

F.P.: Right now, what we are seeing that the costs make us only target gamers that are really willing to spend a lot of money on new devices and so on. So, we are not making a candy crush-like game in VR, it would not make any sense because the women between 15 to 35 have not experienced VR that much and will not be willing to spend too much time in it. So, we are targeting hardcore gamers, so far.

B.E.: Even with mobile...?

F.P.: Less-ly with the mobile stuff because *Hungry Shark* is for a mass market, we will see what audiences we get with this game but we will be surprised if it were something different than mainly male between 15 and 35, to be honest. Daydream headset is not something I see a lot among my friends and family, only the guys are talking mainly about it so far, so I would be surprised, but who knows.

B.E.: Is the content adjusted to that as well, do you think like to a male audience?

F.P.: Yeah, sure. *Hungry Shark* is a big mobile IP we are having at Ubisoft mobile - it has been downloaded I think either 250 million times so far on mobile in 2D.

B.E.: Is it free-to-play?

F.P.: Yeah, it is free to play ..., so you can play free and hit fish freely and if you want to get bigger sharks, you can try either play long time or pay for some little in-app purchases to make your progression going faster, the usual free-to-play mechanics actually but yeah, we are bringing this IP to VR and even if it is mass market game anyone can play the shark - and hit fishes, we do think that people will be attracted to it will be mild gamers that are willing to try to have these fun experiences for some time and then we want to move on to something else because what we seen so far in VR as well, it is mostly about timed experiences. People are expecting games to last 30 minutes and switch something else, so the business model is not fixed yet for this game and so and so - it is something that is not clear for us yet. That is also something what we are trying to assess – what is the market actually for VR, what is this market expected, what kind of games we can make for it.

To get back to your question on what kind of movies would work even it is not in my area for expertise - I would say animation movies for sure because when you are using computers to create your movie you can make 360 environments more easily. So definitely, it should be cheaper or easier to make and yeah some science-fiction movies and documentary could work well, but not the usual comedy film you are seeing on Sunday evening will work well, at least not for now, maybe later... Or maybe there is a potential, that is also something that I personally think it will happen, but we have this feeling with few colleagues that VR movies would work well for Japanese guys because they are having so little apartments with little rooms and so on and you are able to experience movies in two meters, by two meters on screen easily, so we thought it would be working that well.

B.E.: How do you judge marketability of the interactive kind of film experiences which I have mentioned in the survey, in which you can maybe choose between two paths, an experience that is not really playing a game but you have a little bit of interactivity?

F.P.: I don't know, I think that is something that has been attempted a lot of times, for long time to have interactive movies without VR, but it was not that successful because I think it is going to cost a lot just to shoot all the different elements of

scenery and so on, which is something to achieve more easily in the video game industry and even we have not been that successful, so I am not sure it could work, I don't think so.

B.E.: We were talking about the free to play business model before - how do you see that in conjunction with VR. If it is mobile VR maybe people are expecting it to be free to play? What's Ubisoft's perspective on that?

F.P.: Well that's a tough question - I won't speak in Ubisoft's name but I can just speak about global facts that I have been seeing so far, if you take Oculus Samsung Gear VR Store, you can see a lot of premium content for different reasons:

First one is that people have invested to make those games, so they want to get quick return on investment so the best way to get quick return on investment is by going premium, because you know that if there is like one hundred thousand people playing, you are making one hundred thousand x Euros thanks to that so that you can quickly know what you are going to get.

B.E.: Do you mean by premium content that the user must pay for initially?

F.P.: Yeah, you pay to access the game; this is what we call premium. So, premium games were there like five, six years ago on IOS and Apple Store were only making premium titles. I was not at Ubisoft at that time, I was at Gameloft and we were among the best with the premiums content, it was working, it really exploded this is not a working business model on mobile anymore. Everyone expects games to be free and you only can make return on investment thanks to the few people that are paying among the big mass of none-paying user.

So if you have a game that is about only to bring you 5 of 10 % of paying user among the all playing users you have to have a big market otherwise it is not working or not worth it. People are going premium right now because it is less risky.

The second point is that we do believe that technology-enthusiasts that are the first ones to come to VR are much likely to be hardcore-gamers, which are much more frequently complaining about free to play. Hardcore-gamers are less likely to like free-to-play games because they don't want to lose against someone else because that guy has much more money than them, other than has much more skills than them. So those reasons let us feel that in 2016, the biggest part of the VR market was premium. What we know is that also the purchase experience was not working in VR properly. Oculus was there for long time on mobile VR, it think it has been one and a half now and you had to first purchase your game, then put

your mobile-phone on headset and then play it. You could not make purchase easily within your headset. So when you are trying to make money on free to play, and we are doing it in the normal mobile business, you have to make your purchase experience as frictionless as possible. So it was not the case, so you cannot expect a good conversion ratio, when the experience is a night-mare. This is something was addressed by Google, and that is likely to be addressed by Oculus 2. You can purchase within your Daydream experience. When you plug your phone and when you are entering the Daydream home environment you can browse your application, you can start downloads and you can purchase as well.

B.E.: And you have a controller...

F.P.: Yes, you have the controller helping as well, but I think that even without the controller they would have made it that way because as I mentioned if your transactions are not frictionless you are not going to transform at some points. If they want to push free-to-play as they did on mobile, they must make it easy for people to consume, so the market was not ready, the experience was not ready so the free to play model may happen, may explode as it did on mobile previously but when figures/ audiences will be there and when the experiences will be perfect, which is at least on the second part going to happen quite soon -as Daydream is going worldwide and coming with a frictionless experience. So maybe we will see free to play coming, maybe we will see something in between - we had this kind of experiences on console the 'try and buy-experience' so you have the game that you downloaded for free, but you have only the first level. Then you have to unlock a premium price to get the whole experience. So, you are not asked to buy it regularly, you only have one pay wall, as we call it, and this pay wall is happening at some point late enough that you can have a feeling of the great experiences you are going to have, but not to fall so you cannot at least tease him with some new stuff happening after that. It is not something you can sell on mobile, normally speaking not anymore, as a last biggest example is Nintendo with *Super Mario* in December. *Super Mario* which is free for everyone but only the first three levels, if you want to go above that, you have to pay 9.99€, which was medium successful, they had lots of bad comments because of that because people are not used to do that anymore on mobile, they expect the whole experience for free but maybe on VR it will the way, we don't know yet. This is something which is not clearly defined; we will see where it goes. So, that's the third possibility besides premium free and free-to-play, the try-and-buy model...

B.E.: So, this model is evolving now?

F.P.: Yeah, definitely, we saw that happening on mobile it was exploding in three years, premium went to free-to-play in three years, it may happen the same way in VR, I see. Or maybe VR will never happen, maybe, I don't know, we will see. They try to make it happen anyway, the big players, Facebook, Google and Samsung.

B.E.: On the PC side, I read just yesterday an article, it's like that the *Eagle Flight* got converted into a multi-player cross-platform game, like so the PlayStation guy could join the Oculus-platform.

F.P.: On mobile we won't be able to play with the PC-console for now, maybe because PC and console have a stable internet connection, which is something that you do not have on mobile. So when we were doing a mobile development, I am speaking generally only about VR but online is always a specific component, in a lot of cases you are losing on network or you are going under a tunnel so you have to figure out all this cases that you are not going to have in front of your TV with your console, so it is very difficult to imagine tomorrow mobile playing with PC and console VR, also because the experience is not the same right now as I mentioned, the body tracking is not there, you are not going to be able to offer something similar because if we take another game *Werewolves Within*- the graphic are not so incredible, it is running on various amount of platforms on PC and so on, so we could image to have a degraded version on mobile, but we don't have the head tracking that is allowing us all the moves we can have on *Werewolves Within*, so that's complicated. On *Eagle Flight* we could imagine it on mobile but the environment are so big, even in terms of space, a blue ray is so big, it is like 50 GB of data, we can't offer that on a mobile phone when the so entry devices start at 60 GB and you have your photos on your phone etc.. So, we have less space, we have constraints that do not make this possible and to speak about *Eagle Flight* being cross-platform. It is not something that is easy as well but it is something that is historical. We were never able to easily offer, and I don't think it even exists, multi-player experiences between X-Box and PlayStation. You are not able to do what you want on those platforms. Sony and Microsoft had decided how it works and I don't believe they are not making it easily doable... What we have seen in the past - not in VR - but that may open doors for us is that consoles are agreeing to have a PC working with them, but not consoles among them. So, X-Box is not working with PS 4, but we have seen a lot of PS 4 - games working with PC-games and X-Box1 games working with PC-games. They have announced recently is going to work *Guilds of Warfare*, they are going to make some modes working between people playing on PC and on console. so I think that those first

steps happening in normal video game industry will be happening in the VR as well, but, well it is still not that clear. We have seen exclusivity which is something quite strange on PC, we have some seen exclusive content for Oculus, which is not something that is common on PC, that is quite unexpected, so if they start to put limits on hardware that is not going to help VR at all.

B.E.: When we first talked about it like some time ago, we had a chat like there ... how is that about the different versions like for one game like *Eagle Flight* like you do it on the Oculus and on the HTC Vive and then because the HTC Vive you know you can do more, so when you have to develop it treated differently, right?

How much more effort and costs goes into the different versions or how do you deal with this matter at Ubisoft?

F.P.: That's tricky.. We have been doing this for a long time because the consoles are different, so Ubisoft Teams are used to work on different kind of hardware and adapt to that so what we could achieve on PS4 is not likely to be the same as on X-Box One. It is less true nowadays because those consoles are a bit more alike than they used to be in the past. XBox360 and PS3 was very different kind of architecture and even the way we were developing it was quite different so it was much more headache for us at that time, it is less likely today but we have been used to develop - if you have Nintendo devices on that the motion control, so we always manage to handle that on a developing point of view - but what we try to do is always to take advantages of the different features we can see on these platforms. So, when we were doing games for the Nintendo Wii U, if we take *Rayman* for example, we are using the game pad and offering a five player to be able to play with the four other ones creating platforms, we try to make gimmicks, little game plays. We have sometimes exclusivity with those platforms, so I think *Eagle Flight* was first on Oculus Rift. So, this is timed exclusivity.

So this is something we are doing with partners because they are bringing some interesting stuff on the table as well as offer them exclusivity - I have no idea what the deal was about but you can imagine it is not only about money, it is also about getting visibility by being part of the official communication when Sony was revealing the PS VR and making TV-advertising which is costing a lot, having your game being part of the portfolio of games which are shown at the reveal is really something valuable, so maybe this it was what make us decide to offer exclusivity and then you open to the other market, when the exclusivity deal is finished.

Sometimes games are exclusive to one platform but as far as I know it is not the case at Ubisoft. I can't recall again a game that this was not the point on other

platforms at some point. Even the *Rayman* was Wii exclusive for our time, finally arrived at PS4.

B.E.: If a new headset came out now, would you have to readjust a game again to make it compatible for the new headset each time?

F.P.: Yeah, well on PC when you are making a game you can't address all the different kind of GPUs, there is like thousands of different devices. It is the same on mobile, the entry devices are tons of devices with different resolutions. What we know on mobile is that Google is trying to help us as developer by having a label Daydream certified, so Daydream certified, will be compliant to a different amount of resolutions, latency, GPU power and so on, that help us to define the minimum specification requirements that we will have to meet for games and it is the same on PC. They say that we had to run I think it was on a Geforce970 that allow the resolution we are targeting and then we are trying to offer what we can on a higher end. If a new device is released maybe we will have better latency and so on and by default, the games will take whatever the hardware allows us to get. We are not fixing a contract for example, for like the movie industry, the number of frames, not always at least on normal gaming industry. On VR, it is maybe different; we have a limit of frame rate to reach to avoid emotion sickness. On mobile we must be at least at 60 FPS to be comfortable, on PC, I think, Oculus put the bar at 90 FPS, but if the game is running 120 because you have a better hardware, it is not a problem.

B.E.: I guess that's possible because you have like the real time rendering in games and many videos are pre-rendered experiences...

F.P.: Exactly, there were some issues in the past, very long time ago when games were made using a blocked frame rate, so the speed at which your character was moving was time based. So if your GPU was rendering images faster, the character was moving too fast but it is not the case anymore, we are not programming that way anymore so we do not have an issue.

B.E.: You talked about Daydream, how they give out all these specifications... Do you feel Google is trying to be the universal kind of platform?

F.P.: Yeah, I think they heard us. They heard our complaints from all kinds of developers and a common feedback they have been receiving for around 5 years, is that is there were no big constraints on hardware manufacturers when it comes to mobile phones which is creating the big mess where evolving right now we have lots of different kinds of devices on Android and they knew to get content for VR

they have to make clear specifications for two reasons: - for content provider to be able to provide a satisfactory experience that will run properly and - for the end user, the final consumers because if VR is not good, as I mentioned, they are going to lose a mass market. So they really need to have a high quality experience and when they made the card box, which was really a bet, I don't know, they have seen lots of people coming with cheap headsets, even on Amazon you could find VR headsets, 20 Euros or so, and they were lousy. So, I think they wanted to avoid that, they really wanted to say ok, Daydream is really going to be some professional quality and joyful experience and for that to happen we have to fix those issues. So, for me that's a good thing for everyone, for end users, for us as publishers and even for the manufacturers because they want get that label easily and they will be able to know requirements, their phones will be part of something that makes sense, so for me it is really something good for everyone.

B.E.: One last question: which area do you think VR will be most successful or which areas maybe, you can name a few? For which industries do you see the biggest potential?

F.P.: Hmm, that's difficult - I think gaming and movie industry.

B.E.: In the long term...?

F.P.: Yeah, much more than tourism and something like that. I know lots of people believing on - that's not my case, I am maybe wrong but definitely movie and gaming industry, because it is not like when they put some glasses and say: look it's going to be 3D in your living room. I was not very enthusiastic about that technology but VR is something different. So, I cannot believe that this will change so the way we are experiencing things and when mobile gaming was happening, lots of people were seeing this as making crappy for five minutes and now the discover that we can make interesting entertaining little games for sure, maybe they will only consume in the subway, but still it is a part of your life, maybe that was not that expected and I believe we can do the same in VR.

B.E.: So, you think VR will be more in the entertainment sector than anything else?

F.P.: Yeah, if you ask me on a professional field, I would much more believe in AR than VR.

F.P.: Yeah and maybe that's why Microsoft is only releasing their HoloLens at very high prices because they know that only this is going to be professional. So entertainment VR, that's my guess..

Appendix E: Expert Interview Guillaume Fortier | 2017-Mar-04 | Paris

Guillaume Fortier is an engineer specialized on vision. He worked in multiple vision oriented projects over the past 10 years such as face recognition or shape detection. He has been working for motion-recall for a year and is a software engineer in charge of 3D reconstruction from camera feed.

[For this interview, Gabriel Prevot (marked as G.P.) took the role of an additional interviewer to support for translation purposes.]

B.E.: Could you please explain us a bit what your work is about?

G.F.: Yes, I can. We make 2 things in the startup. The first one is the main product we want to do. It consists on a camera that can film at 360 degrees and the idea is to go out, to make a film. And when you come back, you can reprocess your film, you can see your film in 360 and you can see the trajectory of your camera. And so you can go in another point of view, to see another thing, to change the point of view of your film.

B.E.: So that would mean like 6 degrees of movement and ...

G.F.: So the idea is just to go, to film and after we have some different kind of software to see the film and make a 3D reconstruction of the scene. So you can reconstruct all your scenes in 3D. And knowing this you can change your point of view as you want. The idea is to look the movie in a virtual reality helmet. We have exactly 4 cameras, to see all the different directions. So after you combine all the 4 different videos to make just 1 in a spherical environment. Like a GoPro, they do the same.

G.P.: Vous, vous utilisez des caméras classiques ... ?

G.F.: Oui, classique.

G.P.: Après vous déplacez votre caméra sur un axe, vous savez de combien vous l'avez déplacé et après vous pouvez calculer les temps de vol. C'est pas ça que vous faites ?

G.F.: On fait de la reconstruction 3D à partir de 2 cameras, on fait de la stéréovision. Donc on a 2 caméras qui filment... Alors pour l'instant on fait des tests sur une vraie caméra stéréovision, c'est-à-dire qu'à partir de 2 caméras on peut

reconstruire tout l'environnement en 3D par triangulation. Pour l'instant c'est de la vision pure. On utilise pas temps de vol. On a fait des tests avec, les données ne sont pas très fiables.

B.E.: Ok, so they have not 4 cameras, it's 8 cameras?

G.F.: Just 4 fisheye. But for now we have use one normal stereo camera more. It's 2 cameras put on the same axis and can reconstruct in 3D the environment. But just in the direction it saw the scene. And so after, we got 4 others cameras, but fisheyes cameras with big angles. The fish eyes have 180 degrees, they are here to capture all the scenes and make the 360 videos.

B.E.: But the fisheye cameras are not stereo cameras?

G.F.: No, but we know exactly their positions so we can make stereo with 2 of them. Because you know, you need just stereo to have "recouvrement" (overlap) area. You need to have points on the 2 cameras. If you can see the same point on 2 cameras, you can reconstruct this point in 3D.

G.P.: You know the exact distance between the 2 cameras and you see the same object you can see the depth of it actually.

B.E.: Because it's fisheye it overlaps ...?

G.F.: Yes, you need some overlaps between cameras. On en a 4 pour voir dans toutes les directions. En, gros si tu en met 2 en opposition, tu as déjà 360 car c'est 180 à peu près le champ de vue. Sauf que là, tu n'as pas de recouvrement, et ce que l'on fait c'est que nous les avons mis à 120° chacune, ce qui fait qu'elles ont à peu près 60° de recouvrement chacune.

B.E.: So, there's many overlapping parts. But the fisheyes do no cover each other completely.

G.F.: Non, pour l'instant c'est de la recherche et les fisheyes sont surtout là pour la video, pas forcément pour de la 3D. Pour la 3D on a une autre caméra stéréo, que l'on utilise pour le moment. Et après si nous pouvons, nous enlèverons la caméra stéréo et nous ferons la 3D qu'avec la fisheye. Sachant que l'on peut faire la 3D même avec une seule caméra, si tu arrives à savoir comment la caméra se déplace, que tu as exactement sa position d'une frame à l'autre et du coup, tu peux remonter en 3D.

G.P.: Je pensais que c'est déjà ce que tu faisais.

G.F.: C'est ce que l'on fait, mais pour l'instant on le fait avec une stéréo car c'est une technologie que l'on maîtrise et pour laquelle on est sûr de la distance et de la

profondeur. Les algos sont maîtrisés. Et l'idée c'est ensuite d'enlever la caméra stéréo pour n'utiliser que la caméra mono. Le problème est qu'avec une caméra mono, il existe une incertitude sur la profondeur, il est possible de reconstruire la scène en 3D mais elle ne serait probablement pas à l'échelle.

G.P.: Mais si tu connais exactement la distance de la caméra.

G.F.: Si tu connais exactement le déplacement, il n'y a pas de problème.

G.P.: Qu'elles sont vos pistes pour régler ce problème ?

G.F.: On regarde, pour l'instant nous sommes au début. par exemple, on pourrait ajouter l'utilisation d'un IMU pour calculer le déplacement de la caméra. Pour le moment, on le calcule par software, on lance un code qui fait du SLAM, qui s'appelle le SLAM en robotic. Le SLAM est un code qui calcule une trajectoire et fait une carte de la scène. Et du coup, il est capable de calculer la trajectoire et la position de la camera.

Pour l'instant, nous utilisons ce qui existe, l'état de l'art, la stéréo. Mais notre direction, c'est au-delà de l'état de l'art du coup c'est expérimental.

B.E.: Doesn't the fisheye distort the scene a lot?

