Playing with Virtual Reality: Early Adopters of Commercial Immersive Technology

Maxwell Foxman

Submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy
under the Executive Committee
of the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2018

ABSTRACT

Playing with Virtual Reality:
Early Adopters of Commercial Immersive Technology

Maxwell Foxman

This dissertation examines early adopters of mass-marketed Virtual Reality (VR), as well as other immersive technologies, and the playful processes by which they incorporate the devices into their lives within New York City. Starting in 2016, relatively inexpensive head-mounted displays (HMDs) were manufactured and distributed by leaders in the game and information technology industries. However, even before these releases, developers and content creators were testing the devices through "development kits." These de facto early adopters, who are distinctly commercially-oriented, acted as a launching point for the dissertation to scrutinize how, why and in what ways digital technologies spread to the wider public.

Taking a multimethod approach that combines semi-structured interviews, two years of participant observation, media discourse analysis and autoethnography, the dissertation details a moment in the diffusion of an innovation and how publicity, social forces and industry influence adoption. This includes studying the media ecosystem which promotes and sustains VR, the role of New York City in framing opportunities and barriers for new users, and a description of meetups as important communities where devotees congregate.

With Game Studies as a backdrop for analysis, the dissertation posits that the blurry relationship between labor and play held by most enthusiasts sustains the process of VR adoption. Their "playbor" colors not only the rhetoric and the focus of meetups, but also the activities, designs, and, most importantly, the financial and personal expenditures they put forth.

Ultimately, play shapes the system of production by which adopters of commercial VR are introduced to the technology and, eventually, weave it into their lives. Situating play at the center of this system highlights that the assimilation of digital media is in part an embodied and irrational experience. It also suggests new models by which future innovations will spread to the public.

Table of Contents

List of Charts, Graphs, Illustrations

Acknowledgements

First, I would like to thank the many Virtual Reality, Augmented Reality and Mixed Reality enthusiasts who so honestly and wholeheartedly let me observe and interview them over the course of this study. They are the bedrock upon which this document is built.

I would like to sincerely thank my adviser Todd Gitlin for not only the many spirited conversations we had regarding the medium of Virtual Reality, but also for giving me the freedom and respect to pursue the technology.

I would like to also give special thanks to my chair Andie Tucher. It was her constant guidance on all parts of the dissrtation that brought it into being. I am truly proud of how this work has turned out in no small measure as a result of her excellent recommendations.

Furthermore, I would like to acknowledge and thank the other members of my committee, Brooke Erin Duffy, Robbie McClintock and Dennis Tenen for their detailed comments and thoughts both before and during the defense.

This dissertation came together because of the many peers and colleagues who sustain my intellectual inquiries. To that end, I would first like to thank David Nieborg, who has acted as a consummate professional and intellectual sounding board, Charles Berret who inspired key sections of this dissertation, Pete Brown who provided input on methodology, and Peter Schaefer who offered invaluable advice about my academic pursuits.

I come from a unique department where the counsel of fellow students remains one of the great joys of research. I would like to recognize Colin Agur, Burcu Baykurt, Gal Beckerman, Jonah Bossewitch, Diani Citra, Rosalind Donald, Elena Egawhary, Shant Fabricatorian, Alexandre Goncalves, Bernat Ivancics, Joscelyn Jurich, R. H. Lossin, Malwina Lys-Dobradin,

Kathryn Montalbano, Travis Mushett, Lluid de Nadal, David Noel, Tracy O'Neill, Ri Pierce-Grove, Annie Rudd, Soomin Seo, Caitlin Shure, Madiha Tahir, Danielle Tomson, Angela Woodall and Emilie Xie among many other incoming and outgoing Comm PhD students for their unceasing intellectual curiosity.

Some of the theoretical work for this dissertation was the fruit of great conversations of the "Doctoral Reading Group on Organizational Ethnography," a consortium of students from NYU and Columbia. Thanks to Elizabeth Anne Watkins, Andi Dixon, Kevin Lee, Larah Lebovitz, Anat Hurwitz and Rohini Jalan for exploring all that is Organizational Ethnography.

Finally, I must acknowledge Gloria and Margaret Foxman. The two of you make everything I do possible through your neverending love, encouragement, consultation and care. Thank you.

INTRODUCTION

On August 6, 2015, *Time* Magazine's cover heralded the coming of a new age: Virtual

Reality (VR) would "change the world" and "revolutionize the way we live, play and learn"

(Stein, 2015). Splashed across the cover was a photo of the VR wunderkind and Oculus founder

Palmer Luckey.

Figure 1. Time magazine cover, August, 2015.[1]

Wearing the iconic "Rift" headset, which was acquired (along with his company) for $2

billion by Facebook, Luckey, described as a "tinkerer," hovers, arms outstretched, almost in mid-

---

[1] "TIME Magazine The Surprising Joy of Virtual Reality," Time, accessed March 12, 2018,
http://time.com/3987059/in-the-latest-issue-41/.

flight. In a pastel polo and jeans, eyes concealed by the head-mounted gear, he floated above a beach with the tether of the Rift stretched out into the distance.

The image is awkward and goofy. It is the portrait of an unlikely harbinger for the latest and greatest technology, or at least that is how he had been dubbed in enthusiast and mainstream media. Unsurprisingly, the cover was quickly lampooned, and photo-montages appeared of the suspended Luckey on ponies, flying through the air with Peter Pan and the lost boys and in the arms of Leonardo DiCaprio on the deck of the Titanic. Even the article demeaningly compared him to other "Silicon Valley nerds." Together, the picture and text created a dissonant view of Virtual Reality as an eccentric innovation; hardly an inevitability, but rather "A Surprising Joy."

This attitude—at once optimistic, sarcastic, and guarded—has bedeviled the slow adoption of Virtual Reality over the last six years. Starting in 2012 with Oculus' Kickstarter campaign, when it surprisingly met its fundraising goal in 24 hours, the medium has increasingly diffused to the wider public, spurred by significant corporate investment and hype from media outlets, while hardware manufacturers vie for commercial dominance. Despite past failures and nagging skepticism, Virtual Reality—or at least the idea of it—is gaining popularity, even though its technological cousin "Augmented Reality"[2] is stealing some of its limelight. But who are its faithful admirers? Why and how are they spreading its gospel?

Current users have a different agenda from innovators like Luckey. They are not necessarily the offspring of major tech and games companies that manufacture devices, or outlets for venture capital that are looking to profit from the technology. Instead, this group of enthusiasts, excited about VR's potential, are independently seeking ways to integrate it into their work and other activities.

---

[2] I discuss the relationship between VR and Augmented Reality in Chapter 4 and the Conclusion.

This dissertation enters the world of these early adopters whose interest has been piqued by media—like the *Time* cover— by tech and game industry marketing, and by the popular culture that has surrounded VR for years. As the devices become more and more accessible, what do enthusiasts do with them? How do they imagine VR's place in their lives and in what ways do their practices affect the technology's wider diffusion?

This dissertation explores the visceral experience of "adoption." What makes VR a "Surprising Joy," as *Time* suggested? Ultimately, these ordinary adopters will help define the future of the medium and how, if at all, it is embraced by the broader public.

What is Virtual Reality?

Luckey's headset was not the first Virtual Reality display, nor will it be the last. Despite recent commercial growth, hype, and investment, the concepts surrounding the technology can be traced back to the foundations of Western philosophy. Aristotle and Plato both wondered how humanity engaged with "virtual" spaces, or facsimiles of our reality.[3] According to Susanne Langer (1953), the act of artistry itself entertained notions of the "virtual." Painters created virtual space; musicians created a virtual representation of time and its passage; writers created a virtual past and dramatists a virtual present. Langer (1950) emphasized that in all cases, the virtual was an act of creation and not recreation (p. 531). The artist needed to create an "entirely independent" and "self-contained, total system" (Langer, 1953, p. 75), which accounted for all senses through symbolic representation within the imagined space.[4] Painters, for instance, needed to depict smell and touch within the system of a two-dimensional canvas. As a

---

[3] To see an analysis of both their views see de Souza e Silva & Sutko, 02/2011.

[4] Langer (1953) also refers to dance and performance as a "Magic Circle," based on gesture and act.

consequence, the virtual, whether applied to a canvas, an online game or emerging media has represented a contained and artificial space that at once utilizes symbols of our own reality, while being an aesthetic creation.

With the 1800s came further technical advances which could immerse viewers into a virtual space. These included stereoscopes—viewers for looking at two images placed side-by-side which gave a sense of three-dimensional space from a single photograph or image. Some contraptions went far beyond viewers. The Sensorama, invented by Morton Heilig in the 1950s, was a booth that not only provided stereoscopic imaging but blew in artificial smells and "haptic" or touch feedback via a rumbling chair.[5]

Perhaps the most identifiable part of Virtual Reality are the goggles, or "Head-Mounted Display" (HMD). Even this technology has a fifty-year-old history, starting with computer scientist Ivan Sutherland's invention, which displayed little more than wireframe graphics, all that a computer's processor was capable of at the time. Still, he imagined it as the first step into an "ultimate display" whose computational power could enhance all senses (Sutherland, 1965). Since the 1980s, viewable content for HMDs has been designed and available for consumption.

It is also during this time when the term "Virtual Reality" was first promulgated by Jaron Lanier, the founder of VPL Research, which made both headsets and accessories for mass audiences. Although the concept of the virtual had long preceded Lanier's definition, his term served two purposes. On the one hand, it described the viewing of three-dimensional computer graphics. But more than that, it newly articulated a "digital wonderland" (Staley, 2015, p. 95), the artificial reality that could be set apart from the real world. However, Lanier's concepts were

---

[5] These insights are common to almost any history of the technology, but in this case are drawn from "History Of Virtual Reality," Virtual Reality Society, accessed March 6, 2018, https://www.vrs.org.uk/virtual-reality/history.html.

tied to concepts like cyberspace, another computer-generated online reality imagined first by author William Gibson. Consequently, Virtual Reality became associated with the cybercultural tropes and technology of Silicon Valley and, to a degree, was unmoored from its artistic and philosophical roots.

Despite steady improvements, as well as continued presence in popular media and science fiction—Lanier's headsets even appeared in the 1992 movie *Lawnmower Man*—mass adoption of VR devices remains limited, and past failures have overshadowed commercial success. Most notable was Nintendo's Virtual Boy, released in 1995 and dropped in 1996, a development that became exemplary of a "Virtual Reality Winter," when industries abandoned the budding medium in droves. Lanier's own VPL Research filed for bankruptcy in 1999.

The current rise of VR has been driven by Luckey's invention, which borrowed common smartphone components, including gyroscopes and accelerometers, to construct an affordable headset, a few hundred dollars compared to the $9,000 price tag of VPL's device. These ubiquitous parts spurred a half decade of innovation which continues today.

Modern commercial VR headsets burst onto the marketplace in 2016; they now ship from companies like Facebook-owned Oculus, HTC (in partnership with major game distributor Valve), Microsoft, Google and PlayStation. In addition to headsets, a wide array of peripherals have been released including hand controllers, room-scale scanners and mobile accessories. "Augmented Reality" headsets have also started to be merchandised. Rather than "occluding" or blocking the real world from sight, to create the illusion of virtual space, these devices instead overlay computer graphics onto reality. But what qualifies as "Virtual Reality" is somewhat nebulous. For my purposes, VR will be defined as any mass-market technology used to create an immersive experience through a computerized headset or mobile device. This will encompass

apparatus—the Oculus Rift, HTC Vive, PlayStation's PSVR—all of which began to be distributed in 2016 and mobile devices—Google's "Cardboard" and "Daydream" headsets and Samsung's "GearVR," which use smartphones placed in a viewer to deliver a virtual experience. It will include other commercial devices, such as the $3,000 Microsoft HoloLens, a "Mixed Reality" headset, and accessories, such as the Oculus "Touch" controllers. However, my focus will discount the military and industrial simulations of VR. These have their own longer history, going back to flight simulation in the 1920s, but neither are part of the same popular imagination, nor do they have the individual user orientation of the latest spate of devices.[6]

Ultimately, Virtual Reality represents a confluence of different technological, cultural and industry forces. It is typified by a moment in 2015 when *The New York Times* released 1.3 million cardboard headsets made by Google, which utilized the smartphone as the engine to power *The Times'* content. This combination of innovative hardware (smartphones), software (made by the *Times*), and the influence of industry leaders was devised to "hook" (Wohlsen, 2015) readers on VR. The initiative was successful enough for the *Times* to continue its VR application and experiments to the present day. However, more importantly, who was hooked? For some, seeing the headsets in their mailboxes was a dream come true. For others, it was a new experience—an awakening. For still others, presumably, it was an uninviting gadget requiring no further attention. This dissertation, however, will explore the process by which enthusiasts came to adopt VR and incorporate it into their everyday life.

---

[6] This definition also mirrors the perspective of my interviewees and the media ecosystem which will be explored in upcoming chapters. It reflects how VR and associated technologies were perceived by my subjects. However, it does not encompass the relationship between virtuality and aesthetics described earlier. Thus, it does, to a degree, fall into the popular historical account of VR as put forth by Lanier and cyberculture. Future work should address this discrepancy.

Prevailing Themes

The following themes and questions anchor and permeate the study.

Diffusion and Definition

Given its rich, complicated, and ongoing development, how will VR spread? What do the headsets mean to the customers? How do they avoid the missteps of their antecedents? How will VR affect subsequent forms of interactive and immersive computing? Understanding requires delving into diffusion of innovations research, not to mention decades of Virtual Reality analyses by the computer sciences and industries that have propagated it.

To refine the study, I will address two interconnected topics: The first is early adopters, who they are and how they come to and appropriate this technology. Today's commercial release of devices presents an interesting moment of diffusion for adopters. The VR market is governed by the game industry and tech giants like Google, Microsoft and Facebook, whose business practices determine how VR is commercially distributed. Initially, they made devices available to developers and content creators through kits and beta testing. Developers, therefore, not only became the de facto early adopters of VR, but also approached it differently from armchair consumers; they were commercially oriented and wanted to adapt the medium to their creative practice. How will the focus on development impact adoption for VR enthusiasts? How do the industries who disseminate the devices and make content—such as games, software design and film—influence this process?

This relates to a second topic, namely the shape and definition of the medium as it popularizes. As mentioned, the specific term "Virtual Reality" has been attributed to Jaron Lanier, a Silicon Valley habitué who started his career at the video game company Atari's

Sunnyvale research facility. As a consequence, the medium has been associated with digital games for over a quarter century. VR, as a concept, cannot be distinguished from it, and yet not every early adopter is a gamer. Will VR be defined by the game and tech industries or can early adopters realize a new future for it?

Media Ecosystems

The current diffusion of VR as well as the development of original content are not happening in a vacuum. Adopters and other broadcasters are documenting the process as it occurs. Through a rich media ecosystem, enthusiasts share information and perpetuate the hype which they can easily access and circulate. Journalists are very much integral to this ecosystem—while at once covering and critiquing the technology, they are using it to promote their own organization's exclusive content. It is through this saturated environment of journalism, entertainment, literature and information that many are introduced to VR. With the devices appearing in movies and featured in science fiction novels, online articles, gaming and news outlets, the media reach is unusually wide for a technical innovation.

As a result, it is necessary to comprehend the media ecosystem publicizing VR and at the same time to ask how it affects the process of adoption, particularly given the promotional nature of most coverage.

The Process of Adoption

Rather than thinking of adoption as a singular event—when a consumer purchases a device—think of it instead as a series of decisions and activities that occur before, during and after acquisition. My research thickly describes this process, captures the perspectives of

adopters as they come to the technology, and details the pressures exerted by media and industry on decision-making.

From this, two motifs emerge. First is the value of community. Since the commercial release of VR headsets, a plethora of industries have embraced the technology.

Figure 2. The 2017 VR Landscape. From The Venture Reality Fund.[7]

The figure above from the venture capital firm "The Venture Reality Fund" depicts the logos of startups and more established corporations working within VR. What ties this staggering

---

[7] "The Venture Reality Fund," The Venture Reality Fund, accessed March, 7, 2018, http://www.thevrfund.com/.

number of parties together? How does this diversity help or hinder adoption? In an attempt to answer this, my study focuses on a setting where many different industries and professionals converge—enthusiast meetups around VR. These are informal zones where VR technology both takes center stage and is celebrated outside any specific profession.

A second topic is how the rhetoric and vision of VR affect the adoption process. Despite the disparate industries and media girding the technology, a vision and discourse of limitless potential and boundless opportunity is common. Adopters' perspective is shaped through meetups, media and industries which hope to gain from VR's wider diffusion. How do this vision and rhetoric frame adoption?

Games and Play

Digital games and their respective industry have a deep connection to the development of VR. Uniquely, this current moment of diffusion accompanies the rise and use of games in broader contexts. Whether it is the escalation of "gamification," or "the use of game elements in non-game contexts" (Deterding, Dixon, Khaled, & Nacke, 2011) as a design strategy, or the pervasiveness of digital games on mobile devices, the industry has reached a level of influence and wealth not previously experienced.

Within this study, the sway of the game industry is of key interest on several fronts. First, it has very specific models of how to distribute content, make products and exert control. VR's commercial diffusion has copied its use of development kits, beta testers and promotional media. Additionally, game engines power VR content creation.

How shall VR be framed as it gains popularity? Is it just, or primarily, a gaming device? How does the industry deal with the professions, workflows and practices of those who elect to develop content for immersive media?

Finally, not only is VR an outgrowth of the game industry, but its adoption is very much propelled by play. Like hobbyists, VR enthusiasts expend excess time and energy outside of work hours on their avocation, along with playing just for the fun and glory of it.

Chapter Outline

Having identified major research themes, the dissertation proceeds as follows:

Chapter One reviews the Communications literature that surrounds Virtual Reality and its diffusion. Because of the high costs of the devices, most of this literature has been speculative about VR's potential. The mass commercial release of VR and the prevalence of developer kits and content creators necessitates a new paradigm to frame VR's diffusion. In order to do this, I introduce Game Studies literature and analyze the blurry boundaries between play and labor in VR's adoption process.

Chapter Two details the multimethod approach I undertake in my study. This entails the use of participant observation, semi-structured interviews, discourse analysis and ultimately autoethnography to relay the visceral experience of adoption.

Chapter Three scrutinizes the media ecosystem that promotes and broadcasts information about VR. An abundance of sources interact with each other to bolster and promote the medium. These include many different types of journalism, promotional media, blogs, in particular the blogging platform *Medium*, Facebook, Slack and other online groups, YouTube, tutorials, "Let's Play" entertainment videos, conferences, festivals and finally arcades.

Chapter Four defines the different categories of content cited by both media and adopters. After explaining how they are unified by common (and usually free) software platforms—in particular "engines" originally used to develop digital games—I distinguish "Virtual Reality," "360° Video," "Augmented Reality" and "Mixed Reality."

Chapter Five accounts for the geographic location of my study—New York City. Adoption within The City's boundaries is different from other locales. New York does not have the same techno-utopianism associated with the cyberculture of the West Coast. Instead, government, research institutions and a number of entrenched businesses—particularly media companies focused in journalism, advertising and film—support the local VR economy.

Chapter Six focuses on meetups. Meetup.com makes sense in a city where it remains difficult to find people with common affinities and places to meet. Because of their enthusiast constituency, the meetup is an ideal sampling and opportunity to identify supporters; how, why and where they organize, schedule activities and negotiate common understandings about a mutual pursuit.

The rhetoric of VR adopters is the subject of Chapter Seven. Through the ninety interviews I undertook, I find most informants describe the medium in terms of novelty, innovation, potential and still being in an inchoate state, with few rules guiding its future. Their optimism is balanced against the realities and practical, technical and institutional limitations of working with VR, which "play" helps to overcome.

While play is addressed in part in the previous chapters, Chapter Eight deeply probes the topic. I establish three operant definitions of play in the context of the adoption process: play as activity, play as design and play as expenditure. VR adopters engage in each as they learn about, develop content for and ultimately showcase their work. It also suffuses the activities of meetups. Finally, I show how play motivates diffusion: Users "play" with manufacturers' development kits to stretch, build on and surpass their pre-programmed limitations. This effort generates no specific economic benefit, but provides feedback to manufacturers and reifies their place within the VR ecosystem.

Why do adopters play? Chapter Nine answers this question through five autoethnographic accounts of my own VR experience. I lay bare how I devoted excess hours and money to produce a 360° film, dived down rabbit holes of exploration in recreating in VR a now-demolished graffiti mecca, found glory in presenting the project on demonstration day and finally recount the bacchanalia of a meetup afterparty.

Finally, the conclusion explores future areas of research, and ultimately discusses why play is pivotal in the relationship between early adopters and emerging forms of digital media.

CHAPTER 1: LITERATURE REVIEW

The core of this study is the relationship between a specific population of users—namely "early adopters"—and a particular medium: Virtual Reality (VR). Characterized by the popular press as "consumer leaders" and "ideal shoppers" looking for "new products to keep up with emerging trends" (Mourdoukoutas & Siomkos, 2010, p. 30), or simply those who "like working with new products that have cutting-edge technology" and "want the bragging rights as the first to use a fresh, cool product" (Gehrich, 2012, p. 102), this group's fascination with the medium might seem obvious. However, fundamental questions arise when defining not only both sides of this alliance, but also the very concept of early adoption.

What makes up the experience of early adopters? While the term typifies a specific group of actors, it hardly describes how they act. What is it like to adopt a new technology? Imagine the long lines of enthusiasts curving around city blocks in wait for the latest iPhone. What passes through their minds as they idle away countless hours once they finally obtain it? Is it a sense of exhilaration? Or frustration? Maybe both? Do they feel superior as the "cool kids" with the best new technology? In those first moments, as they begin to incorporate an innovation into their everyday life, do they fiddle with the device—testing its limitations—or have they carefully researched details about it in advance? It is these seemingly mundane activities that set both the adoption process in motion and early adopters apart from their more mainstream counterparts.

The rapid pace of both the innovation and dissemination of digital consumer electronics makes it difficult to even determine who the early adopter is. Today's smartphones contain only modest improvements ranging from new cameras and sensors to software-specific upgrades. Are then the Apple disciples queuing for the newest iteration of iPhones early adopters? Or are only the first iPhone fans the true early adopters of smartphone technology? I owned an exorbitantly

priced Palm Treo in 2005, which offered Internet access, applications and telephony. Did that make me an early adopter, although I didn't own an iPhone until a decade later? Why do I, or anyone else, eagerly line up to purchase the latest digital gadget? How did we come to that place? Our presence is the culmination of a process of adoption based on a confluence of personal, social and cultural forces.

This convergence is even more pronounced for "early adopters" of VR and other immersive media.[1] The associated technology—and specifically the hardware and three-dimensional graphics necessary for virtual portrayals—is over fifty years old. In 1968, scientist Ivan Sutherland created the first "head-mounted display" (HMD) for 3D graphics, the infamous "Sword of Damocles," a name indicative of the device's extreme weight.

VR developed in tandem with two-dimensional graphics and the personal computer. It also existed as a mainstay in the public imagination, appearing in popular science fiction from William Gibson's *Neuromancer* to popular films like *The Matrix* trilogy. As a consequence, many of the current adherents of immersive technology grew up with expectations promulgated by fictional accounts of its capabilities and a steadily growing market of commercial products. For adopters of Virtual, Augmented (AR) and Mixed Reality (MR) devices,[2] the technology's cultural and social backdrop is essential to interpret their experiences.

It is the contemporary network of adopters who are key in the formation of immersive technology. Drawing on everything from lifelong dreams of virtual worlds to disparate professional opportunities, and, of course, the trove of media currently surrounding VR's

---

[1] Rogers (1995) defines early adopters by "respect" and being "opinion leaders" in new technological diffusion. They are the group that is not innovating, but instead spread the technology to the wider public (loc. 4773). However, as will be discussed, this term is more ambiguous in the case of Virtual Reality diffusion.
[2] These four types of content classifications will be reviewed in detail in Chapter Four.

diffusion, this interconnected group of enthusiasts are first in line to attempt to recognize the technology's potential as it commercializes.

This chapter presents a theoretical compass for navigating their path of discovery. First is a review of the literature exploring immersive technology—and specifically VR—within Communications. Scholars discuss the innovation's diffusion beginning in the 1990s, but their work tends to speculate on VR's potential impact, rather than survey how industries and other social factors are currently fashioning it. Part of the reason for this is practical; commercial devices were rare and costly. However, Social Construction of Technology literature helps establish the wider sphere within which to situate immersive media.

A key factor in the current adoption movement is the labor of (often) uncompensated developers, content creators and enthusiasts. This group expends time, energy and significant funds to publicize and construct new content for immersive media, outside of their vocations. These workers' occupational backgrounds begin to frame the process of adoption, along with the specific industries which support and spread the technology to the wider public.

The billion-dollar AAA video game industry looms largest over VR's diffusion and produces most commercial headsets. This close relationship between games and commercial VR was a key reason to use Game Studies research as a theoretical foundation to comprehend its diffusion. The culture, costs, and labor of the game industry mold VR as it encounters other enterprises.

Play is paramount in the experience of early adoption and phenomenologically frames the assimilation of VR into the lives of enthusiasts. Play also articulates the labor processes that surround the disparate group of enthusiasts, freelancers, creators and developers I studied. A

language of fun, optimism and competition binds these subgroups together across genres and interests.

Virtually Infinite

VR literature is almost *too* vast. The pages of computer science journals and annual conferences, particularly the proceedings of the Special Interest Group on Computer Graphics and Interactive Techniques (SiGGRAPH), catalogue fifty years of technical discoveries of the medium. However, this literature emphasizes practical applications more than the technology's communicative potentials. A single article in *Virtual Reality* cites early adopters, only to credit craniofacial surgeons as users of 3D imaging (Robb, 2008, p. 247). Similarly, most articles on diffusion talk about fidelity and the reduction in the cost of hardware (Riva, 1998, p. 264).

A professor, prominent in the local enthusiast scene in New York City, described his three decades studying the medium as having "no concept… of how long it took for things to become relevant. I'm a typical researcher. I have my head in the clouds." However, he was acutely aware that the literature he pioneered was not only well-established, but increasingly finding its way into enthusiasts' discussions of VR and its potential. Immersive technology was the "genie that I've been partially responsible for helping craft and let out of the bottle." One offshoot was the Mixed Reality (MR) spectrum. First defined by Milgram, Takemura, Utsumi, and Kishino (1995), the concept illustrates the various types of digital representations that might appear in head-mounted display, or as originally stated, the "environment as one in which real world and virtual world objects are presented together within a single display" (p. 283).
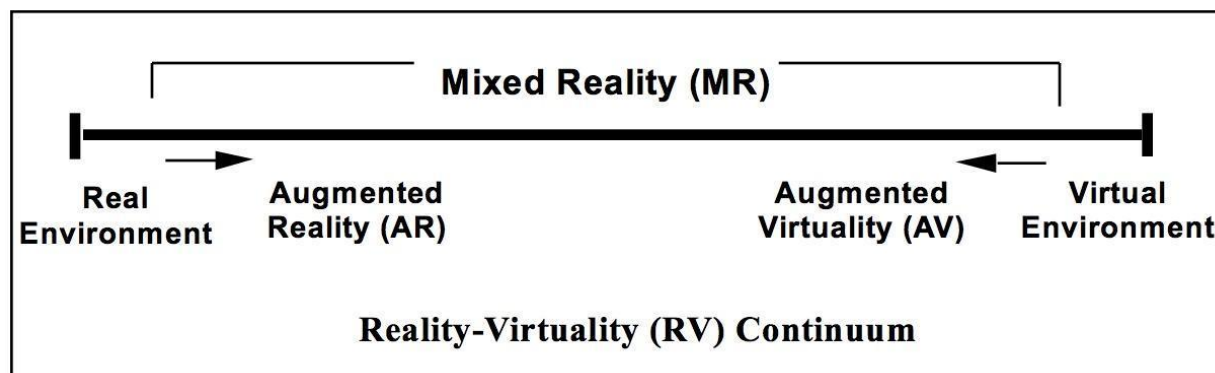
Figure 1.1. The Virtuality Continuum. See Milgram et al., 1995, p. 283.

Not only has this term been adopted by computer giant Microsoft to describe its

particular brand of immersive headsets, but the spectrum is also prominent in much of the

popular literature published on VR. Throughout my study, the figure above was shown to

enthusiasts at meetups and conferences a number of times to articulate AR, particularly as it rose

in popularity through the summer of 2017, and to distinguish it from VR.

The language voiced by early adopters I interviewed, either knowingly or not, derives

from academic works such as Jim Blascovich and Jeremy Bailenson's (2012) *Infinite Reality:*

Avatars, Eternal Life, New Worlds and the Dawn of the Virtual Revolution. Inevitably,

enthusiasts bring up "tracking and rendering" (p. 42), "orientation" (p. 46), "lag" (p. 51),

"simulator sickness" (p. 52), "wireframes" (p. 52), "geometry" (p. 52), "texture" (p.52),

"monoscopic" and "stereoscopic" displays, and "agents and avatars" (p. 59). References also

appear constantly in online articles and how-to videos. A guide made by VR streaming company

Visbit contains a full section explaining stereoscopic and monoscopic video and gets fairly

technical when describing lag: "There is another 'latency' concept [that] shows up when we talk

about foveated streaming or foveated rendering" (Inc, 2016). *Infinite Reality* is replete with

potential applications for VR, such as "shopping" (Blascovich & Bailenson, 2012, p. 194),

forensics, medicine, physical therapy, "[t]reating [p]ost-tramautic [s]tress disorder" (p. 208),

military, flight simulators, vacations (p. 221). The language and perspective surrounding VR, AR and MR is distinctly technology-focused with sparse social and cultural references.

There is a dearth of conversation surrounding Communications and social adoption of the medium. In the edited volume *Communication in the Age of Virtual Reality*, only a single article considers the social consequences of its diffusion. Instead, the majority of the volume explains what Virtual Reality *is* and the means by which to design communications systems around it. The two editors, who have long researched and taught in mass communications programs state that their goals are first to "introduce the medium of virtuality" and "some of the major concepts that it embodies," and secondly to describe "the emerging issues in the creation of communication applications and experiences" (Biocca & Levy, 1995, p. vii). Such explanatory writing isn't surprising given its 1995 publication date, during the first major attempt to commercialize the headsets. Furthermore, Frank Biocca reasons why diffusion of this technology is so difficult and depicts the process as still in the "knowledge phase" (p. 5), where even understanding the term is in flux. In another paper, he raises still pervasive practical issues that challenge diffusion research of VR. Among them are "simulation sickness" (Biocca, 1992, p. 10), where people become sick while using the device; "technology cluster" (p. 10), when a range of innovations including haptic feedback, audio, video, computational hardware, and software come together, but each diffuses at different rates; and finally the rate of adoption in "various segments of society" (p. 10), which may differ wildly based on need. While Biocca is speaking of different industry segments, this could also include strata of society.

Another chapter in the book, "Virtual Diffusion or an Uncertain Reality: Networks, Policy, and Models for the Diffusion of VR Technology" begins by suggesting that the form the medium takes, as "entertainment or tool" (Valente & Bardini, 1995, p. 305) will ultimately shape

how it diffuses, and assumes a rapid spread of VR theatres and performances by the turn of the 21st century. The two, who are also Communications professors, do not imagine the surge of video communication that wireless broadband propagated. In contrast, they portray diffusion within the social context of the early 1990s, predicting a kind of "VR theater" home entertainment system or "telephone delivery" of the device over the ensuing years (p. 306). There was no way they could have envisioned the proliferation of smartphones, the rise of high speed mobile tech, cloud computing and other technology clusters that opened VR to users through innovations like Google Cardboard. This inexpensive configuration allowed *The New York Times* (among others) to distribute free headsets to subscribers and give many their first foray into 360° Video.

Still, the authors spell out an important set of factors in the diffusion of VR: it will be the network of adopters who will ultimately shape what the technology will become (p. 309); "uncertainty is never totally eliminated and the socio-technical system is never totally stable" (p. 312); the importance of the "feedback loop" (p. 316) in the process of diffusion; and how prohibitive expense could deter widespread adoption or regular use. In fact, the entire chapter concerns itself with the creative and technical limitations of the technology. Valente and Bardini make a few important (and surprisingly accurate) prognostications about VR's diffusion. They foresee that "the first phase of VR diffusion will likely be input/output devices attached to existing videogames hardware" (p. 306), and while in the ambit of video game manufacturers, it will remain a "toy" with only "stunted technological development" (p. 319).

While Biocca's entries in the book question the potential of the medium, he concludes that a new communication system, possibly incorporating VR, was in the making: "[I]t is clear that radically different communication capabilities are being designed for an emerging

communication system and VR interfaces are an example of these new capabilities" (Biocca & Levy, 1995, p. 29).