G.F.: It's my job to undistort the fisheye footage..

B.E.: OK, I see. But when you put together the different parts and make it like one 360 video, do you have a lot of issues? Does it look correct or does it need fixing?

G.F.: Well, it depends. We don't work a lot on 360 stitching, but we have tests some good software like autopano de Kolor.

G.P.: Donc vous offrez une alternative à l'usage des technos des autres entreprises qui ont fait les choix du LiDAR, des caméras lightfields, etc...

G.F.: C'est l'idée, avoir une caméra qui filme dans toutes les directions et après avec fait le film, ce n'est que du software qui calcule la scène 360, la trajectoire de la caméra, qui calcule tout.

G.F.: And so we have a 2nd product. The second product is different than the camera but use the same technology. It was to create a big room of 10m by 10m and 4 people can enter the room with VR headsets, and we can have a scene and interact with objects in the scene.

We use exactly the same technology with cameras to compute the position of people in the room.

B.E.: In this you said scene, so what is happening, is it like a game?

G.F.: Yes it is mainly for game, like escape room games in real life.

B.E.: I have never done it, but I have heard of it.

G.F.: Donc l'idée, c'est avoir une salle fermée avec des choses à faire dedans et on peut changer l'univers, les avatars, à peu près tout à moindre coup.

B.E.: So you basically have to solve different assignment in the virtual room before you can escape. But can you also touch things and stuff like this?

G.F.: Yes, for example you have a chair un the room, you can touch the chair and you see it in the headset.

B.E.: So it's a real chair!

G.F.: You can change the environment and have an old chair or a new chair. You can change the kind of looks depending of the environment you load.

B.E.: I have another question. As I understand, you are trying to do this camera so it's less expensive to do this 360 scene where you can move, is that right? Without using professional devices?

G.F.: Yes.

B.E.: What does your company have in mind? What kind of content will be produced later, where do you see the potential for videos, which kind of videos ?

G.F.: Le marché, c'est la grande distribution. Le but étant d'aller au-delà de l'état de l'art, c'est difficile de savoir les cas d'usages finaux, ce qui sera ou non possible de faire. Par exemple, on pourrait imaginer faire une descente de VTT filmée et tu vas pouvoir reconstruire en 3D ta descente.

Une personne descend une pente en VTT en filmant. Donc tu peux rejouer tout ton film que tu as fait en 360, et en plus de ça tu pourrais te décaler de la trajectoire, te mettre à un point plus bas et tu pourrais te voir passer. Et à ta place, il y aurait un avatar, car sur la video tu ne te vois pas. C'est un peu l'idée.

B.E.: And where do you personally see the potential to be good for video content ?

G.F.: ça dépend de l'exigence des gens, personnellement, je vois ce qui est faisable en reconstruction 3D. Mais tout dépend du compromis acceptable entre réalisme et virtuel. Si une personne veut filmer en 1 passage et obtenir un rendu ultra réaliste, c'est très difficile. Il va y avoir des trous dans les objets, Il y a des choses que la caméra ne va pas filmer et que tu ne pourras pas reconstruire. Du coup, c'est dur de se projeter sur l'appli. Le fait de changer de point, c'est le plus dur. C'est le but et l'originalité mais c'est ce qu'il y a de plus dur.

Un autre exemple, on pourrait s'en servir pour un appartement. Tu le film et tu te balade dedans, tu pourrais le reconstruire en 3D.

G.P.: Par rapport à rejouer un film 360 3D dans le casque en suivant la trajectoire de la caméra et le faire dans une environnement reconstruit en 3D, y a-t-il une vrai différence ?

G.F.: Quand tu regardes un film 360, l'image est projetée sur une sphère située à une certaine distance. La reconstruction permet d'avoir une meilleure immersion, car les objets, les décors donnent l'impression d'être vraiment à coté de toi. Donc il y a un réel intérêt.

Appendix F: Expert Interview Christopher Jeckl | 2017-Mar-21 | Vienna

Christopher Jeckl is a renowned filmmaker in the field of advertising, based in Vienna, Austria. In 2015, he founded the company 'hyde.media', which has already produced Augmented and Virtual Reality projects. In September 2016, Christopher Jeckl organised the first Holo-Lense-Hackathon ever to take place in Austria and in the same month, he organised the first Austrian Mixed Reality Workshop.

B.E.: Könntest du bitte kurz erzählen, was du im Bereich Virtual Reality bereits gemacht hast?

C.J.: Wir haben begonnen mit 360-Grad Filmen, das waren die ersten Dinge und da gibt es halt gewisse Einschränkungen für das Medium und haben dann das Ganze weiterentwickelt und jetzt machen wir hauptsächlich gebaute Sachen, sprich digital erzeugter Content.

B.E.: Da gibt es schon Konsumenten dazu?

C.J.: Das Hauptproblem ist ja, dass es keiner benützen kann. Es gibt ja wenige, die überhaupt die Hardware zu Hause haben und deswegen muss man sich Einsatzzwecke suchen, wo man die Konsumenten mit dem versorgt und ihnen das zeigt an gewissen Orten und zu unterschiedlichen Settings. Es ist immer noch eine Spielerei muss man sagen. Also es gibt noch keinen wirklichen professionellen 'case' dafür, es gibt ein paar Sachen wie Präsentationen - also alles was Präsentationszwecke gedacht ist... Ich sage einmal so, es ist für mich die Evolution von klassischen 3D Animationen, weil im Endeffekt kannst du als Architekt zum Beispiel (die profitieren recht stark davon) kannst du auch in einer Handskizze oder 2D Skizze jemanden den Plan aufmalen. Dass man dann begonnen hat, in 3D Räume zu bauen und ja schauen wir einmal am Computer und machen das vielleicht so, ist ja noch ein zusätzliches Verständnis für das ganze Objekt, aber in Wahrheit brauch ich keine 3D Simulation von einem Haus.

B.E.: So wie du sagst Architektur und ich habe gesehen du hast in der Automobilindustrie schon Sachen gemacht, du kommst ja aber eigentlich von der Filmvideoindustrie, also momentan sind die b2b - Anwendungen eher nicht aus dem Film-Videobereich. Wie siehst du das?

C.J.: Also Film ist für mich nicht interessant... Es gibt so viele Jahrzehnte Filmgeschichte und es hat einen Grund warum Filme so sind wie sie sind, mit vielen Schnitten, dieser Spannungsbogen. Die wirkliche Wirklichkeit ist halt nicht so gut erzählt, wie ein gut erzählter Kinofilm oder ein gut erzählter Film. Also wenn ich jetzt als dritter Beteiligter zuschauen muss bei jeder Szene, man steht daneben und passiert halt so, das ist nie spannend. Das war vielleicht lustig in den fünfziger Jahren, mittlerweile ist das nicht mehr so interessant. Und beim 360 ist es halt so, du kannst nicht groß schneiden, du bist immer der unbeteiligte Dritte, hast aber nicht den Freiraum dich zu bewegen, wo du willst. Bist zwar immer dabei, ich sag immer so 360, ich finde 360-Grad Filme immer ein bisschen 'Spannertum', du stehst dabei und du musst dir alles selbst erarbeiten, du weißt nie wo du hinschauen sollst. Ich sehe hierbei den Mehrwert nicht so richtig, wenn ich über Stories rede und über Film. Also es gibt sicher einzelne Cases wo es gut funktioniert, weil halt alle POV-Sachen usw, natürlich ist das irgendwie interessant. Aber die POV-Filme die in One Shots, die wirklich aus POV Perspektive erzählt sind, das ist total auf einer Hand abzählbar.

B.E.: Also die meinst so First Person-Perspektive?

C.J.: Also da gibt's sicher paar lustige Cases, wenn man das so erzählen würde, aber du wirst nicht jeden Film so erzählen und ich glaube es limitiert halt mehr als es bringt. Was ist der 'Benefit' von 360-Grad Filmen? Und irgendwo gibt es was, was ich sehen will, das ist ein Highlight und das schau ich mir an und das Highlight ist genau die Handlung mehr oder weniger und da bin ich dann dabei und das schau ich mir an. Was interessiert mich dabei der Kühlschrank hinter mir?

B.E.: Und wie steht es um Interaktive Experiences, also die so ein bisschen Mischform aus Spiel und Film?

C.J.: Also wir kombinieren das, was ich spannend finde und wo ich durchaus Film mache, ich kombiniere diese Elemente. Wir versuchen so Sachen zu machen, wo wir immer bewegtes Bild oder reale Umgebungen kombinieren mit digital gebautem Zeug in der Nähe, also so, dass man sagt das ok das ist Kulisse, das ist die Textur im Endeffekt. Du hast eine reale Textur von irgendeiner Umgebung in der Weite und hast aber in der Nähe etwas Gebautes, weil für mich VR ist Interaktion. Die freie Bewegung in einem virtuellen Raum und dort mit allem zu interagieren, mit allem wie du es normal machen könntest, das mit allem zu Interagieren ist für mich das Spannende. Das Umschauen ist ein kurzer Wow – Haha - Effekt, wenn man es noch nie gemacht hat, aber das Umschauen ist so verpufft. Und dann wirklich einen guten Content zu haben, das ist Interaktion.

Interaktive Dinge zu basteln... - da bemühen wir uns halt was in diese Richtung zu finden, was halt spannend ist.

- B.E.: Also, computergenerierte Sachen, real-time-rendered content?
- C.J.: Also alles in Game-Engines gemacht und das halt kombiniert. Und da gibt es unterschiedliche Arten, wie du dich in dieser interaktiven virtuellen Welt bewegst, ob du einen Controller hast usw., mit Infraroterkennung usw. und so Sachen, das hat alles Vor- und Nachteile.
- B.E.: Da wird ja stark dran gearbeitet, an der weiteren Entwicklung, dass es nicht nur Controller sind?
- C.J.: Ich würde sagen, Controller sind super in gewissen Dingen, aber nur in Kombination mit, also, wenn ich im echten Leben keinen Controller brauche, warum brauche ich es dann dort? Und wenn ich was mache, weil ich ein Werkzeug in der Hand habe im echten Leben dann ist es auch für mich ok und in Ordnung, wenn du es in der virtuellen Welt machst. Aber wenn du jetzt irgendetwas brauchst, damit ich es dann greife und ich muss auf einen Knopf drücken dann finde das Ganze ein wenig schwierig, das nimmt das ganze heraus...
- B.E.: Also das nimmt das Intuitive heraus, meinst du?
- C.J.: Ja also, im Endeffekt, wie soll ich sagen, ... VR Ist für mich super spannend, ich bin ein großer Fan. Ich glaube aber, dass es
- a.) noch länger dauern wird bis da wirklich man sagt, weil das ist ein bisschen die Katze beißt sich in den Schwanz, solange es keine User gibt, die das Zeug zu Hause haben, gibt es keine Hard- Software die das spannend macht, damit die User zu Hause wieder sagen ok jetzt kauf ich mir das.
- Die großen Labels wollen kein Geld hineingießen oder nicht Unmengen Geld, sondern jeder macht ein bisschen was, aber wie ein Blockbuster kommt es nicht und da hast du schon die Marktsegmentierung auf dem Gamebereich: Jetzt musst du schon den PC für X-Box und für Play Station was machen. Wenn ich jetzt noch für Rift und Vive was machen muss - steht das überhaupt in Relation zum Aufwand, wieviel Leute erreiche ich damit? Es wird noch lange dauern. Das heißt in der Game Szene wird es vielleicht einige Titel geben, die sind ganz interessant, die können aber nicht competen mit tollen Graphiken etc., die User sind total verwöhnt, aber die wollen die Spalten Dinger haben, aber diese kosten viele Millionen in der Herstellung, und wenn ich es niemandem verkaufen kann, mache ich es nicht.

B.E.: Also für den Content Producer ist es noch sehr riskant momentan...?

C.J.: Ich glaub es ist momentan überhaupt kein Geschäft für die breite Masse, das ist nur Idealismus sagen wir mal, aber ich glaub mit der Zeit wird es billiger werden, es wird weiterkommen, gerade im mobilen Bereich erwarte ich mir einen ganz großen Schub

B.E.: Das wäre noch eine Frage...

C.J.: Gerade im mobile Bereich hat ja jeder so in der Hosentasche, irgendwann kriegst du dieses Ding dazu und brauchst dann nix mehr dazu und es gibt Content, den du dir so anschauen kannst und da gibt es sicher durchaus spannende Konzepte - auch nicht überall für alles, aber alles was Multi-Screening und wenn es darum geht mehrere Informationen gleichzeitig abzurufen, ist das eine schöne Sache.

B.E.: Das Mobile meinst du?

C.J.: Ja oder überhaupt VR oder AR. Auch das ist ja so- Augmented Reality und Virtual Reality wird immer mehr in einer Hardware verschmelzen, langfristig und dann irgendwann ist das gar nicht mehr so scharf abgegrenzt. Und natürlich sind das zwei Paar Schuhe jetzt, das eine ist eine völlig komplett virtuelle Welt, ich bin nicht mehr hier, sondern ich bin woanders, die andere Sache ist, ich bin hier und habe noch zusätzliche Informationen. Aber ich bin sicher, dass da irgendwann einmal mit eye tracking-Kombinationen und zig anderen Dingen, dann irgendwann mal das Device kommt, dass alles kann und das ist noch dazu klein leicht etc... Das ist natürlich nicht morgen, aber wo haben wir angefangen mit dem Handy vor 20 Jahren. So gesehen, wo sind wir heute und wenn man das umlegt auf VR/AR - sogar noch schneller in der Entwicklung, dauert es schon noch 10 Jahre. Bis das wirklich so toll ist, dass jeder sagt, jetzt brauche ich das und ich glaub das Augmented Reality sogar eher der Driver ist für das Medium und dann eher die Leute dazu bringt...

B.E.: Ja könnte das daran liegen, dass AR wahrscheinlich auch mehr in den Geschäftsbereich geht und zu Beginn wahrscheinlich daher dadurch schneller verbreitet wird?

C.J.: Virtual Reality ist eine wirklich kleine Nische nur - da geht es darum letztendlich etwas zu visualisieren, was nicht da ist und es ist eine Evolution von 3D Animationen und 3D. Jeder, der hier heute irgendetwas zeigen möchte, macht das in 3D und dann kann er es noch einmal besser präsentieren in VR.. Es geht darum wirklich eine Verbesserung des 3D Mediums. Nicht jeder zieht sich rein die 3D Animation von irgendeiner Waschmaschine ja, das muss man halt wollen, aber

beim Auto z.B. ist das schon interessant, wenn es um Kombinationssachen geht und Visualisierung und wie schaut das wirklich aus. Auch für die Architektur ist es ein Superdriver, weil also durch Wohnungen marschieren können, bevor sie da sind ist super. Und alles gilt für hochpreisige Produkte, die man jetzt in 3D Animationen, die wird man halt einmal ganz normal in VR anschauen. Und mittlerweile, wenn du schaust, gerade in der 3D Software Entwicklung, in vielen Architekturprogrammen ist es mittlerweile auch schon so, dass es einen Export gibt für VR, weil ich meine du hast es ja eh gepaart und das dann zu connecten mit irgendeiner Realtime Engine ist kein Riesenwurf. Es gibt halt paar Firmen, die das schon bei der eigenen Engine, die das schon implementierten - und natürlich schaue ich mir dann die Wohnung, wenn ich da ein bisschen ich bin ein Architekt und baue mir ein Haus und natürlich möchte ich dann auch auf den Knopf drücken und mir das anschauen, was ich gebaut hab. Es ist ganz klar, dass das so kommt und ich glaub nicht die Euphorie war und die Angst, die da mal war, war größer als es im Endeffekt ist. Das ist einfach nur ein erweitertes Medium neben TV und das Schöne an dem Medium ist, dass es ein bisschen die Grenze von diesem 'Kastl' auflöst, dass es nicht mehr so gebunden ist an einem Ort wo das dann rennt, sondern das ist ja bei AR noch mehr, dass du sagst ich habe mehrere Erlebnisse gleichzeitig und die platziere ich mir irgendwo hin, wo ich sie gerade brauche und das ist ganz sicher spannend...

B.E.: Weil du mobile VR erwähnt hast... Ich sehe du hast es viel eher die High End Versionen...

C.J.: Es ist ganz lustig so ein Museum, wo man begonnen hat, die ersten Schritte und so weiter und irgendwann ist man jetzt schon da und das sind schon Produkte, die man fast schon brauchen kann ... Wir machen auf Messen einiges und Point of Sale Sachen und da gibt es noch so viele banale Probleme, die noch gar nicht gelöst sind - ich spreche gar nicht von motion sickness, weil das war in verschwindender Anzahl von Menschen, die wirklich motion sick geworden sind. Und wenn du heute mit aktueller Hardware arbeitest ist das - natürlich gibt es manche, die sagen: da wird mir ein wenig lustig und das ist dann nichts für die, aber das ist echt, ich würde sagen, wenn es 5 % sind, also gefühlt. Und das einem richtig also die Geschichten, die einem die Leute tagelang mit Übelkeit usw. hatte ich noch nicht einen und wir haben es wirklich vielen Leuten gezeigt. Und es ist einfach so, es gibt ein paar Dinge, wenn die Physik gar nicht mehr zusammenpasst mit der Realität, dann ist das komisch, ist das unangenehm. Aber wenn du dich an gewisse physikalische Grundgesetze hältst, mit diesen Latenzen

heutzutage ist das kein Thema.

B.E.: Du hast zuerst erwähnt, es gibt dann aber noch andere Dinge, also neben motion sickness..

C.J.: Also banal ist Hygiene für mich, das Um- und Aufproblem, ich finde, ich würde mir das nicht einfach so aufsetzen irgendwo im öffentlichen Raum... Ich bin selbst verwundert, weil wir bemühen uns immer sehr, wir haben da so Masken aus Japan importiert, die gibt es nämlich nicht hier in Österreich - das sind wie diese Papiermasken vor den Augen, die wir den Leuten so anbieten und viele Leute nehmen die Masken aber dennoch nicht. Entweder er macht das oder er macht es nicht, und das ist für mich schon ein Thema. Ich würde das nicht machen... Es gibt noch keine bekannten Krankheiten, wie z.B. Augen Herpes, das verbreitet werden könnte über VR-Brillen oder so Zeug, das hat sich noch nicht herausgestellt, also ich glaube es wird eher kein wirklich medizinisches Problem sein, sondern es ist eher einfach grausig. Es ist für Menschen einfach unangenehm und dann andere Themen wie z.B. beim Reisen find ich es phantastisch, VR-Brillen beim Reisen ist super, weil man einfach so die Umgebung ausblenden kannst – also, wenn ich irgendwohin flieg ist das eigentlich immer im Handgepäck und setzte es dann im Flugzeug auf. Und ich schaue mir Filme an auf einer Riesenleinwand und ich schaue ein bisschen in den Gamesbereich und ich schaue mir keine 360-Grad Filme an, sondern klassische 16:9 Filme auf einer virtuellen Leinwand und in einem virtuellen Kino oder Netflix, wenn du irgendwo wartest - das zahlt sich echt aus, finde ich.

B.E.: Also das würdest du bevorzugen, gegenüber jetzt am Laptop z.B. den Film anzusehen?