This prediction reflects a specific optimistic cyber-utopian vision of immersive technology formulated by early founders such as Jaron Lanier, who is credited with coining the term "Virtual Reality." In one early account of VR, he is described as "symboliz[ing] the Virtual Reality industry. He represents its West coast origins and values. He wears dreadlocks in his auburn hair; he is chubby; he talks fast and apparently in parallel, several lines of thought expressed at once…" (Woolley, 1993, p. 3). Lanier began his career at the video game company Atari's research laboratory in Sunnyvale, along with Brenda Laurel, William Bricken, Warren Robinett and Scott Fisher (p. 5). Laurel, who became an advocate for VR in the 1990s, defined it more broadly as "a multisensory representation of some imaginary object, or of a real object in an imaginary context" (Laurel & Sand, 1994, p. 70). This was fitting since she considered "Virtual Reality" part of a grander project: The "research all began before VR had a name" and "VR was the nexus that revealed new synergies and gave each of them new impetus and a new arena of expression" (Laurel, 1993, p. 202). Laurel's focus extended to all forms of human-computer interaction. Working from her experience in theater, she proposed *any* computer system, and not just Virtual Reality displays, should be designed and thought of as fully imagined worlds (Laurel, 1993).

Lanier, who was instead known more for his soaring rhetoric, expected VR diffusion to become the norm by the turn of the 21st century (Lanier & Biocca, 1992, p. 153). He has mostly advocated a utopian view of immersive technology and its future (p. 166), and envisioned the technology as inherently one of vast communicative potential: "it becomes possible to imagine a future culture of use in which people would improvise realities together as a means of

communicating" (p. 160). Much of the scholarship of Lanier's era does not ground itself in present and widespread application of the medium, because so little broad use existed.[3]

While there is minimal literature on the communicative possibilities of immersive media, there are numerous analyses of the medium in the context of science fiction portrayals. The most notable work of this genre is foundational thinker Janet Murray's (2017) *Hamlet on the Holodeck*, which invokes Virtual Reality to express a new medium for storytelling embodied in the *Star Trek* holographic room that she describes as a "universal fantasy machine" (p. 15). Murray bridges the narrative tropes and structures of the past with what she considers the new technologies of video games (p. 28), personal computers and similar digital media. In one chapter, she explores the notion of immersion itself, founding it in the pleasurable practice of conjuring images while reading (p. 98). Her work shows how traditional modes of narration inform and grow within virtual environments. As the title implies, Murray critiques new media based on how it will reshape storytelling. She even posits her students will be half hackers, half bards because of their engagement with digital devices (p. 9). This is particularly prescient with Virtual Reality, which she identifies as a mode of computer science research looking increasingly towards storytelling (p. 59) and as "loosening of the traditional boundaries between games and stories, between films and rides, between broadcast media and archival media" (p. 64).

Murray bases her work around the potential disruptive power of immersive technology, as does much of the critical Media Studies scholarship on the subject. In *Virtual Reality: Representations in Contemporary Media*, Melanie Chan (2015) dissects Virtual Reality as a

---

[3] Lanier's optimism has been counterbalanced by a pessimism about the Internet's broader development, outside of immersive technology, not to mention the influence of corporate interests in it. See Lanier (2011) for details of this.

concept, tying it to emergent technology. She also takes a distinctly critical perspective, predicated on Baudrillard's concepts of hyperreality and simulation (p. 39). She uses this posture to analyze notions of the virtual in films from the 1990s, particularly *Strange Days*, as well as contemporary depictions in video games and films such as *Catfish* and James Cameron's *Avatar*. Her adherence to fictive portrayals of immersive media ultimately results in an assessment of not the current spate of technology, but rather of a wider set of phenomena that surround the potential future of media more generally.

These trends in the study of Virtual Reality and other immersive media are deficient in addressing the two questions I posed at the beginning of the chapter. The first set of literature, which focuses on the immediate limitations and practical concerns of the technology, does not shed light on the activities and experiences of adopters, nor does it consider their social context; the second set of literature uses immersive technology broadly as a metaphor for general issues of new media. In both cases, there is no acknowledgment of the social and cultural backdrop of the current process of adoption, or its phenomenology, in part because the technology itself has simply not reached the level of commercial viability for widespread adoption. This is despite the fact that in most models of cultural diffusion, the culture and specifically local culture may affect adoption. As Rogers (1995) asserts in his seminal work, "An innovation's incompatibility with cultural values can block its adoption" (loc. 4085).

Bringing the Social into the Virtual

An underlying issue absent from previous studies of immersive media is a lack of acknowledgement that its success relies on how it is socially formed. The professor I quoted earlier opined that VR could fail "for reasons that arguably have nothing to do with the tech. Other things fail because the tech was before its time, or it was preceded by something that came

out a little bit sooner and beat them to it. All of these things happen. And it's just fascinating watching those things happen, and trying to think when is it finally going to become real in a day-to-day kind of way."

Histories of VR recount such missteps. The first head-mounted display, invented by Ivan Sutherland in 1968, was too heavy to wear. Innovator Jaron Lanier's VPL research went bankrupt in 1999. Arcade company Virtuality produced crude experiences that made children sick, and game hardware manufacturers like Sega and Atari hyped but never brought their HMDs to market.[4] Ultimately, these failures had a long-lasting effect, particularly on the game industry. As one article exclaimed: the company "Virtuality had shaped the future of VR gaming while subsequently demolishing it through a thorough misunderstanding of what consumers expect from their gaming experiences; the flashy gear could only temporarily mask a set of harsh realities" (Fowle, 2015).

Perhaps no product epitomized the role of social and, to a lesser degree, technical determinants than the unsuccessful 1995 Virtual Boy headset from Nintendo. Lauded for its 3D Graphics, affordable price and other worldly ability (Murphy, 2016) as well as "immersing players into their own private universe" (Boyer, 2009, p. 29), the headset failed for distinctly social reasons (Boyer, 2009). First, the price point relative to other portable game systems was too high. Headaches were common among users, and headache warnings festooned the product packaging. Games for the Virtual Boy were in 2D rather than 3D. Finally, the lack of any player physicality or other immersive qualities led to the headset's downfall. Boyer argues that although the system further solidified Nintendo's stance as a company dedicated to "innovative gaming concepts" (p. 25), the headset was unsuccessful because Nintendo did not recognize the

---

[4] For examples see Fowle, 2015; Heffernan, 2014.

"technological desires held by this [its intended] audience" (p. 31). The legacy of the Virtual Boy

hangs over the reception of VR devices and, implicitly, their adoption.[5] An article from *Wired*

specifies how early technical failures were precipitated by different cultural portrayals of the

technology through films like *Lawnmower Man* in the 1980s and 1990s: "But the experience

served up by Nintendo's hardware was quite different—rather than a first-person, alternate-

reality experience, most of the Virtual Boy software consisted of standard game designs with

rudimentary depth-of-field effects added" (Kohler, 2010). Kohler concludes that these blunders

doomed VR's commercial release. Oculus' founder Palmer Luckey agreed: "A real shame, too,

because the association of the Virtual Boy with VR hurt the industry in the long run."[6]

Ironically, one of Nintendo's other products offers a quintessential example of innovation

diffusion based primarily on geographic and social factors. In Everett Rogers' foundational

Diffusion of Innovations, the author credits the popularity of the Nintendo Entertainment System

to specific choices by executives on how to market the system to U.S. audiences. Rogers (1995)

states that "[m]uch of Nintendo's success with these video game-players traces to some very

astute product planning by Hiroshi Yamauchi, the company president…" (loc. 4490) who, along

with head of US operations, "carefully positioned the new product's attributes to suit U.S.

consumers… (loc. 4513)." Rogers uses Nintendo's success in the United States as a case study

for illustrating his five attributes of successful innovations: "relative advantage," "compatibility,"

"complexity," "observability" and "trialability." He makes a compelling argument for how

---

[5] Boyer (2009) argues that "New technologies emerge out of general societal desires when producers attempt to project these widespread hopes onto material goods as a means to both make a profit and stimulate cultural progression" (p. 31).

[6] Palmer Luckey, "I am Palmer Luckey, founder of Oculus and designer of the Rift virtual reality headset. AMA!," Reddit, last modified January 11, 2016, accessed March 7, 2018, https://www.reddit.com/r/pcmasterrace/comments/40ea0x/i_am_palmer_luckey_founder_of_oculus_and_designer/.

businesses can market their innovations, but Rogers' account omits the gamut of social forces

that contribute to the common perception of video game technology, and how game play

ultimately fashions this perception. While he mentions the marketing strategies of the Nintendo

campaign (loc. 4505) and the video game crash of 1983, when an oversaturation of consoles in

the American market deflated sales and commercial interest in systems,[7] he limits social factors

mainly to Nintendo's choice of branding and dissemination. Rogers overlooks how Nintendo's

decisions were embraced by consumers and ultimately directed the ideation of video games and

gaming for years to come. Nintendo certainly found success by branding their devices as

consumer toys for boys. However, this left enduring impressions within the US on what video

games could be and oriented the medium toward young men for decades.

One reason for this omission lies in how Rogers positions the role of society in the

construction of technology. For him, social determinations shape the technology in the pre-

diffusion phase (loc. 2607). Other research surrounding the relationship between society and

technological development suggests a persistent push and pull between acceptance and

perception of the technology as it diffuses to the public. Pinch and Bijker's (2012) Social

Construction of Technology (SCOT) theory proposes that technologies remain in a state of

"interpretive flexibility" or "that scientific findings are open to more than one interpretation" (p.

409) as they are publicly accepted. As an example, they study how conceptions of the bicycle

were reformulated to emphasize safety over a nineteen-year period (p. 416). Their text

recognizes that not only did the advent of the safety bicycle rise from historical and social

conditions, but that racers and average users, or "relevant social groups," interpreted safety

---

[7] The crash also caused media giant Warner Brothers to unload Atari, at the time the leading game hardware manufacturer in the US market.

features differently even after the technology reached a point of "stabilization" and "closure" (p. 428). Their approach takes a snapshot of much larger social circumstances, which exist beyond the initial diffusion of an innovation and are constantly renegotiated.

SCOT theorizes that there is a confluence of social, technical and human factors that provide a more holistic view of the initial negotiations of innovations as they are merchandised. This has been the inspiration for a profusion of different models of innovation diffusion. Nelson, Peterhansl, and Sampat (2004) nicely summarize these as "rational choice," "quasi rational choice diffusion, with the possibility of lock-in," "social construction" and "fads," (p. 682) which vary based on the feedback of audiences and the degree to which they adopt the device. Their work depicts how innovations are mediated with users, or as they put it "stochastic factors, or the positions taken by opinion leaders can strongly influence the long run" (p. 684).

The wider study of the diffusion of innovations fits these hybrid models well and acknowledges the role of a variety of actors and networks within the early adoption of new technologies. Burt (2000) has examined the bridging of "structural holes" in the diffusion of innovations and building social capital. His approach suggests less of a hierarchical structure to innovation diffusion and instead the value of individuals who can broker between innovators and different groups. "Thus, individuals with contact networks rich in structural holes are the individuals who know about, have a hand in, and exercise control over, more rewarding opportunities" (p. 355).

Accounting for the interplay between various institutions, experiences and actors in innovation seems absolutely necessary. Qualitative descriptions are difficult to produce and apprehend, but can paint unprecedented pictures of the process. M. Pilar Opazo (2016) provides a thick description of the organizational innovation of the Michelin 3-star Catalunyan restaurant

elBulli, in which she details how chef Ferran Adria fashioned and popularized molecular gastronomy. Opazo not only shows an important synergy between Adria and his cadre of workers, but also accounts for the importance of publications they generate (p. 152), media coverage (p. 161) and various modes of institutional recognition, ranging from Michelin ratings to patrons. While Opazo's ethnography focuses on a managerial hierarchy, with the restaurant's charismatic leader at the top, it is still a vivid picture of social and institutional strategies that spread Adria's concepts around the world.

Such a portrait needs to be drawn of Virtual Reality's current adoption. Technical innovation is not issuing from a single source, but from many competing institutions, including major game developers, large tech conglomerates and a highly critical media. In the case of VR, the social framework supports its diffusion.

Opazo analyzes Adria's conceptual work in inventing molecular gastronomy, but devotes few words to how chefs or even patrons utilize and "work" with this innovative form of cooking. While minimizing such labor may be acceptable in the highly structured world of haute cuisine, the labor of individuals is crucial in studies of innovation diffusion.

Labor of Love

If there is a single event that launched the advent of commercial Virtual Reality for many developers and IT enthusiasts, it was the Kickstarter campaign for the Oculus Rift, a relatively inexpensive head-mounted VR display designed by (at the time) relative unknown Palmer Luckey in 2012. The low cost of the device and the "years of Virtual Reality research… [put]

into a package that anybody can use"[8] caught the eye of not only media outlets, who touted its

technical advancements, such as the "sheer depth of the stereoscopic image," (Orland, 2012) and

called it the "future of gaming" (Douglas, 2012), but also developers who were poised to create

content. This was because the Kickstarter actually financed and eventually allowed a

"Development Kit"—an imperfect version of the HMD rather than a finalized product—to ship

to enthusiasts.

Development-stage products have been instrumental for the evolution of computer

technology. Steve Jobs and Bill Gates both tinkered with the mail-order Altair 8800 computer,

which had to be assembled by hand. The hobbyist orientation distinguished these devices from

their high-end counterparts. For $400 a kit could be purchased, a computer constructed and

programmed. While this opened up significant possibilities to the amateur, it didn't give them

free reign over the device. One scholar reminisced about the Altair on his personal blog: "When

the hobbyist had completed the construction of the Altair there was only the Altair 8800 in its

steel enclosure and a power cord that plugged into a wall outlet" (Ellis, 2014). Those who

gravitated toward the device had to have knowledge about computer programming, while

accepting its limitations. The same blog describes the early users as "skilled in electronics and

computer science. The hardware had to be constructed from individual elements and then

software had to be devised that would run on this built-from-scratch computer." In other

electronic media, such as video games, development kits were rare through the 1980s and only

sold with proprietary licenses from the hardware makers, which prohibited commercial use of

their products. The ability to make and distribute independent games on consoles is a relatively

---

[8] "Oculus Rift: Step Into the Game," Kickstarter, accessed March 7, 2018,
https://www.kickstarter.com/projects/1523379957/oculus-rift-step-into-the-game/description.

recent concept.[9] Only game publishers got access to gaming hardware before its release, which occurred about every three to four years. Since then, software development kits (or SDKs) have now become the norm, with consistent updates issued by major mobile software operating systems like Android and iOS. As in the case of the Altair, development kits, whether for software or hardware, are ultimately constructed for the benefit of the companies that distribute them.

The "DK1" that shipped from Oculus in 2013 was imperfect, but came with a handful of memorable experiences and a specific mandate for developers; as the website instructed, "But we want to make the Rift available to all game developers, today, so they can be part of the development process. Kickstarter makes that possible. Your voice will be critical to making the Rift hardware and software as great as they can be."[10] These early experiences hooked developers who turned out celebrated works like "Tuscany,"[11] made for the "DK2," the second iteration of the headset. More importantly, Oculus enabled content creation for VR from a plethora of accessible tools and stable computer software.

The early adopters of this wave of immersive technology are not the *innovators*, or as Opazo (2016) puts it those involved in "the *purposeful action* of mobilizing change" (p.11). Still, their experience with commercial VR deviates from that of the majority of people who are (and continue to be) exposed to VR solely through commercial releases. This faction of devotees

---

[9] The PlayStation developer program was one of the first to allow independent distribution on a gaming platform, starting in 2014. However, developers need to go through a lengthy process including significant licensing to submit a game.

[10] "Oculus Rift: Step Into the Game," Kickstarter, accessed March 7, 2018, https://www.kickstarter.com/projects/1523379957/oculus-rift-step-into-the-game/description.

[11] "Sixense Tuscany Demo," Internet Archive Wayback Machine, accessed March 7, 2018, https://web.archive.org/web/20160305121401/http://sixense.com/sixensetuscanydemo.

generates content and stretches VR's potential. As with "relevant social groups," there are a number of different entry points and levels of content generation based on when and how people come to the devices as they are commercially released, but each share a unique position on the spectrum between consumption of immersive media and production of original content.

Enthusiasts expect to produce *something* with the development kits, rather than passively experience a finished product. As a consequence, the labor of the adopter is paramount in the adoption process. Users expend time and effort to make a significant contribution in VR. Their labor not only spawns original content that is widely distributed to other users, but also benefits industries and businesses related to immersive media.

Content creators purchase and learn to use ancillary tools in addition to the headsets. Making VR films requires specialized cameras, and developing computer-generated content in VR necessitates mastery of rendering applications such as Maya and/or game engines like Unity. As a result, a multitude of businesses benefit directly from the diffusion process and integrate VR devices into their developer pipeline. Google, Oculus, Microsoft and Apple have all made SDKs for the Unity game engine. Device-makers, including camera manufacturers, release products that are not fully formed, but will reach commercial viability through the work of patrons and enthusiasts.

The diffusion of camcorders presents a comparable history. It revolved around a convoluted relationship between manufacturers, professionals and average consumers. The camcorder initially appealed to professionals with its easy portability and transmissibility of content. Betamax video camcorders, which famously competed with the VHS format for market share, gained popularity through their ability to record personal home videos. However, VHS gained dominance through the unexpected interest in playing pre-recorded cassettes (Cusumano,

Mylonadis, & Rosenbloom, 1992, p. 83). Ultimately, it was the desires of consumers, and not technical proficiency, which led to the format's supremacy. In the case of the development kit, the motivation for developers is not purely self-centered, but also to release products to the public. As a tech term site points out: "Since most companies want to encourage developers to create applications for their platform, SDKs are usually provided free of charge. Developers can simply download a SDK from a company's website and begin programming immediately."[12]

Free labor is prevalent in the digital landscape. In her work on digital cultural production, particularly in fashion, beauty and retail industries, Brooke Erin Duffy (2015) describes what she calls aspirational labor or a "highly gendered, forward-looking and entrepreneurial enactment of creativity" in which laborers "pursue creative activities that hold the promise of social and economic capital; yet the reward system for these aspirants is highly uneven" (p. 443). Her description of this creative economy includes the notion that aspirational laborers "seek to mark themselves as creative producers who will one day be compensated for their talents" (p. 446). Displaying one's passions may open up "various career possibilities" or act as a "springboard to a career in a traditional culture industry" (p. 446). Laborers see an open market as "the traditional barriers to entry surrounding the so-called glamour industries are becoming permeable in the digital age" (p. 447).

Furthermore, the aspirants are in a financial position to engage with the industry and acquire the necessary technical equipment to feature themselves on blogs and other forms of social media (p. 448). Not to detract from Duffy's arguments on gender, but I found both men and women to assume this exact viewpoint as they entered the nascent field of VR production, similarly considered porous and requiring financial investment to be on the cutting edge of a new

---

[12] "SDK," TechTerms, last modified April 15, 2010, accessed March 7, 2018, https://techterms.com/definition/sdk.

technology. Furthermore, Duffy implies that aspirational laborers must devote themselves and be invested in the very industries in which they aspire to enter. I found a similar level of devotion bolstered by personal blogs and social media presences in my interviews and analysis.

Duffy (2015, 2017) compared this form of aspirational labor to "Playbor." She places both within the context of online labor: "Indeed, with the rapid ascent of interactive technologies, social theorists have drawn attention to the economic and social productivity—that is, the *labor*—of online consumer-audiences. Portmanteaus such as pro-sumption, produsage, por-am, and playbour capture the nuanced ways in which production and consumption, work and play, and amateurism and professionalism bleed into one another in digital contexts" (Duffy, 2017, p. 45).

Playbor stems from the gaming community. Julian Kücklich (2005) originated the term to convey the activity of User-Generated Content (UGC) in video game culture. While UGC has become common in any number of social activities including online marketing campaigns, such as those by Doritos and Dove mentioned by Duffy (2017, p. 139), in video games it acknowledges the operational relationship between game developers and their consumers. Publishers, the leaders in the game industry, release limited access to their source code, via SDKs, to allow players to "mod" or modify particular games. "Modders" exploit this freedom with wildly creative changes, from changing human characters to elephants that rampage through the game landscape, to creating entirely new games within games. Kücklich (2005) argues that such modding directly benefits game developers and publishers by capitalizing on already existing customer loyalty, adding to the shelf-life of original products with new content, and becoming a de facto source for innovation because it serves as a large "test-market" of new ideas. Modding can also serve as a recruitment tool to find new talent. There are many tales of the rare

modder hired by developers after making popular mods, such as Alexander Velicky, who was signed by the game developer Bethesda (Gaston, 2013). When discussing playbor as a concept, it is important to remember that the industry tightly controls access to code, rather than the players, and thus the rules of development; profits from modder content (where they exist) usually revert to publishers rather than users; and players dedicate a tremendous amount of creative expression and passion to their preoccupation.

Kücklich's (2005) idea of playbor muddies the boundaries between labor and leisure. While he recognizes that recreational activities are productive, playbor directly benefits the industries that support it. Unlike "productive leisure activities," such as "knitting and woodworking," playbor is not associated with personal growth, but instead with the frivolity of play. Also, modders forego many of their rights in what Kücklich eloquently describes as "submission to the rules of the game." While this submission is inherently part of play, in the context of modding, playborers give up intellectual property and are locked-in, like aspirational laborers, to the norms of the industry in which they are part. Keenly aware of these pitfalls, noting that playbor is "[s]imultaneously voluntarily given and unwaged, enjoyed and exploited" (Terranova, 2000, p. 33), Kücklich (2005) does not address why modders continue in this exploitative relationship. While some modders may enjoy a false sense of power due to the disguised "power structures within which the modding community operates," motivations of modders beyond passion are absent. However, Kücklich's playbor model explains how innovations are both controlled on a technical—by way of SDKs—and a social level, while simultaneously being in dialogue with users and consumers.

Major game franchises now embed playbor in their designs. Businesses have come to value players/audiences input: "Today, people don't just consume entertainment but increasingly

play an active part in it. Ranging from modding to streaming, from cosplay to competitive gaming, the market for gaming presents a much broader and more diverse mix of opportunities and challenges than ever before" (admin, 2015). The numbers are staggering, with UGC generating up to 24,000 mods (modifications spawned by users) for a single game over a four-year period (Van Dreunen, 2015). This model of labor has corollaries in social media. Programs such as Facebook tightly control the material users can produce through explicit technical constraints built into their software and clearly profit from their content.

In addition, there are cultural implications in playbor for both business and design. Scholar PJ Rey (2012) addresses playbor in an analysis of the phenomenon of gamification. He suggests that play in such non-game contexts commodifies social interaction, de-couples alienation from capitalist production and makes play "lose its innocence" by bringing it out of the realm of work and into leisure time: "Playbor makes productive activity an end in-itself (namely, fun). Far from being shunned, playbor is sought out and done voluntarily. The object of production is no longer to create value; instead, value becomes a mere byproduct of play." Rey, like Kücklich, does not delve deeply into why playborers engage in this process, but his work stresses the importance of play, games, and labor in technological diffusion and the businesses surrounding it.

Rey and Kücklich ignore ethnographic research into organizations that are almost three decades old. Studying 1970s factory work, Burawoy (1982) describes labor as a game of "making out" or a series of tasks controlled by machines and the shop floor alike. For Burawoy, the labor game involves a delicate balance, negotiated with management to meet the "relative satisfaction" (p. 81) of workers. He suggests that such a game "obscures the relations of production in response to which the game is originally constructed" (p. 82) because workers feel

autonomous within the rules they helped to install and "game-playing generates consent to the social relations in production that define the rules of the game" (p. 82). Activities by both management and workers are "evaluated and interests established as a consequence of the game" (p. 85).

Burawoy starts to unravel why workers opt to participate in a type of game as part of their work and to construct boundaries and rules they can play with or against, all of which imparts a sense of empowerment. However, the conditions in which he conducts his research deviate drastically from the economic models previously described. This makes his work instructive, but not directly related to VR diffusion. While he thinks that uncertainty is problematic (p. 87), many of my interviewees relished the unpredictability of VR as a way for them to realize its potential. His argument, however, underscores that games and play in the labor process are not only well established, but also clearly evolving in today's social and technical climate.

Getting into the Game

Games and play, as well as the conditions in which they exist, are instrumental in the process of contemporary VR diffusion. Many adopters view the rise of Oculus as a watershed moment in gaming. Not only was founder Palmer Luckey a gamer, but also it was the investment of famed co-founder of id Software (maker of the first-person shooter games *Doom, Wolfenstein* and *Quake*) John Carmack who helped form Oculus as a company and eventually became its chief technology officer (Kumparak, 2014). In its earliest period of adoption, the Oculus Rift headset was "only practically available to be experienced firsthand at videogame and technology conferences, conventions or events" (Golding, 2017, p. 3).

Even the earliest texts on the medium, such as Rheingold's (1991) *Virtual Reality*, tie major figures in the field to Atari's research lab. Game development fostered many of the early hopes and expectations of Virtual Reality, most notably the failed Nintendo Virtual Boy. The Oculus Rift's Kickstarter campaign pursued gamers, with the opening lines of the campaign describing it as "a new Virtual Reality (VR) headset designed specifically for video games that will change the way you think about gaming forever" and going on to say it is "[d]esigned for gamers, by gamers."[13] While academia has contributed innovations to the medium, it is the game industry and, in particular, major hardware manufacturers who are the market leaders.

The close connection between gaming and VR still persists. Google and Apple provide distribution platforms for VR games, and the gaming juggernaut Valve[14] helped develop the HTC Vive headset. Playstation created a VR headset to go with their PlayStation 4 console. Companies specializing in game engine software such as Unreal and Unity have invested in VR ready software and most major game publishers, with the exception of Nintendo, have developed content specifically for VR headsets, as of this writing. These are not the only industries bankrolling VR—Disney acquired VR company Jaunt and the *Huffington Post* bought producer Ryot—but generally gaming and tech are the major VR financiers.

When contextualizing VR's diffusion, it is impossible to discount games' hold. As a consequence, Game Studies offers valuable insights. First, game researchers have sought to formulate *how* best to design games. They have worked throughout the last two decades to establish best practices, including the process of ideation, development and, to some degree,

---

[13] "Oculus Rift: Step Into the Game," Kickstarter, accessed March 7, 2018, https://www.kickstarter.com/projects/1523379957/oculus-rift-step-into-the-game/description.

[14] Valve is the company behind the games distribution platform "Steam," which it claims has over 35 million users. See "Welcome to Valve," Valve, accessed March 7, 2018, http://www.valvesoftware.com/company/.

dissemination in game design. Although many of these practices apply to both analog games and independent games (Fullerton, 2008; Salen & Zimmerman, 2003; Schell, 2014), they closely compare to steps in User Experience Design, Agile Software Development and Human Computer Interaction (Blythe, Overbeeke, Monk, & Wright, 2006; Malone, 1980, 1982; Zhang, 2008). Deterding (2015) suggests this is because Human Computer Interaction is "increasingly interested in designing for enjoyment and motivation" and a shift toward "self-realization, self expression, and experience." Also, the "commoditization of utility and usability" has led to the prizing of fun as an experience (p. 294). Agile development has expanded to business management itself and advocates the rapid development of software and constant iteration based on user feedback.[15] Training texts incorporate the two methods (Bond, 2014, p. 406) and there is tacit, if not direct, acknowledgement of the use of game design principles in software design (Dubois & Tamburrelli, 2013, p. 2). This is not surprising, especially since many developers were raised playing video games.

Secondly, there is a body of critical Game Studies literature that analyzes games as media and scrutinizes their epistemological value and place as cultural symbols. Juul's (2005) seminal text closely assays the medium of games and homes in on rules and the creation of virtual/fictional worlds. Based on a ludological tradition, he determines that gameplay not only allowed scholars "to carve out video game studies as a separate academic field" (p. 16), but also that "players need first to be socialized in order to perform" (Frasca, 1999) within games. Narrative can shape the aesthetics of the game experience, but the action of play is the central concept of study.

---

[15] See the Manifesto for Agile Software Development for basic tenets. "Manifesto for Agile Software Development," Manifesto for Agile Software Development, accessed March 7, 2018, http://agilemanifesto.org/.

Examinations into video games as cultural symbols has instigated important Game Studies scholarship, as seen in papers regarding the marketing of games to white males (Kirkpatrick, 2013); the representation of women in casual games (Chess, 2017); the influence of national cultures, such as Japan, on global gaming (Consalvo, 2016); and generally an advocacy for the inclusion of new and underrepresented voices into the study of digital games (Leonard, 2006; Shaw, 2010, 2011, 2015a, 2015b).

These studies, however, tend to harbor a narrow construct of digital game players and their medium. They do not consider the wider social context of games. They exclude occasional players, those who are "playful" without explicitly playing digital games, and professional practitioners. Nor does this body of work touch on the dynamism between developers and players.

While early studies recognized the vague boundary between digital games and labor (Pearce, 2006; Yee, 2006), this distinction has become more amorphous as the types of people who play with video games expands. TL Taylor's (2015) study of the budding eSports industry uncovers "serious leisure" in which game players negotiate the "bumpy" (p. 31) road between amateur and professional culture. However, her focus is primarily on an industry solidly populated by gaming enthusiasts. eSports players are some of the most avid and their conduct does not truly elucidate how players of all sorts engage with playful media.

One arena where the lines seem to blur completely is with game developers who must literally play in order to work and vice versa. Casey O'Donnell's (2014) authoritative treatise on the social practices of game development, *Developer's Dilemma*, is an ethnographic study which scrutinizes game developers through the pre- and post-production process of game-making. His work is vital in exposing the unrealistic and unsustainable hours and practices that programmers

keep, and the imbalance between their work and play lives. He also signals that such practices are infiltrating other creative industries.

Furthermore, O'Donnell details the relationship between play and the labor of developers with an emphasis on the myths of play embedded into the somewhat secretive game industry, the use of tools in fostering play, and just plain fun, which he considers a job requirement. Developers must "play games to make games… as it is about understanding what it is that makes a particular game interesting or fun" (p. 46). This makes programmers "gamers par excellence" (p. 48).

O'Donnell's study paves the way for my own in many ways. However, the influence of the game industry on non-developers, a particular phenomenon in VR development, early adopters and the nebulous relationship between creator/consumer are not substantive in his research.

The few tracts that describe this dynamic relationship underscore the intimate interaction between early consumers, developers and industries in shaping content. In their study of the online game *Faunasphere*, Mia Consalvo and Jason Begy (2015) present a detailed analysis of how a group of Beta testers, early consumers of the game who could play for free, similar to developers using SDK's, championed particular modes of play, including that "politeness was expected in all social interactions," something Consalvo and Begy did not witness in other forms of online play. However, when the game went public and appeared on Facebook, the norms of that platform and the "rudeness" of younger players ultimately challenged the game's viability and even may have contributed to its demise. The two scholars conclude that it was this interchange between designers and players that configured the overall structure of the game: "even if developers give players a world and a set of rules, players will make of it what they

please. As a result, who gets invited to take part in the early shaping of the game matters a great deal" (p. 56). Consalvo and Begy reveal the value of not only players, but also play in the development and survival of online games, along with the interaction between institutions, platforms and businesses.

These accounts show the extension and expansion of both laborer and play within the adoption of digital media. Burawoy's decades-old idea that labor is a type of game obtains more traction when the relationship tightens between players, consumers, producers, designers and industries. As an example, O'Donnell (2014) cites the "Scrum," an increasingly popular exercise practiced by a wide variety of companies, as overstepping the boundaries between work, play, design and development. Product managers tally a wish list of tasks and then, through a series of competitive sprints with employees, accomplish all the items on the list. The process is iterative and tightly controlled by a "scrum master" through timed activities including the titular "scrum" or "stand-up" where issues are shared daily in brief 15 minute spurts. The entire practice is guided, playful and game-like, as I witnessed during my research at BuzzFeed's headquarters (Foxman, 2015, p. 28). Clearly, play's value has surpassed mere frivolity and become a constituent in business practices, design strategies and, most pertinent for this argument, the adoption processes of consumers.

The Purpose of Play

Play is not a straightforward concept to apprehend; even linguistically, play has multiple connotations. Play and games derive from the same root in a number of European languages including French, Spanish and German. In English, scholar Brian Sutton-Smith (1997) identified no less than seven "rhetorics" of play, including progress, fate, power, identity, imaginary, the self and frivolity. Sutton-Smith asserts that these different rhetorics represent both ancient and

modern ideologies, used to understand individuals and their place in the world. These rhetorics exhibit the breadth to which play manifests in society.