C.J.: Auf einem kleinen Laptop ja, aber da ist es ein Problem, wenn du es dann eilig hast und zum Gate laufen musst und bist du dann angekommen bist und du bist verschwitzt und dir ist heiß, dann läuft das Ding läuft wie bei der Schibrille, also auch das sind auch so Themen, die noch nicht gelöst sind... Und dann ist Performance ein Thema, da willst du natürlich immer mehr als du haben kannst von der Hardware und das musst auch erst mal hinkriegen, dass du mit 2 x 16K – Files oder Datenmengen arbeitest, das wäre so das Ziel und das ist eigentlich unrealistisch, dass du das in real-time renderest aber so geht es halt dahin und ich glaube in 10 Jahren wird das kein Problem mehr sein. Und die Frage ist, wie gut wird diese wireless-Geschichte, da gibt es ja die ersten Dinge und ich habe dann echt gesagt, da warte ich jetzt einmal - die gibt es ja schon zum Kaufen - so mit diesen Drop-outs - also es funktioniert ganz überraschend gut obwohl es eine

höhere Latenz hat. Also ich rede hier nicht von mobile VR, sondern von Desktop-Computern und da ist es eben so, da haben wir jetzt ab und zu probiert, da gab es so ein drop-out und es gibt nix Ärgeres als wenn du so da herausgerissen wirst mit diesen Fehlern. Auch wenn das nur kurz und nicht oft ist, aber jetzt im professionellen Bereich funktioniert das noch nicht gut genug... Schauen wir weiter in 3 Jahren - da wird auch alles viel besser und da wird es schon spannend, da kannst du wirklich immer mehr damit machen.

- B.E.: Austrian Airlines hatte das auch, die Mitarbeiter sind mit so einer Samsung Gear-VR um für ein Upgrade in die Business-Class zu werben mit einem 360 Grad-Video, aber da ist eben auch erstens das Thema mit der Hygiene und zweitens das Ding, immer, wenn man das aufsetzt, dann muss man immer zuerst weiterklicken mit dem Button.
- C.J.: Meiner Meinung nach kommt hier das typische 360-Grad Problem zu tragen - es ist halt nicht die Spitze vom Mount Everest, die so toll ist, sondern da schaut es oben aus wie auf jedem anderen Berg, überspitzt formuliert, sondern es ist die 3 Monate Base-Camp, die Minus 30 Grad und der Weg nach oben, der jetzt visuell mäßig interessant ist, weil er einfach dauernd Schneesturm ist, aber das ist die beste Fahrt meines Lebens. Also es ist ja nie wirklich das Bild alleine, das Spannung macht in unserem Leben, es ist immer die Erfahrung, die mit diesem Bild in Kombination geht, also quasi der mühsame Weg da rauf und das ist genau das Gleiche beim (runtergebrochen auf Austrian und First Business Class – es ist halt nicht nur ein Bild von der 1. Klasse) sondern es ist, dass jemand dir wirklich einen Champagner in die Hand drückt und das tolle Essen serviert bekommst und du das auch schmecken kannst, es ist wie so im echten Leben, dass im Ledersitz sitzt und es ist nicht ein Foto davon und dieses Power-Erlebnis, ich glaube nicht, dass jemand sich denkt, 'wow' es ist hier so super, weil ich weiß doch, wie es da ausschaut ja, ich muss ja immer durchgehen und nicht hinten gehen in die Economy - also ich weiß das doch alles ja. Es ist für mich kein Kaufanreiz als Konsument zu sagen, weil ich jetzt ein wahnsinnig langweiliges 10-Minuten-Video sehe davon wie es da aussieht und wie alle bewirtet werden, gebe ich jetzt 3.000 Euro aus..
- B.E.: Hast du auch so Anfragen für solche Projekte? Machst du die dann auch manchmal?
- C.J.: Ich sage den Leuten was ich meine und dann gehen sie meistens woanders hin.. Ich rede es ihnen eher aus, ja. Weil ich finde es hat keiner was davon, wenn wir jetzt irgendwas machen für viel Geld, es kostet ja was, weil damit es wirklich toll

wird, müsste man ja viel Geld in die Hand nehmen - mit der Gopro aufnehmen und zusammen-stitchen kann ja quasi jeder.. Leichter war drehen noch nie, aber es ist halt das Unspannendste der Welt und was macht es interessant? Na ja stereokopische Inhalte wären mal die erste, bevor ich keine stereoskopische KameraRig anbieten kann, mache ich kein 360 Video ernsthaft, weil ich hab noch niemanden erlebt, der da gesagt hat wow das ist so eine tolle Aufnahme, 360 Grad ja – es ist immer dann, wenn jemand was auf dich schießt und du denkst dir, oh Gott es trifft mich, oder da fliegt ein Flugzeug, also irgendwas wo in die eigene Komfortzone was kommt - da gab es ja anfangs von den Hardwareherstellern Dos und Don't, aber ganz ehrlich in jeder Experience, die wir machen, versuche ich ganz bewusst etwas einzubauen, dass den eigenen Komfortradius von 80 Zentimeter oder mehr um dich herum unterschreitet und das ist dann genau das, was du im Fernsehen oder auf ein einem Bildschirm nicht hast - oder wo du jemanden wirklich für eine Sekunde das Gefühl gibst, das muss real sein, weil sonst hätte er nicht so reagiert. Und wenn das in der 360-Grad Sphäre passiert von einer Go-Pro wird keiner um die Ecke hüpfen, das ist quasi nur ein aufgeblasenes Bild.

B.E.: Ich glaub ist oft bei diesen Regeln, die sich so am Anfang aufstellen, eben dass man die dann oft brechen muss..

C.J.: Ja man muss alles brechen..

B.E.: Bei 360-Grad frage ich mich auch, wie relevant die Regel des Nichtschneidens zb. ist...?

C.J.: Ja man kann durchaus schneiden, aber es halt wie soll ich sagen, wir haben uns wirklich echt viel beschäftigt mit dem Thema, ja und ich hab keinen einzigen Content, also nix produziert selber oder gesehen, wo ich mir gedacht habe, das hat mich jetzt echt vom Hocker gerissen, alles was spannend war, war immer ein total gemischtes Ding, oder erstens mal diese Interaktivität und selber etwas mitmachen können, das fand ich immer ganz toll, das muss nicht mal super ausschauen, das ist trotzdem lustig also nur das 360, also ich kenne keines, also ob du eins kennst, also ich weiß nicht z.B. bei einem Emirates Film, ein Werbefilm, den sie gemacht haben für ein paar Millionen haben sie ausgegeben dafür, dass sie die Nicole Kidman in den A 380 von Emirates hineinsetzen und zeigen und diese kleine Story, und dann haben sie überlegt, wie sie möglichst kompliziert Geld verbrennen können, indem sie teure Sachen gebaut haben, mit mehreren Alexis haben sie gedreht oder so und aufwendigen motion control rigs und das haben sie dann zusammengebaut in einem Video und dafür, dass du dann in einer

Mono-Experience drinnen sitzt und dir denkst, also das ist jetzt die Story.. Also den Flieger hätten sie auch billiger haben können, nur um zu zeigen wie es da drinnen aussieht.. also das ist fraglich, ob das wirklich Sinn macht..

B.E.: Und von den interaktiven experiences, hättest du da Beispiel, das dich sehr beeindruckt?

C.J.: Es sind meistens banale Sachen, eine der besten Sachen ist immer noch das von Oculus - wenn du das rig kaufst, bekommst du dazu ein Demo file, und da werden ein paar Sachen kurz angerissen und eigentlich superschlau - die zeigen, was das Headset kann in ein paar Einzel-experiences, wie z.B. ein Dinosaurier, der auf dich zukommt etc.. Das ist jetzt kein Gesamtpaket, aber nur zum Zeigen, in welche Richtung man dieses Medium verwenden kann... Zum Beispiel auf der Brücke stehen, also du stehst auf der Brücke und vorne ist eine Stadt und da hat sich noch keiner getraut, einfach den Schritt zu machen und da runter zu steigen und damit beunruhigt man die Leute, wenn man das gezeigt hat und im Endeffekt ist es immer so, je mehr Höhenangst du hast desto mehr sensibel reagierst du drauf, aber dass jemand faktisch macht den Schritt und trotzdem wie schaut ein Zeichen, das ist schon powerful. Du kannst die Leute schon so tricken, dass sie ein mulmiges Gefühl haben. Das kann ich jetzt nicht erzeugen, wenn ich dir jetzt ein Foto zeige von einer Brücke, da wirst du niemals dieses Kribbeln in den Beinen haben. Und dann so Dinge, da hast du ganz schön gesehen, du musst du ein bisschen Phantasie haben was da alles dahinter steht in diesem Ding und in diese Richtungen versuchen wir natürlich Sachen zu probieren. Nur es ist natürlich Thematik, dass das alles sehr aufwendig und zeitintensiv und ohne dass du so einen Kunden hast, der ein bisschen was investieren will, ist es auch gar nicht möglich, dass du jetzt sagst, ich haue jetzt 5 Monate rein, wo zig Leute beschäftigt sind, die dann an einer Sache basteln, die keiner braucht. Also das ist jetzt für uns nicht machbar. Und deswegen versuchen war halt immer, Themen heraus zu picken, die wir spannend finden und dann suchen wir jemanden der das brauchen kann und der eventuell das machen kann und wo wir halt etwas bauen, das auch wirklichen einen „Need“ hat, weil ich denke ich möchte nichts machen, wo dann nicht wirklich unter dem Strich ein Return on Investment rauskommt und es muss nicht immer Geld sein - Es können auch andere Dinge sein, aber es muss einen wirklichen Sinn erfüllen, weil ein sinnloses Produkt zu bauen nur der Sache willen, da tut sich keiner was Gutes, weil ich bin sicher, die Austrian wird nicht mehr so bald ins Thema rein gehen, weil das 360-Grad Video wahrscheinlich nicht das erfüllt hat, was es hätte sollen...

Ja, was ist jetzt wirklich der Benefit gewesen, ja? Es war am Anfang auch dieses „ja – wir müssen was mit 360 machen“, es ist ganz en-vogue, wir wollen jetzt allen zeigen, wir sind auch dabei... Da mache es lieber nicht... Und deswegen sage ich schon Dinge ab, wenn ich das Gefühl hab, es funktioniert nicht, sage ich du da bin ich vielleicht nicht der Richtige. Weil du hast halt immer nur eine Chance, wenn es dann nicht gut wird, wird der Kunde nie mehr kommen und was machen.

B.E.: Und es gibt aber auch Kunden, die ein bisschen investieren wollen?

C.J.: Wenn es um die Visualisierung geht, da ist es jetzt nicht die Diskussion um das Bauen oder nicht, sondern es ist der nächste Schritt, also da gibt es jetzt keinen Weg vorbei daran, in Zukunft wird jeder so Content präsentieren, der halt schon etwas für eine Zielgruppe präsentiert. Und deswegen glaube ich, ist es einfach keine Frage, ob das eine Zukunft hat oder nicht. Es ist eine Möglichkeit, Content in einer sehr speziellen Weise zu präsentieren. Und das werde ich nützen als wenn ich weiß ich habe Kunden, die etwas verkaufen möchte oder das wollen wir ja alle, die etwas herstellen oder eine Dienstleistung anbieten, dann werden sie sich überlegen, das möglich gut zu präsentieren, und es möglichst schön verpacken und das ist eine Möglichkeit dazu. Ich glaube nicht, dass VR/AR wieder verschwindet. Ich glaube auch z.B., dass es im Kinobereich, war das 3D Kino immer so und ich glaub es wird durchaus eine Evolution geben im VR Kino nur anders als wir das jetzt glauben, also nicht im Sinne von, dass wir uns jetzt in 360 Grad umschauen werden, sondern über eine Mischung einfach. Dass den klassischen Film mit so Ambience mehr oder weniger, so quasi dass du hast die Explosion in der Leinwand und dann fliegen die ganzen Teile auf dir aus der Leinwand raus und wie das jetzt 3D Kino auch ist – nur funktioniert das nicht gut, weil das Problem ist, dass halt aus ist links und rechts in der Leinwand und in diesen Zukunftsformaten, was ich glaube was ganz gut ist, dieses klassische 3D-Kino verschwindet wahrscheinlich irgendwann mal und dann hast du halt, wenn du 3D möchtest, die VR experience, weil du viel weiter mit Effekt ziehen kannst.

B.E.: Würdest du das dann eher sehen mit den VR-Headsets oder in welcher Form würdest du dir das vorstellen?

C.J.: Ja und das kannst du zuhause anschauen, musst nicht ins Kino gehen dafür. Also ich glaub nicht, ich sehe das 3D Kino als semi–spannenden, das hat sich ja nicht wirklich durchgesetzt, nach AVATAR ist es vorbei und das macht man halt jetzt mit, wenn es nichts kostet. Aber du muss etwas nachkommen und ich glaube das ist doch ein Thema, mit dem wir uns stark beschäftigen momentan, weil es gar nicht so leicht umzusetzen, und da glaub ich, dass in Wahrheit diese Brille ist

anders als die Evolution des 3D Kinos - das ein Bereich ist, sondern dass du einfach die 3D Filme letztendlich mit der VR Brille anschauen kannst und den Effekt weiterziehen kannst als bis jetzt.

B.E.: Also das wäre dann ein real time rendered-Film, quasi?

C.J.: Die Problematik ist die, wie löst du das? Es hat noch keiner gelöst, deswegen ist es immer noch sehr spannend, wäre dann der erste, der das hinkriegt. Es gibt mehrere wirkliche Möglichkeiten: du kannst es real-time machen, du kannst es pre-rendered machen, dann ist die Frage, wie bettest du es ein, ist die Hardware gut genug, die du das dann abspielen kann... Und wieder das Problem, die Kosten müssen auch zum Nutzen stehen, dass jemand das kauft, weil es wird auch was kosten, dass du das zusätzlich herstellst, es kostet natürlich was und ich habe noch niemanden gefunden, der gesagt hat, ja ok er steckt viel Geld dafür rein, dass er vielleicht dann 10.000 Leuten etwas verkaufen kann. Also auch da ist es so, es ist halt definitiv ganz 100 %-ig / 1000%-ig die Zukunft, aber eben noch nicht heute.

B.E.: Wie siehst du das Thema VR Cinemas momentan?

C.J.: IMAX hat jetzt mit Google eine Kooperation, die machen jetzt etwas in die Richtung. Das kann ich mir gut vorstellen – es wäre der erste Schritt glaube ich schon, dass man eben mit STAR VR, ultra widescreen headsets und ich könnte mir vorstellen, dass du da ganz spannende Dinge bauen kannst. Ich könnte mir vorstellen, dass man damit geile Sachen bauen kann und es könnte so sein, dass man damit ein bisschen wie das ist jetzt die Zukunft von diesen ganzen 5 D Kinos usw., aber es ist halt kein Massenphänomen. Da hast dann halt den Weißen Hai, den du früher im IMAX – Kino angeschaut hast oder in diesem DOM-Kino noch 5 Filme, die für diesen Content produziert hast, das ist dennoch kein Massenprodukt. Für mich aber ein Massenprodukt, wenn ich mir Stawars anschau, und Darth Vader kommt aus der Leinwand heraus in der Szene in der er mit Luke Skywalker kämpft. Das wäre für mich ein Wow-Effekt und wenn mir die Tiefighters um die Ohren fliegen, das ist „Wow“. Und das ist relativ simple zu lösen, wenn du das mischt, diese Formate und das wird sicher de facto ein Zukunftsprodukt sein. Aber da ist halt die Frage, wie weit technischer Natur, a: wie gesagt wer ist derjenige, der viel Geld investiert, also Jungle–Book war das erste für einen VR Film, muss nur jetzt überlegen, wieviel Benefit hat das was sich umschauen kann, weil meistens, ich weiß nicht ob du es kennst..?

B.E.: Ja, weil du vom 'umschauen' in dieser experience sprichst - diese ist doch real-

time rendered?

C.J.: Ja, genau; aber das Thema ist halt – ich finde auch, in diesem Bereich funktioniert das sehr gut, weil in dem ganzen Comic-Bereich und Animationsbereich ist das glaube ich, dass es sicher in Zukunft ganz viele Content gibt, weil dort es so, das ist alles real-time rendered, weil bist du dann mehr verstrickt, bist nicht so angenagelt, es funktioniert alles viel besser und ich finde das schön, das kannst du ja, wenn du es ja eh baust, baust du halt den Rest fertig kostet dich immer noch ein Vermögen, weil das musst ja alles mal im workflow „derblasen“, damit du das in diese Welt hinbekommst - die Render-Zeiten sind absurd ja und auch das ganze bauen und so aber ich glaube, das wird sich dahingehen. Wenn du dir „Henry“ anschaust, diese Beispiele - das ist einfach nett, viele Leute, denen ich das gezeigt hab, schauen sich diesen Film bis zum Schluss an. Für mich ist das immer interessant, dass Menschen, die VR zum ersten Mal sehen, die Brille herunternehmen, obwohl die experience noch nicht beendet ist. Dann frage ich, warum hast du es nicht fertig angeschaut, dann weiß ich, das war nicht so ganz. Bei „Henry“ sitzen sie dann (nicht jeder) aber, wenn du das machst, ja dann sitzen die dann da und schauen es sich bis zum Schluss an... Es funktioniert halt einfach irgendwie, du magst dir das anschauen, da fliegen die Ballons und dies und das. Das hat überhaupt keinen Sinn, wenn du jetzt 360 hättest, das würde auch super normal funktionieren, aber du bist so irgendwie drinnen irgendwie und es ist einfach schön, dass du da mit dabei bist, aber es halt nur an einem Ort... Die experience ist in Unreal gebaut, die haben das super gemacht, es gibt es viele Stolpersteine, was die ganzen Partikel, light reflections usw. betrifft. Jetzt mittlerweile gibt es schon wieder viel Zeug wieder, aber das ist real-time rendered und du kannst aufstehen und kannst da rübergehen und zuschauen. Aber das ist halt ein wenig das Problem, es spielt in einem Raum und du bist an das gebunden. Jetzt mittlerweile gibt es schon wieder viel Zeug wieder, aber das ist real-time rendered und du kannst aufstehen und kannst da rüber marschieren und dann zuschauen... Wobei es wurde ja auf Oculus released, und daher ist es kein roomscale Format. Ich müsste es mir jetzt nochmals anschauen mit dem Rift Roomscale, ob es jetzt geht.. vielleicht geht es wahrscheinlich ja - du hast ja keine Limitierung, im Normalfall ist es so, wenn du jetzt nicht irgendwie künstlich ein Limit eingebaut haben, kannst du auch aus dem Iglo rausmaschieren, weil in diesem Unit/Unreal - meistens ist das Kabel ja das Ende - man könnte auch wohin steuern und ich gehe aus der experience einfach heraus, also das ist wie in einem Computerspiel im Endeffekt.

B.E.: Also in dieser Richtung siehst du also hohes Potential?

C.J.: Ja also da wächst jetzt eine neue Generation an. Mein Sohn ist noch klein, aber der ist auch bereits mit der Oculus gesessen und das hat ihm sehr gut gefallen. Mein Sohn ist vier Jahre alt und er konnte gut zwischen Realität und VR-Brillen-Welt unterscheiden. Also ich glaube, dass die Kritiker die hier sagen, die Kinder werden in eine falsche Realität abdriften VR noch nie ausprobiert haben. Mein Sohn wollte immer aufstehen und zum Igel gehen, da war aber immer das Kabel aus. Und meine Tochter ist drei Jahre alt und geht dann zum Fernseher hin und versucht zu wischen - die versteht überhaupt nicht, dass das kein Touch Screen ist. Aber so gesehen glaub ich, diese Generation wächst mit dem auf und das ist ganz normal - und wenn es coole Comics gibt, dann schaue ich diese halt an in diesem Medium und da hast du auch nicht das Problem, dass es quasi unsozial ist wenn man dann als Teenager mit seiner Freundin auf der Couch sitzt und beide so eine Brille aufhaben (das höre ich immer wieder), aber ein 13-Jähriger in seinem Kinderzimmer ist froh, wenn er nichts sieht und nichts hört. Der hat kein Problem damit, überspitzt formuliert und so gesehen. Und was das Thema Kino betrifft, hör ich immer dieses Thema Social also ganz ehrlich: wie sozial ist es, wenn wir ins Kino gehen? Du isst Popcorn, schaust dir den Film an und willst nicht, dass ich mit dir rede, und ich dasselbe. Unterhalten werden wir uns dann später, wenn es aus ist. Also es gibt doch auch kein wirkliches Social, wenn du jetzt gemeinsam im Kino gehst und dir einen Film reinziebst. Also das ist jetzt nicht anders, als mit der VR Brille. Wenn ich mir den Film anschauen möchte, ist es nicht so relevant ob ich den anderen sehe. Am Abend auf der Couch, wo es weniger darum geht, was wir uns ansehen, sondern dass wir uns unterhalten wollen nebenbei, da würdest du dann eher nicht die Brille verwenden wollen.

B.E.: Henry wurde ja von Oculus Story Studios finanziert, um auch die Hardware zu pushen.. Für die Content-Producers, die diese computer-animierten Filme - weil du gemeint hast, du möchtest auch nur Sachen, machen, wo dann Revenue wieder zurückkommt - wie wär da die Chance, welche Distributionswege stehen zur Verfügung? Welche Möglichkeiten hätten Content Producer, die in die Richtung gehen möchten, eben den Content an die Leute zu bringen und auch wieder Geld zurückzubekommen?

C.J.: Da gibt es glaub ich keinen, User-Formate produzieren und hoffen, dass ein paar Enthusiasten, die das kaufen, aber sonst... Was hast du für Kanäle, du kannst es auf den üblichen Plattformen anbieten oder du kannst es einem Kunden verkaufen, der es für seine Kunden published?

B.E.: Kann man derzeit über die Plattformen auch Gewinne erzielen deiner Meinung nach?

C.J.: Das würde ich nicht unterschätzen, aber es gibt sicher ein paar, wie viele Brillen wurden verkauft und die Leute schauen es sich vielleicht nicht an, aber jeder kauft es sich trotzdem einmal, weil er sich guten Content sich eben einmal anschauen will und wir zahlen dem ja auch 10 Euro, und wenn das jetzt 50.000 Leute und da kommt schon was zusammen.. Schau es ist halt ein Risiko, wenn du jemand bist, der sagt ich produziere das selber, mit 2 Freunden, ich habe auch viele Kollegen, die in dem Bereich tätig sind und die dann z.B. die sind einmieten bei mir und sitzen dann den ganzen Sommer und bauen an VR Spielen und so Zeug, die sitzen die zu viert, haben nur sich selbst als Kosten und machen es weil sie es gerne machen - die sitzen dann von Mai bis September und dann wird es gelauncht und dann schauen sie was passiert und das und das für die dann das Einkommen des Sommers, dividiert durch 4 - abzüglich aller Nebenkosten. Aber wenn du sagst, ich bin eine Firma – ich bin der Toni und der Toni möchte mir jetzt sagen, er möchte ins Business einsteigen, dann wird er sich denken, ich muss die Leute alle einkaufen, die hier alle sitzen, ich muss die Hardware zur Verfügung stellen, das kostet alles und jetzt muss ich daher wissen, ob das Ding sich verkauft – ich weiß es nicht. Das weiß keiner ja, das ist wie Handy Apps zu programmieren, das kann dir keiner sagen, ob sich das verkaufen wird. Du möchtest dich in deiner Arbeit auf Film setzen?

B.E.: Ja es geht um das mögliche Potential von VR für die Film-/Video-Industrie...

C.J.: Wie siehst du das Potential?

B.E.: Ich sehe momentan auch das chicken-egg Problem, das du eh schon angesprochen hast also eben das nicht genug Leute so eine Brille zu Hause haben um wirklich einen großen Markt zu haben, und andererseits gibt es nicht genügend compelling Content, um die Leute wirklich an das Medium zu binden, also und die ältere Generation sowieso, wenn ich meine Eltern anschau, die würden sich nie so was aufsetzen zu Hause umso eine experience anzusehen...

C.J.: Da habe ich bei der Automesse vor kurzem eine lustige Erfahrung gemacht - Donnerstag ist quasi immer der Pensionisten-tag quasi und dann ist es so, dass das Publikum bis Sonntag hin immer jünger wird. Am Donnerstag bei dieser Autoshow hatte man dann gut Zeit sich mit den Älteren auseinanderzusetzen und da gibt es 2 unterschiedliche Arten: es gibt die, die total offen sind für dieses Ding, wo man es gar nicht glaubt. In einer Gruppe von 8 älteren Menschen gibt es

immer einen Mutigen und der macht das dann und findet es super – es ist aber so, die sind selber neugierig – in Alpach z.B. wo sich auch schon herausgestellt hat, da sind diese Technologiegespräche, wo Opinionleader und CEO's der großen Cooperates kommen und diskutieren eine Woche lang über alle möglichen Dinge der Zukunft und da hat sich herausgestellt, dass sich manche schwer tun mit dem Medium, obwohl man sich denkt du bist Opinionleader und solltest schauen, was kommt auf dich zu. Die waren a) sehr zurückhaltend und b) konnten nichts damit anfangen. Es war so der Unterschied ein bisschen.. Die ganz junge Generation am Samstag/Sonntag war non-stop angestellt und die coolen 17 Jährigen, die waren zu cool es zu probieren, dann haben sie es doch probiert und fanden es toll. Und dann merkst du wie es dann in jeder Schicht irgendwie eine Gruppe gibt von Leuten, die generell offen sind und sich das anschauen wollen und durch die Bank alle wahnsinnig positiv reagiert haben und jeder sagt „Wow – cool“ und ... Dann stellt sich die Frage: hat es jetzt einen Impact gehabt, auf das Produkt? Wahrscheinlich ist es jetzt nicht so, dass jemand ein Auto kauft, weil er eine tolle VR experience hatte. Das ist mehr ein schauen, ein Einstieg, aber da hat man schon etwas gezeigt: ok so eine Power hat jetzt TV schon lange nicht mehr. Wenn du den Leuten am Bildschirm zeigst das neue Auto wie es durch die Landschaft fährt und wie toll die Sitze sind, geht jeder vorbei, und das ist schon irgendwie spannend weil du hast doch ein neues Medium, mit dem du den Leuten etwas zeigen kannst, wie sie es noch nie vorher gesehen haben und das ist auch wieder so dieses Thema es gibt Bereiche wie die Oculus Demo, da funktioniert das irgendwie und das gibt dir irgend einen emotionalen, irgendeinen Kick, eine emotionale Reise, eine Experience, die du vorher nicht hattest. Es wird irrsinnig missbraucht mit schlechten experiences, wo du dir denkst ehhh fad, ja aber es ist halt nicht so, dass du sagen kannst, viele sagen halt ja VR kenne ich schon, da ist genauso, wenn du mir sagst, fernsehen kenne ich schon. Es gibt eine Milliarde Filme und Werbungen, was kennst du? Ein Prozent und von dem einen Prozent ist wiederum nur ein Prozent gut und das ist bei dem Medium ganz genauso. Du hast die Möglichkeit eines Impacts, weil du einfach viel mehr da bist und du musst halt einen guten Content produzieren, und die Leute zu treffen, und das ist nicht anders bei VR und deswegen hast du vollkommen recht, wenn du sagst und du siehst das sehr kritisch, aber ich glaube und es sehen viele Leute das Potential und hoffen halt, dass sie dahinkommen.

B.E.: Weil du Experience sagst... siehst du es auch so, dass es mit dem verkauft wird, dass dieses „Immersion“ und es ist eine Experience, die man noch nie hatte in einem anderen Medium - kann es auch langfristig damit angepriesen werden

oder?

C.J.: Überhaupt nicht. Also auf der Messe, jeder der es einmal probiert hat, macht es nicht nochmal - er hat es schon probiert, die Experience hast du nur einmal, das erste Mal ist die Experience und danach hast du keine Experience mehr. Das ist genauso eine Experience wie, wenn ich mir ein tolles YouTube-Video anschau - sondern ist es guter Content, der mich interessiert oder nicht? Und das war so am Anfang wie ich begonnen hab, habe ich den Leuten immer dasselbe gezeigt und da hab gemerkt, ein paar reagieren gut und paar schlecht drauf und dann ich gemerkt mit der Zeit du bist ja gar nicht die richtige für diesen Content, ich glaub dich könnt viel für mehr das und das interessieren und da habe ich begonnen, so jedem das zu zeigen, wo ich das Gefühl gehabt hat, das könnte dich interessieren. Man kann sich ein wenig hintasten, es ist nicht anders als fernsehen nur auf eine andere Art zu zeigen und es ist glaube ich keine Experience sondern es ist einfach nur ja warum gehen die Leute ins Kino und schauen sich das nicht zu Hause an am Fernseher? Es ist einfach toll, wenn du es auf einer riesigen Leinwand anschauen kannst und wenn die riesige Leinwand noch größer ist, ist es auch geil und irgendwie das Ziel von Kino ist doch immer dieses „die Leute packen“ von der Geschichte natürlich. Du kannst die größte Leinwand haben, wenn die Story schlecht ist, geht das nicht. Aber wenn der Film gut ist, du freust dich drauf auf keine Ahnung, was du vor kurzem als sehenswürdig angeschaut hast, wo du sagst „wow“ das ist jetzt ein Film-Spektakel, da geh ich jetzt ins Kino, dann machst du das einfach, weil du es auf einer fetten Leinwand sehen willst, mit einem geilen Sound und du willst da reingezogen werden in die Geschichte und willst 2 Stunden abtauchen in die Story, das ist doch das Ziel und das sehe ich als exakt selben Anker für das Medium und nicht das es jetzt für cineastische Seite, für die interaktive Seite gibt es andere cases, da gibt es Training - ich wurde gefragt, ob wir für Militär und Polizei Sicherheitssimulationen bauen können. Das fand ich sehr interessant, weil es anscheinend einen großen Bedarf im Bereich Simulation und Training gibt, im Zuge dessen damit beschäftigt, hab mal gesehen, wie viel Geld investiert wird, um Leuten Dinge beizubringen und Simulationen zu machen, die meistens sehr schlecht sind, wenn wir nicht von einem Flugzeugsimulator zu sprechen, der Unsummen kostet und wo Leute trainieren...

B.E.: Ich habe auch eine Online-Umfrage gemacht zu dem Thema und da war Simulation bei den Leuten, als Frage zu wo sie VR gerne nützen würden, ein relativ hoher Prozentsatz...

C.J.: Simulation und Präsentation, das sind so glaube ich die 2 großen Einsatzzwecke

für mich - beispielweise meine Frau ist Ärztin und wir haben überlegt, das für auch eine Frage von einem österreichischen Krankenhaus, das sehr fortschrittlich denkt und wollten eine VR Simulation machen - es gibt ein paar Operationen, die nicht so häufig gemacht werden und da war die Idee durch das Einsetzen von VR das zu üben, dass vielleicht die Anzahl der Komplikationen zurückgeht. Wir haben ein paar Ärzte aus dem chirurgischen Sektor eingeladen, und die haben gesagt, ja aber das Problem ist ja nicht nur das ich sehe, wie es ausschaut, weil das kann ich mir auf dem Foto auch anschauen, auf dem Bild und Videos. Die meisten machen es ja jetzt so, sie schauen sich die Operationen ja an, wie man das macht und so – es ist aber dieses haptische Ding, das du dann wirklich richtig machst und dieses haptische Ding kannst du halt wirklich produzieren, weil die Haptik hast du halt nicht. Es gibt stereokoptische Simulatoren, wo du auch schneiden üben kannst, aber das alles ist irgendwie besser mit der Haptik, weil es irgendwie Tun ist und nicht nur das reine „ich schau nur zu“ mit dem Joystick mache ich das so dann ist das schon so. Deswegen waren wir nicht überzeugt, vielleicht müsste man noch andere Ansätze überlegen, dass man anders machen könnte, wo du wirklich ein Arbeitsgerät hast, das erkannt wird und du hast echt ein Skalpell in der Hand und die richtige Schere usw. Das wieder wäre interessanter, aber ist auch schwer, weil da hast du wieder keinen Druck.... So stellt sich die Frage, wo klappt es und wo eher nicht. Aber zum Beispiel bei der militärischen Geschichte, da kannst du sicher viele Leute in eine gewisse Situation bringen, was auch spannend ist und da haben wir jetzt auch überlegt, wenn du diese Ausbildung machst als Stewardess ist es ja wichtig, dass du alle möglichen Situationen kennst, die so passieren können und dann wenn du den Leuten sagst, schnell und jetzt geht ein Procedure durch, das du ab-arbeiten musst und dass kannst du jemanden zeigen und der kann es üben, zu Hause - da ist es ja nicht so, dass es darum geht an einem Hebel zu drehen vom Notausstiegang, und zu wissen, wie sich das anfühlt, sondern da geht es darum, die richtige Reihenfolge der Handlungen zu kennen. Wenn du das Procedure mal gemacht hat, kannst du es im Fall der Fälle abarbeiten. Und das finde ich, funktioniert auch gut und ich glaub das wird sicher jetzt kein Massenprodukt, aber da nahezu alle in Zukunft viel Kohle ausgeben dafür, die einen sagen, das gibt es für einen Bruchteil günstiger und ist besser und ist definitiv ein Markt.

Ich finde VR/AR super spannend, es ist wirklich eine Nische, soll die Message sein am Ende, aber eine Nische, die Zukunft hat, ja und die einfach nicht mehr wegzudenken ist und die noch viele Möglichkeiten bringt und deswegen glaub ich, es ist nicht nur eine Phase, sondern dass es wirklich ein neues Medium ist.

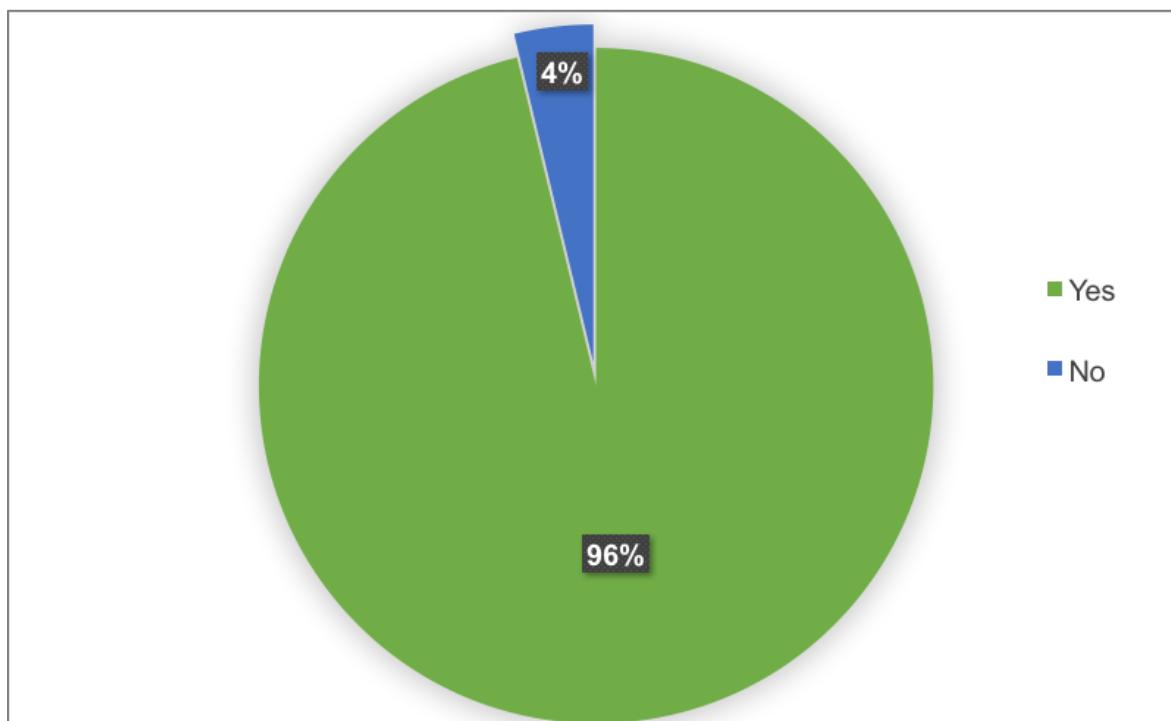
Hier kannst du gerne einmal alle Brillen durchprobieren... Eben die mobile cases ganz links, das ist die Samsung Gear, die wir jetzt mit Leap bestücken. Alles was da in der Mitte ist ist eine Rift mit einem Leap – Sensor, da geht es um Infrarot und zwar mein Ansatz ist es, ich möchte keinen Controller mehr haben also wir versuchen alle Experiences mittlerweile nur noch zu machen mit den echten Händen, wo dann die Hände gescannt werden so quasi und erkannt werden. Aber es gibt schon Prototypen, die haben wir getestet und zwar wirklich auf mobile, Leap Erkennung auf einem einem mobile device und das ist ein total mächtiges Ding, ja. Weil es ist gar nicht mehr so wichtig für mich, dass du dich jetzt super bewegen kannst im Raum, ja es ist schon toll, aber es gibt eine Studie, da haben sie herausgefunden, dass letztendlich 80% aller Menschen das Roomscale überhaupt nicht benützen. Warum? Weil ja den Platz hast du nicht und zum zweiten, es gibt wenig „benefit“ z.B. du rennst ja nicht irrsinnig irgendwo hin, sondern du beamst dich dahin. Du kannst eine Distanz überbrücken und da gehe ich da hin und natürlich gibt es ein paar Spiele, wo du sagst, da kannst du nicht so raus, aber Roomscale ist z.B. nicht so essentiell beim VR, finde ich nicht so spannend. Aber was ich richtig gut finde ist, wenn du die Hände reinbringst und was eine mobile experience mit den Händen wirklich machen kannst, ja. Dann bist du vielleicht fix in einer Position, ok, das fühlt sich im ersten Moment vielleicht komisch an, ja aber trotzdem und da geht es nicht darum, wie du es aufhebst, da geht es darum, dass du so Knöpfe hast oder irgendwelche Buttons oder Dinge, die du betätigen kannst in deinem Radiusbereich und dann hast du plötzlich die Möglichkeit, dass du wirklich eine Eingabemöglichkeit hast in der virtuellen Welt. Aber jetzt ist es ja zum Beispiel den Namen zu schreiben ist mühsam. Aber mit dem virtuellen Desktop, wo du wirklich sagst, ok ich schreibe jetzt einfach auf einer virtuellen Tastatur, wie ich es gewohnt bin, ja und habe halt 10 Bildschirme, ist eine total banale Office-Anwendung. Weil jetzt die Auflösung besser ist, ist das super und solche Sachen und ich glaube mit dem mobile mit dem Leap gemeinsam erwarte ich mir die nächsten großen Driver für die VR-Szene und Eye-tracking halt auch noch dazu.