Play is so culturally pervasive and complex that an ontological definition might be less important than understanding its experiential value. By deciphering the purpose of play and its worth to players, a framework for the playful process of adoption can be constructed.

In order to deduce the role of play, the rudiments of play studies or ludology must be revisited. Foundational scholar Johan Huizinga along with his followers, from Roger Caillois (2001)[16] to Sutton-Smith, perceive play as an integral part of social activity. As a cultural historian, Huizinga (1971) posits that play preceded contemporary civilization (p. 47). In *Homo Ludens*, Huizinga unearths play in all of European society, including legal conflicts, war and even electioneering (p. 207).[17] Huizinga distills this playful milieu into a singular abstract, which has come to be known as a "magic circle." Although the circle itself has been adopted as a metaphor for game design strategy,[18] which has resulted in endless analysis of the term by scholars, in essence the geometric figure, which is mentioned a scant six times in the book, conveys a simple but powerful idea. Huizinga positions play in a specific time and place for a rarified activity: first, entry into the magic circle conveys a sense of freedom; and second, play is

---

[16] Caillois is perhaps most notable for articulating different types of play stemming from Huizinga's work. He developed four types of games: "Agon," or competition, "Alea," or chance, "Mimicry," or roleplaying and "Ilinx," vertigo. Caillois situates this work in Huizinga's own thinking about games, play and culture. The first pages of *Man, Play and Games* (2001) state that, unlike Caillois' work, Huizinga did not commit "to a study of games, but an inquiry into the creative quality of the play principle in the domain of culture," resulting in a definition that was "at the same time too broad and too narrow" (p. 4). Therefore, the types of gameplay described in Caillois' work grow out from a critique of Huizinga.

[17] It is important and I have written elsewhere (Foxman, 2016), that this view of play was hardly positive. Dogged by the looming threat of World War II, Huizinga specifically warned of the potential deleterious effects of play in "the formation of social groupings which tend to surround themselves with secrecy and to stress their difference from the common world …" (Fuchs, 2014, p. 531).

[18] Zimmerman (2012) situated the magic circle in the realm of game design, stating that it should only be employed for solving problems. He ultimately defined it as a "context for meaning creation."

"distinct from 'ordinary' life both as to locality and duration" (Huizinga, 1971, p. 9). A quintessential example is the boxer, who in the sanctity of the ring, commits acts that are deemed criminal and violent outside of it.

Huizinga's concept is problematic in modern contexts. Scholars have asserted that in the postmodern era play and games have progressed beyond Huizinga's simple bifurcation, and no longer have a "clearly demarcated transformational (liminal) period, but have become a never-ending (liminoid) phenomenon" (Frissen, de Mul, & Raessens, 2013, p. 82). Modern digital and networked technologies have altered four fundamental qualities of play. They constrain the expression of human freedom that games usually facilitate (p. 84); hinder the ability to pretend (p. 84); intermix the pleasure of play with the boredom of work (p. 85), reminiscent of Rey's playbor; and dissolve the "specific limits of time and space" (p. 85) of traditional play. Analyses conclude that the developments and technology of contemporary culture complicate the time and place where play occurs.

However, even if imperfect, Huizinga's articulation of play introduces the idea of "framing" playful modes and moments in relation to everyday activity, where they are not relegated just to gameplay, but multiple interactions with both objects and people. Throughout their day, developers and content creators have periods that are framed by play, whether when testing a given scene, exploring a new SDK, performing or showing off their work to others, or simply playing games themselves.

The play frame as a metaphor has a long history. Micro-sociologist Erving Goffman (2013) frames social encounters in terms of a poker game. Some Game Studies scholars counteract the rigidity of the magic circle (Deterding, 2009; Juul, 2008) with frames. Deterding (2009) links framing to sociological inquiry, extrapolating that because frames can be nested and

layered within each other, they allow scholars to see play "not as something irreducible or standing out of the rest of cultural and social reality, and that explain rather than merely state the social or cultural constructedness of games" (p. 2). Navigating this line between social reality and play has spawned a growing body of work that examines micro-movements in gameplay. Tobin (2013) vividly recounts playing the Nintendo DS across the home, refiguring the domestic space in terms of digital play. His research demonstrates the swathe of situations where mobile play can occur, hardly disaggregated from everyday life when perceived from a micro-sociological viewpoint. Similarly, Seth Giddings (2014) has advanced "microethology," or "an approach that describes an event constituted by the circuits of agency, affect and play between human and technological participants" (p. 60). Giddings takes this approach because he sees no distinct connection, especially in the play of children, between the objects of play and their bodies, but rather "looped together with intangible circuits of information" (p. 62). The result are films of children's minor moments and activities from play. It is from these micromovements that Giddings "can identify emergent behaviors that can be looked for, and tested, in larger scale research" (p. 64). This methodology recognizes the importance of the body at play. Consequently, a play frame can illustrate the phenomenology of innovation, as well as how conventions and activities arise from it.

Such a phenomenology inherently also requires a kind of adoption of play by the player. Philosopher Hubert Dreyfus (1996) renders a rather poignant explanation of a phenomenology of play when he describes attaining expertise or "maximum grip" with a tennis swing:

> If one is a beginner or is off one's form one might find oneself making an effort to keep one's eye on the ball, keep the racket perpendicular to the court, hit the ball squarely, etc. But if one is expert at the game, things are going well, and one is absorbed in the game, what is experienced is more like one's arm going up and it being drawn to the appropriate position, the racket forming the optimal angle with the court - an angle we need not even

be aware of - all this so as to complete the gestalt made up of the court, one's running opponent, and the oncoming ball.

Dreyfus observes how the body conforms to and eventually absorbs the explicit movements of play. In essence, this is a kind of adoption. As the play is incorporated/adopted by the body, it becomes less conscious and more natural. This end-state is construed as "flow," a play state derived from the work of Mihaly Csikszentmihalyi in which complete focus is energizing and enjoyable and one is "in the zone." Csikszentmihalyi (1997) proposes that such immersion is the optimal state for learning new skills and overcoming challenges; it finds positive applications in a range of fields: to "perform a religious ritual, play a musical piece, weave a rug, write a computer program, climb a mountain, or perform surgery. In contrast to normal life, these 'flow activities' allow a person to focus on goals that are clear and compatible, and provide immediate feedback." Flow also eludes the work/play boundary, with Csikzentmihalyi's original psychological experiments showing "that work, as well as play, can occasion deep flow" (Nakamura & Csikszentmihalyi, 2014, p. 253).

Rogers' (1995) process of diffusion also discloses the conscious decision-making required to normalize innovations for users. He articulates five stages, beginning with "knowledge" and "persuasion" in learning about the innovation, proceeding to the conscious "decision" to take on the innovation and the slow "implementation" and eventual "confirmation" of the innovation's use in one's life, at which point the innovation is normalized. In describing the process of adoption, play provides an important and highly personal, even embodied, means of understanding how adopters proceed to incorporate and normalize innovations into their lives.

The play frame reaches beyond the individual to the larger social milieu. Because it is defined outside of "ordinary" activity, when we play can dictate the boundaries of social conventions. This is evident in the political-economic implications surrounding the division of

work and play. Play, along with leisure (Veblen, 2008), is designated as the antithesis of work, which connotes frivolity, a lack of labor and a time and place outside the workspace. Marxist thinkers embrace this dichotomy. Capitalism distinguishes hours of play from those of value— when one labors. Marx himself saw leisure as a necessary part of the capitalist cycle. If the inherent sin of capitalism was to commodify time as labor, Marx saw leisure as "direct labour" in the production process, with the development and improvement of the self as a mode of fixed capital, which is self applied (Komlik, 2016). As Rey (2012) puts it, "Work provides the basic economic resources necessary for play, while play restores those productive energies that are sapped each day in the workplace. If playbor is nothing more than mutual dependency, then it is a deep-rooted and long-recognized facet of capitalist production." There is little question that such self-improvement can be warped, as seen in Veblen's (1899/2008) critique of leisure and the conspicuous consumption of lower classes who aim to emulate those who have the economic freedom to have "non-productive consumption of time." In other words, the leisure class, by having an inordinate amount of time to play, inspires excess labor and emulation in the lower classes.

Georges Bataille (1985) views the play/labor dichotomy similarly in presupposing a leisure-like attitude that he sees in "luxury, mourning, war, cults, the construction of sumptuary monuments, games, spectacles, arts, [and] perverse sexual activity" (p. 118). Bataille's analysis posits the idea of play in terms of expenditure, excess and waste. He compares it to "toxic states" which are "defined as the illogical and irresistible impulse to reject material and moral goods that it would have been possible to utilize rationally" (p. 128). Bataille, who was a friend of Roger Caillois and influenced by Huizinga, connects the "expenditures" he associated with games and play in his theory of "General Economy" to other behaviours outside of traditionally productive

activity. Turning to pre-industrial society, he applies these expenditures to human sacrifices and the much-studied "potlatch" gift-giving ceremony cited in early anthropological work. He does this to conceive an alternative economy to capitalism.

I have delved into this topic in other work (Foxman, 2014). To briefly summarize, play for Bataille is a political act, powerful in its futility. Play was built into the gift-giving potlatch, in which chiefs were "obliged to *give* and to *play*" (Bataille, 1991, p. 63) by wasting their excess food and goods in lavish parties for their tribespeople. However, only an elite player can indulge in such play. Only chiefs are able to obtain the excess to expend on others, which they do with the goal of "humiliating, defying, and *obligating* a rival" (Bataille, 1985, p. 121). They do this for what he determines as the most "unproductive" of values: for "glory" (p. 128). It is the privileged who, with the time and ability to expend, are best positioned to be playful. Not only have I observed similar pursuits for glory in my own work on gamification (Foxman, 2014), but also Bataille intimates that "states of excitation," along with seeking glory and playing are responses to the restrictions of a capitalist economy, and a means of rejecting them. Play within this context is distinctly political, enacted to break the shackles of ordinary life and production.

Current social conditions have transformed this perspective, which has mutated into concepts like playbor. By blending labor and play, this portmanteau bastardized the original premise of a political act. Capitalist production has incorporated play, as Rey (2012, 2016) and others feared.

Scholars resuscitated playbor to attack gamification, in which game elements are designed into non-game contexts (Deterding et al., 2011)—an elitist concept which has found traction in educational, business and medical settings. In his study of gamification, Mark J. Nelson (2012) attributes its growth as part of the neoliberal model of the "funsultant," who

throughout the 1980s and 1990s was hired to turn dreary corporate offices into more fun environments. In reviewing the literature, Nelson notes that the two reasons games were introduced into the workspace included the more "mercenary" motive of eliciting additional labor through non-monetary incentives, as well as finding new modes of productivity, which can't be generated through traditional labor models (p. 2).

In contrast, Sebastian Deterding (2014) associates the term with the cyber-utopian thinking of Silicon Valley and the tech industry (p. 30) and underscores how the concept reached its apex in the first decade of the 2000s, when it was thought to "'solve' the problem of user acquisition and monetization" (p. 31), two neoliberal and capitalist issues. Deterding concludes that one of the ways to define gamification is through a rhetoric of exploitation, or as the "most recent adaptation of capitalism to reproduce the power and property relations of bourgeoisie and proletariat" and to "manifest symbolic goods, modes of production, and ideologies that commodify dissent and optimize surplus value extraction while covering up their exploitative nature with a false consciousness" (p. 40). In these cases, gamification presents a new mode of and relationship to play, where the expenditure of play is integrated into an individual's work. This relationship implies that for VR adopters, there exists a gamified element. Is a developer, while working with a SDK, expending excess energy for the benefit of his own glory and free time? Does she have to sacrifice time and effort beyond her work days in order to "play" with the device? Questions such as these materialize when considering the play of developers in this "gamified" environment, along with questions about glory, sacrifice and excess based upon Bataille's assessment. Are Bataille's agonistic, glory-seeking, elitist implications germane to early adopters as they invest in VR and other immersive media?

Conclusions and Questions

The diffusion of immersive media has progressed in fits and starts—a nearly fifty-year-old march alongside two-dimensional digital counterparts. As with so many in the parade, decades of social and cultural forces have shaped the public's imagination of the technology.

For the current group of early adopters, the process of diffusion of HMDs and other headsets represents a social construct epitomized by the investment of time, energy and money and the influence of games and play. The adopters are products of and bound to the larger game industry, and many grew up toying with early lackluster gaming VR headsets, and now use game engines to develop content for VR. From the companies that disseminate the headsets and platforms to the user-generated content display on SDKs, the aura of games and gameplay is pronounced and promulgated by the media ecosystem. The effect of the multi-billion dollar AAA establishment on VR (along with every major entertainment medium) is inestimable.

Games and play define this course of adoption. The value of play has increased for the institutions and public who embrace Virtual Reality. Game consultancy SuperData calculates that three out of every four VR headset users are gamers.[19] Along with the rise of gamification as a commonly employed design strategy, the wide-scale acceptance that gameplay elements benefit corporations, education and business signals the steady incorporation of games and play in work activities and marketing plans. While in some cases this may be problematic, as in the exploitation of playbor, play as a mode of engaging with immersive and other digital technologies seems to have normalized.

---

[19] "Virtual Reality Market and Consumers," Internet Archive Wayback Machine, accessed March 7, 2018, https://web.archive.org/web/20170619060234/https://www.superdataresearch.com/market-data/virtual-reality-industry-report/.

This chapter first decried the dearth of real world studies at the intersection of VR, communications and culture. Instead, most work scrutinized the future of the devices, rather than the present, because they hadn't reached commercial viability. Studying VR in a contemporary context requires acknowledging the influence of the game industry and the (sometimes competing) role of developer/users. For these early adopters, the boundaries between "play" and "labor" are quite porous.

Given the prevalence of both games and play in the adoption process, a review of Game Studies research and play proceeded. Understanding play as an action outside of the bounds of traditional work is important in order to begin to describe the unique relationship developers and content creators have with this new technology as not only consumers, but also makers of future content. Along with the broader phenomenon of gamification, there is the implication that the efforts of these early adopters lie precariously between labor and play, which ultimately fuels their outlook and process of adoption. Consequently, I aim not only to analyze the role of gaming in the adoption process of contemporary immersive technologies, but also to acknowledge the importance of play in that process. Although it is difficult to disentangle the varied meanings of play, it remains an important analytical frame that brings to light new concepts surrounding adoption.

With this body of literature as a backdrop, the following questions and the search for their answers comprises the rest of this treatise: How do consumers adopt immersive technology on a visceral level? How do they conceive their adoption? What role does it serve for them? How do they take this new technology and incorporate it into their work practices? How does the media and cultural ecosystem surrounding the technology bolster or resist these modes of adoption? How do they facilitate or hinder adopters? How is adoption playful, with all its implications?

What is the organizational, political and economic culture surrounding VR adoption? How do adopters situate themselves and their work and play within this environment? How do they expend their energy on behalf of this adoption process and how does this process manifest on a bodily, even phenomenological, level?

CHAPTER 2: METHODS

Defining Diffusion

In the previous chapter, I disclosed the dearth of research relating to the experience and interaction with Virtual Reality and other immersive technologies in Communications literature. This is partially due to how immersive technology has spread to the public. Limited access to the devices by "average" consumers has precluded any deep study into how early adopters affect the current state of the medium.

Another dilemma is to find an appropriate method for analyzing diffusion of innovations. The multitude of investigations based on the theory is overwhelming and covers a vast array of methodologies. Greenhalgh, Macfarlane, Bate, Kyriakidou, and Peacock (2005) reviewed 1,024 sources of diffusion of innovation studies in healthcare and found approaches from social contagion to storytelling were used.

Qualitative examinations into diffusion of innovations in Communications research tend to turn to interviews (Lowrey, 1991), focus groups (Harting, Rutten, Rutten, & Kremers, 2009), participant observation (Liao, 2016) or some combination of the three. However, these methods do not refute the two most significant critiques of diffusion of innovation research. The first is the inherent pro-innovation bias built into the theory, which assumes that innovations are for positive effect. Second, the theory puts inordinate emphasis on individuals and network structures in its orientation. Simply, advocates tend to credit opinion leaders and individuals too heavily for an innovation's successful adoption.[1]

---

[1] For an example of a critique see Lievrouw (2006) and Peres, Muller, and Mahajan (2010).

New information technology systems have especially attracted this criticism, the result of which are calls for multidisciplinary sociocultural analyses. Lyytinen and Damsgaard (2001) urge scholars to "recognize the complex, networked and learning intensive features of technology" and to "understand the role of institutional regimes, focus on process features (including histories) and key players in the diffusion arena" (p. 1). MacVaugh & Schiavone (2010) add to the chorus of recommendations for "the need for academics to study technology adoption through a multidisciplinary lens" (p. 209). All agree that to draw a clear picture of technological adoption is difficult. Something is bound to be missed. Eveland (1986) thinks it is a phenomenological (ie experiential) account: "Understanding how the utilities of technology as seen from many diverse points of view interact with implementation processes is one of the major advantages of a phenomenological approach to technology transfer" (p. 305).

Diffusion of innovations scholarship eschews the experiential and socially negotiated aspects of the process, despite acknowledgement by Rogers and others that such bargaining is part of the activity. I also support a holistic approach in order to capture a more consummate account of early adopters.

VR Diffusion and its Difficulties

Three specific issues arose when it came to studying current VR diffusion. First was to discern where on the continuum of the diffusion process early adopters of VR were located. Because innovations in the technology have been diffusing steadily, from the incorporation of gyroscopes into mobile phones to the refinement of computer displays, the early adopter is difficult to pinpoint.

However, VR's current commercial climate makes it less challenging to identify its early adopters. The drop in equipment prices, starting in 2012 with the Oculus Rift, and the release of

development kits has brought about unprecedented access to head-mounted displays. A headset with minimum computing power in 1995 cost the equivalent of $1,130 in today's dollars[2] and the infamous Augmented Reality headset, Google Glass, retailed for $1,500 in 2013. By contrast, Oculus introduced its first headsets at $300.[3] Furthermore, the company marketed the headsets specifically to developers to give them a device for which to make content. This propelled the content creation and development to hopefully escalate the technology's diffusion. As a consequence, today's early adopters are those who have a stake in, or enthusiasm about, not just novel hardware, but the process of content creation itself. Manufacturers, through their marketing, anointed developers, artists and businesses the de facto early adopters.

Having identified the group, a second issue complicated the actual process of diffusion. VR adoption does not occur in a media vacuum. Online and other news channels stoke interest in VR as much as word of mouth. No shortage of articles declared 2016 to be "The Year of VR" (Cellan-Jones 2016; Morris, 2015; Pearson, 2016). Games, technology and business-focused websites like *Polygon* and *VentureBeat* churned out significant media about the subject while outlets such as *VR Focus*, the short-lived *Versions*, and *Upload VR* exclusively covered content and innovations. One article summarized the messaging as "A full spectrum of optimism, cynicism and fairly wild speculation, the stories we've written about the most talked about gaming innovation in years have revealed a medium and ecosystem very much in the throes of its wild adolescence." He added that "every mainstream media outlet has covered the dawn of true

---

[2] The Forte VFX1 had a MSRP of $695. By contrast the popular Virtuality pod, mentioned in Chapter One, cost $73,000.

[3] The original commercial Oculus Rift retailed for $599.99 and has subsequently dropped in price.

consumer VR in one format or another, giving rise to discussions about healthcare, tourism, social interaction, estate agency and product design" (Pearson, 2016).

Manufacturers also posted support documentation and details about their headsets and ancillary controllers[4] and sponsored events such as Google's I/O developer conference[5] and Oculus' annual "Connect"[6] to debut new technology and expand their user base. Finally, many adopters created blog posts, tutorial videos and original content, building an ongoing record of its transformation and growth. The media ecosystem in its zeal to publish newsworthy information has encouraged, if not promoted, the growth of VR throughout the last five years as much as developers and content creators have.

A final issue was that VR enthusiasts hail from a variety of different fields. While certainly gaming and entertainment dominate, consultancy SuperData notes that showrooms, retail, architecture engineering, construction and design (AECD), and education, among others, hold significant market share (SuperData, 2017a, p. 18). The question of which professional category to study is somewhat superfluous since so many early users interact with each other online and companies work in "multiple segments" (p. 18). The goal then was to discover the means by which to study such cross-pollination of ideas that was the norm online.[7]

---

[4] For example, see "HTC Vive Tracker Developer Guidelines," Vive, last modified July 17, 2017 accessed March 7, 2018, https://dl.vive.com/Tracker/Guideline/HTC_Vive_Tracker_Developer_Guidelines_v1.5.pdf.

[5] "Google I/O 2018," I/O, accessed March 7, 2018, https://events.google.com/io/.

[6] "Oculus Connect 4 | Oculus," Oculus Connect, accessed March 7, 2018, https://www.oculusconnect.com/.

[7] Various industries invested in VR have specific loci of power throughout the United States, with the tech and games industries primarily situated on the West Coast, while media-makers and advertising have long-established residence on the East Coast. This study is limited to the US, although commercial VR's diffusion has been a worldwide phenomenon. See Fink (2017b) for more details.

A Multimethod Approach to Studying VR Adoption

Participant Observation of Meetups

VR meetups, which convened weekly, if not daily, around New York City were amalgamations of different fields and professionals. The brainchildren of New York-based company Meetup.com, meetups consist of open gatherings organized around a specific affinity group, or "an online social network that helps you find local groups of people, who meet in person to discuss topics of interest" (Kelsey, 2010, p. 398). The meetup has significant literature devoted to it, especially its influence in organizing activists during the Howard Dean presidential campaign (Chadwick, 2007; Kreiss, 2012; Sessions, 2010; Teachout & Streeter, 2008; Vaughn, 2015).

Today, meetups represent a unique space for enthusiasts of Virtual Reality and immersive technology. Some are oriented around self-promotion. In others, for little or no cost, participants can get exposed to the latest innovations and interact with developers. It is also an environment whose sole purpose is the pure exploration of these technologies and not their integration into other fields.

As a consequence, the first stage of this research involved participant observation of meetups. In January 2016, I began informal observation of any meetup related to Virtual Reality, Augmented Reality and, shortly after, Mixed Reality devices in New York City.[8] Meetups are semi-public spaces. With the exception of having to occasionally pay for specific meetings and answer short questionnaires about one's interest in the subject, the meetups do not sanction

---

[8] Some of the meetups had events in the New Jersey area. I traveled only about an hour from New York City by train or car to visit these sites.

secrecy. As a matter of course, most are recorded for posterity and I was even asked to livestream one meetup.

In total, over a two-year period, I attended 157 meetings across 32 different groups.[9] At these assemblies, I took extensive notes on the public talks. I also conversed with other attendees before and after the meetup, in particular to find out what drew them to the technology. In all cases, I explained my research and focus and quickly discovered that many attendees were eager to share their beliefs about the state of the VR industry.

The following chart highlights my meetup attendance:
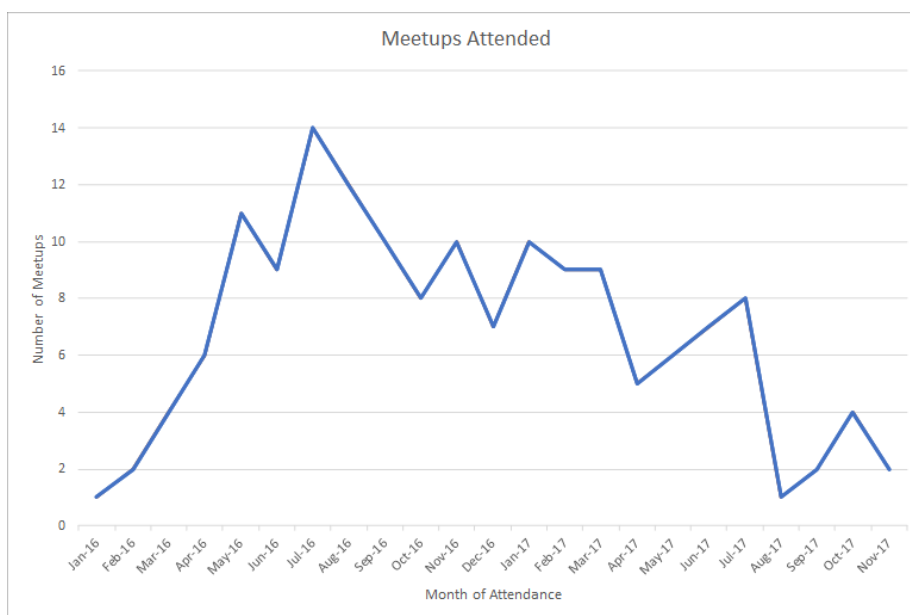
Figure 2.1. Number of meetups attended over the two-year period.

After a few months, I noticed there was a pattern to the types of meetups. They fell into four categories—for promotion, information, education and fun. While these categories certainly

---

[9] The activity of going to "meetups" encompassed a variety of public gatherings beyond those that appeared on Meetup.com alone. Eventbrite was often used as a way to produce tickets for meetings or just used exclusively as an organizing tool for roughly the same ends as Meetup.com. See "Eventbrite," Eventbrite, accessed March 7, 2018, https://www.eventbrite.com/.

overlapped—some meetup groups might cross-promote an event or a promotional meetup might have a fun meeting, etc., their differences directed the next phase of my research.

In July of 2016, I approached a few recurring meetups to perform deeper participant observation. With these groups, I received written and/or verbal consent to attend all possible meetings and participate in planning and administration on an organizational level that the facilitators felt appropriate. For the sake of discretion, I use pseudonyms for my descriptions of the meetup.

As a result, I officially observed four meetups, a total of 58 meetings over a one and a half year period. One meetup group focused primarily on education and fun, another provided information—primarily to developers—and the final two were generalist and promotional in nature.

For these meetups, I performed a variety of administrative tasks. Primarily, I checked-in attendees. The number of attendees fluctuated with one meetup consistently having around 200, and others as few as three or four. In several cases, I recorded events. For one, I assumed more managerial responsibilities, which included signing up users for mailing lists, brainstorming ideas for future meetups and helping to coordinate participation in festivals. These additional duties were done when requested by the meetups, which were perennially understaffed. As Ryfe (2012) describes in his ethnography of failing midwestern newsrooms, he was commissioned to report and write articles because he was a "warm body" (p. 56). His participation was an important—and common—way to socialize himself to the habits and practices of his research subjects: "Journalists everywhere are socialized into the profession in just this way, and so tend to believe that the best way to become a journalist is to practice" (p. 58). Similarly, volunteering

offered welcomed access to the meetups on a weekly and monthly basis, and affirmed most enthusiasts' belief that the best mode of entry into adoption was by doing rather than observing.

The meetups also led me, in February 2016, to a private lab committed to making VR content. After applying and explaining my research, I joined the lab in order to learn the basic skills of VR development. The lab provided a more hands-on and granular understanding of how developers were shaping VR, while the meetups showcased the broader culture of VR adopters. On a weekly basis, lab attendees troubleshooted problems while discussing the future of the medium. After attending the first full semester of the lab, I officially requested permission to be a participant observer there as well, under the same conditions as I had in the meetups. I observed the lab for a six month period. The lab afforded the unique opportunity to capture and describe how developers and content creators came to use and incorporate VR into their creative practice.

Interviews

In addition to participant observation, I desired to more deeply probe the motivations and perspective of adopters from both meetups and the lab; therefore, I solicited organizers and attendees for interviews. I provided them with my business card—a common practice at meetups—briefly explained my research and, if interest was expressed, followed-up with an email. I did not actively pursue potential interviewees beyond a second message, in part to maintain a somewhat random sampling. In total, I conducted 90 interviews with participants over the duration of the study. In two cases, I obtained interviews via a snowball sampling. Finally, I also separately solicited interviews from lab attendees during the time of my official observation and conducted follow-up interviews subsequently.

Interviews were semi-structured and lasted between fifteen minutes and two and a half hours and were performed via phone, in-person and, in two cases, email. At the outset, I

explained the project's goals and requested permission to have an audio recording made of the conversation. Respondents were given the option to be anonymous. As a consequence, respondents have not been identified in this work. I will use pseudonyms throughout. All interviews were transcribed and coded.

While I ultimately covered the same topics over the course of my interviews, I took a grounded approach to how I conducted them by consistently retheorizing the digressions from my core questions over the course of the research period.

This manifested, for example, in how I undertook the subject of education in VR. Within the first few months of my study, I noticed that the subject was covered in a number of meetups and presentations. Furthermore, it frequently was a topic of conversation, especially how the technology could upend traditional schooling. As a consequence, when education arose in interviews, I explored it more deeply and coded it in my overall analysis of transcripts.

In the end, my interviews reflected approximately the population I observed at meetups. Figure 2.2 displays the demographics:

Occupational/Demographic Category	Overall Number	Percentage of Total
Male	69	77%
Female	21	23%
Meetup/Lab Organizers	20	22%
Lab Attendees	21	23%
Developers and Content Creators	68	76%
Work in Development-Oriented Business	31	34%

Owner/Chief Executive of Business/Startup	27	30%

Figure 2.2. Demographic information collected and observed based on interviews.

These demographics underscore the general proportion of males to females at most meetups, which was usually around 75% male. Unrepresented is the range of ages, which skewed toward the 30s and older, and racial/ethnic makeup. 63% of interviewees were indentifiably caucasian, again matching the general trends of meetups. While my focus was oriented toward New York attendees of meetups, due to both the international interest in the medium and the city itself, my interviewees came from not only New York, but also the Tri-State area, the Eastern Seaboard, California, Canada, Australia and, in one case, India.

As Figure 2.3 illustrates, interviewees represented a wide variety of professional interests. While some attended meetups to find employment in VR either because they were out of a job or a student, others worked in VR-focused companies. Several were investigating it for their personal professions, be it law, media, architecture, etc. Ultimately, the diversity of viewpoints within the interviews mirrors the broader interest in the medium over the two years.

Interest in Immersive Technology

Immersive
19.1%

AR Content
2.2%

Architecture
2.2%

Art/Storytelling
2.2%

Education/Museum
3.4%

Animation
4.5%

Business
4.5%

Film/Art
14.6%

Education
5.6%

Journalism
6.7%

Software
13.5%

Games
7.9%
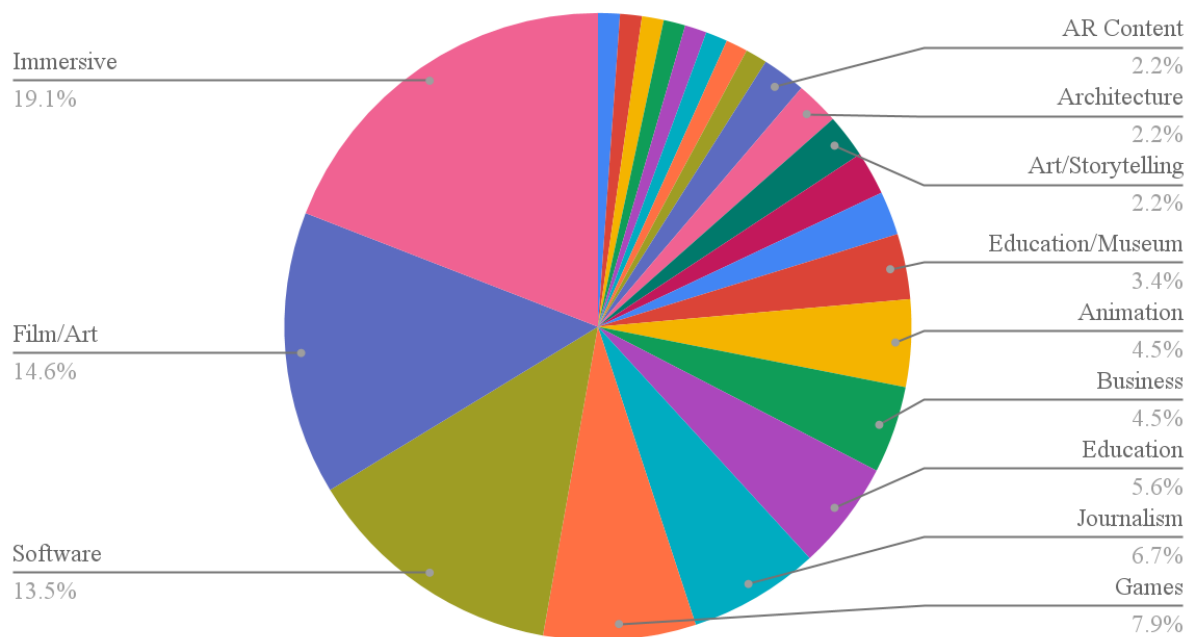
Figure 2.3. Professional interest of interviewees.