Ein befreundetes Unternehmen in Wien, ein Studienkollege, der ist jetzt eingestiegen bei einer eye-tracking-Firma und die gehen in eine andere Richtung und ich versuche ihn schon lange zu überreden, dass man versucht, das ein bisschen zu kombinieren und ich glaube, dass wird zusammenwachsen, stark ja. Dass du einfach eye-tracking hast und das wird dann wirklich seamless sein und mit den realen Händen und den eye-getrackten Augen und das Rendering, wo du nur hinschaust und es wird gerendert, das ist ja die einzige Chance für mobile,

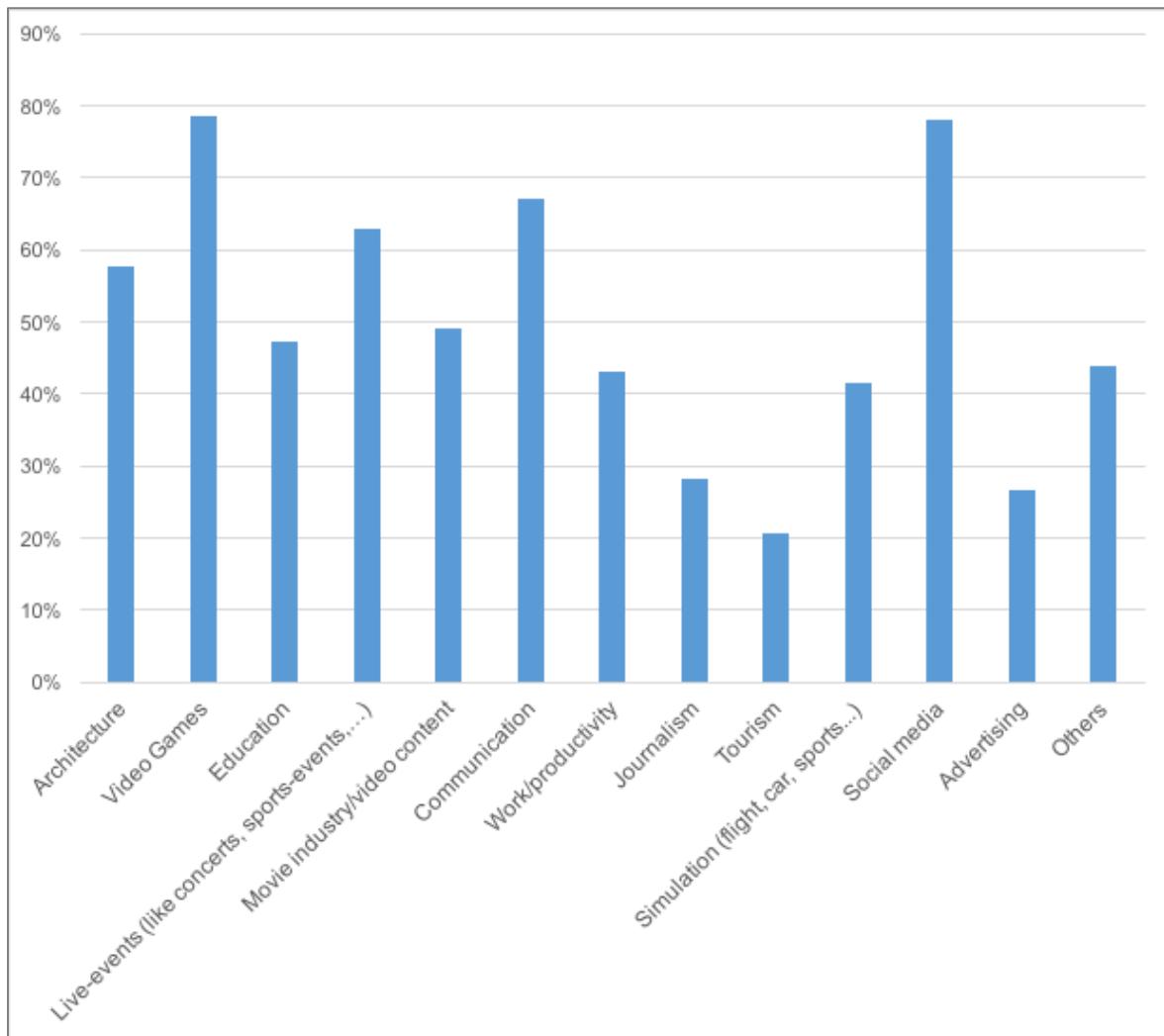
dass das geil wird, ja. Ja das Ziel ist es und da gibt es noch niemanden der das kann, aber das Ziel ist es, dass du nur das voll rechnest, wo du hinschaust, also, wenn du jetzt einen Fernseher, einen Monitor hast, und du spielst, also liest irgendetwas, ist es halt pervers, dass der ganze Bildschirm voll gerendert wird, aber du nur so ein „Mini-Teil“ wirklich scharf bräuchtest, weil den Rest siehst du eh nicht mehr scharf. Also es verpufft eigentlich 90% der Performance um die zu rendern, die nicht relevant sind und das wird ein ganz arger großer Schritt sein, wenn das in Echtzeit, fast beinahe Echtzeit, bei minimalen Latenzen funktioniert, dass ich den eye-tracker auf minimale Latenzen ausrichte und dann nur eben diese Punkte gerendert werden, die ich wirklich anschau, dann ist mir in Wahrheit der Rest gleichgültig und ich kann die komplette Performance auf diesen Teil konzentrieren, ja und man kann einen irrsinnigen Sprung hinlegen in der Qualität, ja und mit einem einfachen Handy plötzlich viel mehr herausholen, ja oder auch mit den anderen Devices. Und z.B. das ist am klassischen Desktop gar nicht gut machbar, ja. Natürlich gibt es jetzt schon eye-tracking Desktops, wo du so quasi steuern kannst usw. Du hast es ein bisschen weiter weg ja, du nimmst es z.B. viel mehr wahr als du es letztendlich so wahrnehmen würdest, aber in VR ist es wirklich ein arger Effekt, ja - weil richtig scharf siehst du nur ganz wenig, der Rest ist schon wieder unscharf und da macht viel aus. Aber das ist ein anderes Thema...

Appendix G: Survey Results 2017

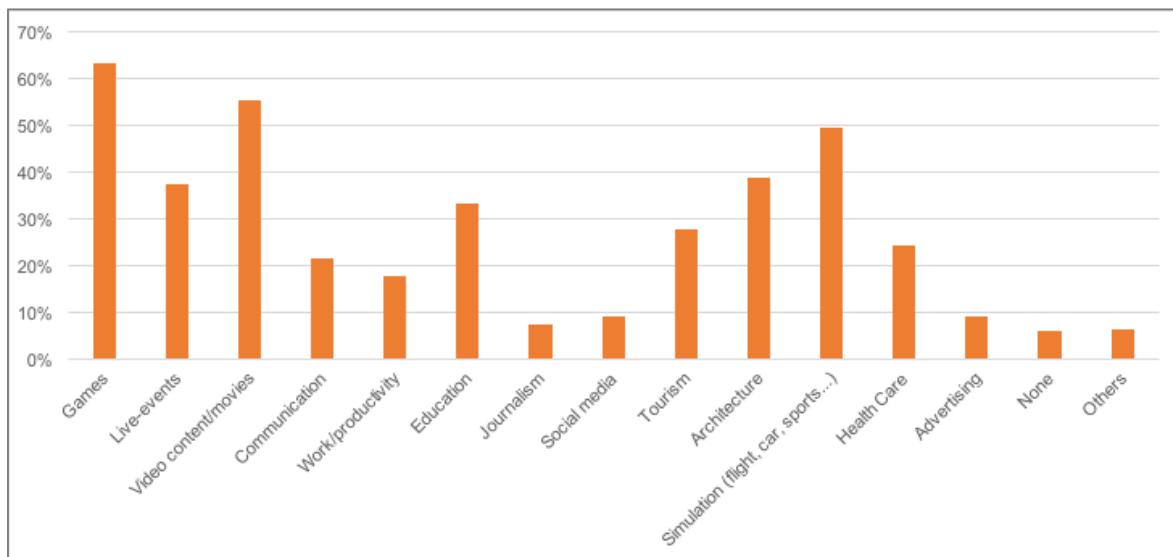
Have you heard of Virtual Reality before?



Virtual Reality is currently broadly defined as a computer-generated environment that brings the user to/into a virtual world within physical presence is simulated. In which of the following areas do you think Virtual Reality is going to be used successfully in the future?



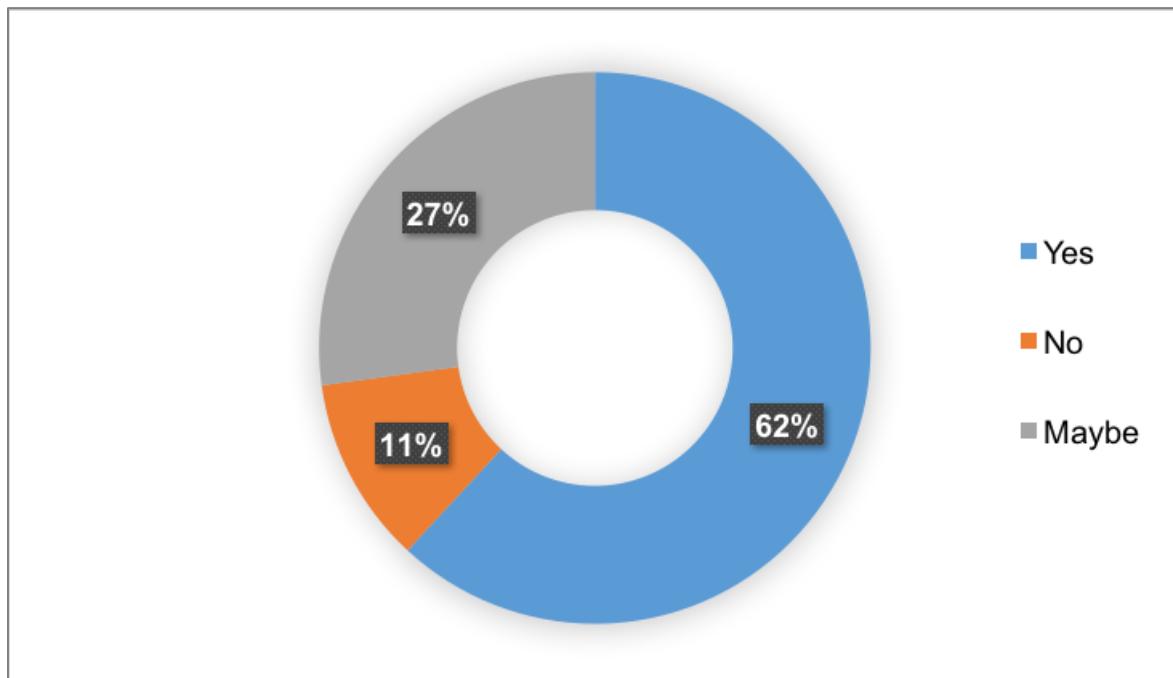
What content would you personally like to experience with the VR technology?



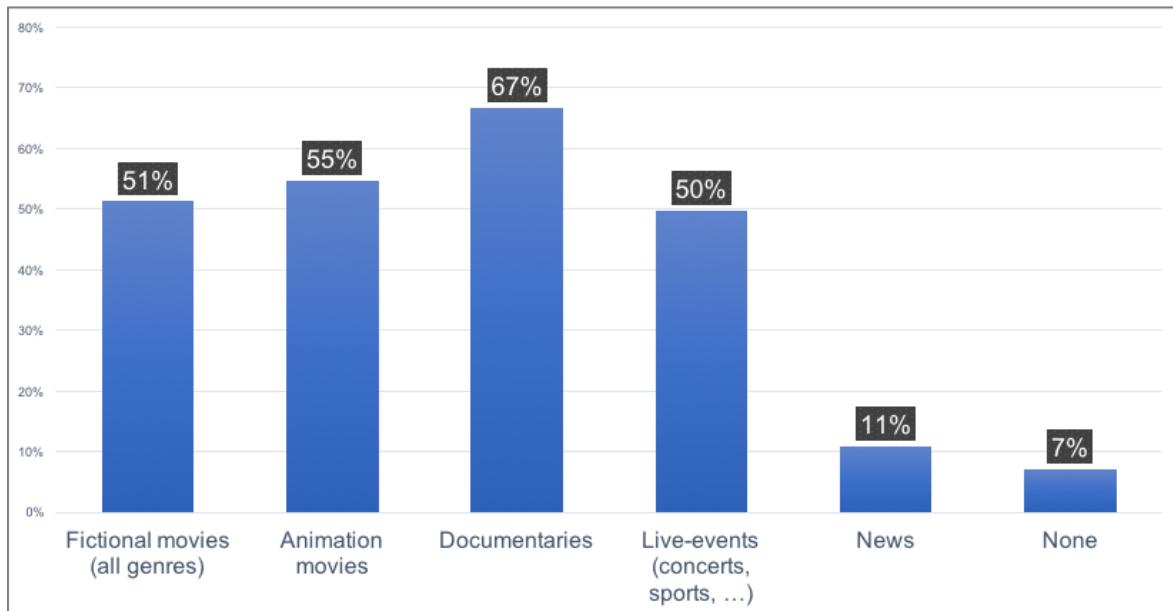
Video content in Virtual Reality headsets / Immersive film

Virtual Reality Headsets are also used to view 360-degree video footage (both for fictional and non-fictional content) as well as computer-generated 3D video.

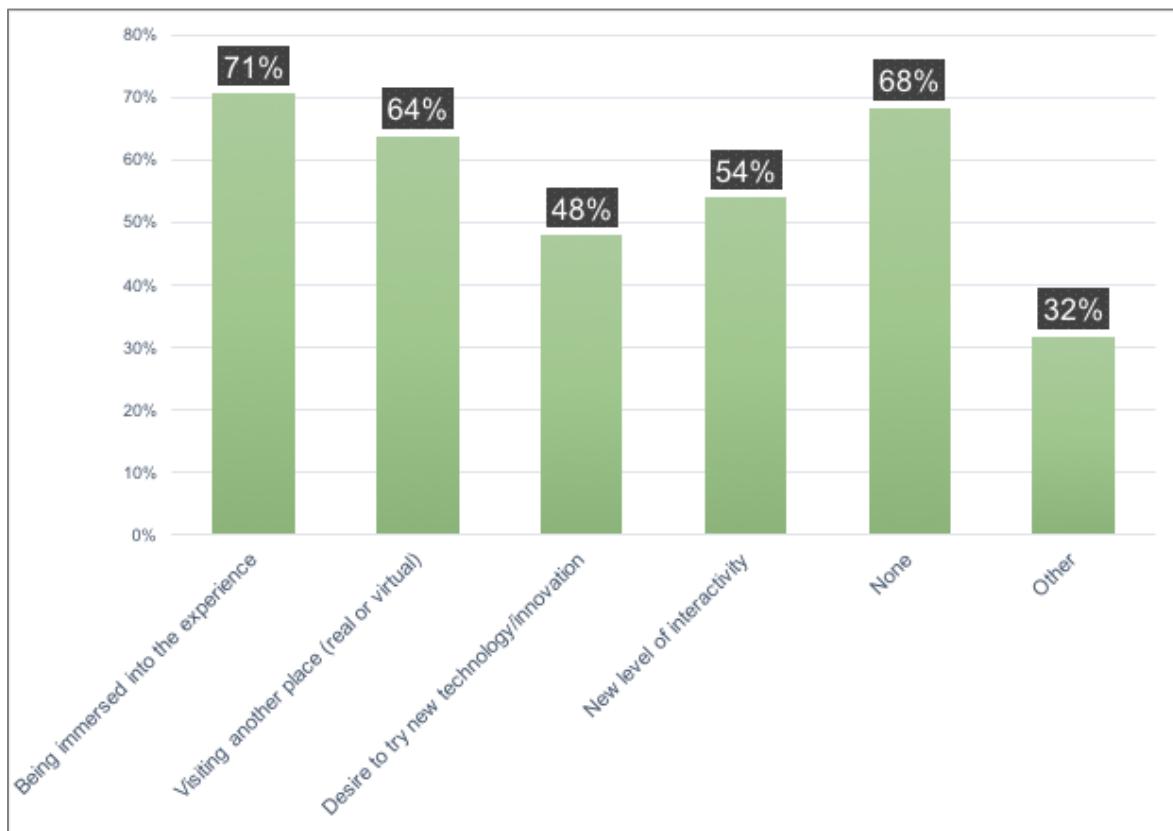
Are you interested in seeing video content with a VR-headset?



What category of video/film would you be interested in seeing in VR, if any?

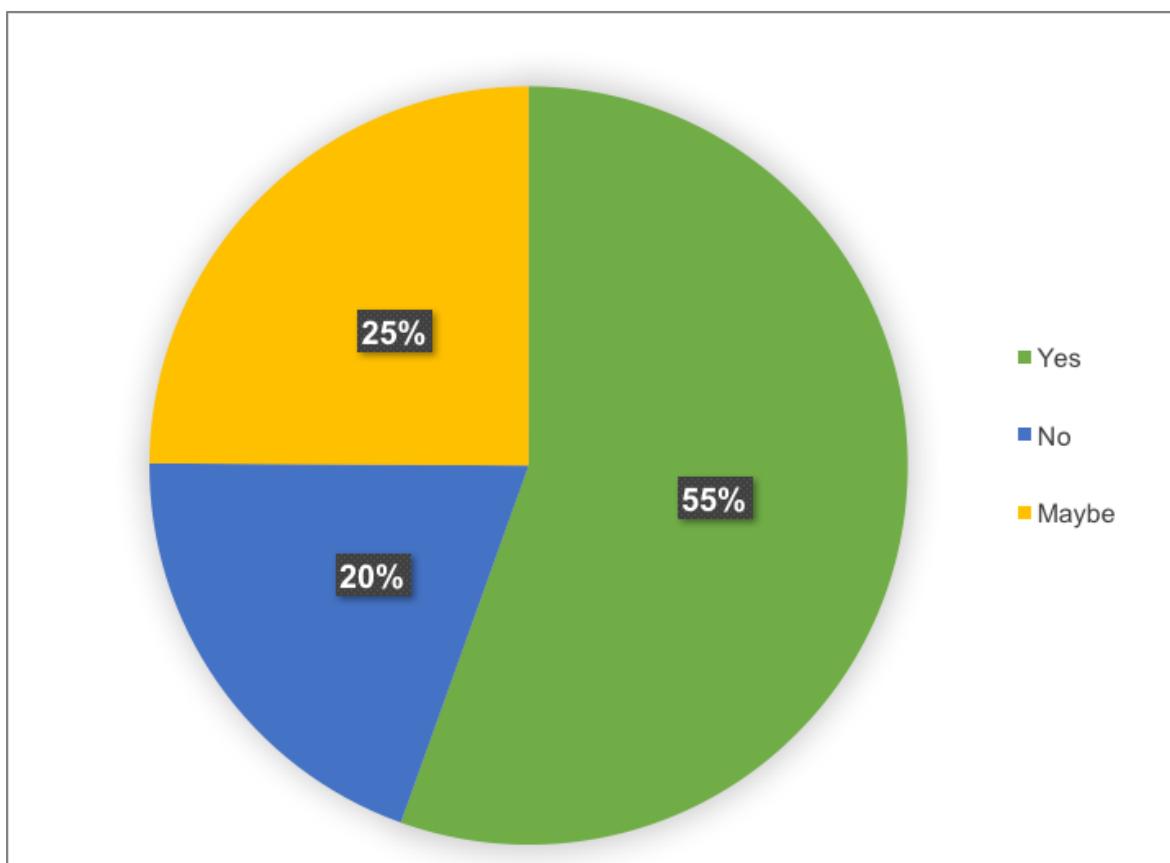


Why do you find it interesting?