The interviews served a number of purposes. First, the interviewees provided personal perspectives on the adoption process, along with their vision and ideas about the technology and its future, the labs and meetups I observed. Also the interviews were a means to test the theories derived from my own observations and autoethnographic research. Because of the nature of my observations, I, for instance, asked lab attendees to describe the process of development and content creation that I had observed during our weekly meetings. Finally, the interviews served to ascertain the function of play within the adoption and development process. Given the broad sense of this term, I kept questions about play open and consequently received a rich dataset of viewpoints on its role in VR.

Media Discourse Analysis

Media were a constant presence during the time of my study. Many of my interviewees published work to blogs, posted videos and gave public talks. Meetups were recorded and broadcast online. One group began each of its monthly meetings by showcasing videos of the latest news in immersive technology. Another meetup presenter liked to start his presentations by relaying tidbits from major Unity conferences. Much of the conversation during the lab not only sprung from online messaging services like Slack, but also referenced particular articles, podcasts and online groups.

A clear example of media influence was the Women in VR Facebook group.[10] During meetups, I heard from female attendees that this was an important space for conversations that might not occur in person. A number of articles and blogs touted its influence (Shafrir, 2017; Sivaraman, 2016), with one declaring, "I would say it is the most popular VR group in general, but it's called '*Women* in VR'" (Sivaraman, 2016). An interviewee stated that the group "is where I found out about this scholarship and got into the Oculus Conference in the first place. And, just the amount of information and support that I see on it. I actually check in on them on a daily basis."

The everyday language, conversations and vision of Virtual Reality can't be fully distinguished from the media frames surrounding the technology's diffusion. It initiated the discourses of the groups in my study whose relationship with media was quite dynamic. As an example, the Unity Education NYC - VR && AR meetup[11] consisted of not only an in-person

---

[10] https://www.facebook.com/groups/womeninvr/

[11] "Unity Education NYC - VR && AR," Meetup, accessed March 7, 2018, https://www.meetup.com/Unity-Education-NYC-VR-AR/.

session, but also was recorded and the videos were posted on the organizer's webpage.[12] These were then referenced at subsequent meetups.

Over the two-year period, I amassed representative samples of this material from this interconnected media environment, including slideshows from meetup presentations, a plethora of blog posts speculating on the technology via the website *Medium*[13] and other personal websites. I accumulated articles about VR from a variety of sources, including enthusiast websites like *VR Focus* and major news outlets such as *The New York Times*. I also collected videos from major conferences produced by industry leaders in VR including Unity, Google and Oculus. Finally, I stockpiled YouTube videos, tutorials and other online material on *how* to develop and create content for VR. In some cases, this material came from interviewees and those I observed. In other instances, I sought out articles because of conversations in the media or I found them through daily research into news surrounding VR over the two years. In total, I collected 165 articles on the subject.

Afterwards I analyzed and coded this corpus of texts through a Multimodal Discourse Analysis. The interpretations draw a backdrop for the ongoing subjects which intrigued my interviewees. At the same time, they reflect and can be juxtaposed with their views. Endemic issues concerning VR, along with discussions about its practical and cultural limitations, circulate from this media environment to my informants and back through their own output.

---

[12] "Unity Education," Unity Education, accessed March 7, 2018, http://unityeducation.com/.

[13] "Welcome to Medium, where words matter," Medium, accessed March 7, 2018, https://medium.com/about

Autoethnography

The methodologies outlined so far only divulge the cerebral and rational part of the innovation adoption experience.[14] Especially for content creators and developers, much of the process is tedious, consisting of trials and errors, creating, iterating and reiterating on concepts to test the limits of the technology. Adoption is not a one-step process, but progresses over time. Analyzing the experience solely through language and motivation paints only a partial picture. Engagement with VR is a corporeal and intimate experience, where individuals enter the immersive space alone. Bailenson, Blascovich, and Guadagno (2008) suggest that users display the highest level of intimacy with virtual representations of themselves (p. 2687). In order to derive the visceral experience, traditional methodologies fall short.

This is the reason I added an autoethnographic phase to my study. The novel method is based in the broader anthropological tradition of how best to represent the researcher. Anthropologists in general have become increasingly aware that their presence should be considered in their work. Not only has this outlook found particular traction in performance (Gingrich-Philbrook, 2009) and film studies, where documentarians have long accounted for themselves in the filmmaking process (Russell, 1999), but also is manifest in journals of ethnography, symbolic interactionism and Communications. Authors also interchange the term autoethnography with other methodologies and theoretical approaches, most often ethnomethodology and grounded theory (Ellis, Adams, & Bochner, 2010). It is frequently one technique among many undertaken in a multidisciplinary study.

---

[14] If I had exclusively focused on technological adoption through previous methods, my work would resemble Liao, 2016. However, while he does give a detailed account of AR consumers' rationale for why they use headsets, his work does not articulate the experiential component advocated by Eveland (1986) and others.

Ellis et al. (2010), in their overview of the methodology, note that its use stemmed from two interrelated concerns. First, a postmodern "crisis in confidence"—and subjectivity—in the 1980s led social scientists to question the universality of their practices and for some to turn to autoethnography in order to account for personal values embedded within their research. Second, autoethnography provided a methodological platform for underrepresented groups to have a voice outside of the stereotypical "[w]hite, masculine, heterosexual, middle/upperclassed, Christian, able-bodied perspective." Ellis et al. list a profusion of treatises that take this approach to represent "gender," "sexuality," "age," "ability," "class," education and "religion." A quintessential example of autoethnography is Preciado's (2013) *Testo Junkie*, which recounts the author's own journey of experimenting with testosterone in an effort to de-gender themself, a story which in its specificity of subject can only be told by the author.

The desire toward self-accountability belies a much broader application across traditional research. Advocates of autoethnography suggest that popular culture makes it difficult to distinguish our analyses from ourselves. As Herrmann (2013) wrote, "Our identities and identification with popular culture artifacts assist in our creation of self. Our identities and popular culture have a long-term recursive relationship" (p. 7). The method is well positioned to overcome this objection because it requires self-reflection and confession by the researcher in order to divine deeper understanding in his investigation (Ellis et al., 2010).

This is conspicuous in the study of Massive Multiplayer Online Games where researchers assume avatars to interact in virtual worlds. Studies such as Brown's (2015) and Sundén's (2012) advocate for scholars to account for their presence in order to locate the emotional impact of the ethnographer in a digital space. In an analysis of the method, Brown (2015) argues that "by placing the ethnographer at the centre of the research, autoethnography is able to provide a deep,

rich account of social interactions and bonds in a community through first-hand knowledge" (p. 85).

Brown further champions the method for articulating "details about the complex relationship between character and player" on a "biological" or, I would argue, experiential level. She adds that the method is "a great way to provide an intimate account of the emotions involved in both play and research" (p. 86). This reflects the conceit that in order to understand play we must have an awareness of our own bodily activity. Ethnographers cannot easily divest themselves from the fact they are playing in a virtual space. When engaging with and learning how to play the game, they must ultimately assume their avatar.[15]

In order to understand online play, we must attend to our own bodies. Sundén's (2012) work literally embodies this principle as she recounts her corporeal reaction within gameplay especially the dissolution of the boundary between the experience of her avatar and herself:

> I experienced firsthand the sensation of desiring someone through the game interface. An already enticing, immersive game experience was all the more charged through the ways in which desire and physical attraction came to circulate through the game. I would see "her," the muscular orc woman, with her white tiger, come running toward me (or Bricka) across the dunes, the sand spurting from under foot and paw. Bricka's heart would skip a beat. Or was it mine? Does it matter? (p. 168)

This experience, as in VR adoption, is intimate and visceral. The physical transport into an immersive space is the aspiration of VR content creators. At the same time, unraveling the embodied practice of adopters allows for a better appreciation of the relationship of that practice to play. The process of development entails phases that appear inherently playful. Developers design virtual spaces, enter them through a headset, test the environment and then adjust and iterate upon the design. This playful progression is alluded to in interviews and articles alike. As

---

[15] Autoethnographic studies of games actually precede the use of the term. Sudnow's (1983) account of his adoption of the Atari game system is ostensibly an autoethnography.

one New York developer stated in an interview, "Very quickly that became… the process… just playing. Playing with it. Like seeing what worked, iterating, trying that, and then popping on the headset and experiencing it… just trying to break what I did and then find out where… the limits of that is."

Autoethnography permitted me not only to embed myself in and play with the technology, but also to compare my experience with behavior in my participant observation and interviewees' narratives and comments. It was the consummate tool for navigating the visceral experience of adoption while simultaneously distinguishing my role as researcher. As Sundén (2012) argues, "New media ethnography rarely puts the researcher in isolated and lonely situations (even if spending long hours at the computer sometimes feels that way), but it nonetheless involves closeness to the medium, and possibly to others through this medium and beyond" (p, 172).

To that end, I kept a journal through January 2017 of all activities in which I participated. This included participant observation, my work on a variety of projects, my play with VR, decision-making regarding the selection and purchase of gear. Some notes were recorded as audio entries and reviewed later. Others were written. I evaluated this data regularly, both to code for play and delineate the boundaries of my own enthusiasm about the technology. Brown (2015) suggests that such work is one of a number of techniques for building walls between researcher and player, and is simply part of "professional behavior" (p, 83). She further adds that this also allows for the emotions of the researcher to be publicly recognized: "Recognising this emotion, and being honest about it, enables the researcher to not only re-enter the field, but also re-enter it with additional insight" (p. 90).

Limits and Conclusions on a Multimethod Approach

This four-part methodological structure—participant observation, semi-structured interviews, multimodal discourse analysis and autoethnography—rendered a rich portrait of the process of immersive technology diffusion within New York City over a two-year period.

The synthesis of approaches empowered me to take a snapshot of a moment in time during which early adopters incorporate immersive technology into their lives. The picture is bounded spatially, temporally and geographically. It reflects the city in which it is located and the industries that invest in and promote it.

Advertising, journalism, healthcare and education supported the diffusion, along with artists and freelance filmmakers. To some degree, the game industry and hardware manufacturers were in the background, although Google, Microsoft and HTC all hosted events, and their technologies were always present. Furthermore, meetups attracted a particular type of enthusiast—someone with a thirst for knowledge, who was unwilling, or incapable, to significantly fund his or her exposure to the technology, but who had the time and desire to network and build businesses regardless. While entrepreneurs, startups and developers attended meetups, I do not want to suggest that these were the exclusive sites for adoption even within New York. During the period of my study, paid conferences and events occurred frequently. These decidedly more elite events attracted executives and those willing to spend hundreds, if not thousands, of dollars to gain intimate access to innovators and technology. However, it is worth noting that attendees and speakers at these more exclusive affairs often overlapped with meetups. Meetups were testing grounds for developers to practice and refine their pitches. For instance, the company Littlstar had a representative give presentations in less than a month across three different meetups. By focusing on meetup members, I ultimately gained a better

understanding of "ordinary" users of the product, in contrast to those investing significant

corporate capital in the creation of the innovations themselves.

To distinguish the place, time and actors in the adoption process imparts value. It

facilitates a meaningful and thick description of the process while recognizing that it is only one

point in the continuum of interpretive flexibility in which immersive media is shaped. It situates

the process within a social and media milieu which has a subtle influence and dynamic

relationship with adopters.

The conclusions drawn from this study are based on a specific timeframe and location.

While sharing much with other VR adopters worldwide, it may not fully encompass the entire

process. However, its findings, from my own initial exposure to and discovery of the medium, to

the overarching attitude toward VR development, the role of play and even the media

ecosystem's messaging are more universal.

CHAPTER 3: VIRTUALLY EVERYWHERE: MEDIA COVERAGE OF VR

The media ecosystem around Virtual Reality content during the extent of my research is important because: it offers an array of communications that sustain, color and frame its diffusion; and it governs the discourses of adopters. Participation in this ecosystem is customary for many enthusiasts. Their messages circulate to and from media outlets and institutions. In this way, the media environment filters the language for entrance into, education about and, ultimately, transactions with Virtual Reality.

A set of interconnected media formats, including enthusiast and mainstream journalistic articles, promotional media, individual blogs and publications, online groups who congregate primarily through Facebook and Slack platforms, YouTube and online tutorials, conferences and festivals, gaming distribution platforms and arcades, constantly produce new media concerning VR. After defining these formats, their place, function and stakes within the media ecosystem, I present a case study surrounding "WebVR" technology in order to show how information passes from various media sources to adopters.

Finally, I distill the specific discourses promoted by this media ecosystem. In an analysis of 165 articles, blog posts and talks, the following becomes apparent: discursively, VR is in an inchoate state that still needs to be defined beyond its potential to be a revolutionary medium; the game and informational technology industries are seen as the de facto leaders and "players" in the field despite entry and influence of many others; and finally, the economic value of VR is emphasized above all else.

The VR Media Ecosystem

The media ecosystem for Virtual Reality is complicated, in part, because of the variety of industries that employ the technology. Still, throughout the course of my study, a specific set of interconnected media emerged to serve the community of VR adopters in five ways.

First, it functions as a network of national and international coverage that frames the concept of VR more broadly. Media reify VR as a holistic concept, rather than merely a subset of one or many industries.

Second, media entities speculate on VR's future; they critically appraise not what VR currently is, but what it will be. This harks back to the tradition of thinking of VR as a futuristic technology, as well as a certain techno-optimism associated with digital culture and innovation. Turner (2008), Barbrook and Cameron (1996), and many others, have recounted the neoliberal cybernetic origins of this culture, but generally this outlook is best defined by Rushkoff's (2002) seven tenets: technology reflects the best aspects of human nature, improves communication, democratizes society, is progressive, has positive unforeseen impacts, increases efficiency and consumer choice, and solves problems from old technology.

Third, the system dictates *specific* modes of instruction for making VR content. A variety of resources provides practical instruction to professionals, artists and novices alike, which allows for a relatively low barrier of entry to content creation and mitigates the higher costs of the hardware.

Fourth, media outlets offer public and semi-public forums for conversation about the technology. Knowledge is passed as much through information sharing as through in-person exchanges. As a consequence, many novice developers learn their craft through instructional

material, articles regarding the technology and online groups who answer questions about its limitations.

Finally, the coverage unites the work and perspective of users within the community and the hardware manufacturers, most of whom are members of the broader "tech" and game industries. These industries transmit significant information in the form of blog posts and tutorials. It is through media releases that the public is first exposed to a majority of innovations. These announcements consistently feed the hungry community and are the substance of weekly discussion in meetups and online.

For these reasons, I consider the saturation of media content surrounding VR an "ecosystem." The term emphasizes the interconnected quality of discourses. In a literature review of "media ecosystems," Anderson (2013) traces two origins: first, traditional media ecology, espoused by Neil Postman, tends to imagine different media "species" interacting and finding a kind of homeostasis with each other. Second, Fuller (2005) sees the ecosystem as a collection of wires, antennae and other physical materials tying media together. Anderson (2013) eventually admits that not only do the two perspectives share a common vision of materialism exerting power over a network, but also ultimately defines media ecosystems by how information moves and changes across networks "of which humans are only a part" (p. 6).

In his ethnography of game developers, O'Donnell (2014) describes an analogous, if less complete, ecosystem; since there are few publications catering to game studios, with more mainstream coverage coming from the industry (p. 9), developers turn to personal blogging as part of their process (p. x). He describes a similar set of media outlets (including blogs, talks and enthusiast magazine coverage) within his text (p. 18). O'Donnell's study necessarily focuses on

this smaller niche set of publications. By contrast, the current VR media environment and coverage about it is incredibly complex.

Discourses surrounding VR technology pass through several layers of mediation before adopters repeat it to contextualize their work and activities. The result is not only a uniform language, but also a distinct circuit for the continuous promotion of the technology. Since entities within the ecosystem have interest in the medium's success, they tap into it to find stories that affirm their preconceptions. As a consequence, the ecosystem enthusiastically touts achievements, while allaying (or providing answers to) concerns surrounding VR's diffusion.

The following set of interrelated media entities, representing different institutions and platforms for disseminating information about VR, are in direct conversation not only with each other, but also adopters.

Journalism

Journalistic outlets, both mainstream and enthusiast, are essential in defining VR. Even in early accounts of Oculus' successful Kickstarter campaign, reporters presented contradictory discourses, at once heralding VR's economic potential, while remaining ambivalent about both its practical use and content. A 2013 *New York Times* article about the Rift exemplifies this tension. Nick Wingfield (2013) first writes that users of the prototype HMD were "amazed by how the game world surrounded them," but a few paragraphs later adds, "There are still big obstacles that could send Oculus Rift to the graveyard of failed virtual reality headsets."

While the press generally raved over VR hardware, reflecting a bias towards Silicon Valley's technological dynamism and innovation, it depicted content as experimental, ephemeral and embryonic. Other than noting the substantial investment in VR devices by venture capital and tech firms like Google and Facebook, popular coverage inconsistently characterized the

budding medium; was it entertainment, a game, a film or something else? By the end of 2016, the confusion devolved into outright skepticism (Wingfield, 2017).

Journalists play a critical role in shaping public perceptions of VR as it gains broader acceptance. Often, they have the earliest access to equipment and innovations because of the nature of the game industry. Nieborg and Sihvonen (2009) in their study of games journalists explain that "[t]he 'carrot' used to foster greater industry-dependence" between journalists, advertisers and publishers "is exclusive access. In practice it is hard, if not impossible to gain access to original material for a story or (p)review before competitors do, without the support of a game publisher" (p. 4).

Such dependence highlights the endemic challenge of distinguishing between promotion and journalism in the realm of cultural production (Bourdieu, 1993), or the means by which practices, values and symbols are cultivated and circulated to the broader public. Using literature and art as his primary examples, Bourdieu argues that such production occurs through "cultural intermediaries:" advertisers, publishers, critics, gallery owners and, of course, journalists, each of whom translates and assesses creative value. Where newsmaking as a practice fits into cultural production remains somewhat tenuous because current information about society does not require the same assignation of cultural value, but is rather presupposed. Also, in newspapers, breaking news and reportage occurs on the same pages as other forms of cultural mediation, such as advertising and criticism.

This is further complicated by the nebulous professionalization of journalists, particularly in the United States. As Carlson (2007) put it, "There exists no formal credentialing, no pervasive trade or labor group, and no standard career or educational path for journalists—in short, no definitely recognized divide between who is and who is not a journalist" (p. 266).

Instead, reporters define themselves in part by "boundary work" (Gieryn, 1983), or the daily "codification and legitimation" of the boundaries of what falls under the umbrella of "news." It is an activity "in which journalism is particularly engaged" because of its "malleable, evolving character" (Lewis, 2012, p. 842). Setting boundaries not only outlines the profession, but also conforms with the long-standing notion of "gatekeeping" (White, 1950) where journalists protect and choose the content and nature of messages that disseminate to the wider public.

The boundary work of journalists also establishes a specific set of "values, strategies and formal codes" (Deuze, 2005, p. 446), or an "occupational ideology" for the profession. According to Deuze, it comprises five values—public service, objectivity, autonomy, immediacy, and ethics. By constantly relying on these evaluative and deliberative measures, journalists are able to reify both their daily practice and their gatekeeper role.

However, much of this boundary work is to some degree ceremonial. Revers (2013) describes what he terms as a distinct "boundary performance" of government reporters in Albany, who, in order to maintain their authority, must publicly act out their professional roles by choosing how they conduct themselves with officials and potential sources. Such studies affirm the work of journalists more closely resembles, or is at least intertwined with, that of other cultural intermediaries. Certain beats typify this: Lotz (2008) has described television critics evolving, particularly in the 1980s, into more investigative reporters, holding executives to task, while grateful for information from them. Similarly, sports writers, often relegated to the "toy department" (McEnnis, 2017; Schwartz & Vogan, 2017) of newspapers, carry on both a promotional role and more "serious" coverage because of the exclusive access they have to the industry.

Another means by which journalistic institutions assert their identity is through common codes of ethics. In the United States, the Society of Professional Journalists' Code of Ethics, which was last updated in 2014, has been held up as the gold standard. The Code mandates that journalists act independently and "Refuse gifts, favors, fees, free travel and special treatment, and avoid political and other outside activities that may compromise integrity or impartiality, or may damage credibility."[1] Refusal of such gifts prevents those particularly covering the culture industries from becoming obligated to them. Still, as Singer (2003) notes, such codes are voluntary and that "failure to abide by them does not necessarily mean a loss of professional status." Adherence to codes in "day-to-day newsroom practices is dubious," and are not "cited in arguments over controversial cases." However, their value is to provide direction for journalists who "see themselves as abiding by ethical guidelines, in the interests of fulfilling their public service responsibilities" (p. 145). Moral imperatives can guide journalistic practice and are even reinforced in mainstream news organizations who have their own internal codes of ethics in addition to the self-assigned ones.

Furthermore, journalism's move online resulted in a "grand identity complex" (Robinson, 2010, p. 126) in which the profession as a whole was called into question both internally and externally. The result has been an erosion between the boundaries of journalists and other cultural intermediaries. Beckett and Deuze (2016) see this as part of how consumers encounter news, where serious reporting is "blended into people's digital mobile lives alongside kittens, shopping, sport, music, online dating and mating rituals, pornography, and games" (p. 2).

---

[1] "SPJ Code of Ethics," Society of Professional Journalists, last modified September 6, 2014, accessed March 8. 2018, https://www.spj.org/ethicscode.asp.

Barzilai-Nahon (2008) likewise calls attention to "network gatekeeping" where non-journalists take on some of the gatekeeping function usually associated with the profession.

I found something similar in my study of the VR media ecosystem. In part because it is so heavily promotional, authors and ideas roam quite freely through it. Even the most traditional coverage from the *Wall Street Journal* or *Time* could contain celebratory elements and circulate information that was also covered by enthusiast publications.

The following different types of journalism occur within the media ecosystem and often overlap for the average consumer of VR news and information.

Mainstream Journalism. When it comes to both "boundary work" and articulating an "occupational ideology," the most rigid journalistic outlets are more "mainstream" news organizations, such as *The New York Times, Wall Street Journal* and *Time*, which also have international audiences. In his literature review of contemporary professional journalism, Lewis (2012) has suggested that mainstream institutions have dug in their heels, relying even more heavily on articulating their professional boundaries, particularly in online environments. This includes abiding by codes of ethics, both self-assigned and dictated by newsrooms. For instance, *The New York Times* has its own internal editorial standards for different sections. This includes two specific rules regarding technology: first, writers on business, technology and media may not "play the market" and must be wary of investing in companies due to conflicts of interest; second, when using a technology, "reporters may not accept gifts of equipment, programs or material from manufacturers or vendors," nor endorse equipment, but may test new equipment if given prior approval by editors.[2]

---

[2] "Ethical Journalism," The New York Times, accessed March 8, 2018, https://www.nytimes.com/editorial-standards/ethical-journalism.html/.

For these organizations, the commercial diffusion of VR is therefore "news," starting with the Oculus Kickstarter campaign in 2012 when it raised $2.4 million. The roller coaster of venture capital and tech firm investment, as well as the commercial release of the headsets, have all provided additional fodder for the outlets to cover.

At the same time, these organizations are also actively pursuing VR as a medium for exhibiting their work. Time revived its *Life* brand under a VR-only application and platform.[3] *The New York Times* performed an ongoing VR experiment throughout 2016 and 2017. Entitled "The Daily 360," they produced a series of VR-ready 360° Videos with a broad edict to look at "the big stories" of the day, "style and culture" and "experimenting with formats" (Lichterman, 2016). In a piece about the use of the technology in 2015, *The New York Times, Frontline,* the Associated Press, Gannett, the *Wall Street Journal* and CNN are all mentioned as experimenting with VR (Wang, 2015). Even more institutions are listed in a 2017 AP report along with the assertion that "[i]nnovators throughout the news industry are collaborating with technology companies and building their own studios to push the envelope in a number of immersive media projects" (Marconi & Nakagawa, 2017, p. 1). They go on to say that "this wave of technological innovation follows a similar path from others that come before it. Each new technology reinvents how we experience news, activating each of our senses in a brand new way" (p. 2). Journalists have as much a stake in the ongoing success of the medium as other media entities and consequently are making efforts to relay ideas about it while foregoing some of their objectivity.[4] This can also make the ethics around use questionable when it comes to dealing with new

---

[3]"Life VR," Life, accessed March 8, 2018, http://interactives.time.com/lifevr/.

[4] Part of their investment includes the ability to promote content through the new medium. For instance, *The New York Times* showcases promotional content alongside journalistic content in the NYT VR app. It is housed within the marketing section of the site. See "The New York Times: VR," The New York Times, accessed March 7, 2018, http://www.nytimes.com/marketing/nytvr/.

technologies. To return to the example of *The New York Times*, Usher (2014), in her ethnography

of the organization, describes there not being "a stable code of ethics, for better or worse" (p. 29)

at the paper regarding social media use during her period of study, leading to significant

experimentation by journalists.

As a consequence, while adhering to journalistic standards, even mainstream outlets are

promoting VR, whether making the new technology the subject of a "headline grabbing" story,

or simply utilizing it in their coverage to capture new readers and audiences.

Games Criticism and Journalism. Gaming websites and magazines, ranging from

classics such as *PC Gamer* to newer portals such as *Polygon* (part of Vox Media) have avidly

reviewed and promoted VR and related games since 2012. Much of games criticism and related

journalism is heavily dependent upon publishers and hardware manufacturers. Writers rely on

them to gain pre-release access to new content and do not usually have the same code of ethics

regarding gifts as mainstream organizations.[5] This inevitably shapes the types of stories written,

which usually consist of sneak peeks and critiques of games and game systems. Since VR

hardware manufacturers are tied to gaming, including computer company HTC, Oculus and

PlayStation, as well as distribution channels, such as Steam, and the Apple App and Google Play

stores, much of the content is game-based and thus subject to previews and reviews. While VR

provides additional content for such publications, it has not supplanted other types of game

journalism, but is part and parcel of an ever-expanding landscape that now includes eSports,

mobile gaming, casual gaming along with AAA titles. Game reviews have also expanded to

more mainstream outlets. *The New York Times* employs longtime critics Stephen Totilo and

---

[5] This varies from publication to publication, but particularly because many reviewers freelance within the business, the onus falls on them to self-assign their standards. As a consequence, most game critics are ambivalent about their occupational ideology. See Fisher, 2012; Foxman & Nieborg, 2016; Prax & Soler, 2016.

Chris Suellentrop and games writer Simon Parkin freelances for publications like the *New Yorker*.

Technology and Business Journalism. Business news organizations, such as *Business Insider* and *Fortune*, as well as technology-focused sites like *Verge,* feature articles about immersive media. Technology and business reporting have long been connected; in her study of science and technology journalists' motivations at the *Chicago Tribune*, Martin (2007) observed that business interests ultimately determined the type of technology, innovations and even scientific discoveries authors chose to cover. She quotes a reporter: "Technology [writing] is often applying basic scientific findings for applications in health or business or just to build cool gadgets" (p. 20).

The type of technology and business reporting varies. More "mainstream" journalists report on VR as they do on any other major innovation in Silicon Valley. By contrast, sites like *Verge* or *CNet* review new computer and digital hardware, which now includes VR headsets and ancillary gear. Finally, niche business sites evaluate and analyze investments and profile startups along with the associated hardware/software they produce. Like game publications, these outlets are bound to the technology and associated industries that perpetuate their businesses. Consequently, VR is not the mainstay, but only a subset of their coverage.

Entrepreneurial Journalism. Although somewhat ill-defined, "entrepreneurial journalism" has also taken on VR. Entrepreneurial journalists deal with and model themselves after startups and startup culture. Hallmark examples include business website *VentureBeat* and technology site *Recode*. This type of journalism departs from its more mainstream counterparts by touting novel forms of audience interactivity and news products.

The much critiqued if pervasive "entrepreneurial" go-getter attitude—tied to the gig economy and finding personal success at all costs—seems to be all that binds the aforementioned news outlets together, rather than any singular ethos. Because the Internet has so negatively affected the revenues of traditional newspapers and websites, entrepreneurial journalists are expected to find, through their own gumption, ways of making a living in this new atmosphere (Anderson, 2014). They are almost inherently promotional, since they need to advocate for themselves in what they deem to be a competitive marketplace. Providing novel content is absolutely necessary, so writing about immersive media is very appealing.

Subject-Specific News Sites. One place where entrepreneurial journalism abounds is on VR and other immersive-specific news sites. Enthusiast portals have grown in tandem with the technology. Sites such as *Upload VR*, *VR Focus* and *Haptical* constantly detail the medium. Their subject matter is diverse: In one week in 2016, *VR Focus* reported about VR's presence at the Sheffield Doc/Fest (Al-Obaidi, 2016a), PlayStation's potential announcement of VR content for its headset at the E3 exposition (Eva, 2016), a recap of HTC Vive shipping lengths (Graham, 2016a), a guide to Samsung Gear compatible smartphones (Al-Obaidi, 2016b), and an update stating that Oculus Rift was ranked in the top five of the world's most influential products (Graham, 2016b). These were only a few of the articles and didn't include the countless previews and reviews of content, which made up the bulk of posts. Because of the assortment and depth of coverage, they have become necessary reads for the most ardent enthusiasts and have made careers for their authors.

Aside from generating constant news about VR, subject-specific reporters are much more wed to the budding VR industry than games critics or business/technology journalists who only

incidentally include the subject among their coverage. Sites like *Next Reality News*[6] organize

their sections around the latest immersive products—including the HoloLens, Magic Leap and

Meta 2 AR glasses—and extensively publicize the benefits of the devices. Such sites neither

resemble their mainstream counterparts, nor practice the strict boundary work of traditional

outlets. Their output more closely corresponds to that found in "Arts and Entertainment"

sections, inherently promotional and linked to a distinct industry. Site-specific news outlets are

also major engines for news on VR. They often are the first with breaking stories about the most

recent innovations as they come to market.

      Journalism's Contribution to the VR Media Ecosystem. While these different

channels may represent divergent perspectives, audiences and interests surrounding VR and its

diffusion, they are relatively uniform in their appraisals. As an example, upon the release of the

Oculus Touch hand controllers, a number of articles praised them as in some way completing a

long-awaited feeling of immersion in VR: "It's much easier to lose yourself in a world when

you're using your own limbs" (Tsukayama, 2016). The "Rift users can finally join in on the fun"

(Hardawar, 2016). "The Oculus Rift is Finally Complete" (Robertson, 2016). "[P]layers can

finally 'Reach Into Rift' too" (Lang, 2016b).

      Journalistic institutions display two main tendencies as media entities. First, journalists

have spent significant energy to define and critically frame the current moment in VR, as each

new milestone passes. Outlets devoted much of 2016 to explaining the supposed "Year of VR."

One article concluded optimistically: "Virtual reality will bring new ways for all sorts of

organisations and businesses to talk to us. This year we may find out whether… it's as good as

---

[6] "Next Reality >> Augmented & Mixed Reality news, Rumors & Dev Guides," Next Reality, accessed March 7, 2018, https://next.reality.news/.

the actual thing" (Cellan-Jones, 2016). Another skeptically quotes an analyst: "To over use the

not used often enough baseball analogy, we don't even think we are in the first inning yet"

(Morris, 2015). This sentiment is particularly prevalent in mainstream and business journalism,

which often introduces the medium to the broader public.

Second, journalism spotlights the industry's star and potential "players." Cellan-Jones'

(2016) article tags the major industries in the VR Space. "The games industry is betting big on

virtual reality…" adding "I suspect that, just as Microsoft found with its Kinect motion sensor,

many gamers will see VR as no more than a gimmick." Journalists not only pay tribute to those

industries already ensconced within VR, but also promote outside industries vying for entry.

Cellan-Jones then follows up with "just as Kinect's technology has found lots of uses beyond

games, virtual reality may still prove a ground-breaking technology in many areas of life."

Articles simultaneously weigh the impact of VR on various industries. Virtual Reality is

cited in pieces about reinventing education (Reede & Bailiff, 2016), law enforcement (Lewis,

2017), medicine (Jolly, 2017), military conflict (Barrie, 2017) and tourism (Graham, 2016).

Collectively, they document the growth of the technology in the last few years, point out how

specific companies can remedy problems with it, and ruminate on VR's future. Reede and

Bailiff's (2016) article on VR and education tracks the history of VR to the 1950s, then lists a

number of companies that are contributing to the idea that there is "great success of 3D

immersion and VR technology in hundreds of classrooms in educationally progressive schools

and learning labs in the U.S. and Europe." After, they suggest that future uses of VR may

enhance collaboration and empathy in students. The authors conclude that "In this educational

reality, VR has a definite place of value."[7] Industry profiles like these are models of entrepreneurial, technology and business coverage as case studies of VR's success that invite further investment.