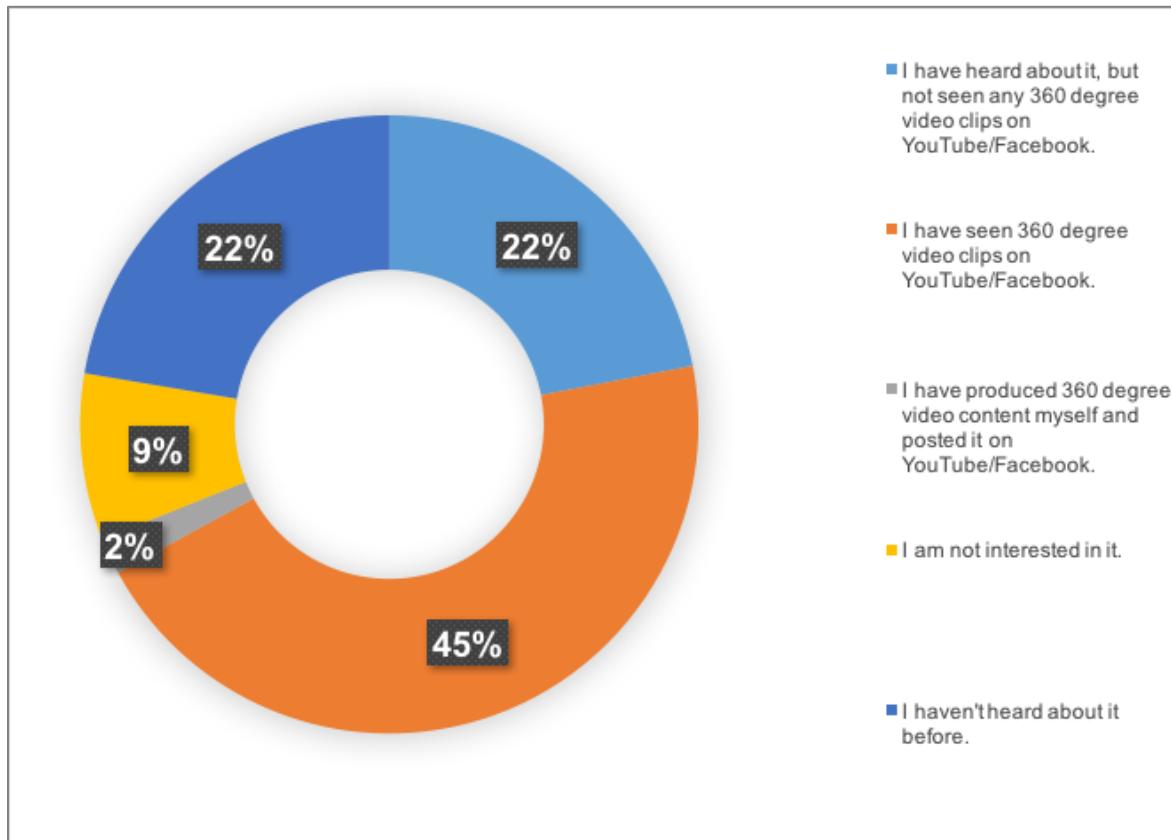
Interactive film experiences in Virtual Reality

VR environments are also supposed to be more or less interactive. The headset's screen re-adjusts its field of view according to the viewer's head movements, and there is the possibility of higher levels of interactivity like influencing the story too. Do you find that kind of interactivity in movies interesting?

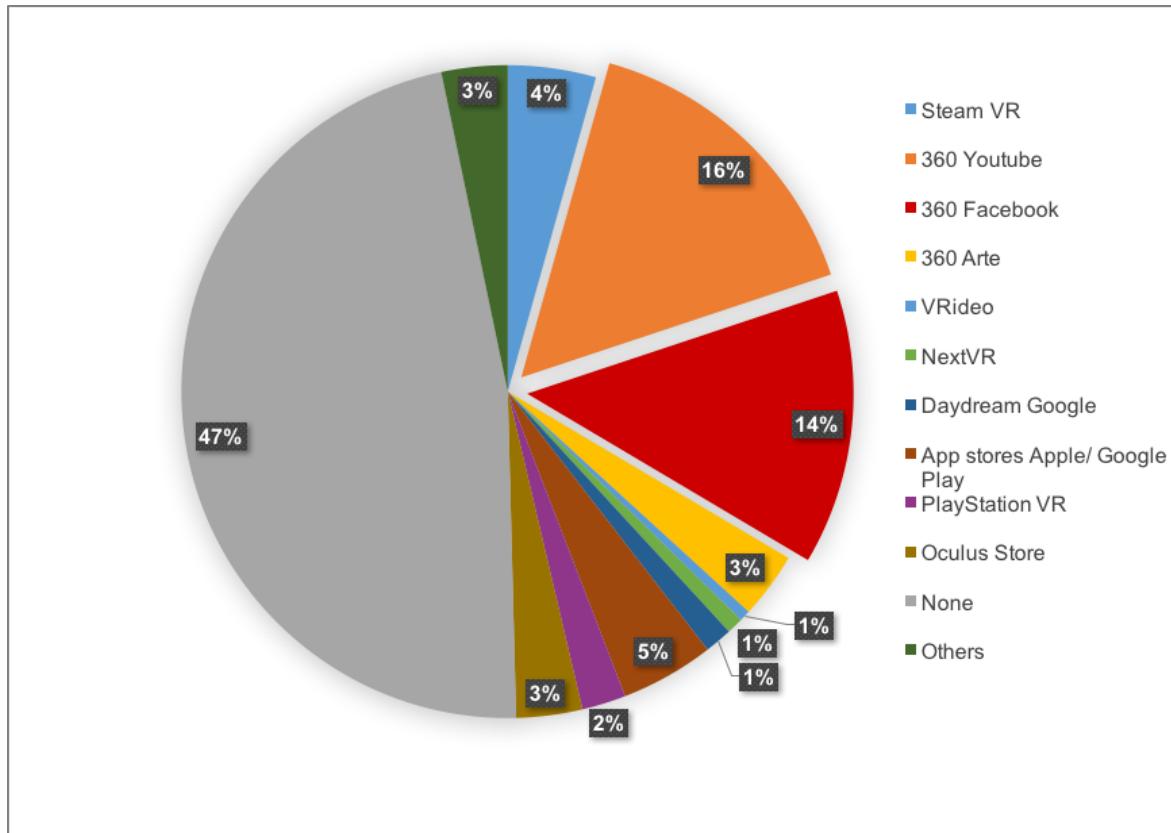


360-degree video footage

Facebook and YouTube are both offering 360-degree video content channels. How do you stand towards those?

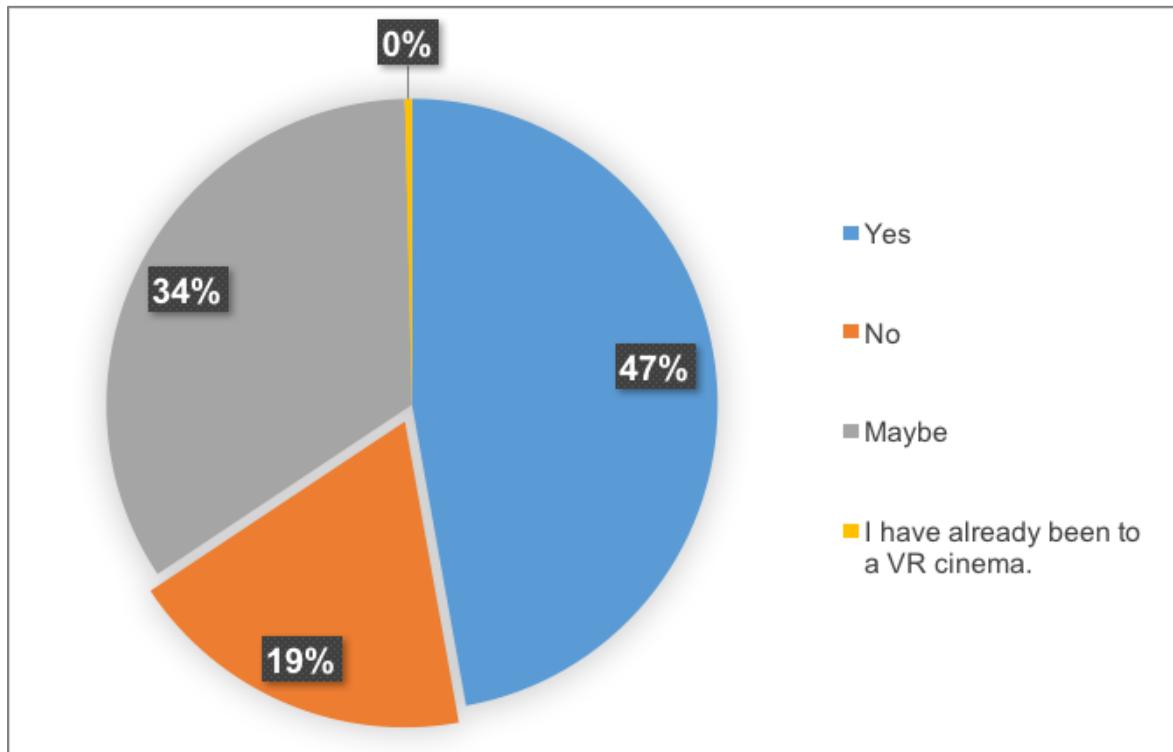


Do you access any VR / or 360-degree video content or VR games on any of those platforms?

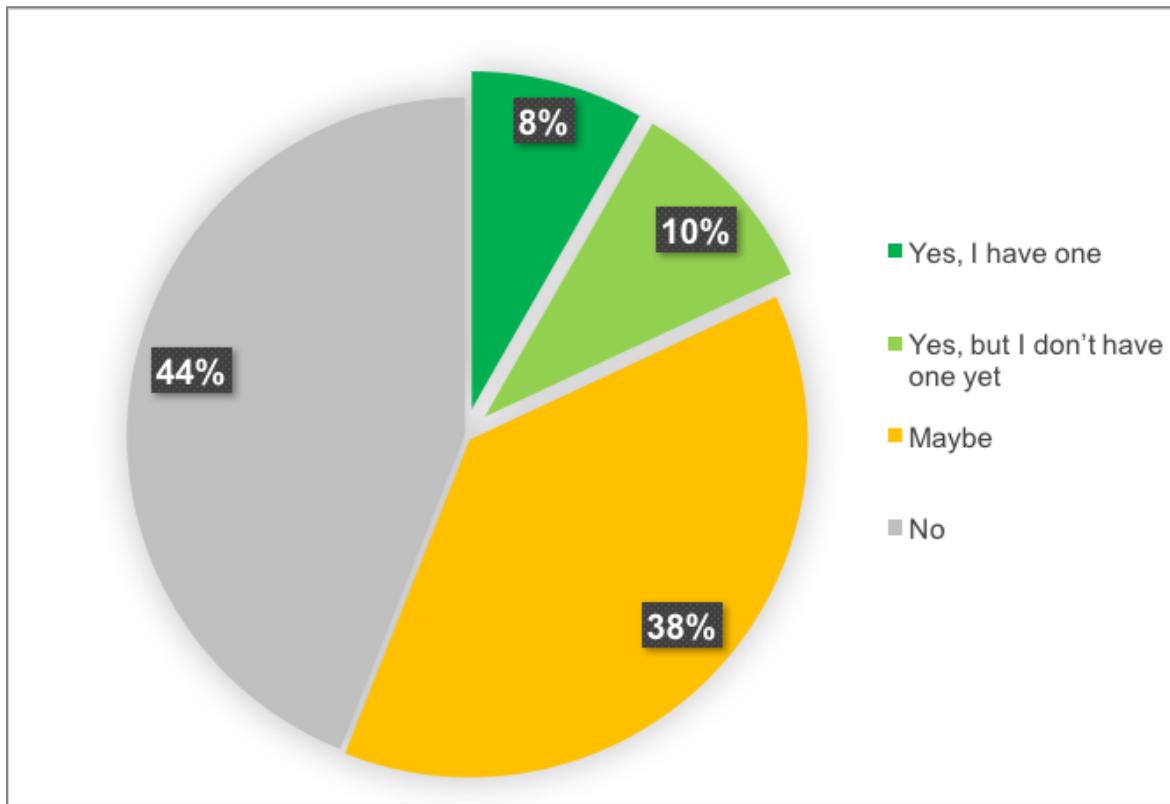


Virtual Reality cinema & Virtual Reality headset

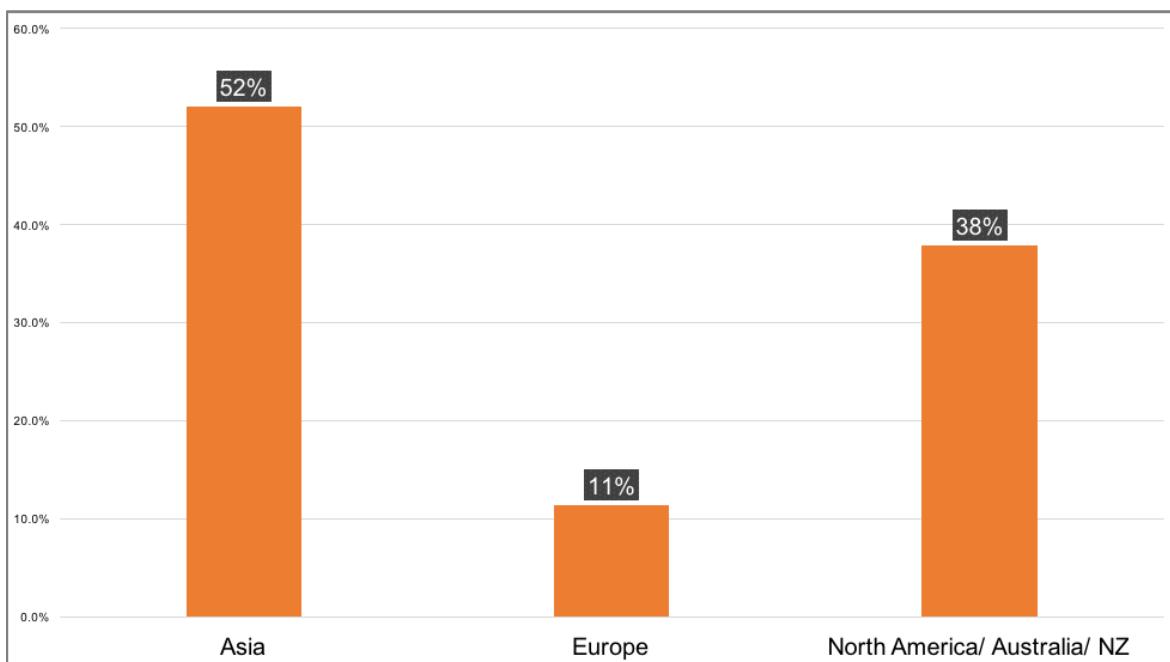
Can you imagine going to a cinema and putting on a VR headset to see video content / movies?



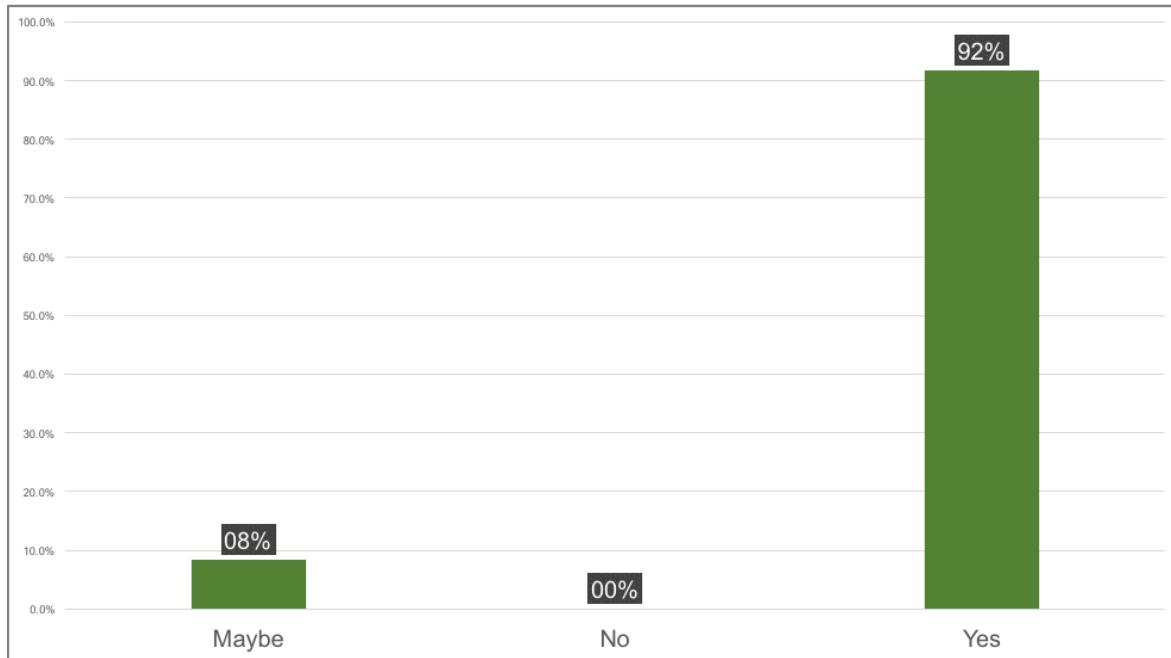
Are you planning to own a VR headset for home usage?



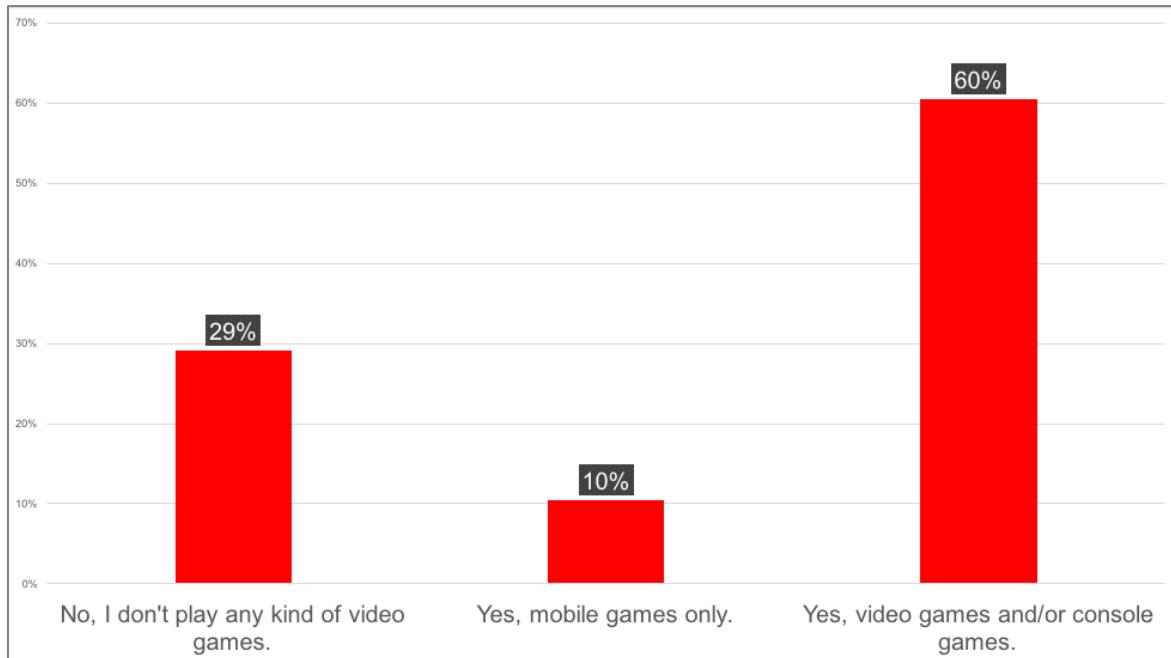
Out of people already owning a Virtual Reality headset, only a minority comes from Europe:



Out of people owing or planning to buy a headset, how many are interested in video content in VR?