As a whole, journalists promote a cohesive concept of VR, what it is and where it is going, along with a depiction, albeit evolving, of what the industry looks like and who and what occupations it may impact. Major news outlets, along with enthusiasts, consistently advocate for the medium, a reflection of their mutual investment in the technology.

Promotional Media

Journalists are not the only ones endorsing VR. A surfeit of promotional publications headline accomplishments and opportunities for investors. Boosterism is prominent in a wide variety of newsletters, such as the AR/VR Weekly newsletter from *VentureBeat*,[8] a newsletter from *ReadWrite*,[9] and a weekly newsletter from "Virtual Reality Summit."[10] Some publications are products of research analysts and consultancies that track industries associated with VR. The companies aim to predict the medium's future course.

Promotional media shares much with entrepreneurial journalism. Both obscure the lines between promotion and information dissemination. Both tend toward aggregation, collecting news and information from around the Internet to distribute to readers. Deuze (2001) describes such practices as befitting one of four main categories of newsmaking online, namely "Index &

---

[7] Further discussion of the hype of computers in classrooms will be discussed along with VR in education in Chapter Seven.

[8] "VentureBeat | Tech News that Matters," VentureBeat, accessed March 8, 2018, https://venturebeat.com/.

[9] "ReadWrite | The leading Internet of Things News Platform," ReadWrite, accessed March 8, 2018, https://readwrite.com/.

[10] "Virtual Reality Summit," Virtual Reality Summit, accessed March 8, 2018, http://virtualrealitysummit.com/

Category Sites," which included *Yahoo! News* and online newsletters. Promotional media differs from these sites in that it makes no specific claims to journalistic authority. Instead, promotional outlets market themselves as one-stop shops for snagging the latest and greatest on VR. Furthermore, they are distinctly bullish about the potential of the technology.

Much of this media is illustrative—lauding successes and spotting trends in the industry on a weekly basis. This can be seen in a June 2016 *Virtual Reality Summit* newsletter, published during the heart of my study**.** The newsletter consists of a series articles: one is about a partnership between an AR company and the Star Wars franchise to make content (Helsel, 2016b); a trend piece addresses how retailers are using AR and VR to get customers (Helsel, 2016d); another article features phone company OnePlus' release of a phone in VR (Helsel, 2016c); and the last article discusses global AR and how Israel is investing in that market (Helsel, 2016a). Each publicizes the specific value of the innovation overall and invites newcomers to invest within this space.

Promotional media manifests the value and prominence of advertising in the dissemination of VR and related content. In New York City particularly, advertising and journalism steer the medium and partner with VR studios to make sponsored material. Promotional media is yet another outlet for championing the medium and drumming up hype.

Blogs and Individual Media

Gwan Yip is hardly a leader in VR. Working at a small New York City startup, Yip (2017b), who professes "[f]or the past year and a half… thrown myself into the VR world, culminating in a VR experience I developed called The Virtual Boutique that aims to bridge the gap between the physical and digital worlds of shopping," is archetypical of the VR enthusiast blogger. His handful of articles are posted to the blogging platform *Medium* and co-posted on the

Medium news "collection" *Virtual Reality Pop*.[11] One of Yip's (2016) earliest articles tackles the

big issue of why he loves VR. It was the experience of his extended family who "put on a

headset for the first time and were blown away." That experience, he said "is something I'll never

forget." His other articles offer practical advice on becoming a VR adopter. He writes about the

pain "in the ASS (or ARSE) carrying the equipment, tripping over wires, things overheating or

running out of batteries, programs crashing, etc…" when showing people VR equipment (Yip,

2017c). He forewarns how "the numerous different technologies and concepts you're exposed to

in the world of VR can be quite intimidating, so having that inspiration and reason to push

through is paramount" (Yip, 2017a). He is candid and detailed about the learning process: "When

I started to think about what type of experience I wanted to create for The Virtual Boutique

(TVB), I jumped straight to the exciting parts: importing a 3D model of a mannequin wearing a

dress we scanned in using a Structure Sensor and shooting a 360 video catwalk on green screen.

However, as I started to build different scenes in Unity, I could feel things begin to fragment"

(Yip, 2017b). Although a novice compared to researchers at Oculus or the Virtual Human

Interaction Lab at Stanford University, Yip shares his previous knowledge as a UX designer

(Yip, 2017b) and all he has garnered throughout his short career in VR. Posters are neither

journalists, nor publicists for a particular brand. Instead, writing as individuals, they leverage

their expertise, or simply follow their whims.

This sort of entry, which can either be "one-off," sporadic or regular, serves an important

role for many enthusiasts. It transforms the rhetoric, focus and speculation that originate from

journalistic outlets into practical exercises that test the limits of such assertions. Their

publications then in turn feed journalistic coverage surrounding VR. Sometimes, the relationship

---

[11]"Virtual Reality Pop," Virtual Reality Pop, accessed March 8, 2018, https://virtualrealitypop.com/.

is quite specific. For instance, a series in *Medium* regarding how to edit and construct stories for VR by Jessica Brillhart (2016a), who is one of the senior VR filmmakers at Google, was featured in many articles on the subject.[12]

The blogging platform *Medium* is particularly significant in spreading this type of media and has received attention (Masumian, 2015; Sussman, 2014) for its blend of journalistic and non-journalistic contributors, what Sussman (2014) calls "social journalism." *Medium* uniquely does not promote individual posters' pages as owned websites. Instead, it aggregates information and has users subscribe to particular interests (such as "technology"), writers and publications (ad hoc newspapers like *Virtual Reality Pop*). It also allows users to upvote articles meaning that anyone—whether written by a journalist or not—can bubble to the top. *Medium* posts are thus networked and connected by common threads.

As a consequence, *Medium* is a vast repository of information for newcomers working with VR. It is an easily obtainable resource on how to program and construct content. Enthusiasts can access newsletters such as *Haptical* which is hosted on *Medium*. Interviewees and meetup attendees, as well as hosts, cite articles on *Medium* in their presentations. The posts are enthusiastically consumed. Mai Luong (2017), an enthusiast who is just "fascinated" with VR/AR according to her profile wrote an article about understanding the applications of the technology beyond gaming that was upvoted 513 times. Brillhart's (2016b) most upvoted article from her series, despite the fact she is considered one of the foremost thinkers on VR, was only upvoted 234 times. Each post is a kind of digital calling card that showcases the abilities of creators and developers within the VR spectrum. Their posts flaunt their acumen, while expanding the knowledge base of the entire community.

---

[12] See Haridy (2016) as example.

Medium also, to a certain degree, democratizes the vision of VR. Technologists', such as Brillhart (2016b), HTC Evangelist Dario Laverde,[13] longtime developer Tony Parisi,[14] posts dwell alongside more amateur content. In all cases, the style tends to be highly personal—Brillhart (2016b) starts off a post with a call to the reader, "Let's start with an embarrassingly straightforward exercise. Take a look at the series of images below" and proceeds down this path to discuss point of interest (POI) in viewing. Her work refers back to herself often: "If I did my job right, the overall experience will resonate without the visitor embracing this journey." These posts seem to "get in the heads" of neophytes, mid-level and more professional developers.

This avenue of communication then serves dual purposes for posters. It is a promotional outlet—a calling card—for their work and a resource for seeking information about VR. In building a popular repository of articles, freelancers and rookie developers display their skills, spread knowledge about VR and seal their reputations.

Facebook, Slack and Online Groups

Blog posts on *Medium* represent the best work of enthusiasts and developers. They are often polished, well-conceived and blatantly promotional. Another media entity, on a more mundane level, exposes the process that eventually leads to these blog posts, as well as the debates and conversations raging about the medium. Specifically, an assortment of online groups, primarily housed on Facebook and Slack platforms, offer a conduit for public and semi-public conversations.

---

[13] "Dario Laverde - Medium," Medium, accessed March 8, 2108, https://medium.com/@dariony

[14] "Tony Parisi - Medium," Medium, accessed March 8, 2018, https://medium.com/@tonyparisi

The scope of groups is extensive. Facebook sponsors numerous national groups including Women in VR/AR,[15] AR & VR Developers which mostly comments on current releases,[16] VR NYC which focuses on local news and questions in VR,[17] VR & AR Jobs,[18] VR and AR Storytelling, which covers cinematic VR,[19] and Patching VR which broaches hardware and other experiments in VR.[20] Generally, these groups have low barriers of entry, one merely requests to join, and, as a consequence, contain hundreds of members. As of this writing, Women in VR/AR has 8,477 members and VR and AR Storytelling has 1,727 members. Other groups, like NYC VR, have 365 members, and the more experimental Patching VR 133 members. Finally, there is no shortage of online forums. The Unity game engine supports both a forum[21] and community answer section.[22] Oculus has hosted discussion forums for years.[23] Some forums, such as

---

[15] "Women in VR/AR," Facebook, last modified March 8, 2018, accessed March 8, 2018, https://www.facebook.com/groups/womeninvr/.

[16] "AR & VR Developers," Facebook, last modified March 8, 2018, accessed March 8, 2018, https://www.facebook.com/groups/ARVRMR/.

[17] "VR NYC," Facebook, last modified March 5, 2018, accessed March 18, 2018, https://www.facebook.com/groups/vrnyc/.

[18] "VR & AR Jobs," Facebook, last modified March 8, 2018, accessed March 8, 2018, https://www.facebook.com/groups/VRARJobs/.

[19] "VR and AR Storytelling," Facebook, last modified March 8, 2018, accessed March 8, 2018, https://www.facebook.com/groups/oculusriftvrfrance/.

[20] "Patching VR," Facebook, last modified December 15, 2017, accessed March 8, 2018, https://www.facebook.com/groups/396836590687887/.

[21] "Unity Community," Unity, accessed March 8, 2018, https://forum.unity.com/.

[22] "Ask a Question - Unity Answers," Unity, accessed March 8, 2018, https://answers.unity.com/questions/ask.html.

[23] "Oculus Discussion Forums," Oculus VR, last modified March 8, 2018, accessed March 8, 2018, https://forums.oculusvr.com/community.

VRTalk, are more generalist.[24] All provide opportunities for enthusiasts and developers to answer specific questions.

The messaging platform Slack also has its share of groups, some of which are national and international. Unity has a number of Slack groups including "Unity Slackers"[25] with a variety of subsections within it. These include a local #uug-nyc channel (along with Unity user group channels for many other cities), a #vr-ar channel, along with more general channels on events, news, promotion, and jobs. There are also groups for related subjects including everything from a WebVR Slack,[26] a Slack group for the social VR app AltspaceVR to work on their SDK,[27] and the more generalist VR Theory group.[28] The size of these groups vary and can be temporary and tactical.[29] Some, such as W3C-VR Slack channel, which was made for the workshop surrounding the development of WebVR,[30] are organized around specific events and hackathons, while others, such as the Seattle VR Slack[31] channel, are geographically oriented and (because of their locale) good avenues for job seekers (Hunter, 2016). There are even smaller slack groups organized around confederations of developers and coworkers. The lab in

---

[24] "VR Talk - Virtual Reality Forum," VR Talk, accessed March 8, 2018, http://www.vrtalk.com/forum/.

[25] "Unity Slackers," Slack, accessed March 8, 2018, https://unityslackers.slack.com/.

[26] "WebVR," Slack, accessed March 8, 2018, https://webvr.slack.com.

[27] "AltspaceVR SDK," Slack, accessed March 9, 2018, https://altspacevrsdk.slack.com.

[28] "VR Theory," Slack, accessed March 9, 2018, https://vrtheory.slack.com.

[29] In this way, these groups resemble the collective intelligence communities described by Henry Jenkins (2006) in earlier Internet culture, which he said are defined through voluntary, temporary, and tactical affiliations, reaffirmed through common intellectual enterprises and emotional investments (p. 27).

[30] "W3C Web & VR Workshop," Slack, accessed March 9, 2108, https://w3c-vr.slack.com.

[31] "Seattle VR," Slack, accessed March 9, 2018, https://seattlevr.slack.com.

which I participated contained a closely guarded Slack channel comprised of current and past

members where postings occurred daily, if not hourly.

At whatever size, the primary goal of these Slack and Facebook groups is to informally

pool resources. Most are conglomerations of articles, blog posts and promotional material and

are interspersed with plenty of practical advice, snippets of code and screenshots. The VR

Theory[32] #general channel includes announcements of Oculus' price drops, random greetings of

new individuals, links to Q&A and other presentations and remarks on the other posts. They run

from commentary about an article stating how "WebVR isn't sexy" is wrong, to someone's

inquiry about the latest trends in VR in architecture. These postings carry a casual and open air,

and their tone is positive and inviting. They are safe havens, as well as spaces for advertising the

latest and greatest VR productions, where users can ask questions on how to make VR and other

immersive media. One interviewee described his company's internal VR Slack channel:

"Anybody who finds anything interesting throughout all the studios, including the European

studios, they'll post something on the VR slack channel. It just keeps everybody up to speed on

what's new and interesting."

These resources are valuable since the discipline is not housed in any single institution,

let alone at universities. Instead, it exists within segments of different industries. While in New

York City, adopters can gain knowledge through one-time classes such as those hosted by the

IFP Media Center,[33] the professional programs sponsored by the New York Film Academy,[34]

---

[32] Applying for entry will get you automatically into the Slack group.

[33] "SURROUND YOUR SOUND: 3D AUDIO PRODUCTION FOR VR AND 360 VIDEOS," Made in NY Media Center, accessed March 9, 2018, http://nymediacenter.com/classwork/class/?id=60345B09-0CCB-4BDA-88D8DCC63D65C70D&slugid=surround-your-sound-3d-audio-production-for-vr-and-360-videos

[34] "Virtual Reality Courses & VR Design Classes," New York Film Academy, accessed March 8, 2018, https://www.nyfa.edu/vr/.

and the International Center for Photography's New Media narratives one-year certificate program which includes VR storytelling elements.[35] For those outside of a city, or in relative isolation, when it comes to the development process, online groups are a means to engage with a community and find a sense of camaraderie.

Still, their greatest value is to convey very visceral and granular instruction in *how* to create VR content. While the other media entities are speculative and attempt to define VR, these groups are more supportive through a steady stream of media by which to be connected and from which to learn.

YouTube and Other Tutorials

Another form of media charged with educational value are online tutorials, and specifically videos on YouTube which broadcast real-time strategies for solving development and programming problems.

Video tutorials are completely normalized in the VR software environment. When I began to learn VR in 2016, I was immediately informed by three different enthusiasts that I needed to study the "Space Shooter" tutorial.[36] One adopter told me that I would "know everything I needed to know about VR" and become completely inculcated in the Unity universe once I completed it. An online search took me to the tutorial page of the Unity game engine where a series of nineteen videos, supplemented with pdfs of documentation and updates, illustrate in minute detail how to make a space shooter game. I diligently followed along, step-

---

[35] "New Media Narratives | International Center of Photography," International Center of Photography, accessed March 8, 2018, https://www.icp.org/school/programs/new-media-narratives.

[36] "Unity - Space Shooter tutorial," Unity, accessed March 9, 2018, https://unity3d.com/learn/tutorials/s/space-shooter-tutorial.

by-step with the video, pausing and rewinding when I made mistakes until my space ship was zooming along and destroying asteroids. Since this initial introduction to online tutorials, I have consistently returned to YouTube for visual answers to development conundrums. Tutorials with similar step-by-step walkthroughs can be found for almost any query about the program.

The videos also vivify the iterative process of development as it unfolds over time. Developer James Andrew, who describes himself as "an early adopter of Consumer Virtual Reality, quickly becoming a well-known thought leader, conference presenter, and highly regarded designer of many iconic VR experiences,"[37] has been recording the evolution of his Virtual Reality game on YouTube for years, illuminating small changes and additions throughout. In one video on the final stage of his game Z0NE, he picks up on the idea of "Torroidal" movement that he had introduced in a previous video and proceeds to show how that movement on X and Y axes of the avatar make what he calls "a really pleasing mechanic" (PixelRouter VR, 2015, 1:20).

Made by experts and "amateurs" alike, tutorials have become the standard path for learning game and VR programming. And, as I will later attest in Chapter Nine, they are the first resort for unlocking the mysteries of VR.

Online Courses

While much of the online tutorials are video, YouTube is not the only audiovisual platform for distribution. Given the range of skills required for development and the extent of

---

[37] "James Andrew | LinkedIn," LinkedIn, accessed March 9, 2018,
https://www.linkedin.com/in/jamesandrewpixelrouter/.

questions that need answers, other modes of tutelage have been codified into formalized online courses and developer pages hosted by hardware manufacturers.

These courses, which encompass from a few to over 85 hours of study, aim for a level of holistic expertise in the development process. The courses are available on for-profit educational and training platforms, such as Coursera, Udemy and Lynda, and can cost anywhere from about $15 (especially when on sale) to well over $100 depending on length, complexity and depth of skill required. Corporate and educational licenses are also available. As a consequence, they can be accessed by university libraries.

In conversations with enthusiasts, completing these courses was often an aspiration. By passing the entry-level courses, an enthusiast achieves a benchmark and acquires basic skills in the subject. Within the first few months of observation, members of the lab and meetups also advised that I take "Make Mobile VR Games in Unity with C# for Google Cardboard" started by game developer Ben Tristem on Udemy.[38] Ben states in his profile on Udemy that "I fell in love with teaching game development through one of my investments, and I now spend all of my time sharing my passion with people like you. I can't wait to help you experience the fulfilment, and financial freedom, that having a deep understanding of technology brings."[39] The course consists of 94 videos, each ranging from about one minute to fifteen minutes in length, as well as activities and quizzes and teaches C# programming fundamentals, 3D scene creation and building for Google VR/Cardboard platform, each through developing a game. Imposing in

---

[38] "Make Mobile VR VR Games in Unity with C# for Google Cardboard | Udemy," Udemy, accessed March 9, 2018, https://www.udemy.com/vrcourse/learn/v4/overview.

[39] "Ben Tristrem | GameDev.tv Founder :: Entrepreneuer :: Passionate Teacher | Udemy," Udemy, accessed March 9, 2018, https://www.udemy.com/user/bentristem/.

length, few in the lab completed it in full, myself included, but used it until they felt comfortable with the device.

Furthermore, the coursework is used for certification. A number of courses[40] prepare students to pass the Unity certification exam which is offered only a few times a year by the company. While passing this exam doesn't guarantee a job, it is an impressive credential on a resume.

Hardware Manufacturer Support

Hardware manufacturers also support tutorials. They release a significant amount of documentation to developers in order for them to learn about and better comprehend the new hardware. It is from this information that developers discover the limits of the technology as well as its potential.

One example is the documentation for HTC Vive "Trackers," specialized pieces of hardware used in conjunction with the "Vive" headset. The PDF for the trackers begins with a series of use cases for the spherical devices,[41] which can be attached to realworld baseball bats, guns and swords. The goal of these use cases is to illustrate how the trackers can be incorporated

---

[40]For instance, see three examples: "Pass the Unity Certified Developer Exam - Lifetime Access | Unity," Udemy, March 9, 2018, https://www.udemy.com/unitycert/learn/v4/overview.; "Cert Prep: Unity Particle systems, AI, and Audio," Lynda, accessed March 9, 2018, https://www.lynda.com/Unity-tutorials/Cert-Prep-Unity-Particle-Systems-AI-Audio/536423-
2.html?srchtrk=index%3a2%0alinktypeid%3a2%0aq%3aUnity+Certification%0apage%3a1%0as%3arelevance%0a
sa%3atrue%0aproducttypeid%3a2.; "Cert Prep: Unity Fundamentals," Lynda, accessed March 9, 2018,
https://www.lynda.com/Unity-tutorials/Cert-Prep-Unity-Fundamentals/536422-
2.html?srchtrk=index%3a3%0alinktypeid%3a2%0aq%3aUnity+Certification%0apage%3a1%0as%3arelevance%0a
sa%3atrue%0aproducttypeid%3a2.

[41] "HTC Vive Tracker Developer Guidelines," Vive, last modified July 17, 2017 accessed March 7, 2018,
https://dl.vive.com/Tracker/Guideline/HTC_Vive_Tracker_Developer_Guidelines_v1.5.pdf.

into a virtual game. The documentation then further specifies the technical guidelines of the

hardware, such as how inputs to the trackers mirror the traditional Vive controller.

These tutorials and manuals come in the form of both documents and software packages,

where a user is given sample scenes to build. Included in Google VR's developer documentation

is a digital package of software (SDK) for use in Unity. Opening this within the program places

the user in a small room with a cube and some basic functions with which to interact. No matter

the type of documentation, on a very technical level, manufacturers control the pathways, visuals

and limits of what can be developed with existing VR tools.

Let's Plays

Let's Plays is another video-information source, although not as technical nor

instructional as those previously mentioned. These widely popular videos are primarily found on

video streaming sites like YouTube and Twitch.Tv. They are filmed more for entertainment, paid

for by targeted advertising, and feature charismatic hosts who lead players through digital games.

Many of these Let's Players are the highest paid stars on YouTube. For instance, the Forbes 2017

list of top YouTube stars includes two Let's Play figures—Daniel Middleton, who does videos of

Minecraft and Felix Kjellberg aka PewDiePie (McAlone & Lynch, 2017). Oriented toward a

gaming crowd, Let's Plays' advantage is that it is a way to see the full round of play without

owning a device.

Conferences and Festivals

While these amateur and pre-professional videos are ubiquitous, their views pale in

comparison to the posted videos from conferences and festivals, which stir up excitement about

VR's future. There exists a complex of developer conferences where innovations of VR and other

immersive technology are announced and visions of VR's future are articulated. Most major

manufacturers conduct conferences at least once a year to much fanfare. Google sponsors the

annual "Google I/O" conference,[42] Oculus the annual "Connect" conference.[43] Apple has an

annual Worldwide Developers'Conference (WWDC)[44] and Unity underwrites a series of Unite

conferences.[45] These are just a few of the major conferences surrounding VR and other

immersive technologies. Coverage of Oculus 2017 Connect Conference tied the announcements

of the conference to the future of VR: "… [I]t's helpful to remind developers (and, by proxy,

consumers) about how bright the future is—even if the present feels like those billion users are

impossibly far away" (Rubin, 2017).

Developer conferences have also been the engine for revving excitement about new

development kits (both software and hardware packages) and business strategies. Apple's ARKit,

which opened up the iOS operating system to Augmented Reality development, was announced

in the 2017 WWDC (Roettgers, 2017).[46] At the 2017 Google I/O conference, the company

unveiled what its future vision of technological innovation and "Immersive computing" agenda

or a design strategy that oriented their development to a "spectrum" (Wilson, 2017) of immersion

and mixed reality technologies. They also explained their logic behind this agenda: "these

technologies mattered because they enable us to experience computing more like [we]

---

[42] "Google I/O," I/O, accessed March 9, 2018, https://events.google.com/io/.

[43] "Oculus Connect 4 | Oculus," Oculus, accessed March 9, 2018, https://www.oculusconnect.com/.

[44] "WWDC - Apple Developer," Apple, accessed March 9, 2018, https://developer.apple.com/wwdc/.

[45] "Unity Unite," Unity, accessed March 9, 2018, https://unite.unity.com/.

[46] The developer conference has gotten the reputation of being just for this purpose. It was in the WWDC conferences where Steve Jobs' iconic releases of new products, such as the iPhone, occurred. Many of the conferences are implicitly styled after Jobs' talks.

experience the real world. They enable computing to work more like we do and we think that's a big idea."[47]

The fanfare and spectacle around the conferences have the rhetorical power to shape the medium's destiny. Presenters premier their latest innovations, which are assessed and discussed online, in journalistic and personal outlets, and during meetups. When Mark Zuckerberg announced the Oculus Go standalone (and even cheaper) headset during the latest Oculus Connect conference, he revealed the company's future path in that product category (Rubin, 2017). His pronouncements were discussed, critiqued and ultimately directed development and adoption by users.

Festivals and panels, which take place with regularity across the country, reaffirm and expand upon these ideas. The festivals also guarantee consistent public exposure to the medium and its dominant players. In New York City, festivals have associations with major cultural and industry events. Throughout the period of my study, events were held in concert with the Tribeca Film Festival, the Northside Music and Technology Festival, CES, along with original VR-focused festivals such as "The Future of Storytelling," the New Museum and KillScreen's "Versions" festival and NYVR expo which was held under the aegis of the PhotoPlus Expo. This is only a partial list and does not include media industry subsidized panels and functions.

These local festivals and panels draw industry luminaries and allow attendees to interface with them and other key figures from across the country. The 2016 "Virtual Reality Summit" in the Jacob Javitz center featured long-time web VR developer and vice president of "Platform

---

[47] "VR and AR at Google (Google I/O '17)," YouTube, accessed March 9, 2018, https://www.youtube.com/watch?v=tto90e-DfeM.

Products" at WEVR Tony Parisi,[48] who has written a handful of practical books on VR,

SuperData consultant Joost Van Dreunen, local advocate Lex Dreitser, and other city dwellers

such as Dario Laverde, a senior developer evangelist at HTC.[49]

Festivals also introduce newcomers to VR through demos and playgrounds. As temporary

exhibitions, they highly curate a set of innovative experiences to attract and impress those who

have not been previously exposed to the technology. And often these select experiences will

travel from festival to festival. Two experiences by the production company New Reality Co.[50]

entitled *Giant*[51] and *Tree*,[52] which feature novel extrasensory features—*Tree,* which simulates

the life and death of deforested trees, has users sprayed with water, heated by actual fire and

buffeted by artificial wind—have been featured at Sundance Film Festival, Tribeca Film

Festival, the Camden International Film Festival, as well as more VR-focused events such as the

Weird Reality conference and The Future of Storytelling.

In addition, online conferences and meetings, such as "VR Voice"[53] and VR & AR With

the Best,[54] book well-known panelists. VR Voice and the VRARA[55] include dozens if not

---

[48] Parisi has subsequently moved to work at Unity Technologies.

[49] For full list of attendees, see "Speakers | Virtual Reality Summit," Virutal Reality Summit, accessed March 9, 2018, http://virtualrealitysummit.com/new-york/2016/speakers/.

[50] "New Reality Co." New reality Co., accessed March 9, 2018, http://newreality.co/.

[51] "Tree Official," Tree, accessed March 9, 2018, https://www.treeofficial.com/.

[52] "Giant," Giant, accessed March 9, 2018, http://giantofficial.com/.

[53] "Home - VR Voice," VR Voice, accessed March 9, 2018, https://vrvoice.co/,

[54] "VR & AR With The Best, Sat, Dec 3, 2016, at 10:00 AM | Eventbrite," Eventbrite, accessed March 9, 2018, https://www.eventbrite.com/e/vr-ar-with-the-best-tickets-28365344509#.

[55] "VR/AR Assocaition - The VRARA," VR/AR Assocaition, accessed March 9, 2018, http://www.thevrara.com/.

hundreds of conversations, interviews and groups and open up the opportunity for nationwide if not international networking for an entry fee.

Finally, meetups in many ways serve a similar function to festivals on a significantly smaller scale. Speakers appear and reappear at individual meetings, or traverse a number of meetups to exhibit their work. Additionally, meetups often offer discounts to admissions to the more expensive festivals. In this way, they serve as a gateway into the discussions and discourses of the larger conference and festival circuit.

Arcades and Installations

Unlike festivals, VR arcades and installations accommodate a more permanent space for exposure to content. For a fee,[56] entry is given to a variety of experiences. These spaces may not seem to be rhetorically powerful, but the manner in which they are constructed and what is featured in them contain important implications of VR's formation. The current spate of Arcades include temporary exhibits like "Ghostbusters," which is housed at Madame Tussaud's wax gallery. Dedicated arcades look very different, with "Jump into the Light" advertised as "America's First VR Cinema & Playlab;"[57] VR World courts tourists as "the largest Virtual Reality Center on this side of the planet;"[58] Hubneo is marketed as a lab, and includes significantly more hardware for motion simulation;[59] and the Virtual WorldVR in Long Island City located next to an "extreme sports center" bills itself as adventure-based entertainment with

---

[56] As of this writing, most arcades charge around $40 for admissions. Jump into the Light charges $29. VR World offers a day pass for $60. VR Bar charges $14 for 15 minutes of play time. Hubneo charges by the experience. Yokey Pokey, another VR cinema in Brooklyn, charges $40 an hour. Virtual WorldVR charges $25 per hour.

[57] "Virtual Reality Cinema & PlayLab - America's First VR Cinema," Jump into the Light, accessed March 9, 2018, https://jumpintothelight.com/.

[58] "Home | VR World NYC," VR | World, accessed March 9, 2018, https://vrworldnyc.com/.

[59] "Hubneo - Virtual Reality," Hubneo, accessed March 9, 2018, https://www.hubneo.com/.

rock climbing, VR race cars and even VR ziplines.[60] Each arcade represents different aspects of the medium's current state. As a form of entertainment, they have a distinct vision of how to engage audiences with a novel product.

However, the population that frequents VR arcades is different from the early adopters described throughout this dissertation. While arcades are an important point of entry, attendees spend neither the time, effort nor funds to invest in the medium as do the developers and content creators I describe. This group may visit arcades, but a larger "early majority" are being courted.

Distribution Platforms

A final media entity that also grants entry into VR is the distribution platform. PC game distribution software Steam, the Android Play Store and the iOS App Store, allow those who already have equipment to get access to and run their content.[61] In all cases, most experiences offer text to describe themselves. The popular SUPERHOT VR, in which the player shoots through a polygon-based universe in slow motion, almost as in *The Matrix* movie, has the following description: "Blurring the lines between cautious strategy and unbridled mayhem, SUPERHOT VR is the definitive VR FPS in which time moves only when you move… It's just you, outnumbered and outgunned… "[62] Fees are contingent upon degree of access. Most experiences cost between five and fifty dollars, in line with digital games and the value of the headset—higher end headsets have games that cost more. With digital content circulated primarily through these platforms, they are increasingly the norm. Like arcades, distribution

---

[60] "Virtual World VR," Virtual World Vr, accessed March 9, 2018, http://virtualworldvr.com/.

[61] Hardware manufacturers have also started their own VR exclusive platforms.

[62] "SUPERHOT VR on Steam," Steam, accessed March 9, 2018, http://store.steampowered.com/app/617830/SUPERHOT_VR/.

platforms are an important introduction to VR, but not necessarily as discursively connected as the other media mentioned.

Case Study: WebVR's Media Path

Movement of information through different media entities is quite dynamic. Collectively, they form the views of and frame a common perception of VR innovations, and ultimately establish the hierarchies that arise in information dissemination.

The ascent of "WebVR" exemplifies how developments in three-dimensional computer graphics moved from individual innovators into business, were promoted in conferences and by the media, and eventually formalized through tutorials and meetup demonstrations.

WebVR, as a concept, launched years earlier. Ideas for an online Virtual Reality have persisted since the mid-1990s when the plan of a "Virtual Reality Markup Language" began to crystallize as part of the World Wide Web. The notion didn't gain traction and like many ideas in the "first wave" of Virtual Reality lay dormant. However, during this time period, the inclination to create three-dimensional worlds on the web grew, leading to, among other things, "WebGL" a Javascript library for creating 3D objects which was authored by the Mozilla Foundation. First released in 2011, the code had many experiments, such as the recreation of classic games like *Quake* completely on the web.[63]

WebVR began development within Mozilla, which also promoted the WebGL API in 2014. The idea was fairly straightforward: incorporate VR into Mozilla's Firefox web browser. A number of developers at Mozilla and Google (which also had interest in the technology) began to design the application programming interface (API), so it could be integrated with other

---

[63] "Quake 3 WebGL Demo," Tojicode, accessed March 9, 2018, https://media.tojicode.com/q3bsp/.

software. They initially posted their vision, which was optimistic and cyber-utopian, online in personal blogs. One developer's blog stated about VR: "It is, arguably, an early version of the Metaverse—the browser is the portal through which we access it. It's not perfect, though, and lacks many… 'virtual' and 'immersive' aspects."[64] Developers released the code on GitHub—an online code repository—to allow enthusiasts to provide feedback.

The release of the "1.0" version of the software was announced on the Mozilla blog in March 2016. While it included rhetoric similar to much of the fanfare at the time, citing 2016 as "the banner year for Virtual Reality" (Yee, 2016), the majority of the document was practical, outlining the necessary base code, limitations and resources for developing VR for web browsers.