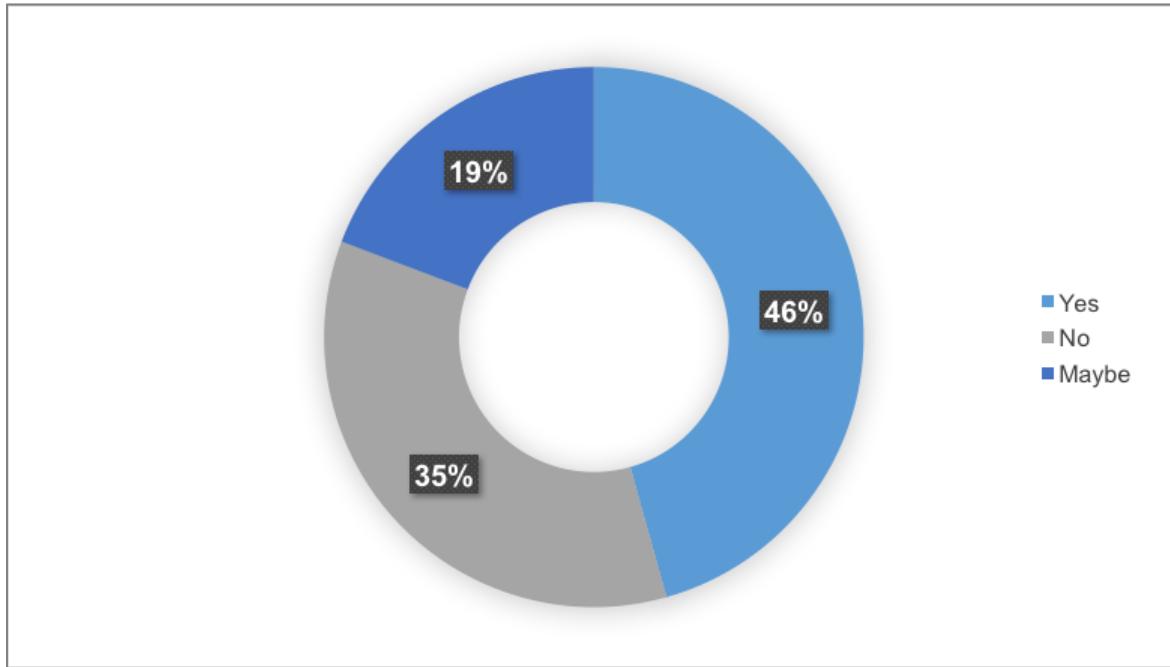


Out of people owing or planning to buy a headset, how many are playing videogames?

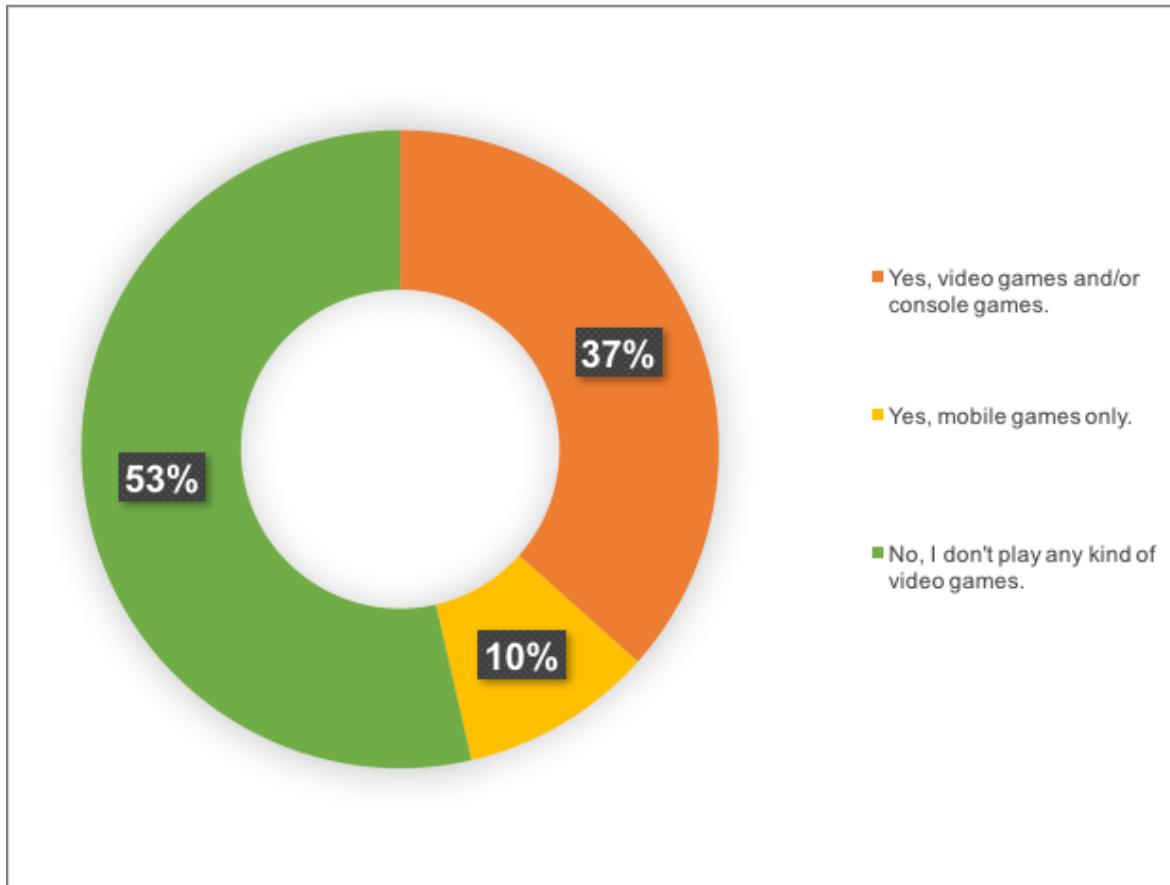


Gaming / Virtual Reality and video games

Are you interested in playing Virtual Reality games?

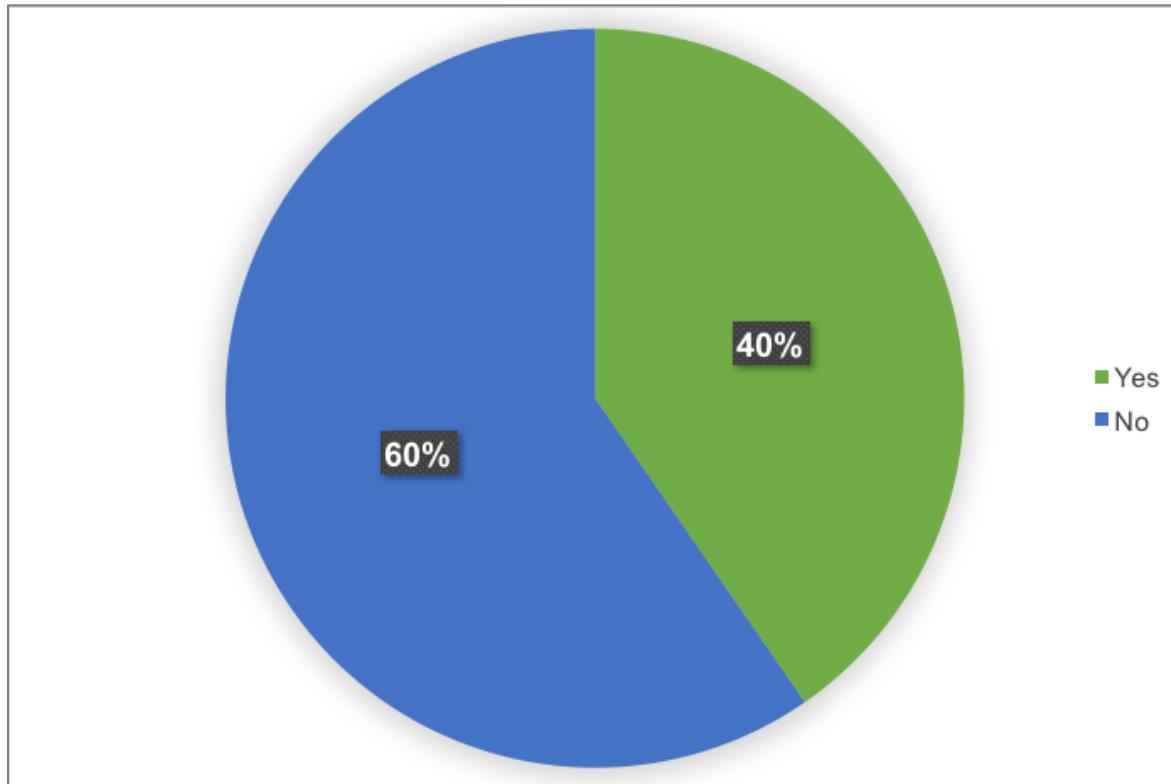


Do you play video games?

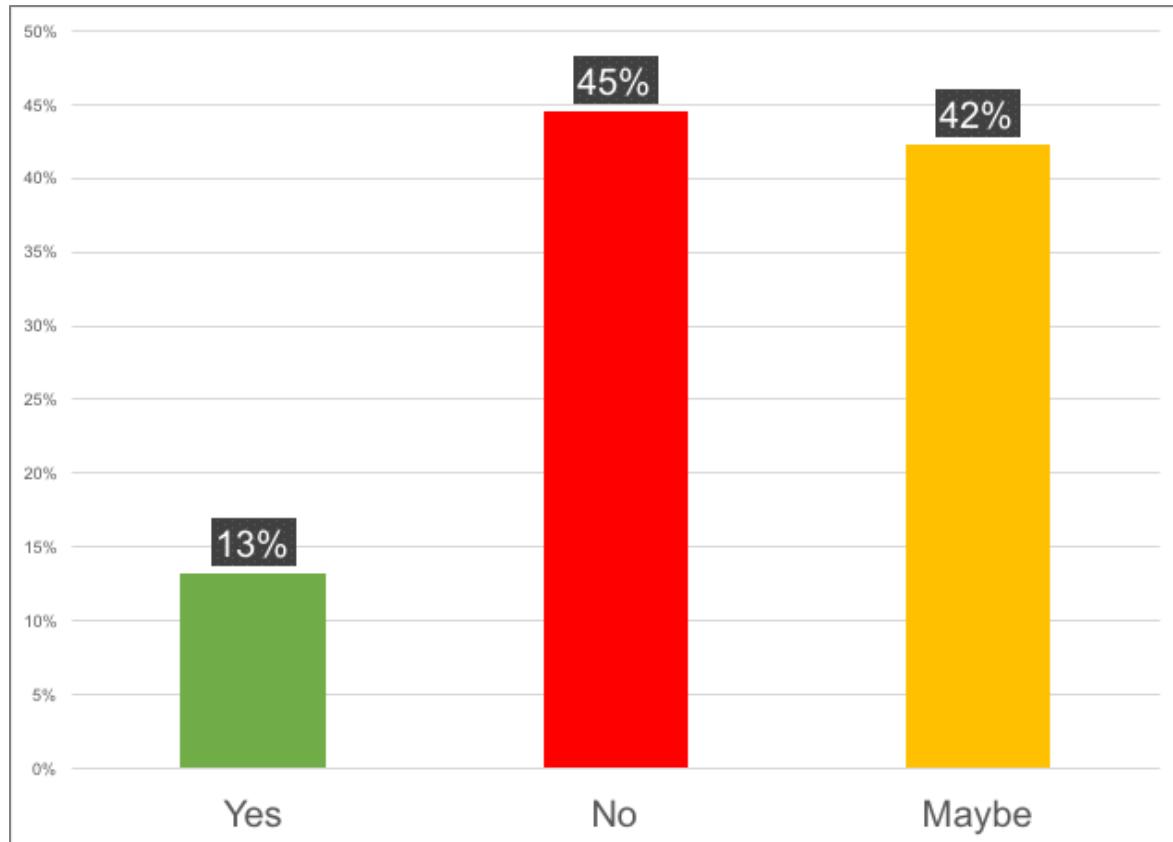


Netflix & streaming services

Do you have a Netflix/Hulu or other video on demand streaming service account?

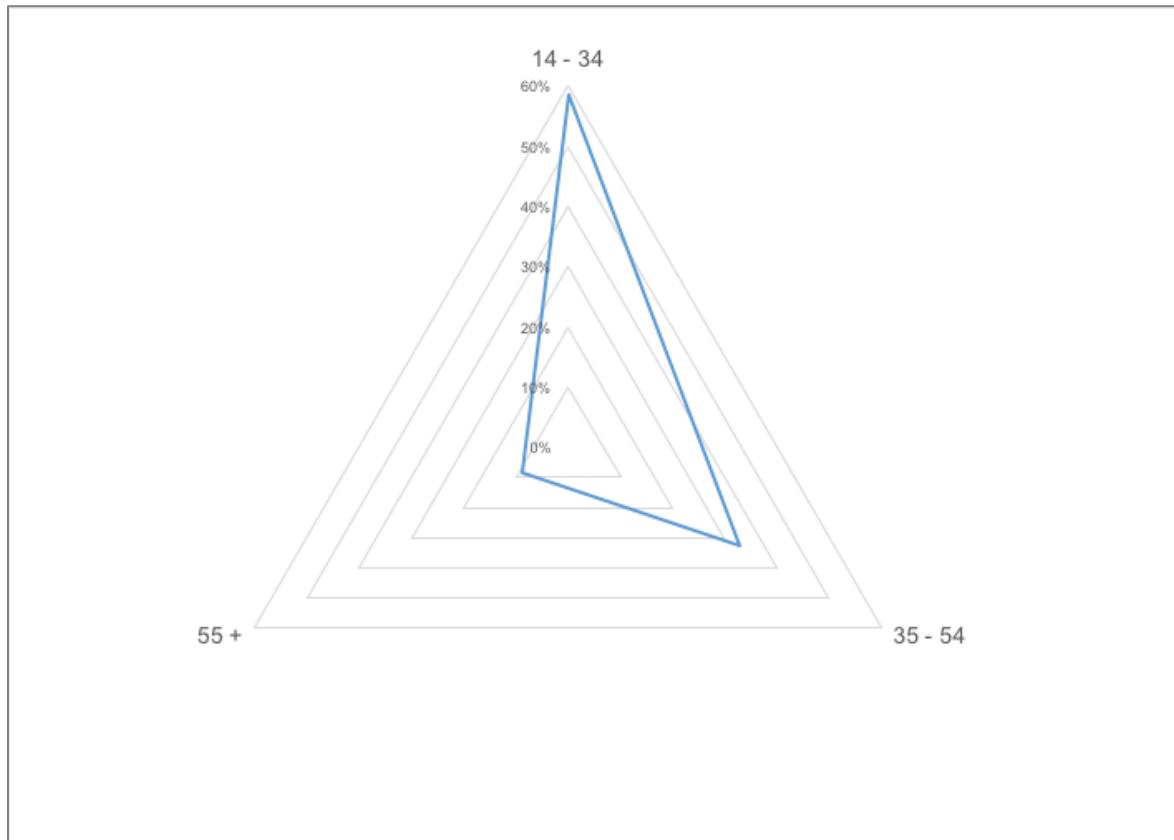


Would you consider paying a subscription for viewing VR content similar to Netflix/ similar video services?

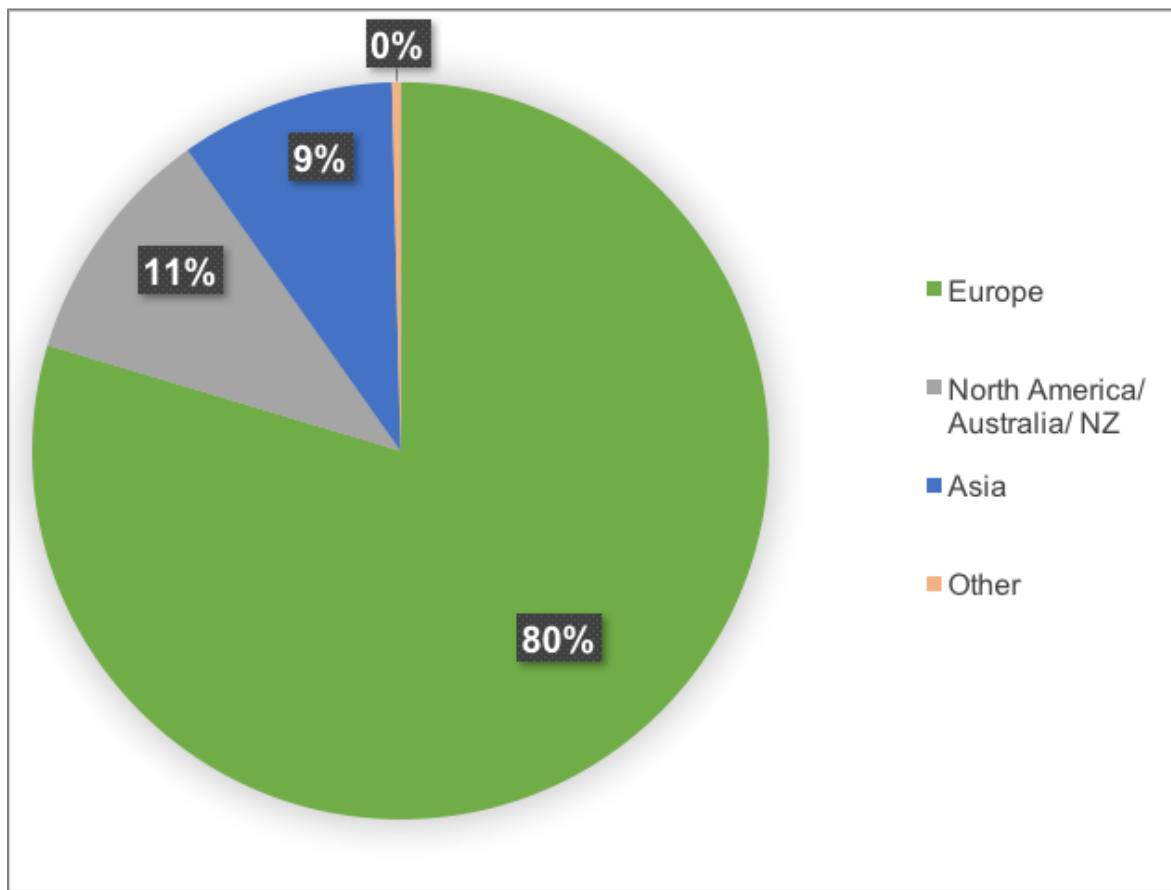


General information

What is your age group?



Where is your country of permanent residence located?



Appendix H: Online-Survey | 2017-01-10 - 2017-02-11 | English version

Virtual Reality | Immersive Film - Survey

Thank you for taking the time to participate in my survey! It will only take you a few minutes while at the same time it will provide me with precious data for my master thesis paper for my currently-running MBA in ‘Film-, TV-, and media management’. Please be assured all information given is treated anonymously.