During the two years between the initial concept and its release, the WebVR developers had enmeshed themselves in the media ecosystem. They appeared on enthusiasts podcasts,[65] and gave talks at enthusiast meetups. They also received coverage from mainstream outlets which hailed the democratizing potential of the software (Kuchinskas, 2014). By 2015, broadcasts of their experiments were extensive. A blog describes the early trials: "The technology is early and rough around the edges, but the raw fun of building immersive worlds motivated a cadre of early adopters to create a fascinating collection of WebVR experiments. Today, if you visit mozvr.com or search for #webvr on Twitter you can fly from a drone high over Arctic glaciers, manipulate an iridescent fluid with your hands, or guide an animated avatar through a surreal musical world" (Carpenter, 2015).

---

[64] "First Steps for Vr on the Web," Internet Archive Wayback Machine, accessed March 9, 2018, https://web.archive.org/web/20140701000349/https://blog.bitops.com/blog/2014/06/26/first-steps-for-vr-on-the-web/.

[65] "Reinventing the Web in Virtual Reality with Josh Carpenter and Vladimir Vukicevic | The Web Ahead," last modified Februrary 18, 2015, accessed March 9, 2018, http://thewebahead.net/96.

Also by 2015, Mozilla developers released A-Frame: "an open source framework for creating WebVR experiences with markup. A-Frame makes it easy for web developers to create virtual reality experiences that work across desktop, iPhones (Android support coming soon), and the Oculus Rift" (Reality, 2015). A-Frame was a simpler web-design tool, similar to a game engine, for creating VR scenes. The release was picked up by enthusiast blogs. *Road to VR* reported the release, quoting one of the developers about the intent of the software: "A-Frame is aimed squarely at the web developer community, the vast majority of whom have been frozen out of WebVR development because they don't know WebGL, the powerful-but-complex 3D API that WebVR runs on" (Lang, 2015).

At this point, the development team of Mozilla and Google, which were outputting the code, tightly controlled WebVR's knowledge base. However, even at this stage of diffusion, individual enthusiasts via blogs, podcasts and press coverage highly publicized development and carried out experiments.

With the release of A-Frame, this group of devotees expanded. Over sixty individuals contributed to the code by late 2016.[66] The actual A-Frame software was given its own website, with documentation, blog and community forum to which people could subscribe and begin to share problems.[67] Examples of basic content appeared on the website including how to make 360° film and even a virtual snow globe of New York City.[68] The Mozilla team hyped experiments by the community in their own posts including a drawing app, an indie game in VR, and use in medical education (Ngo, 2016).

---

[66] "Contributors to aframevr/aframe · GitHub," Github, accessed March 9, 2018, https://github.com/aframevr/aframe/graphs/contributors?from=2015-11-27&to=2015-12-17&type=c.

[67] "A-Frame — Make WebVR," A-Frame, accessed March 9, 2018, https://aframe.io/.

[68] This final experiment was added many years later.

Even as the W3C consortium—which decides on updates to and the fate of the World Wide Web software and code—held workshops to determine the applicability and potential future of A-Frame and WebVR,[69] its promulgation within the media ecosystem was reaching saturation. The first meeting of WebVR New York took place in May of 2016.[70] They launched a two-week long hackathon, bringing in developers from the original Mozilla team to instruct individuals online and creating a unique Slack group.[71] Slack proved an important avenue for sharing and its #help-and-bugs channel became a source for getting up-to-date responses on technical details.

At the same time, *Medium* posts and tutorials evangelizing and teaching about the software rapidly popped up. *YouTube* featured tutorials for setting up a scene from scratch.[72] Udemy offered paid courses.[73] New York WebVR enthusiast Roland Dubois (2016), who had spoken at numerous local meetups, issued a *Medium* post proselytizing WebVR: "The web is going to be the most powerful distribution channel for VR due to the nature of its scalability and unlimited distribution." Other Medium posts were more instructional such as Fabricius' (2016) on integrating A-Frame into the Social VR application AltspaceVR.

---

[69] "Schedule of the W3C Workshop on Web & Virtual Reality," W3C, accessed March 9, 2018, https://www.w3.org/2016/06/vr-workshop/schedule.html.

[70] The group would later change its name to WebXR New York. See "What is WebVR," Meetup, last modified May 24, 2016, accessed March 9, 2018, https://www.meetup.com/WebXR-New-York/events/229328391/.

[71] "WebVR Hackathon & Workshop Kickoff," Meetup, last modified December 1, 2016, accessed March 9, 2018, https://www.meetup.com/WebXR-New-York/events/235015098/.

[72] "A-Frame WebVR Tutorial 1 - Setting Up," YouTube, accessed March 9, 2018, https://www.youtube.com/watch?v=dv6_C4UqTfs.

[73] "A-Frame — Make Web VR," Udemy, accessed March 9, 2018, https://www.udemy.com/a-frame-webvr/.

Google also released a much ballyhooed set of experiments using WebVR tech.[74] Mozilla kept a repository of VR news and information[75] and also featured WebVR as part of their travelling road shows that they held throughout the world.[76] Google headlined WebVR in the I/O developer conferences, advertising the code as creating "frictionless, immersive experiences."[77]

By the end of 2017, Google (Feltham, 2017), Microsoft (Lang, 2016a) and Firefox (Merriman, 2017) had all formally included WebVR into their browsers.

This brief case study demonstrates the way an idea becomes standardized. After years of reciprocal exchanges, ordinary users, such as Dubois, adopted WebVR as their own, which legitimized WebVR and paved the way for its codification into most major browsers.

WebVR's narrative shows how information travels through the media ecosystem. Initially, there existed an interchange between early developers of the technology and groups who assist in troubleshooting. Mozilla then took over the future direction of WebVR. The company validated the technology through a variety of media sources including conferences, which promoted it as an open form of VR development. Breakthroughs were then amplified by media coverage and reinforced by online arcades and meetups. The end result represents a compromise between advocates of WebVR who desire an easy-to-access Web environment and industry players who, for commercial self-interests, set the price for admission to the wider media environment.

---

[74] "WebVR Experiments," With Google, accessed March 9, 2018, https://experiments.withgoogle.com/webvr.

[75] "Mozilla VR | Home," Mozilla, accessed March 9, 2018, https://mozvr.com/.

[76] "Events — Mozilla," Mozilla, accessed March 9, 2018, https://www.mozilla.org/en-US/contribute/events/.

[77] "Building Virtual Reality on the Web with WebVR (Google I/O '17), YouTube, accessed March 9, 2018, https://www.youtube.com/watch?v=jT2mR9WzJ7Y.

Media Discourses in VR

Complexity and interdependence mark the media ecosystem surrounding VR. As the case study illustrates, divergent media entities each play a part in constructing unified discourses about VR, its diffusion and potential to developers and the public at large.

Knowing how they are formed and transmitted, what are the specific discourses surrounding VR diffusion currently? In order to find an answer, I performed a detailed analysis of 165 media texts. I coded the texts according to consistent themes. I especially looked at the influence of manufacturers and the pervasiveness of the game industry in this analysis. Interconnected themes regarding the state of VR as media technology and a general ambivalence about its impact emerged. First, there are consistent debates about the definition of VR, its potential and to whom it is available. Second, a set of industries, and specifically the game industry and culture, are seen as sentinels who guard and guide the future of the technology. Finally, the motivation underlying most coverage is the medium's potential commercial success.

Defining VR

Much of the discourse surrounding VR concerns defining the medium and speculating on the current use and prospects of the tech. Articles explicitly bring up the difficulty in prescribing a definition: one commentary in *VentureBeat* deliberates about the problems of hardware: "Competition is good, but developers haven't really figured out which platform is going to win. The platform makers haven't truly defined the complete set of features that should be in VR. Which features—wireless, 10-finger tracking, haptics feedback, or simply a low price—will lead to mass adoption?" (Takahashi, 2017). Not only do attempts at a definition involve characterizing components of the technology, but also the ways in which it can transform

entertainment and engagement with digital media, i.e. the power of VR as an "empathy machine" (first utilized by VR filmmaker Chris Milk in a 2015 TED Talk)[78] able to elicit a more emotional reaction from users. However, the discourses are almost always conflicted. One article cites director Katherine Bigelow's experiments with VR because of empathy, but then quotes another filmmaker saying, "I never want to hear anybody say 'empathy machine' again" (Robertson, 2017), and concludes the empathy genre will be one of many. An article from *Rolling Stone* claims that "the promises that VR will enhance our humanity, increase our empathy, all of this, I am afraid are overblown" (Kushner, 2016). This type of comment is open to debate, particularly as VR diffuses.

In general, the technology is defined by a few common attributes. A *Medium* post meant to be a primer on VR summarizes the prevailing theoretical and practical visions in these discourses (Betts, 2016). It lists not only broad concepts, including immersion, interaction and social, but also places a heavy emphasis on VR being a gateway to enable "experiences" and "perspectives." Other practical considerations, including an overview of platforms, UI, hardware and design, as well as prototyping and layout, are mentioned and his glossary contains terms ranging from "HMD" and "Room Scale" to display rates.

Many of the defining features are aspirational. In his profile about the future of VR, Kushner (2016) cites another common hope for the technology that traces back to its earliest experiments: telepresence: "engaging your whole body" and highlights the pornography industry's work on this front.

---

[78] "Chris Milk: How virtual reality can create the ultimate empathy machine | TED Talk," TED TED, accessed March 9, 2018, https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine/transcript?language=en.

The definition also reflects its revolutionary potential, influence and uniqueness among digital and electronic technologies. Van Camp (2018), in his coverage of CES, grumbles, "Nobody I spoke with—analysts, developers, or manufacturers—seems thrilled with how slowly VR has taken off, but few believe it's down for the count. Interest rose notably in the last months of 2017 thanks to new Windows-friendly VR headsets entering the market. Price cuts on hardware and more robust titles like Star Trek Bridge Crew and Fallout 4 VR helped as well." Much of the discourse espouses a kind of futurism. A *Wall Street Journal* feature utilizes this language in its depiction of things to come: "You walk into a coffee shop or an office, and half the people around you have their eyes hidden behind opaque goggles. Their heads pivot from one made-up thing to the next as they peer into a world invisible to you. They're in virtual reality." It adds "This might sound like the far future, but I'm here to tell you that it could be our world within five years" (Mims, 2015).

Moreover, the futuristic discourse protects against the nascency of the technology and its faults in the present. Despite VR's fifty-year history, and its prevalence in popular culture, it and immersive media are described as being in its "early days" or constantly improving. "The path to mass virtual reality adoption is still a ways away" (Francis, 2016). "In the broader sense, however, things are still looking bright for the future of consumer VR" (Buckley, 2016). "VR is still in its infancy, and the iterative nature of tech makes it pretty reasonable for you to sit this first round out…" (Rivera, 2016). Claims about the technology's influence are stymied because of the immaturity of the market. Additionally, the "Hype Cycle," another conventional trope, is invoked both to challenge the success of VR and to predict how the future will pan out. A *New York Times* article on the first year of commercial VR is emblematic, alluding to the hype cycle to articulate the "trough of disillusionment" that "comes after a period of inflated expectations,

but before a phase in which their benefits become commonly accepted" (Wingfield, 2017). The article questions VR's relevance, but, like many, assumes that once it is normalized, it will find success. The author cites a venture capitalist as saying, "He is confident that virtual reality will one day be a mainstream technology" (Wingfield, 2017).

Throughout, there is disagreement over the ultimate outcome of the medium. While articles in early 2015 predicted success of the commercial devices, one states, "VR is going to be much bigger, much more compelling, and much less trivial than what its earliest adopters have so far envisioned" (Mims, 2015). Another maintains, "If you can dream it, VR can make it. It's a medium for progress, not the progress itself" ("The Rise and Fall and Rise of Virtual Reality," n.d.). Articles in late 2016 and early 2017 were less positive. "It is time for a reality check for virtual reality," directed one *New York Times* column, quoting an analyst as saying "This is going to be a long slog: as the technology continues to improve, more content becomes available and awareness increases" (Wingfield, 2017). This equivocating slid into outright criticism as the year progressed. A LinkedIn post, entitled "Why VR is dead," blamed the failure of the devices on too much poor content: "VR is a truly amazing technology, and when it's used correctly, with consideration given FIRST to the content (even before deciding to use VR) then the results can be mind blowing. But without the story, it's just technology for technology's sake" (Jenkinson, 2017). This was attributed in part to those industries that gained access to it.

Who Gets to Play with VR

A secondary set of discourses reflected on the influence of industry players in shaping today's and tomorrow's technology. There is an inherent strain between the technology's presumptive and upcoming leaders.

The game industry's ties to VR are taken for granted by most media outlets. A majority of the articles mention games or gaming in some meaningful way. But it is also how they phrase the influence of the game industry that is noteworthy. If the potentials of VR are in the distant future, today it is for gamers. Heffernan (2014) writes, "But whatever its 'use' might be, V.R. is not fundamentally a pragmatic technology, which is why it begins with gamers." A *Medium* post by a VR enthusiast suggests that "Oculus Rift, HTC Vive, and Playstation VR have built a lot of momentum around attracting gamers and enthusiasts, but VR's penetration into the market, as expected, has been much less rapid among most consumers" (Dubois, 2016). An article quotes VR pioneer Nonny de la Peña as saying "It is a natural extension for a generation growing up with gaming" (Manly, 2015). Another directly addresses the influence of the game industry stating findings by SuperData research that "Video games will be the key driver of virtual reality hardware this year" (Gaudiosi, 2016). In all cases, there is an assumption that in its current iteration, VR is only for a niche consumer, the gamer who is willing to shell out the money and time on new hardware and software. In its review of the Oculus Rift, *Time* asks, "So is it worth it? It's easily worth it if you already have a powerful computer and play a lot of video games. It's not much more than investing in a gaming console" (Eadicicco, 2016).

While media coverage framed VR as a gaming device, it envisioned VR as valuable to a multitude of other industries outside the world of gaming. Journalists write about the non-gaming aspect of VR almost wistfully: "If you're like me, you're waiting for the day when virtual and augmented reality aren't just fun buzz words, but a very real part of our daily lives. A time when they're not just for gaming, but something that will allow you to have experiences that transcend the time and space of where you are" (Rosenzweig, 2017). This is often expressed in the titles of articles: "Doctors are saving lives with VR" (Jolly, 2017); "Virtual reality devices could

transform the tourism experience" (Graham, 2016); "Virtual reality helps reinvent law enforcement training" (Lewis, 2017).

Most often, VR's transformative power is featured. "Of course, gaming will influence how the VR technology initially goes but the day will come when the likes of TV content producers or psychiatrists embrace innovations that can benefit their careers. TV content in the future may involve viewers in more ways than we can imagine while treatment of, say, phobias, could make good use of virtual reality. Exercise machines will provide a lot more fun." The article also intimates that it is VR's immersion and telepresence that will ultimately contribute to this drastic shift: "Imagine working alone at home but having colleagues 'nearby'. That, in fact, is an old-fashioned example of what virtual reality can provide. You can play the world's scariest roller-coaster at home or even 'climb' Mt Everest. You can be 'in a stadium' to watch a World Cup final. You can 'play' with or against Roger Federer. Doctors can adapt virtual reality in treatment and the technology can overhaul the entire medical world just as it revamped the aviation training" ("PressReader.com - Connecting People Through News," 2016). Ironically, this language is reminiscent of the views, which have subsequently been abandoned, about the transformative power of digital games that was a primary frame for media coverage in the early 2000s. In his study of leading US magazines' coverage of games from 1970 to 2000, Williams (2003) notes a tension between utopian frames, such as games are educational, and dystopian frames, such as games are a health hazard. However, in the case of VR coverage, the problems concerning the technology are very much cast in the present. It isn't ready for prime time beyond the gaming community.

Yet, there remains the hope that it will transcend its current proclivity. This is evident not only in the industries, but also the professions and individuals impacted by VR. A number of

articles speculate on the representation of women. This alludes directly to the male-oriented game industry: "Because VR is still in its infancy, women… are driving innovation as they experiment to see how consumers react to new experience" (Tunney, 2016). VR, while fostered by gaming, is discursively considered a separate technology with many tendrils into other fields. Articles tend to align it with emerging technologies in signifying digital trends, a *Newsweek* article lumps VR, AR, AI (artificial intelligence) and digital assistants together (Garner, 2017). The introduction of artists and other non-developers to the technology was a popular trope.

While the technology stems from the game industry, is utilized by gamers and has found limited success in this niche, the medium is discursively extolled for its unlimited potential. Because gamer culture has been increasingly maligned and questioned institutionally, academically, and in both games and traditional journalism,[79] VR represents an avenue and medium for the tenets and technologies of games and gaming to be reimagined and redeemed.

Economic Value of VR

Economics is also a major factor in the tension between discourses on the present versus speculation on future potential. Most articles in the corpus question the technology's economic viability. An article queries if it will become "the next big computing platform, but that will depend on it becoming a truly mainstream device" (Dredge, 2016), but then puts that in economic terms, "Most people don't have computers with high-end graphics cards. In the future that's going to change…" (Dredge, 2016).

---

[79] I have written about this representation elsewhere. For detailed analysis, see Foxman & Nieborg, 2016; Nieborg & Foxman, 2018.

Contemporary economic issues are prominent—that the technology's survival currently relies solely on the game industry, with significant support by enthusiasts. However, this is somewhat arbitrary as digital platforms such as the iOS App Store and Google Play Store, have generated $40.6 billion in sales, nearly half of the games market (Takahashi, 2017). While as a game platform, VR has achieved some success—a report from SuperData highlighted 745,000 units sold by PlayStation, outpacing its competitors Oculus and HTC in 2016 (Davidson, 2016)—the development of an independent commercial industry is unproven. Coverage states this obliquely: a *Wall Street Journal* article figures that in order for the device to expand "it will need a much wider cultural acceptance and much lower price point. Becoming a viable platform for games can bring both eventually, they will need to sell to beyond a small sliver of the most devoted gamers" (Gallagher, 2016). Ultimately, the media ecosystem is rooting for its financial success. That the medium is characterized as in an inchoate state, yoked to a specific industry, with the potential for broad appeal is a reflection of the discursive assessment of its present financial position and market.

Conclusions

This chapter mapped the elaborate media ecosystem that covers Virtual Reality and immersive technologies. This environment creates the messaging used by enthusiasts. Coexisting in a dynamic relationship, innovators and early adopters forge the public perceptions of VR. While financially dependent upon specific industry leaders and hardware manufacturers, the media ecosystem distinguishes the technology from other emerging media and businesses that might embrace it. In many ways and on many platforms, this ecosystem constructs and negotiates a unified vision of VR which newcomers and enthusiasts encounter.

In the specific discourses surrounding the medium, the vision of VR is somewhat murky. There is a struggle to define it in part because of the affiliation with and economic success within the game industry. After all, much of VR is built on existing games hardware, software and development strategies. As a consequence, while discursively VR has significant potential, it will be perennially described as in the "early stages" of development until it outgrows gaming and becomes self-sufficient.

So, who benefits from such discourses? Ultimately, both the media ecosystem and the language they use to describe VR designates sets of game and informational technology companies as de facto leaders in its diffusion and development. Because these enterprises play such key roles in disseminating information, hardware and knowledge about the medium to audiences, that they have been discursively labeled as necessary pillars in the construction of Virtual Reality works to their benefit. In order to understand the medium and its potentiality, adopters must pass through and engage with a media ecosystem where games and tech are bellwethers of an embryonic technology with an unimaginable future.

CHAPTER 4: CONTENT CREATION IN VR

In a *Medium* post, Forbes VR writer Charlie Fink (2016) defines "Immersive Experiences" as "deeply engaging, multisensory, digital experience, which can be delivered using VR, AR, 360-degree video, MR and/or other technologies." Nikolai Bockholt, writing for the analyst-focused "think with Google" blog, similarly classifies immersive technology into " '360-degree videos,' 'Virtual Reality,' and 'Augmented Reality'… new technologies that can be put to great use by brands and advertisers in a wide variety of ways to capture consumers' attention" (Bockholt, 2017).

This chapter surveys the classifications of immersive technology popular with media makers and adopters. First, it outlines the overarching content formats surrounding VR. These are based on the level of immersion and quality of hardware used with head-mounted displays (HMDs). Then, it explains how and why each classification lured different actors and industries. Often specific occupations are attracted to one genre of immersive media or another based on institutional expertise. For instance, filmmakers have to only learn a handful of other skills to work in 360° Video. Finally, it maps how meetups organize around different types of content.

A Brief History of Immersive Technology Classifications

VR represents a confluence of various computer innovations, many of which have developed in tandem with two-dimensional and personal computing and is often lumped together with other "emerging technologies." Rotolo, Hicks, and Martin (2015) characterized these as in "the process of coming into being, or of becoming important and prominent" (p. 1828). They then assign "emergence" the following features: "radical novelty," "relatively fast growth," "coherence", "prominent impact," and "uncertainty and ambiguity." Interviewees specified

numerous new technologies in which they were either interested, or might be integrated with VR, such as artificial intelligence, personal assistants, self-driving automobiles, blockchain technology, and robotics.[1] The NYCVRU meetup likewise boasted in a 2016 hosted session, "Complete this workshop to learn IBM Watson cognitive intelligence integration with your VR world and have your mind blown."[2]

VR, although often linked to these current technologies, has always been part of a continuum. One long-time enthusiast and scholar of immersive computing mused about the arbitrariness of the terms: "… in a funny way, if you were holding up your phone, and you were looking around, and seeing only virtual stuff, very few people would call that VR. And yet, because of the emphasis on the combination of real and virtual, people were comfortable calling that AR. I'm comfortable calling it AR. Pretty much every AR researcher is comfortable calling it AR."

Virtual Reality, as a concept, has for decades had a place on the "Mixed Reality" spectrum (Milgram et al., 1995) where reality lies at one end and the purely virtual on the other.[3] However, since the concept of Virtual Reality continues to shift along this spectrum, its classification is indefinite.

From a commercial standpoint, VR classifications have been equally amorphous. Industry has embraced and been drawn to the technology in fits and starts. An enthusiast and 20-year veteran in VR noted on his blog, "VR is a new medium; but we've been here before" (Polinchock, 2017). There has also been a significant history of simulation, either through

---

[1] For example of these being addressed in tandem, see K, 2017.

[2] "VRmicroSummit," Meetup, last modified June 8, 2016, accessed March 7, 2018, https://www.meetup.com/NYCVRU/events/231330883/.

[3] This was discussed in detail in the literature review. See Chapter One.

headsets or CAVEs, "cave automatic virtual environments" i.e. rooms in which images are projected against all walls, ceiling and floor to immerse individuals.[4] The 1990s and 2000s brought everything from flight simulations utilized by the Air Force[5] to commercial experiences of swimming underwater (Edwards, 2016).

Hardware has limited both VR and Augmented Reality's broader diffusion. Early applications started with the military as well: The Mirage F1AZ was a head-mounted display to aid pilots in attacks.[6] The Land Warrior project in the 1990s supplied information to troops through the helmet.[7] In the same decade, Sony invented "Glasstron," a commercial device for theater-like viewing through a head-mounted display. Its second version featured a mechanical shutter that could be adjusted to block more or less of the real world from the viewer (M, 2009). IBM debuted a monocular wearable PC in 1998 with the goal of using it for "maintenance, installation, and repair personnel" (Z. Staff, 1998).

The cost of head-mounted displays, graphic fidelity, gyroscopes and similar tech has decreased over the last decades. In fact, most phones are equipped with gyroscopes and VR-ready displays. Hardware developers are further improving their technology, adding "passthrough" (Karner, 2017) and "spatial mapping,"[8] which can chart the real world and apply

---

[4] For more information, see "A Critical History of Computer Graphics and Animation," Internet Archive Wayback Machine, accessed March 7, 2018, https://web.archive.org/web/20120205051214/https://design.osu.edu/carlson/history/lesson17.html.

[5] For instance, the SIMEYE was purchased by the Air Force in the 1990s for use. See "Virtual Reality and Technologies for Combat Simulation," The OTA Legacy, accessed March 7, 2018, https://www.princeton.edu/~ota/disk1/1994/9444/944403.PDF for more information.

[6] "Aircraft Profiles," Pakistan Defense Forum, accessed March 7, 2018, https://defence.pk/pdf/threads/aircraft-profiles.49997/.

[7] For more information, see Zieniewicz, Johnson, Wong, & Flatt, 2002.

[8] "Spatial mapping," Windows Dev Center, accessed March 7, 2018, https://developer.microsoft.com/en-us/windows/mixed-reality/spatial_mapping.

data derived from it to the virtual. The complexity and speed of advancements accentuate the ongoing problem of categorizing immersive media.

A Unified World of Content Creation

Hardware upgrades have only partially spurred the commercial diffusion of the technology. Content has equally stimulated public awareness. After all, commercial VR headsets lie inert without content with which to engage. Some of the most fundamental changes to VR involve the tools for content creation.

Prior to 2009, software development for VR was both expensive and rudimentary. Try to imagine what it takes to create a world accessible to at least two senses—sight and hearing—since part of the goal of VR is to do just that. There is the fabrication of objects that occupy your creation. This requires ingenuity—to make something out of nothing. Then, where and how to position them in a virtual space becomes a second challenge. And none of what I just described touches upon the basic elements of our universe which we take for granted. What about the physics of the environment? How about lighting? How is the passage of time replicated? When it comes to conceptualizing a virtual three-dimensional and computer-generated space, all of these conditions must be satisfied. While much of this is well within the purview of computer scientists, it demands a significant depth of knowledge that an average person may not have.

However, in 2005, the game engine Unity was streamlined and released for general use, which opened up completely new opportunities for novices to create immersive environments. A game engine is a "software framework" or a set of standardized tools that handle "details of doing common game-related tasks, like rendering, physics, [lighting, sound] and input, so that developers (artists, designers, scripters and, yes, even other programmers) can focus on the details that make their games unique" (Ward, 2008).

The goal of Unity was to "democratize game development" (Rowland, 2011). Whereas game engines had been closely guarded and proprietary secrets for most of the history of digital games, Unity joined a series of efforts to unlock the "hoods" of game engines to players. Counted in this wave was "modding," defined by Van Dreunen (2010) as "the practice of changing some, not all, of the guiding principles or characteristics of a game" (p. 106). Games consultancy SuperData estimates that in 2017 user-generated content, including modding, generated over $2.7 billion in revenue within the industry (Newman, 2015).

While Unity began as a paid application, with a cost of $200 for an independent license, it quickly shifted its marketing plan. The company, Unity Technologies, initially had targeted independent developers as its major demographic. Haas (2014) writes "One of the major reasons for *Unity's* success was its support for independent developers who did not have the resources to license expensive game development technology." Originally available only for the Macintosh computer (in an industry focused primarily on Windows PCs), the software found success with the rise of game development for smartphones, specifically the iPhone. By 2009, as it began to find traction making "middleware" games, Unity Technologies dropped the price of its engine to $0 (Helgason, 2009) and only charged developers after they sold thousands of copies of their games. The reversal came in the midst of an ongoing battle between Unity and Epic's much more established Unreal engine—reminiscent of the competition between Mac and Windows computer operating systems—which only a few days later responded to Unity's announcement with a free version of its own program (B. I. Staff, 2009). Unreal didn't fully free up its engine however until 2015, proclaiming "You can download the engine and use it for everything from game development, education, architecture, and visualization to VR, film and animation" (Sweeney, 2015). In the meantime, Unity increasingly turned toward the VR community. When Unity

released version 3.0 in 2010, enthusiasts outside of the community as well as the company promoted it in a spate of books and online resources (Haas, 2014, p. 23). Unity also launched a marketplace called "The Unity Asset Store" which allowed users to "monetize their skills and talents" by selling 3D objects, code and other tools for Unity and keep 70% of the profits (p. 26). Similar asset stores have subsequently popped up for competing engines as a result of the overall popularity of Unity's model.

This "space race" to democratize game development has ultimately helped users gain relatively easy access to the tools needed to construct virtual worlds—along with simple "drag-and-drop" solutions to issues of physics and lighting. They no longer needed encyclopedic knowledge of computer science in order to work in VR. Furthermore, there is no cost for experimenting with this software, which functions on almost any personal computer.[9] Along with this and the growth of the "Asset Store," where amateurs and professionals alike can upload their own homemade scenes, code and add-ons for anyone to download for free or purchase, objects to populate virtual spaces became quickly obtainable.

While the Unity engine marks a fundamental about-face in computer-generated world-building and game design, it mirrors similar advancements in cinema. Off-the-shelf video editing tools have become standard in personal computing. The widespread distribution of Apple's iMovie and Final Cut Pro, along with the array of applications available in the Adobe Creative Suite, has lowered the bar for entry into filmmaking. In the context of Virtual Reality, the improvements in digital cameras, especially the Wide-Lens "GroPro," made low-cost 360° filming possible. A number of GoPros can film simultaneously in all directions, leaving only the

---

[9] Most game engines have relatively low requirements in terms of computing capacity and are available on all major operating systems. While the actual use of VR is a high-end endeavor, world creation can be done on inexpensive machines.

costly hurdles of acquiring "rigs" in which to place the various cameras. Software then is required to correct and overlay multiple videos, stitching them together into an appropriately distorted equirectangular image that can be wrapped into a 360° sphere to be viewed as a film in a HMD.

The need for rigs has resulted in a surge of experimental camera building, including Freedom 360 camera rigs which allow users to easily slot in GoPro cameras,[10] GoPro's own Omni setup (these both use only six cameras),[11] Nokia's $40,000 Ozo camera (Savvides, 2017), the twenty-four camera "Jaunt Rig"[12] and the sixteen camera Google Jump,[13] which automatically stitches video using Google's own proprietary algorithms. Enthusiasts have even fabricated their own rigs with 3D printers.[14]

The instruments of change in VR content have not only been hardware innovations, which have precipitously dropped in price over the past two decades—but also "off-the-shelf," moderately priced software. The ability to create content cheaply means that a surfeit of content can be produced for VR as it evolves. An intelligence report from *Sensor Tower* stated that there were 226 million VR downloads in 2016 alone and only on the mobile Apple "App Store" and Google "Play Store" (Nelson, 2017). The report also stated that over half the downloads were games, which range from a few minutes to significantly longer, though most VR of this type is

---

[10] "Freedom360 Classic Mount," Freedom360, accessed March 7, 2018, https://freedom360.us/shop/freedom360classic/.

[11] "Omni™ - Rig Only," GoPro, accessed March 7, 2018, https://shop.gopro.com/virtualreality/omni---rig-only/MHDHX-007.html.

[12] "Jaunt ONE," Jaunt, accessed March 7, 2018, https://www.jauntvr.com/technology/jaunt-one/.

[13] "Jump," Jump, accessed March 7, 2018, https://vr.google.com/jump/.

[14] Pacheco (2016) has a brief tutorial for a four camera rig which consists primarily of a STL file from another site and the various screws necessary to bolt the pieces which print from the file together.

less than twenty minutes in length. Other categories, such as entertainment, photo and video and travel, make up only around 15% of downloads respectively.

The rise of Unity also coincides with drastic alterations in the game industry, its demographics and perception. Dubbed by Juul (2010) as the "Casual Revolution," the rise of independent games as a serious economic force is in part a result of the low costs in game-making, distribution via mobile platforms, and more democratized access to production tools. This new order departs dramatically from the traditional game industry. O'Donnell (2014) notes in his ethnography that the engine should be credited for a significant change in development: "Both experienced and amateur game developers now have a tool available for developing games that enables a wide variety of game types and experimentalism on the part of developers. At the same time, it is possible that Unity 3D may continue to be viewed by some as a tool for amateurs who have not yet transitioned to 'real' game platforms" (p. 77). In other words, new tools have empowered different communities and industries to make content for VR.

Content Classification in VR

The following section introduces a set of general classifications for immersive technology and Virtual Reality. Adopters often work across them and commonly refer to them during meetups and in communication with others. To fully illustrate these classifications, I include examples of the type of content being made for each and the necessary tools to make it.

Virtual Reality

The first classification is "Virtual Reality." Computer scientist and designer Jaron Lanier (2017) most recently described it as "one of the scientific, philosophical, and technological frontiers of our era. It is a means for creating comprehensive illusions that you're in a different

place, perhaps a fantastical alien environment, perhaps with a body far from human" (p. 1).

Howard Rheingold (1991) similarly mused decades earlier: "Imagine a wraparound television

with three-dimensional programs, including three-dimensional sound, and solid objects that you

can pick up and manipulate, even feel with your fingers and hands" (p. 16).

One requirement of VR content is blocking the senses from the outside world in order to

"transport" the viewer into another one. That alternative world is commonly computer-generated.

Video and photo-realistic immersive experiences are consistently categorized as 360° Video,

which will be discussed.

The sensory deprivation can vary by degree, with a minimum of "occluding" the vision of

users and the donning of noise-cancelling headphones. There are different levels of "immersion,"

including full body suits which can simulate tactile experience[15] and devices for adding smells to

scenes.[16] Once within the virtual space, there is also an expectation to interact with it, though,

again, this varies widely—from triggering events with a gaze, to manipulation with controllers

and much more complex systems such as virtual skiing.[17]

Within this classification, there is a hierarchy of "experiences." "Mobile VR" uses the

gyroscope, computer and display in smartphones to project VR. This restricts movement and

engagement. because of limitations to the graphics in smartphone hardware. "High-End VR"

permits defined movement through infrared trackers/cameras which follow the position of a

HMD which is, in turn, tethered to a gaming computer. Content for High-End VR tends to be

---

[15] One popular meme is of a simulated VR sex experience with "teledildonic" parts: See Bonasio (2017) as an example.

[16] See Scentience as an example "Front Page - Scentience," Scentience, accessed March 7, 2018, http://www.scentience.org/.

[17] See Ski Rodeo as an example, which utilizes a skiing machine: "Steep Downhill Ski Simulator Ski Rodeo," VR Zone Shinjuku, accessed March 7, 2018, https://vrzone-pic.com/en/activity/skirodeo.html.

longer and more interactive. There is also even higher end, experience-specific arcade-style VR content and one-off projects made through custom hardware, which afford significantly more involvement and immersion.

The most popular experiences fall into the middle category of High-End VR which is associated primarily with gaming. Most of the content is distributed by gaming platforms such as Steam. When looking at the most downloaded experiences from Steam, games dominate. Of the twelve games listed in Valve's top selling VR games of 2017, only one application, Google's "Tilt Brush" painting software, could not be considered a game. Others that top the charts include "Job Simulator" which mimics banal office activities in a future controlled by robots, "Hot Dogs, Horseshoes & Hand Grenades" which is an admittedly silly shooting simulator, a VR experience based on the popular Fallout Role-Playing Game series and SuperHot VR."[18] Beyond this list, other applications include productivity tools, such as Oculus' painting and modeling programs Quill[19] and Medium,[20] as well as computer-animated films, such as *Henry*[21] which is the brainchild of former animators from Pixar Studios (Volpe, 2015).

Unity, or a similar game engine, is required for creating a virtual space, setting up lighting, physics, sounds, etc. For computer-generated models, facility in a modeling program such as Autodesk's Maya or the open-source Blender is also necessary. Aside from that, having the hardware to run the experiences is the only other major requirement.

---

[18] See full list at "The Top VR Titles of 2017," Steam, accessed March 7, 2018, http://store.steampowered.com/sale/2017_top_vr_titles/.

[19] "Quill | Oculus," Oculus, accessed March 7, 2018, https://www.oculus.com/experiences/rift/1118609381580656/.

[20] "Medium," Oculus, accessed March 7, 2018, https://www.oculus.com/medium/.

[21] "Henry," Oculus Story Studio, accessed March 7, 2018, https://www.oculus.com/story-studio/films/henry/.

360° Video

While Virtual Reality immerses a user in a computer-generated virtual space, 360° Video does the same, but in a photo-realistic representation. This classification has been defined by one enthusiast website as "live-action video shot on a 360° camera or rig" adding "[t]he story is set in stone," since everything is pre-filmed, "in theory, nothing the viewer does will change the plot of a given 360° Video" (Damiani, 2016). A *Medium* guide to VR genres similarly states that "aside from sound, you are missing the other senses, and you are lacking true freedom" (Gardonio, 2017). While 360° Video has existed for some time in the form of CAVEs and briefly in Apple's Quicktime film player (Leswing, 2016), today the concept is associated with a photo-realistic 360° sphere filmed either two- or three-dimensionally. Aside from this, it shares many of the same goals for content creation as VR, namely, to fully occlude natural senses to simulate as immersive an experience as possible.

A hierarchy of experiences and levels of interactivity accompanies 360° content. Films can simply be watched, or the viewer can use triggers and other virtual cues to create a "choose-your-own adventure" type of experience. This is best illustrated in the *Wall Street Journal*'s video and article, "The World's Fastest Woman" (Gay, 2017), which employs the same footage to create a variety of videos. The film tracked Denise Mueller's ultimately successful attempt to break the land speed record of 147.7 miles per hour for cycling. The *Wall Street Journal* added photographs from 360° Video to a traditionally written article. It produced a passive 360° documentary from the footage, capable of being watched on computer or a head-mounted display. A more interactive experience was created for the Google "Daydream" headset. With a remote control, users could click on various parts of the film to activate ancillary footage, audio and text.

Unlike Virtual Reality, 360° films are circulated by video streaming channels as well as VR/gaming platforms and unique apps designed by content creators—for instance, *The New York Times* has its own app for 360° Video distribution called NYT VR. YouTube and Facebook support 360° films and upstart platforms like Littlstar also stream videos. Facebook released a list of its top ten films eight months after the launch of its channel in 2016. The selection included a 360° trailer for the *Deadpool* movie, *National Geographic* videos from Russia, a music video of a Brazilian singer and a video of Liverpool FC fans chanting their team's anthem (Heine, 2016).[22]

The tools for content creation in film are somewhat different from those in Virtual Reality. While Unity is central in VR content creation, much of the software necessary for 360° filmmaking is the same used for more traditional movie production, including the Adobe Creative Suite for editing video and adding visual effects. In addition, 360° cameras are a requisite. These can be assembled as "rigs" of anywhere between four and twenty-four cameras. Also a number of inexpensive dual-lens cameras have come to market such as the Ricoh Theta[23] and the Samsung Gear 360.[24] Although the quality of these cameras is poor, they not only provide a less cumbersome way to film, but also automatic stitching of separate camera footage. Without this, stitching software such as Autopano's "Pro" and "Giga" is mandatory.

---

[22] To see the actual videos, links can be found at Heine, 2016

[23] "RICOH THETA," RICOH THETA, accessed March 7, 2018, https://theta360.com/en/.

[24] "Samsung Gear 360," Samsung, accessed March 7, 2018, https://www.samsung.com/us/mobile/virtual-reality/gear-360/s/_/n-10+11+hv1rs+zq1y1/.

Augmented Reality

While Virtual Reality and 360° Video both fully immerse participants in a virtual space, Augmented Reality does the opposite. It superimposes the virtual onto the real world. It was originally defined as technology "used to 'augment' the visual field of the user with information necessary in the performance of the current task" (Caudell & Mizell, 1992, p. 660). In order to achieve this effect, essentially all that is necessary is a lens through which both to project computer-generated graphics and see out into the real world. Such a lens is present in smartphones, by way of the built-in camera which is common to most devices and the viewer that makes up the screen. As a consequence, Augmented Reality (AR) technology does not require a HMD.

AR had a number of commercial ventures over the last decade, including the failed Google Glass, a HMD which was widely panned for its price, weak battery, bug-filled software and propensity to generate headaches (Yarow, 2013). Furthermore, people who wore the devices were often thought to be surveilling and recording other individuals and were colorfully nicknamed "Glassholes" in the media (Schuster, 2014). However, there were two significant AR-related milestones during my study. The first was the mobile release of the game *Pokemon Go*,[25] which was built on the Unity game engine (de la Merced, 2017). Although only a short term fad—numbers for the game dropped severely after the first month though the game reportedly still has millions of users (Frommer, 2017)—at its height it had close to forty-five million competitors playing together on a single day (News, 2016). In the game, players used the camera

---

[25] "Homepage | Pokémon Go," Pokémon Go, accessed March 7, 2018, https://www.pokemongo.com/. The phenomenon also has spawned significant research, including a special issue devoted to the game in *Mobile Media and Communication*. See Hjorth & Richardson (2017) for an editorial of details.

and GPS on their smartphones to navigate the real world and capture creatures from the

Pokemon franchise. A second breakthrough was the release of Apple's ARkit SDK, which

permitted easy AR development for most modern iPhones and spurred Google to turn out its own

ARCore for Android devices. With these introductions, the use of smartphones for AR content is

increasingly becoming commonplace, while AR headsets remain significantly more elusive.

Still, there has been speculation that AR will actually find success over VR in part because of

accessibility ("Game over for virtual reality?," 2017).

Similar to both VR and 360° Video, there is a range of AR devices: from the smartphone,

to subject-specific glasses like the Eyesight Raptor[26] for cyclists, to high-end technical eyewear.

For instance, the ODG R-7 Smartglasses are specifically made for "industrial use. Improve

safety, efficiency and accuracy with telepresence, remote assistance and digital checklist,

training and maintenance tools…"[27] Headsets for general consumption are in pre-production

including the Meta which advertises itself as "bridg[ing] the gap between the virtual and the real

with the world's most immersive AR experience"[28] and Magic Leap which raised $4.5 billion

from many of the largest tech venture capitalists in the United States including Google and

Andreesen Horowitz (Ewalt, 2016).

While some of the technology for Augmented Reality remains speculative, the tools for

its development derive from VR, namely, game engines and rendering software. The other

requirement is a method for projecting virtual material onto real space. This is achieved through

---

[26] "Everysight Raptor - AR Smartglasses," Everysight, accessed March 7, 2018, https://everysight.com/.

[27] "R-7 Smartglasses," ODG, accessed March 7, 2018, https://www.osterhoutgroup.com/r-7-smartglasses.

[28] "Meta | Augmented Reality," Meta, accessed March 7, 2018, http://www.metavision.com/.

a variety of techniques, including GPS coordinates and "Image Targets"[29] where a specific image

or code triggers the projection of 3D objects, or simply a straight overlay onto space.

Mixed Reality/XR

Although the mixed reality spectrum has existed for some time, the term Mixed Reality

has come to classify a different set of immersive experiences. The nomenclature has been

appropriated by Microsoft and described by its evangelists as a medium where the physical and

digital co-exist and seamlessly interact.[30] Microsoft applies the term especially to its HoloLens, a

$3,000 device which generates an archetypical Mixed Reality experience. Like AR, the device

superimposes computer-graphics onto an environment through a HMD, but then maps the space

so that the virtual objects and users can interact within it. A quintessential example is Microsoft's

game "RoboRaid"[31] built for the device. The headset first scans a room for its walls, then

projects robots bursting out of them. The robots have to be eradicated with an artificial gun.

The distinctions between "higher" end AR and Mixed Reality are almost non-existent.

Meta, an AR company, showcased its headset during a TED talk, suggesting how a user could

interact with a crowd and virtual objects at the same time (Gribetz, 2016). Other lower-end

---

[29] This term has been popularized by the AR software company Vuforia: "Image Targets," Vuforia™ Developer Library, accessed March 7, 2018, https://library.vuforia.com/articles/Training/Image-Target-Guide.

[30] "Case study - The pursuit of more personal computing," Windows Dev Center, accessed March 7, 2018, https://developer.microsoft.com/en-us/windows/mixed-reality/case_study_-_the_pursuit_of_more_personal_computing. Microsoft has referenced the spectrum in their own literature. See "Mixed reality," Windows Dev Center, accessed March 7, 2018, https://developer.microsoft.com/en-us/windows/mixed-reality/mixed_reality. However, much of their marketing material prominently states their use of Mixed Reality with little definition. See "Why HoloLens," HoloLens, accessed March 7, 2018, https://www.microsoft.com/en-us/HoloLens/why-HoloLens. See also "Windows Mixed Reality," Windows Dev Center, accessed March 7, 2018, https://developer.microsoft.com/en-us/windows/projects/campaigns/windows-mixed-reality.

[31] "RoboRaid," HoloLens, accessed March 7, 2018, https://www.microsoft.com/en-us/HoloLens/apps/roboraid.

innovations in software foreshadow the potential for the Mixed Reality experience to become the standard of AR. Both ARKit and ARCore include spatial mapping features**.**

As a consequence, and in part because Microsoft co-opted the name, Mixed Reality has splintered into a variety of acronyms including XR, which is used as an umbrella term for either "technology-mediated experiences that combine digital and biological realities" or "an umbrella term encapsulating Augmented Reality (AR), Virtual Reality (VR), mixed reality (MR), and everything in between" (Fink, 2017a).

The tools for building in Mixed Reality mirror those for both VR and AR. The key innovation for this technology is spatial mapping software, which translates the real world into virtual space. This is accomplished through multiple cameras—for instance there are twelve cameras and sensors in the HoloLens that constantly scan and reproduce the space.[32]

Generally, these sundry formats are markedly alike. With the exception of 360° Video, they require almost the same software and hardware for development. The tools for content creation—and specifically the use of a game engine and modeling software—are all that is necessary to work with the technology.

Industry Influence in Content Creation

The four types of immersive content have broad application. These technologies aren't saddled to one particular industry. In fact, the barriers to entrance are readily surmountable. Many of the introductory tools are either free or have vastly reduced price tags. As might be expected, a wide swathe of industries has experimented with VR. In New York, for instance,

---

[32] "HoloLens hardware details," Windows Dev Center, accessed March 7, 2018, https://developer.microsoft.com/en-us/windows/mixed-reality/HoloLens_hardware_details.

YouVisit produces real estate and other cinematic VR Tours; LiveLikeVR employs both CG and 360° Video to transport people into sports games; Obsess VR combines fashion shows and purchases with one immersive application. Still, specific industries have gravitated toward particular classification types, even while the field is in flux.

Virtual Reality Industries

There has been a significant push by the gaming industry to advance content for VR headsets. PlayStation, Valve and Microsoft have invested in the hardware, while major publishers have released content related to their franchises. Perennial series Fallout,[33] Doom[34] and Resident Evil (Webster, 2017) released VR material in 2017. The low hurdle for distributing content through app stores and gaming platforms has also made independent game development less onerous. A developer can release content on the Android "Play" store for the one-time fee of $25 and iOS charges an annual fee of $99 (Mackenzie, 2012). A release on Valve's Steam store costs $100 (Sarkar, 2017).

Gaming isn't the only industry making significant content for VR. Artists have flocked to the technology. The Whitney Biennial featured a much-debated VR experience about violence (Schwartz, 2017). Artists have been making exhibit-quality content for VR for some time. Oculus co-founder Palmer Luckey started his VR career as an intern at Emblematic Media, an art-based media company founded by the "Grandmother of VR" Nonny de la Peña (Helmore, 2015).

---

[33] "Fallout 4 VR," Steam, accessed March 7, 2018, http://store.steampowered.com/agecheck/app/611660/.

[34] "DOOM VFR," Steam, accessed March 7, 2018, http://store.steampowered.com/agecheck/app/650000/.

Social media also has invested in VR content creation. Facebook purchased Oculus for $2 billion because founder Mark Zuckerberg imagined its application for social spaces. "We're making a long-term bet that immersive virtual and augmented reality will become a part of people's daily lives" (Metz, 2016) he is quoted as saying in a 2016 article. Other social venues have quickly appeared, such as AltSpaceVR, which was eventually acquired by Microsoft and VR Chat.[35] VR tools for painting and sculpting make the creation of 3D content less arduous. One enthusiast gushed over Google's painting program, Tilt Brush, in which a user, when wearing a HMD, is able to paint inside a virtual space with two hand controllers. Rather than having a canvas, the virtual paint suspends itself in mid-air, around which the artist can move. "[W]hat an amazing application and tool… you think to yourself, 'Wow, I could be inside the canvas and I'm creating this.' How cool is that? And it's not just cool, it's practical…" The utility easily renders 3D models in the immersive environment rather than having to painstakingly draw on a 2D screen. Google has released other tools, such as an expanded version of its navigation programs "Google Earth" and "Google Street View."

Other industries have shown interest in forms of VR, though these remain less established than tech and gaming. For instance, The Body VR produces educational models and stories for healthcare and other students.[36] IrisVR does 3D modeling workflows for architects.[37] However, with their limited content, the financial viability of these specific companies remains uncertain.

---

[35] "VRChat," Steam, accessed March 7, 2018, http://store.steampowered.com/app/438100/VRChat/.

[36] "Products," The Body VR, accessed March 7, 2018, http://thebodyvr.com/products/.

[37] "Instant Virtual Reality for the Building Industry," Iris, accessed March 7, 2018, https://irisvr.com/.

360° Video Industries

Because of the steep cost of stitching, the barrier of entry to making high-end video is significantly greater than to VR. An average user, particularly before the release of products like the Ricoh Theta in 2013 (Aguilar, 2013), had to purchase a number of cameras, construct their own rig and possess the technical know-how to stitch video together. Since the price of rigs and cameras has decreased and stitching has become increasingly automated, the stage has been set for greater industry influence.[38]

The film industry and filmmakers have taken advantage of 360° Video. They have produced promotions for major blockbusters. Marvel created "Battle for Avengers Tower" to go along with their release of an *Avengers* movie[39] and a series of VR experiences have been issued with the reboot of the *Star Wars* franchise (Jagneaux, 2017). With large budgets already allocated for such films, adding 360° experiences becomes affordable. The cinema has a long history of employing innovations into storytelling and showcasing them through festivals.

However, directorial finesse does not translate well into a medium where traditional film techniques such as close-ups and pans simply aren't possible. This is especially apparent in documentaries like *Growing Up Girl*, made by Ryot, which follows a girl in rural Kenya as she works on her family's farm and walks to get water, goes to school and does homework under the

---

[38] Additionally the software for stitching, cutting and distributing has gone down in cost. While previously a user needed to use a program like Unity to make his own "sphere" for viewing 360° Video, now much of this can be done automatically via YouTube, Facebook, and other video streaming sites. Also, a number of startups such as Eevo allow easy editing and production of 360° Video. See "EEVO," EEVO, March 7, 2018, https://eevo.com/.

[39] "Battle for Avengers Tower," Oculus, accessed March 7, 2018, https://www.oculus.com/experiences/gear-vr/806687776079309/.

streetlights of a nearby town. Each scene is staged, almost like a theatrical production,[40] with the girl crossing the screen. There is no way to focus closely on her face or quckly cut between scenes. Despite this, the genre still provides a "cinematic" experience where the film literally surrounds the viewer. [41]

Likewise, journalists have gravitated to 360° Video. This industry has heavily invested in its own independent applications and published films and documentaries. The idea of transporting and immersing individuals in new places has sparked interest, along with a tradition of implementing new technologies which can be capitalized on. VR is also opportune for sponsored content, which offers a new revenue stream for the industry and drove the release of *The New York Times'* app in the first place (Insider, 2015). However, in some of my informal conversations, journalists have critiqued that 360° films are inadequate because there is little activity and pacing in most scenes, leading to superficial and detached experiences.

Another ongoing debate is how to realistically and objectively represent virtual space. Some of the most provocative experiments are animated, such as *The Guardian's* "6x9," which featured a realistic, computer-generated representation of a solitary confinement experience, culled from interviews or "Notes on Blindness" which recreated the world of a man with severely impaired vision along with audio recordings he made while going blind. Objectively realistic depictions in 360° Video continue to be a major concern for newsmakers.

---

[40] In fact, there were ongoing discussions about the relationship to theatre and VR as well as 360° video throughout the course of my study.

[41] "Growing Up Girl," Ryot, accessed March 7, 2018, https://www.ryot.org/blog/stories/growing-up-girl-2.

The advertising industry has also made significant efforts in 360° filmmaking. Dos Equis' sponsored an advertisement featuring their "Most Interesting Man in the World" character.[42] There are music videos—The Gorillaz released several high-tech promotional features to accompany their album *Humanz*, including a 360° animated VR film and an AR app (Plaugic, 2017). A promotion for the US Open offered an invitation to play virtual tennis with superstar Maria Sharipova (Monllos, 2015).

Many studios produce 360° films for both promotional and documentary content. VR Playhouse has produced work for New York Fashion Week, documentaries on Stan Lee, a film of the Lion King and commercials for George Clooney's Casamigos tequila.[43] The NYC-based Two Goats has done promotional work for the Rugby Football League and documentaries for Doctors Without Borders.[44] Such products are usually tailored to client interests and are "one-offs." One producer told me, "If Toyota has done a VR campaign once and it's great on their website, just to show that they are an innovative team or whatever, would they do it again? That's my biggest question… Once an advertiser has done something, they might not do it again."

Both real estate and education have embraced 360° Videos and photo-realistic representations. Virtual tours of houses is the primary focus of startups in real estate. Realtour 360 allows for WebVR enabled tours with 360° pictures uploaded from people's cameras.[45]

---

[42] "Dos Equis Masquerade 360," THe Mill, accessed March 7, 2018, http://www.themill.com/portfolio/550/masquerade-360.

[43] "Work," VR Playhouse, accessed March 7, 2018, http://vrplayhouse.com/work/.

[44] "Work," Two Goats, accessed March 7, 2018, https://www.twogoats.us/work-clients/.

[45] "Realtour-360°," Realtour 360°, accessed March 7, 2018, https://www.realtour-360.com/.

Case3D[46] and Zillow[47] have similar apps. Because static 360° photographs are even easier to construct than film, this is a good port of entry for enthusiasts. Museums have created ancillary content for exhibitions, such as Framestore's dinosaurs for natural history museums,[48] or use 360° photographs and film for archiving purposes, such as the duplication of the Smithsonian American Art Museum's Renwick Gallery.[49] Initiatives extend to universities: the Columbia University Media Center for Arts History has constructed virtual tours of architectural sites for preservation.[50] Finally, educational companies, which also look for opportune technological innovations, have flocked to 360° Video. For instance, Google started an "Expeditions" initiative to bring films through their "Cardboard" headsets into classrooms.[51]

Augmented Reality Industries

While VR and 360° film have identifiable industrial investors, interest in Augmented Reality is more diverse with a longer commercial history. Experiments in Augmented Reality through smartphones harks back to the earliest days of the iPhone. Local search and review company Yelp included an AR component in its app in 2009 (Parr, 2009).

---

[46] "360 VR Real Estate by Case3D," App Store Preview, accessed March 7, 2018, https://itunes.apple.com/us/app/360-vr-real-estate-by-case3d/id1088769915?mt=8.

[47] "Elevate Your Listings with 3D Home™," Zillow, accessed March 7, 2018, https://www.zillow.com/marketing/3d-home/

[48] "Natural History Museums," Framestore VR Studio, accessed March 7, 2018, http://framestorevr.com/natural-history-museums/.

[49] "WONDER 360: Experience the Renwick Gallery Exhibition in Virtual Reality," Smithsonian AMerican Art Museum, accessed March 7, 2018, https://americanart.si.edu/wonder360.

[50] "Projects," Media Center for Art History, accessed March 7, 2018, http://www.learn.columbia.edu/mc/projects/.

[51] "Expeditions," Google Expeditions, accessed March 7, 2018, https://edu.google.com/expeditions/#header.

Some industries have invested in AR for decades. In enterprise software, AR is considered a route to improve efficiency (Lee, 2012). There has also been a significant record of AR in tourism. In 2010 The Museum of London released an app to overlay historical photos on the real world (Zhang, 2010). Artists have embraced the technology; during Occupy Wall Street, Mark Skwarek created an Augmented Reality event where average users could project virtual images onto the New York Stock Exchange, which could only be viewed via mobile devices (Holmes, 2011).

Current industries interested in AR range from game makers who built on the *Pokemon Go* craze to artists like Amir Baradaran who has spent much of his career working with the technology. One of his projects "Frenchising Mona Lisa,"[52] made it so that when users hovered their phones over the iconic image at the Louvre museum, the portrait animated and draped itself in a French flag. There are social media applications such as Membit that creates location-tagged images which users can cull to "remember" a particular moment, or as they advertise "When you make a membit, you leave an image in place for other Membit users to find and enjoy."[53]

In some ways, AR is a natural extension of other applications already present on phones. Unlike Virtual Reality, which requires complete isolation, it overlays content onto the real world. Because it does not require occlusion, AR fits better into the current user interfaces of digital devices and can just "pop-into" reality opening the possibility for AR notifications and/or targeted advertising based on GPS location, which nicely conforms to business models in the smartphone app-based economy.

---

[52] "Frenchising Mona Lisa," Amir Baradaran, accessed March 7, 2018, http://amirbaradaran.com/ab_futarism_monalisa.php.

[53] "About," Membit Inc., accessed March 7, 2018, https://www.membit.co/about/.

Finding the best ways to get this content to users and how to represent it graphically in three-dimensional space is still being determined and explains the increase of 3D modeling stores such as Sketchfab[54] and the Unity Asset Store,[55] which allow people to search for, purchase and use 3D content in VR, AR and Mixed Reality.

Mixed Reality Industries (or Lack Thereof)

There has been less explicit industry attention on MR compared to the other classifications. The expense of these devices has discouraged a widespread following. At $3,000 per headset, only specific industries can access this market—usually those requiring high-end investment themselves.

Microsoft presently considers the technology primarily for "enterprise" or general business use. The company has integrated the headsets' application into their "Windows Universal Platform" signaling any application for Windows will also work on the HoloLens and vice versa. Their promotional videos demonstrate the device being used with existing telecommunication programs like Skype.[56] Sharing and commenting on the same object in a mixed reality space is very much at the forefront of their advertisements. In one video, a number of engineers at Ford discuss and view hypothetical car redesigns together.[57] Companies are being founded around just these sorts of practices. The New York-based Medivis[58] employs the

---

[54] "Sketchfab," Sketchfab, accessed March 7, 2018, https://sketchfab.com/.

[55] "Asset Store," Unity Asset Store, accessed March 7, 2018, https://www.assetstore.unity3d.com/en/.

[56] "Microsoft HoloLens: Skype," YouTube, last modified February 29, 2016, accessed March 7, 2018, https://www.youtube.com/watch?v=4QiGYtd3qNI.

[57] "Microsoft HoloLens: Partner Spotlight with Ford," YouTube, last modified September 20, 2017, accessed March 7, 2018, https://www.youtube.com/watch?v=3QyA7HhIYkg.

[58] "MediVis," Medivis, accessed March 7, 2018, https://www.medivis.co/.

HoloLens to look at three-dimensional renderings of MRI scans. Still, while the goal for Mixed Reality and XR may be to integrate, or even reimagine the personal computer, it currently is still very much developer-focused in nature.

Conclusions

Industries have made inroads into specific immersive technologies based on the background and knowledge they accrued from older media. Game makers and programmers dominate in the development of VR and AR content, while filmmakers and journalists are more inclined to steer towards 360° Video. Although other industries have tentatively ventured into these spaces, they have neither the institutional knowledge, nor the backgrounds in content generation to hold sway in this emerging technology.

Despite this, a multitude of industries have dabbled in the technology, allowing for some degree of cross-pollination. It is not unusual to see computer-generated graphics utilized by filmmakers or video displays in Augmented Reality projects. Still, most adopters are not only coming to VR and other immersive technology with a perspective framed by their occupational background, but also are entering an environment already solidified around particular professions.

<center>**Meetup Manifestation**</center>

How are Virtual Reality, 360° Video, Augmented Reality and Mixed Reality broached at the meetup level? In New York City, many of the meetups explicitly reference the different

formats. NYVR[59] covers Virtual Reality; ARNY[60] is associated with Augmented Reality; the

360° Video Meetup is self-explanatory.[61] NYXR[62] and Immersive NYC[63] are more catch-all

immersive technology groups, which feature all four types of content. How these meetups

choose content for their presentations reveals what they deem valuable.

The content creation classifications are extremely porous. Many VR meetups, both in

New York and around the country, do not solely concentrate on VR-specific content, but also

highlight Augmented Reality, 360° Video and Mixed Reality. One meeting of NYVR presented

the AR company Augment, human modeling company PRSONAS, Microsoft/HoloLens

evangelist Nick Landry and storytelling company The Body VR on a single evening.[64] Similarly,

a meeting of the Silicon Valley VR group, one of the largest in the country, had a "HoloHack"

for HoloLens which featured VR, AR and MR building.[65] Austin's vibrant VR meetup has

explicitly advertised AR experiences.[66] Introducing innovative game engine-software, 360°

studios, and new immersive gear is very much the norm in these meetups. Furthermore, the term

---

[59] "(NYVR) Virtual Reality NYC," Meetup, accessed March 7, 2018, https://www.meetup.com/NYVR-Virtual-Reality-NYC/.

[60] "ARNY - Augmented Reality New York," Meetup, accessed March 7, 2018, https://www.meetup.com/ARNY-Augmented-Reality-New-York/.

[61] "360° Video Meetup," Meetup, accessed March 7, 2018, https://www.meetup.com/360Video/.

[62] "NYXR -- New York eXtended Reality Meetup," Meetup, accessed March 7, 2018, https://www.meetup.com/NYXR-New-York-eXtended-Reality-Meetup/.

[63] "Immersive NYC," Meetup, accessed March 7, 2018, https://www.meetup.com/Immersive-NYC/.

[64] "January (NYVR Meetup)," Meetup, last modified January 19, 2017, accessed March 7, 2018, https://www.meetup.com/NYVR-Virtual-Reality-NYC/events/235326972/.

[65] "Microsoft and SVVR Present: HoloHack Silicon Valley 2017," Meetup, last modified January 15, 2017, accessed March 7, 2018, https://www.meetup.com/SiliconValleyVirtualReality/events/240253544/.

[66] "VR Austin Jam Showcase 2017," Meetup, last modified November 13, 2017, accessed March 7, 2018, https://www.meetup.com/VRAustin/events/244447602/.

VR itself is widely used. In a study comparing the membership of immersive meetups on

Meetup.com in New York City and Los Angeles in June, 2016, I found twenty-six groups in The

City with 57% focused mainly on VR, 11% on 360° Video, 3% on AR and MR respectively,

19% were multipurpose or ancillary. Figure 4.1 illustrates the respective meetups and

membership numbers at the time.
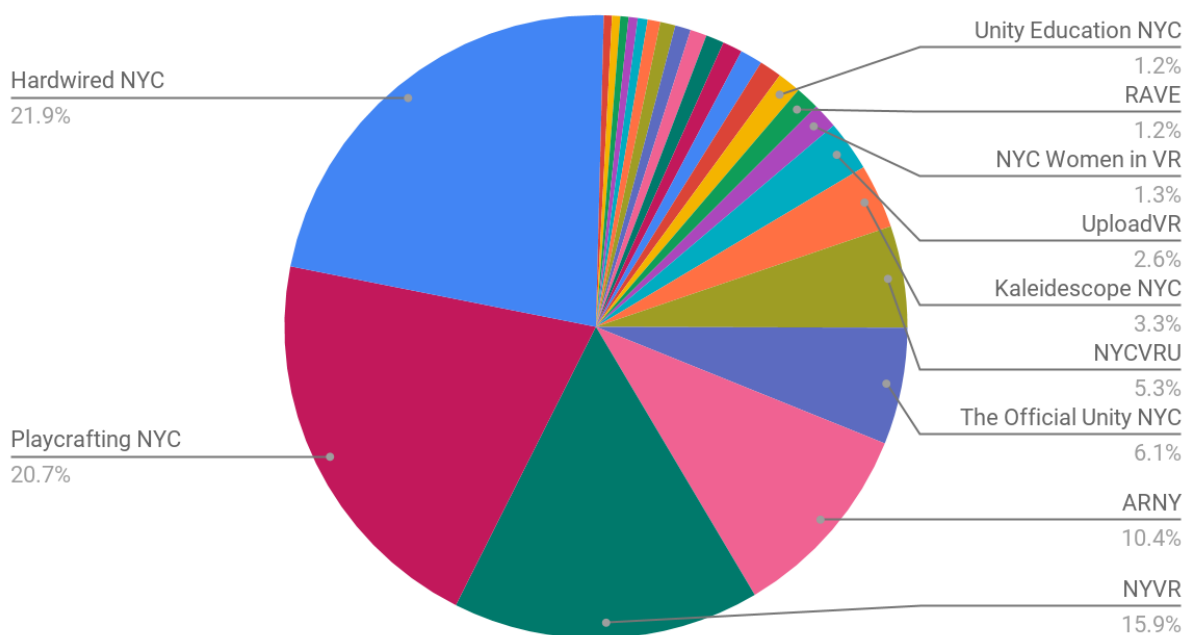
Meetup Membership NYC 2016

Figure 4.1. Immersive meetup membership in NYC for June, 2016.

Los Angeles reflected similar figures: 52% were devoted to VR, 9% to AR, 17% to 360°

Video and 21% to mixed, with no HoloLens meetups.