Virtual Reality

Watch the video if you would like to have an insight on what Virtual Reality is about! (1:30 minutes) <https://www.youtube.com/watch?v=L7MIxGNdOE>

Have you heard of Virtual Reality before? *

- Yes
- No

Virtual Reality is currently broadly defined as a computer-generated environment that brings the user to/into a virtual world within physical presence is simulated. In which of the following areas do you think Virtual Reality is going to be used successfully in the future? *

- Health care
- Architecture
- Video games
- Education
- Live-events (like concerts, sports-events,...)
- Movie industry/video content
- Communication
- Work/productivity
- Journalism
- Tourism
- Simulation (flight, car, sports...)
- Social media
- Advertising
- Others



What content would you personally like to experience with the VR technology? *

- Games
- Live-events
- Video content/movies
- Communication
- Work/productivity
- Education
- Journalism
- Social media
- Tourism
- Architecture
- Simulation (flight, car, sports...)
- Health Care
- Advertising
- None
- Others

Video content in Virtual Reality headsets / Immersive film

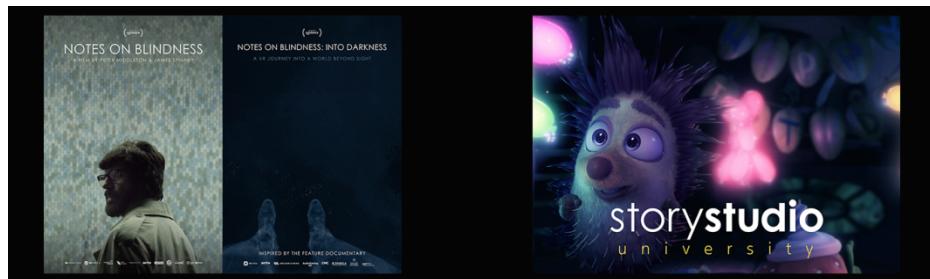
Virtual Reality Headsets are also used to view 360-degree video footage (both for fictional and non-fictional content) as well as computer-generated 3D video. Examples as follow:
Documentaries in 360-degree video | VR Journalism [Screenshots]



Live Events | Sports, News, Concerts, ... [Screenshots]



Fictional movies | Animation, Interactive, ... [Screenshots]



Are you interested in seeing video content with a VR-headset? *

- Yes
- No
- Maybe

What category of video/film would you be interested in seeing in VR, if any? *

- Fictional movies (all genres)
- Animation movies
- Documentaries
- Live-events (concerts, sports, ...)
- News
- None

Why do you find it interesting?

- Being immersed into the experience
- Visiting another place (real or virtual)
- Desire to try new technology/innovation
- New level of interactivity
- None
- Other

Interactive film experiences in Virtual Reality

VR environments are also supposed to be more or less interactive. The headset's screen re-adjusts its field of view according to the viewer's head movements, and there is the possibility of higher levels of interactivity like influencing the story too.



Do you find that kind of interactivity in movies interesting? *

- Yes
- No
- Maybe

360-degree video footage

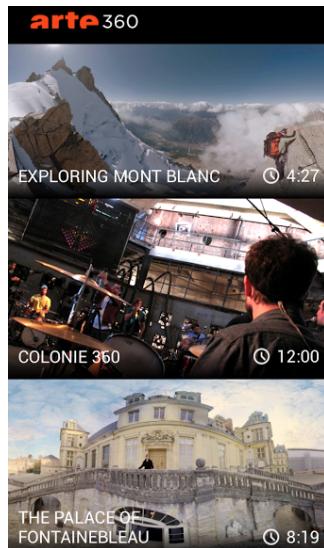
Currently, much Virtual Reality video content is 360-degree footage. The user's viewpoint is within a scene and she/he can turn around 360 degrees in a scene and look around and therefore choose where to look as in the real environment. (Currently, in most of those videos, you cannot actually walk inside the scene.)



Facebook and YouTube are both offering 360-degree video content channels. How do you stand towards those? *

- I have heard about it, but not seen any 360-degree video clips on YouTube/Facebook.

- I have seen 360-degree video clips on YouTube/Facebook.
- I have produced 360-degree video content myself and posted it on YouTube/Facebook.
- I am not interested in it.
- I haven't heard about it before.



Do you access any VR / or 360-degree video content or VR games on any of those platforms? *

- Steam VR
- 360 Youtube
- 360 Facebook
- 360 Arte
- VRideo
- NextVR
- Daydream Google
- App stores Apple/ Google Play
- PlayStation VR
- Oculus Store
- None
- Others

Virtual Reality cinema & Virtual Reality headset



Can you imagine going to a cinema and putting on a VR headset to see video content / movies? *

- Yes
- No
- Maybe
- I have already been to a VR cinema.

Are you planning to own a VR headset for home usage? *

- Yes, I have one
- Yes, but I don't have one yet
- Maybe
- No

Gaming / Virtual Reality and video games



[*Eagle Flight* Virtual Reality Game]

Are you interested in playing Virtual Reality games? *

- Yes
- No
- Maybe

Do you play video games? *

- Yes, video games and/or console games.
- Yes, mobile games only.
- No, I don't play any kind of video games.

Netflix & streaming services

Do you have a Netflix/Hulu or other video on demand streaming service account? *

- Yes
- No

Would you consider paying a subscription for viewing VR content similar to Netflix/ similar video services? *

- Yes
- No
- Maybe
- Other:

General information

What is your age group? *

- 18
- 18 - 34
- 35 - 54
- 55 +

Where is your country of permanent residence located? *

- Europe
- North America/ Australia/ NZ
- Asia
- Other:

Thank you very much for taking part in my survey about Virtual Reality. Your contribution is greatly appreciated!

Bettina Enigl

If you have any comments or want to add anything to the questions, please let me know here! Thanks!

Appendix I: Online-Survey | 2017-01-13 - 2017-02-11 | German version

'Virtual Reality | Immersive Film' - Fragebogen

Vielen Dank, dass Sie sich für meinen Fragebogen, den ich für die Masterthese meines MBA-Lehrgangs "Film-, TV- und Medienmanagement" erstellt habe, Zeit nehmen! Ihn auszufüllen wird nur wenige Minuten in Anspruch nehmen - alle gegebenen Informationen werden selbstverständlich anonym behandelt.

Virtual Reality

Falls von Interesse: Eingangs ein kleiner Einblick in Virtual Reality (Dauer 1:30 Minuten)

<https://www.youtube.com/watch?v=-L7MlxGNdOE>

Haben Sie bereits von Virtual Reality gehört? *

- Ja
- Nein

Ein 'Virtual Reality'-System stellt eine computer-generierte virtuelle Welt dar, in der sich der Anwender physisch präsent fühlen soll und mit welcher er in gewisser Weise interagieren kann. In welcher der folgenden Bereiche denken Sie, dass Virtual Reality in der Zukunft erfolgreich sein wird? *

- Gesundheitswesen
- Architektur
- Videospiele
- Bildung
- Live-events (z.B. Konzerte, Sportveranstaltungen,...)
- Film-, Video- und TV
- Kommunikation
- Arbeitswelt
- Journalismus
- Tourismus
- Simulation (wie Flugsimulation, Autobranche, Sport...)
- Social media
- Werbung

- Andere



In welchen Bereichen wäre es für Sie persönlich interessant, Virtual Reality-Technologie auszuprobieren bzw. zu verwenden?*

- Videospiele
- Live-events
- Film- und Video
- Kommunikation
- Arbeitswelt
- Bildung
- Journalismus
- Social media
- Tourismus
- Architektur
- Simulation (wie Flugsimulation, Autobranche, Sport...)
- Gesundheitswesen
- Werbung
- Keine der genannten Bereiche
- Andere

Video und Film im Virtual Reality-Headset

Mit dem Virtual Reality Headset kann man unterem anderen auch Videos/Filme ansehen. Diese können sowohl fiktionale, dokumentarische als auch animierte Inhalte haben. Einige Beispiele hier:

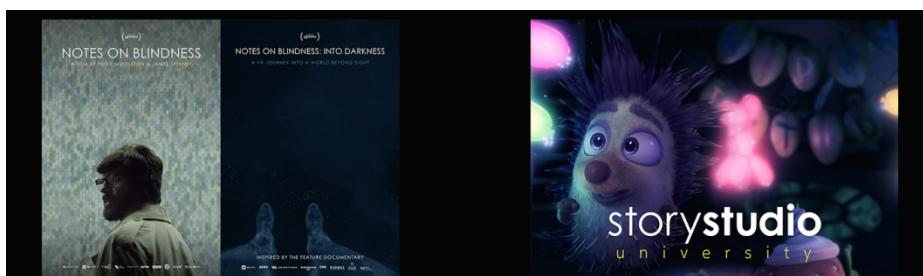
1. dokumentarisches 360-Grad Video in VR [z.B. Syrien-Konflikt und National Geographic | Screenshots]



2. Live Events | Sport, Neuigkeiten, Konzerte, ... [Screenshots]



3. Spielfilm, Animation, Interaktive Filme, ... [Screenshots]



Sind Sie daran interessiert, Filme/Videos mit einem Virtual Reality-Headset anzusehen? *

- Ja
- Nein
- Vielleicht

Welche dieser Kategorien von Film/Video würden Sie gerne in Virtual Reality ansehen? *

- Spielfilm (alle Genres)
- Animationsfilm
- Dokumentation
- Live-events (Konzerte, Sportveranstaltungen, ...)
- Nachrichten
- Keine

Warum finden Sie es interessant?

- Immersion in der virtuellen Welt
- Neue Orte und Welten kennenlernen/besuchen (real oder virtuell)
- Interesse an neuer Technologie
- Neue Formen von Interaktivität auszuprobieren
- Keines
- Andere

Interaktive Filme in Virtual Reality

Virtual Reality soll - per Definition - auch in gewisser Weise interaktiv sein. Interaktivität besteht in Virtual Reality allein schon darin, dass das Blickfeld den Bewegungen des Anwenders angepasst wird. Weiter ist es möglich, eine höhere Interaktivität zu erreichen, in dem zum Beispiel der Verlauf einer Geschichte eines Films vom Anwender beeinflusst werden kann.



Finden Sie diese Art von Interaktivität in Virtual Reality-Filmen interessant? *

- Ja
- Nein
- Vielleicht

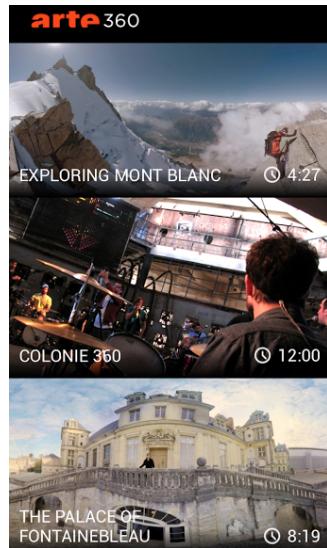
360-Grad Videomaterial und Plattformen

Momentan wird ein Großteil von Videos in Virtual Reality in 360-Grad-Video-Technik hergestellt. Beim Betrachten eines 360-Grad-Videos befindet sich der Anwender quasi mitten in der Szene. Er/sie kann sich in einer Szene 360 Grad drehen und sich auf diese Weise - wie in der realen Wirklichkeit - umsehen. (Allerdings kann man sich derzeit meistens noch nicht innerhalb der Szene in der Form bewegen, dass man sich auch im Raum bewegen kann - der Standpunkt des Betrachters bleibt also unverändert.)



Sowohl Facebook als auch YouTube unterstützen 360-Grad Videomaterial auf ihren Plattformen. Wie stehen Sie dazu? *

- Ich habe davon gehört, aber ich habe noch keine 360-Grad Videos auf Facebook/YouTube gesehen.
- Ich habe 360-Grad Videos auf YouTube/Facebook gesehen.
- Ich habe 360-Grad Videomaterial produziert und habe es auf YouTube/Facebook online gestellt.
- Ich bin nicht daran interessiert.
- Ich habe davon noch nichts gehört.



Haben Sie derzeit Zugang zu Virtual Reality oder 360-Grad Video oder Virtual Reality-Spielen über einer dieser Plattformen? *

- Steam VR
- 360 Youtube
- 360 Facebook
- 360 Arte
- VRideo
- NextVR
- Daydream Google
- PlayStation VR
- App stores Apple/ Google Play
- Oculus Store
- Keine
- Andere

Virtual Reality Kino & Virtual Reality Headset



Können Sie sich vorstellen, Videos oder Filme in einem Kino mit einem Virtual Reality-Headset anzusehen? *

- Ja
- Nein
- Vielleicht
- Ich war bereits in einem Virtual Reality-Kino.

Haben Sie vor, sich ein Virtual Reality-Headset für den Eigengebrauch zuzulegen? *

- Ja, ich habe bereits eines.
- Ja, aber ich habe noch keines.
- Vielleicht
- Nein

Virtual Reality-Spiele und Videospiele



[*Eagle Flight* Virtual Reality-Spiel]

Sind Sie daran interessiert, Virtual Reality-Spiele zu spielen? *

- Ja
- Nein
- Vielleicht

Spielen Sie Videospiele? *

- Ja, Videospiele und/oder Spielekonsole-Spiele (wie PlayStation, Xbox,...).
- Ja, nur 'Mobile Games'.
- Nein, ich spiele keine Videospiele.

Netflix & Video Streaming Service

Haben Sie ein Netflix/Hulu-Abonnement oder ein Abonnement bei einem anderen ähnlichen 'Video on demand' Streaming Service-Dienstleister? *

- Ja
- Nein

Würden Sie es in Betracht ziehen, - analog zu Netflix & Co - eine Gebühr zu zahlen, um Virtual Reality-Spiele und Virtual Reality-Inhalte/Videos anzusehen zu können? *

- Ja
- Nein
- Vielleicht

Allgemeine Information

Geben Sie bitte Ihre Altersgruppe bekannt: *

- 18
- 18 - 34
- 35 - 54
- 55 +

Wo befindet sich Ihr ständiger Wohnsitz? *

- Europa
- Nordamerika/Australien/Neuseeland
- Asien
- Andere

Vielen Dank, dass sie an meiner Befragung über Virtual Reality teilgenommen haben! Ich schätze Ihre Mitarbeit sehr - nochmals lieben Dank!

Bettina Enigl

Wenn Sie noch etwas hinzufügen möchten, bitte ich Sie, es hier anzumerken.

Appendix J: Online-Survey | 2017-01-12 - 2017-02-11 | French version

Merci de prendre le temps de participer à mon enquête ! Cela ne prendra que quelques minutes et me fournira de précieuses informations pour la thèse de mon MBA "Film-, TV-, and Media-Management". Les réponses sont recueillies anonymement.

Réalité Virtuelle

Vous pouvez regarder la vidéo ci-dessous si vous souhaitez avoir une explication de ce qu'est la réalité virtuelle ! (1:30 minutes)

<https://www.youtube.com/watch?v=-L7MlxGNdOE>

Aviez-vous entendu parler de réalité virtuelle avant cette enquête ? *

- Oui
- Non

La réalité virtuelle est généralement présentée comme un environnement virtuel calculé par un ordinateur où est simulée une présence physique. Dans quel domaine pensez-vous que cette technologie sera utile dans le futur? *

- Santé / Médecine
- Architecture
- Jeux vidéos
- Education
- Evénements en direct (concerts, compétition sportive, etc.)
- Films / Vidéos
- Communication
- Travail
- Journalisme
- Tourisme
- Simulation (voiture, avion, sport...)
- Réseau sociaux
- Publicités
- Autres



A titre personnel, quels types de contenus ou dans quels domaines souhaiteriez-vous faire l'expérience de la Réalité Virtuelle ? *

- Jeux
- Evénements en direct
- Films / Vidéos
- Communication
- Travail
- Education
- Journalisme
- Réseaux sociaux
- Tourisme
- Architecture
- Simulation (voiture, avion, sport...)
- Santé / Médecin
- Publicités
- Aucun
- Autres

Vidéos et réalité virtuelle

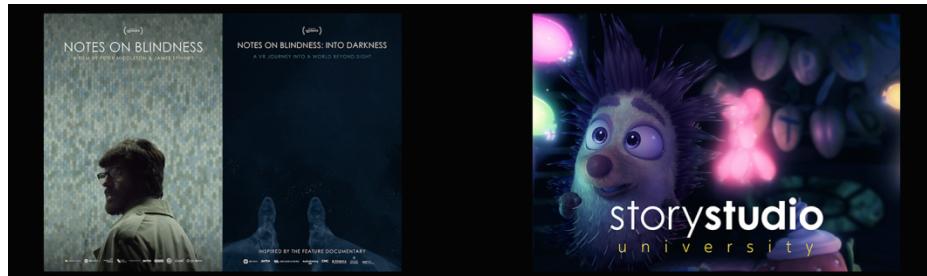
Les casques de réalité virtuels sont aussi utilisés pour regarder des vidéos en 3D ou des films à 360° (fiction ou réaliste comme pour le journalisme VR). Exemples ci-dessous : Documentaires vidéo en 360 degré | Journalisme VR [images]



Evénements en direct | Sports, News, Concerts, ... [images]



Film de fiction | Animation, Interactif, ... [images]



Seriez-vous intéressé par regarder des vidéos avec un casque VR ? *

- Oui
- Non
- Peut être

Sur le sujet du visionnage de vidéos avec un casque VR, quel type de vidéos pourrais vous intéresser ? *

- Film classique (tout genres confondus)
- Film d'animation
- Documentaires
- Evénements (sport, concert, etc.)
- Informations
- Aucun
- Autres

Que trouvez-vous intéressant dans la réalité virtuelle ?

- L'immersion dans l'expérience
- La possibilité de visiter d'autres lieux (réels ou virtuels)
- L'attrait de la nouvelle technologie
- Le niveau d'interactivité
- Rien

Les films interactifs en réalité virtuelle

Les environnements virtuels peuvent offrir un certain niveau d'interactivité. Les casques détectent les mouvements de la personne et ajustent le contenu affiché en conséquence. De plus, il est possible de permettre à la personne d'effectuer des actions susceptible d'affecter l'histoire racontée.



Pensez-vous que l'interactivité peut s'avérer intéressante dans les films ? *

- Oui
- Non
- Peut être

Vidéos à 360°

Actuellement, la majorité des vidéos en réalité virtuelle sont des vidéos à 360°. L'utilisateur est au centre de la scène et peut orienter son regard dans toutes les directions. (La plupart des vidéos ne permettent pas le déplacement de l'utilisateur dans la vidéo.)



Saviez-vous que Facebook et Youtube offrent le support des vidéos à 360° ? *

- J'en ai entendu parler mais je n'ai pas eu l'occasion d'en voir.
- J'ai eu l'occasion de voir des vidéos à 360° sur ces sites.
- J'ai produit et publié des vidéos à 360° sur Youtube/Facebook.
- Cela ne m'intéresse pas.
- Je n'en ai jamais entendu parler.



Utilisez vous une ou plusieurs de ces plateformes pour accéder à du contenu à 360°/ en réalité virtuelle ? *

- Steam VR
- 360 Youtube
- 360 Facebook
- 360 Arte
- VRvideo

- NextVR
- Daydream Google
- App stores Apple / Google Play
- PlayStation VR
- Oculus Store
- Autres
- Aucune

Cinema de réalité virtuelle & Casque de réalité virtuelle



Iriez vous au cinéma pour voir un film en réalité virtuelle (casque fourni par le cinéma) ? *

- Oui
- Non
- Peut être
- Je suis déjà allé dans un cinéma de réalité virtuelle

Envisagez vous d'acquérir un casque ? *

- J'en possède déjà un
- Oui, j'envisage un achat
- Peut être
- Non

Gaming / Réalité Virtuelle et jeux vidéos



[*Eagle Flight*: jeu en réalité virtuelle]

Etes vous intéressé(e) par les jeux en réalité virtuelle ? *

- Oui
- Non
- Peut être

Jouez vous régulièrement aux jeux vidéos ? *

- Oui, sur pc ou console
- Oui, sur mon téléphone
- Non, je ne joue pas

Netflix & Vidéo à la demande

Avez-vous un compte sur un service de vidéo à la demande comme Hulu ou Netflix ? *

- Oui
- Non

Envisageriez-vous de payer un abonnement pour accéder à du contenu en réalité virtuelle en streaming ? *

- Oui
- Non
- Je ne sais pas

Informations Générales

Quel est votre groupe d'âge ? *

- 18
- 18 - 34
- 35 - 54
- 55 +

Quelle est votre zone de résidence ? *

- Europe
- Amérique du nord / Australie / Nouvelle Zélande
- Asie
- Autres

Merci d'avoir participer à cette enquête sur la réalité virtuelle. Votre aide est grandement appréciée !

Bettina Enigl

Si vous avez des commentaires ou des informations complémentaires, n'hésitez pas !