Meetup Membership LA 2016

GameTech Edu
1.5%
Vrideo Meetup
2.9%
LA 3-D Club
2.7%
UploadVR LA
2.5%
Los Angeles VR and Immersive
16.0%
Women in VR LA
3.1%
ARLA
11.7%
Virtual Reality Workshops
3.8%
Kaleidescope LA
2.0%

OCVR
11.0%
Los Angeles Virtual Reality Meetup
3.2%
VRLA
27.2%
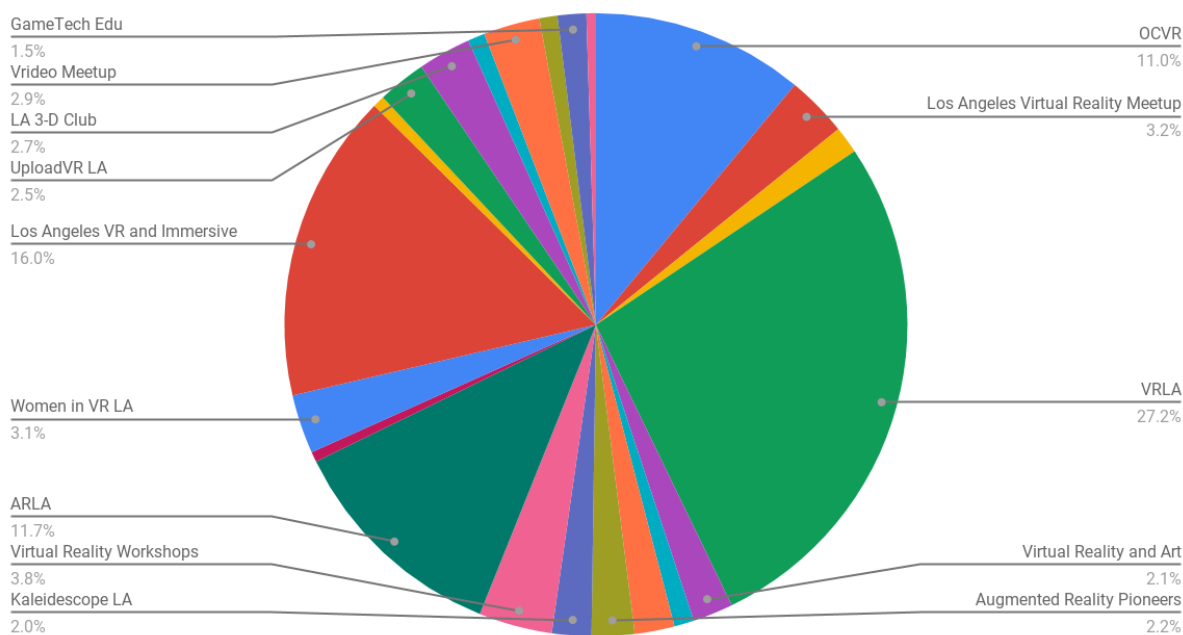Virtual Reality and Art
2.1%
Augmented Reality Pioneers
2.2%

Figure 4.2. Immersive meetup membership in Los Angeles for June, 2016.

By contrast 360° Video meetups tend to be more focused and address cinematic issues.

For example, one group in New York City is explicitly called "Cinematic VR," and another met

consistently at the 360° streaming company Littlstar's headquarters.[67] They also may be industry

specific. Los Angeles houses a meetup entitled "At the Intersection of E-Learning, Filmmaking

& VR."[68] Even though these meetup groups may focus on 360° filmmaking, many attendees and

companies will transition between them and general VR meetups.

Augmented Reality overflows into VR meetups despite the name. There have also been

some historical and current AR meetups based around specific popular phenomena, including

---

[67] "Past Events," Meetup, last modified November 8, 2017, accessed March 7, 2018, https://www.meetup.com/360Video/events/past/.

[68] "At the Intersection of E-Learning, Filmmaking & VR," Meetup, accessed March 7, 2018, https://www.meetup.com/At-the-Intersection-of-E-Learning-Filmmaking-VR/.

Pokemon Go meetups in Manhattan[69] and Brooklyn,[70] as well as Google Glass which has subsequently been abandoned (McPollom, 2013).

Mixed Reality had, to some degree, been consolidated within Microsoft-related meetups until the end of 2017. The Microsoft Makers & App Devs,[71] which centers on Microsoft Development more generally, exhibited the HoloLens. HoloLens-specific meetups also exist including NY HoloLens Developers.[72] These groups mostly concentrate on early experiments. The first handful of meetups were primarily about socializing and throughout the first year examined developer trials for immersive medical software, NASA physical therapy, games and data visualization. However, interest in Mixed Reality has only expanded with the rise of more generalist NYXR and immersive groups whose aims are to cover all of these formats.

There are some meetups that don't fit into any of these categories. Storycode, for instance, which primarily investigates innovative storytelling techniques, featured an interview with the maker of the aforementioned *Wall Street Journal* 360° video,[73] a documentary on relationship formation,[74] a documentary series from the UN[75] and a discussion of game design

---

[69] "Pokemon Go NYC," Meetup, accessed March 7, 2018, https://www.meetup.com/Pokemon-Go-Events-New-York-City/.

[70] "Pokemon Go Brooklyn Raiders," Meetup, accessed March 7, 2018, https://www.meetup.com/PKMNGO-Brooklyn-Raiders/.

[71] "Microsoft Makers & App Devs of New York City (#MMADNYC)," Meetup, accessed March 7, 2018, https://www.meetup.com/MMADNYC/.

[72] "NYC HoloLens Developers Meetup," Meetup, accessed March 7, 2018, https://www.meetup.com/NYC-HoloLens-Developers-Meetup/.

[73] "Breaking VR Out of the Headset: A Case Study from the WSJ Newsroom," Meetup, last modified March 21, 2017, accessed March 8, 2018, https://www.meetup.com/StoryCode-New-York-City/events/238409667/.

[74] "Yes - A Mid-Production VR Case Study," Meetup, accessed March 7, 2018, https://www.meetup.com/StoryCode-New-York-City/events/232387291/.

[75] "Gabo Arora + Socrates Kakoulides Present The UN's Virtual Reality Series," Meetup, accessed March 7, 2018, https://www.meetup.com/StoryCode-New-York-City/events/227109420/.

techniques in immersive storytelling.[76] Venture capitalists and marketers are courted in groups

such as VR/AR Invest,[77] New York Augmented Reality Investor & Entrepreneur Meetup,[78] and

Virtual Reality Marketing and Monetizing VR (VR MBA).[79] In addition, VR arcades sponsor

meetups to get patrons into their spaces. In New York City, Jump Into the Light, Hubneo and

NovoNY all have semi-regular meetups. Outside of New York, similar meetups can be found in

a handful of other cities, such as Dublin, Ireland.[80]

While content creation has been industry specific, meetup level boundaries are blurrier.

Members of meetups traverse different genres and applications of immersive technology. The

meetups themselves are often in dialogue and partner with each other. This will be detailed in

Chapter Six, which looks at meetups as sites of adoption, but this short analysis has two

important revelations. First, that as of 2016, VR from a community perspective was an umbrella

term for all modes of immersive content creation, just as the term XR gains acceptance as of this

writing. However, more importantly, it shows that for adopters the divisions regarding VR, AR,

360° Video and Mixed Reality simply do not matter. For them, the continuum of immersive

media more generally carries an appeal. So, whether it is AR's current rise in popularity, or VR's

historical relationship to devices in the 1990s, few adopters are interested in only one aspect of

---

[76] "Learning from Game Design + Incorporating it into VR/Immersive Storytelling," Meetup, accessed March 7, 2018, https://www.meetup.com/StoryCode-New-York-City/events/242372397/.

[77] "VR/AR Invest," Meetup, accessed March 7, 2018, https://www.meetup.com/VR-INVEST/.

[78] "New York Augmented Reality Investor & Entrepreneur Meetup," Meetup, accessed March 7, 2018, https://www.meetup.com/New-York-Augmented-Reality-Investor-Entrepreneur-Meetup/.

[79] "Virtual Reality Marketing and Monetizing VR (VR MBA)," Meetup, accessed March 7, 2018, https://www.meetup.com/Virtual-Reality-Marketing-and-Monetizing-VR-VR-MBA/.

[80] "Virtual Reality Arcade - Tournament Night," Meetup, accessed March 7, 2018, https://www.meetup.com/Virtual-Reality-Arcade-Tournament-Night/.

the technology. Instead, they try to situate their own interests on the continuum, understanding

that content creation will likely change rapidly, and it is their job to keep up.

CHAPTER 5: VR DEVELOPMENT IN NEW YORK CITY

A 2016 article on the "XMG Walker," a personal computer specifically designed to be worn as a backpack to facilitate movement with high-end VR rigs, satirizes the West Coast's technological culture. After reviewing the device, the writer wryly concludes, "Living in the tech bubble that is San Francisco, it probably won't be too long before I see a XMG WALKER in the wild. I could be catching a bus to somewhere in a distant neighborhood, and see a XMG WALKER-enabled techie using the Vive while waiting for a $40 Uber" (McCarthy, 2016). As the derision implies, materialism is rife in Silicon Valley; lavish experimental accessories like the XMG Walker, after only a few outings, can collect dust next to the Tesla in a developer's garage.

Conversely, private garages are rare in New York. Besides high housing prices and limited space, there is a dearth of commercial computational hardware investment and innovation inside the city, which has prompted government initiatives. These include the Mayor's Office, efforts by the New York City Economic Development Corporation (NYCEDC) and the recent announcement of a city-funded lab for VR/AR development (Hurowitz, 2016). At the same time, New York is renowned as an epicenter for media companies including television, film and journalism, all of which experiment with VR technology, along with other non-entertainment professions from real estate to neuroscience. As a result, unlike their IT-fixated Silicon Valley brethren, local VR developers are ensconced in a city focused on authoring content for all sorts of commerce.

New York City stands out as a unique space for the adoption and development of new technologies. A would-be investor described The City as being in a third place position on the hierarchy of VR development hubs, far behind Silicon Valley and Los Angeles where more

investment was occurring. He compared pursuing VR locally to working in the steel industry without moving to Pittsburgh. However, many enthusiasts tout the city's benefits, reprising the classic idea that "if you can make it there, you can make it anywhere." One interviewee thought it an advantage The City was a "melting pot," which suited VR, the "melting pot medium" with which so many different economic sectors intermingled.

In this chapter, I explore the location where I conducted my research. I first establish New York City as a technological and media hub within the United States. Literature has long acknowledged that the particular form of "cyberculture" (Turner, 2008) which has manifested on the West Coast did not take the same hold in "Silicon Alley"—the New York City tech bubble of the 1990s. Instead, more traditional media, and particularly television, journalism, film and advertising continue to dominate. I illustrate the influence of these professions on VR diffusion through three examples and then explicitly lay out the key industries and institutions influencing VR diffusion in the city.

The chapter concludes with the specific advantages and disadvantages that adopters referenced concerning content creation for VR in New York City: an adoption environment where expertise in the innovation is not required; where professional background outside of VR takes on an outsized role; and where the effort required to gain access to knowledge in and funds for the medium, not to mention spaces to house it, is overshadowed by quick returns on investment.

Cyberculture (or Lack Thereof) in New York City

Unquestionably, much of the modern incarnation of Virtual Reality is a product of Silicon Valley. In *Virtual Reality,* Howard Rheingold (1991) firmly situates VR innovations within this locality. He even suggests that it wasn't uncommon for "promoters" of VR to portray

it in the press as a "brand-new technology from Silicon Valley" destined to change the world overnight (p. 35). Although Rheingold's foundational work describes an international phenomenon, there are certainly geographic hotbeds in VR development, and in the US, it was originally Northern California.

Jaron Lanier and Brenda Laurel, early proponents of the medium, began their careers at Atari's Sunnyvale laboratory. Lanier went on to found the influential 1990's VR company VPL Research. Laurel wrote her dissertation based on her time at the lab, where she imagined computers as three-dimensional spaces. In the first edition of the book based on her dissertation, *Computers as Theatre*, Laurel explicitly ties her work to Virtual Reality, which she states originates from "MIT Media laboratory, Atari Systems Research, and NASA Ames research" (Laurel, 1993, p. 185). She traces its lineage starting with Ivan Sutherland's *Sketchpad*, moving to the Atari game *Pong* and concluding with cyberspace, writing "all are stops on the same route" (p. 187) to VR. Furthermore, many of the companies with vested interests in manufacturing VR hardware clustered around Atari's Sunnyvale facility, among them Google, Apple, Stanford University's Virtual Human Interaction Lab,[1] and, just up the coast, Oculus and Microsoft in Redmond.

The innovations and ideas surrounding VR are an outgrowth of the birth and infancy of cyberculture through the 1990s. Fred Turner (2008) described the moment as a "countercultural critique of hierarchical government and its celebration of cybernetic forms of collaborative organization" which was "linked by networks of computers" (p. 148). In a brief account of Lanier's advocacy for the term "Virtual Reality," Turner states that it was used in part to get fans

---

[1] "VHIL | Virtual Human Interaction Lab," Virtual Human Interaction Lab, accessed March 9, 2018, https://vhil.stanford.edu/.

of cyberspace "to reimagine themselves as members of a coherent community collaborating on the construction of the future" (p. 163).[2] Lanier's (2017) own recollections of the early days of cyberculture are quite ambivalent. In his latest book, he details its history, but does not paint a purely rosy picture, and instead derides the mushrooming of wealth in the early days of the Valley (p. 90), the blandness of areas like Sunnyvale (p. 101), and the paucity of women; in a lengthy footnote, he indicates a longing for women to come out of math and computer science departments to become hackers (p. 336).[3] On the positive side, Lanier reminisces that one of the "wonders of Silicon Valley" (p. 124) was the ability for innovators to spontaneously come together and interact. Ultimately, contemporary Silicon Valley is characterized as captivated by a vapid philosophy of "abundance" and "that humanity will soon get so good at technology that every human being will be able to live well, maybe even live forever, virtually for free" (p. 297).

While VR and cyberculture flourished in Silicon Valley, they were rejected in New York City. The collapse of "Silicon Alley" at the turn of the 21st century is a testimonial to this. The name referred to the downtown Manhattan neighborhood that was home to the financial "Dot-Com" bubble of Internet technology from 1997 through 2001. A number of factors contributed to the Alley's demise, among them: naivete and arrogance of young businesses (Kait & Weiss, 2001); the power of the news and entertainment industry at the time (Hirschfeld, 1997); and the hype and overambitious initial public offerings of companies (Indergaard, 2004). One major factor was incompatibility with the traditional sectors that dominated the New York landscape, and in particular the lack of success in making online content.

---

[2] This "coherent community" resembles the current diffuse interest in VR content creation with which I concluded the previous chapter.

[3] Lanier (2017) also notes the unrecognized value of a set of "Grand Networking Females" (p. 116) who connected developers together. His relationship with them is personal and complicated in part because he recounts dating one of them in the text.

Neff (2004) describes the bubble in terms not dissimilar from my own research into VR, stating that the goal of the Alley in the mid-1990s was to make New York City the "creative capital of the Internet Industry" by joining "arts, media and advertising" (p. 58). An "avant-garde" (p. 66) of developers, Internet agencies and webzines rose next to a handful of larger companies in "print media, advertising… publication and arts" (p. 66). Neff describes long forgotten web magazines such as *Word* (an online culture magazine), *Total New York* (a webzine on urban lifestyle), *gURL* (a webzine for teen girls) and others who saw themselves as "popularizers of the new medium" (p. 67) working alongside Internet service provider Prodigy (itself a partnership between IBM and Sears) (p. 48) and the local offices from Microsoft and Apple. Advertising agencies were also influential in the growth of Silicon Alley where both established names such as Ogilvy & Mather and newcomers such as Agency.com worked with the likes of Hitachi, American Express and Time-Warner to design content for the early World Wide Web (p. 52). Government investment was important to the development of the Alley with initiatives from the Mayor's Downtown Revitalization plan and the Alliance for Downtown New York, which subsidized space in the same buildings for both large occupants, like IBM and Sun, and small firms, like N2K and Sixth Gear (p. 93). According to the author, this melding of different talents, something unique to The City's diversity of industries, helped birth contemporary notions of "New Media," as opposed to the more technologically-focused Silicon Valley and Boston's Route 128 (p. 34).[4]

---

[4] This correlates with an ongoing, if easily critiqued, perception of cities acting as economic and social hubs, particularly for creative workers. Richard Florida (2003) in particular maintained that creative industries consolidate in specific cites: "Not only do people remain highly concentrated, the economy itself—the high-tech, knowledge-based, and creative-content industries that drive so much economic growth—continues to concentrate in specific places from Austin and Silicon Valley to New York City and Hollywood, just as the automobile industry once concentrated in Detroit" (p. 4).

However, in spite of serious initiatives to grow Silicon Alley, Neff, throughout her text, emphasizes how New York was ill-fitted socially, historically and even spatially to Internet innovators. There was neither the easy flow of capital for entrepreneurs that abounded on the West Coast (p. 29), nor "private venture capital firms" (p. 35). The City was suffering from recession and the major industries native to it, "finance, real estate, publishing and advertising" (p. 33), were disinterested in long-term support of the technology. She too notes: "Garages in Manhattan are places people pay to park their cars, not underused spaces for hobbyists to tinker with computer equipment…" (p. 30). However, her greatest criticism is that cooperation of these industries was temporary and tentative. Most Internet pioneers settled in lower Manhattan for the "cool factor" (p. 44), but affiliations were only between individuals and fleeting. Entrepreneurs were unwed to the industries for which they were working and when market pressures came to bear, they weren't sufficiently institutionalized to survive. She concludes, "If the strength of this new field was precisely that it brought together a diversity of values (creative, technological and financial), diversity was not tensile enough, not flexible enough, to weather the later battering by market forces" (p. 250). Ultimately, traditional industries held sway over the emerging ones.

Her findings mirror the strains between NYC media industries and the rise of the Internet, along with a myopia about the integration of the two business models, recounted in the oral history project "Riptide." Interviewees at major journalistic institutions expressed incomprehension about what the Internet could do for their professions. Martin Nisenholtz, former senior vice-president of digital operations at *The New York Times,* stated: "For most people in the organization, [the Internet] really didn't touch them very much. It's not that people were hostile, or that they didn't want to do it. They just didn't care very much, to be perfectly honest." (Huey, Nisenholtz, & Sagan, 2013, p. 77).

Nisenholtz' observations reflect the attitude of a predominantly traditional NYC media ecosystem, especially journalism and advertising. Although not as extensive as in Los Angeles, there are also significant television and film facilities within NYC. A 2009 analysis of New York City employment found that 20% of the nation's magazine industry was centered in The City, 15% of book publishing, 12% of the television industry, 11% of motion pictures and 11.1% of Cable programming (Strauss, Sundjaja, Robinson, & Chen, 2012, p. 5). As of 2013, New York also contained 20% of the advertising industry (McCaffrey & Matsumoto, 2013). These percentages are indicative of the stature of established media entities, within whose orbits startups and tech companies must function. The City is so dominated by these traditional fields, new businesses and startups have a hard time trying to survive.

This constraint does not preclude opportunities for developers or growth in software development and management. Internet industries had grown to 27% of the national total by 2014 (The Boston Consulting Group, 2015, p. 32). The NY State Office of the Comptroller found a 33% increase in high-tech growth within the city as of 2013. Over half the 100,000 new jobs identified were in computer system design and management, 15% in Internet and web search, and the fastest increase of expansion was in software publishing (DiNapoli & Bleiwas, 2014). The report doesn't reflect the additional temporary and freelance work that is commissioned by a multitude of software companies.

Since New York City has the country's largest student population, education also plays a key role in its economic infrastructure. Research at the student level is teeming with initiatives such as the NYC Media Lab: a consortium of universities,[5] the New York City Economic Development Corporation (NYCEDC) and business partners ranging from MLB Advanced

---

[5] These include Columbia University, New York University, The New School and CUNY,

Media to the Associated Press.[6] The Lab was charged with "driving innovation and ultimately job growth in media and technology by facilitating collaboration between The City's universities and its companies."[7] While digital technology is ingrained in New York City society it does not adhere to the libertarian and cyber-utopian ideals of the West Coast, but is instead bounded by major cultural institutions, government support and entrenched professions.

Understanding VR within New York City

How do deeply-rooted media industries affect VR businesses and startups? What types of enterprises thrive within this environment and how do journalism, advertising and other industries interact with them? Ascertaining the influence of local industry on technology is crucial for the experience of adoption.

To that end, three brief analyses follow. The first details the *types* of companies, especially those that visit and market their products and services at New York City VR meetups. Their size and scope gives a better idea of the relationship between meetups and local startups.

The second examines what types of VR businesses are receiving sustained or enthusiastic financial support using the "Crunchbase" database.

Finally, a thick description of the Exploring Future Reality conference,[8] which I attended as part of my research, illustrates the connections between media, educational and startup industries in the formation of VR content.

---

[6] "About — NYC Media Lab," NYC Media Lab, accessed March 9, 2018, http://nycmedialab.org/about/.

[7] "About — NYC Media Lab," NYC Media Lab, accessed March 9, 2018, http://nycmedialab.org/about/.

[8] "Exploring Future Reality — NYC Media Lab," NYC Media Lab, accessed March 9, 2018, http://nycmedialab.org/events/2016-exploring-future-reality.

Businesses at NYC Meetups

Meetups are representative of the New York-based businesses surrounding VR and other immersive technology, and also the professions that appeal to New York adopters. After all, much of the impetus for attending meetups is to network and find investment opportunities. Many meetups resemble conference panels, with a number of speakers who present and field questions from the audience about their products, projects and research.[9] While this isn't the case for every type of meetup—for instance, educational meetups consisted of teaching development strategies—even other formats included some mention of the business backgrounds of presenters. An in-depth analysis of the scope of the industries associated with the meetups I attended revealed that within New York City the businesses using VR and other immersive media came from the traditional local sectors, such as film, advertising and journalism, rather than games or hardware innovation.

I collected a list of companies and individuals who presented at meetups over my research period. I then assigned an industry, such as advertising, education, or journalism, to each. I then grouped companies by their specific focus of immersive technology—VR, AR, MR and 360° Video—within that industry or if they were more generalist. So, for instance, *The New York Times* was listed as part of the "Journalism" industry whereas the Emblematic Group, known for Computer-Generated VR documentaries like Kiya, which through source material of interviews and 911 phone calls recreated a domestic shooting using 3D graphics,[10] was isolated as "Journalism VR."

---

[9] This is presented in more detail in the following chapter.

[10] "Kiya | Emblematic," Emblematic, accessed March 9, 2018, http://emblematicgroup.com/experiences/kiya/.

Over the course of 157 meetups, I found 1,247 organizations and individuals who presented. Festivals such as the Future of Storytelling[11] had hundreds of spokespeople, while other meetups might have a single guest lecturer. A detailed compilation of industry representation appears in the Appendix. The overall list was vast with 136 different industry categories ranging from Toys to Museums. No one field dominated. The most presentations fell in the "Games" category at 8.42% and this number was inflated in part because two of the largest meetings I attended included a game jam, with over 100 independent games, and the Future of Storytelling festival, which also contained many games. "Development VR," or presentations about software development and programming, totaled 8.02%. Artist presentations and work came in at 6.17%. University professors and project presentations added up to 5.93% and VR Studios rounded out the top five at 5.05%. This last category I used as a catch all for content creation studios in VR, though many also promoted work in other immersive technology. In general, the numbers reflect a multiplicity of industries and interests that showcase and sponsor VR-related content

When the same information is broken down by the four classifications of immersive technology (VR, AR, MR and 360°), the influence of specific industries becomes more noticeable. Just under one third of the companies had a VR Related focus. Their industry influence is represented below:

---

[11] "Future of Storytelling," Future of Storytelling, accessed March 9, 2018, https://futureofstorytelling.org/.

VR Industries in NY

Advertising VR
1.9%
Arcade VR
2.2%
Architecture VR
2.2%
Education VR
2.2%
Journalism VR
2.9%
Conference/Meetup
3.1%
Film VR
5.5%
Game VR
5.5%
Hardware VR
6.7%

Development VR
24.0%

VR Studio
15.1%

Arts VR
12.0%
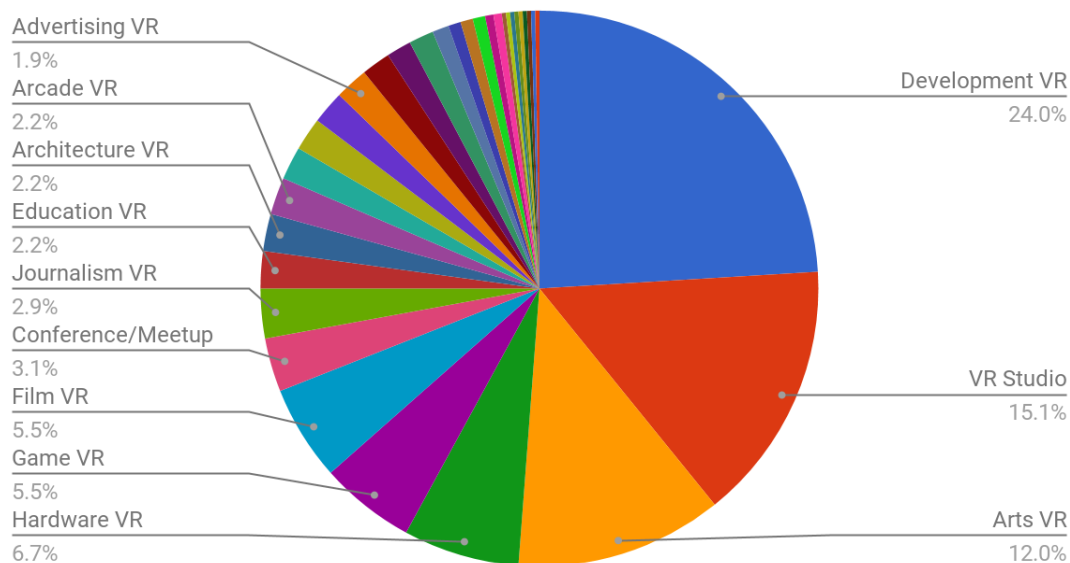
Figure 5.1. Industries focused on Virtual Reality at observed meetups, 2016 - 2018.

Development represented the majority of presentations, but some of this had to do with the frequency of meetups—a VR developer held more meetups in the city than anyone else. VR Studios, which provide content for advertisers and media companies, made up the second largest percentage. Film, journalism, and education also have significant representation, while hardware companies comprised 6% of the total presenters.

Only 51 companies and individuals focused on Augmented Reality:

Figure 5.2. Industries focused on Augmented Reality at observed meetups, 2016 - 2018.

In the AR sphere, Enterprise and Arts-focused companies are more prominent, with games and content studios showing less involvement.

There were only 33 MR presenters.

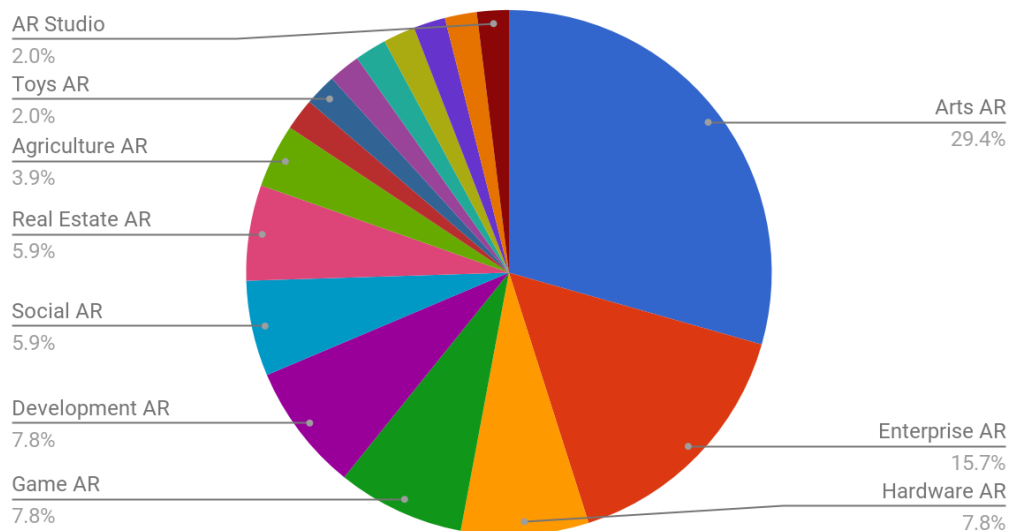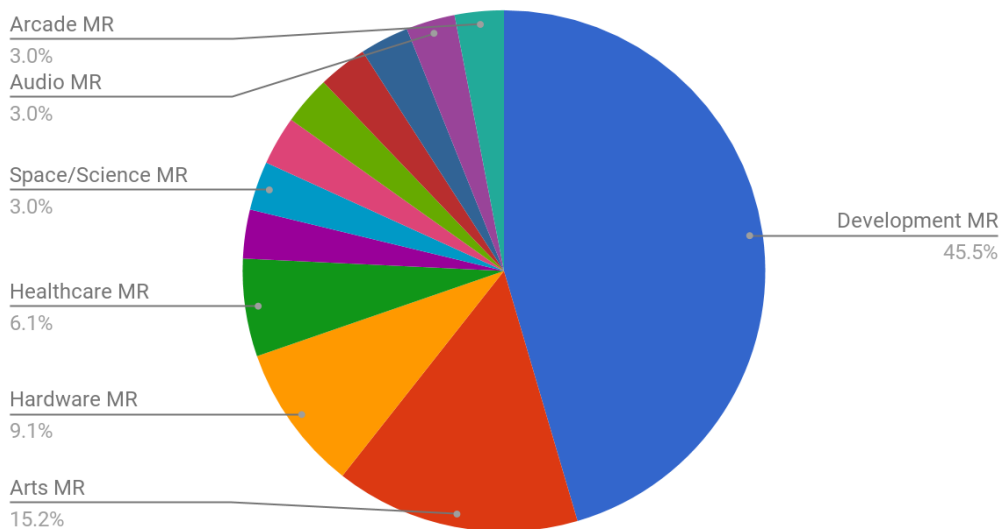*Figure 5.3.* Industries focused on Mixed Reality at observed meetups, 2016 - 2018.

Development once again plays an outsized role. This is in part because evangelists for the Microsoft HoloLens gave many presentations and tutorials during this time period. Games are completely absent from these top numbers.

Finally, 360° video's representation is as follows:

360° Industry in New York

Artist 360
1.6%
Distribution 360
6.3%
Journalism 360
6.3%
Hardware 360
15.9%
Development 360
30.2%
Film 360
36.5%
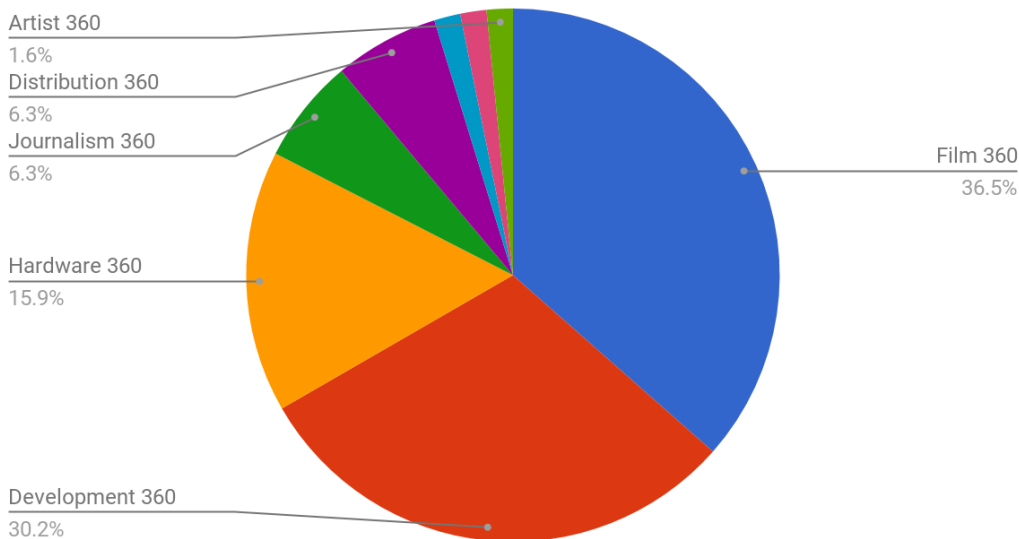
Figure 5.4. Industries focused on 360° Video at observed meetups, 2016 - 2018.

These percentages don't quite represent the actual cross-pollination that occurs on an industry level; many "VR Studios" work in film, as well as traditional VR. The film industry leads in presentations, followed by development platforms like Eevo,[12] which provides the means to stitch 360° video together.

In an examination of industries represented in the VR meetups, it is illuminating when companies focused solely on immersive media, as well as games (to control for the inflated

---

[12] "Eevo," Eevo, accessed March 9, 2018, https://eevo.com/.

numbers created by two large games conferences) are removed. What remains are the independent New York industries that are courting the meetup economy:
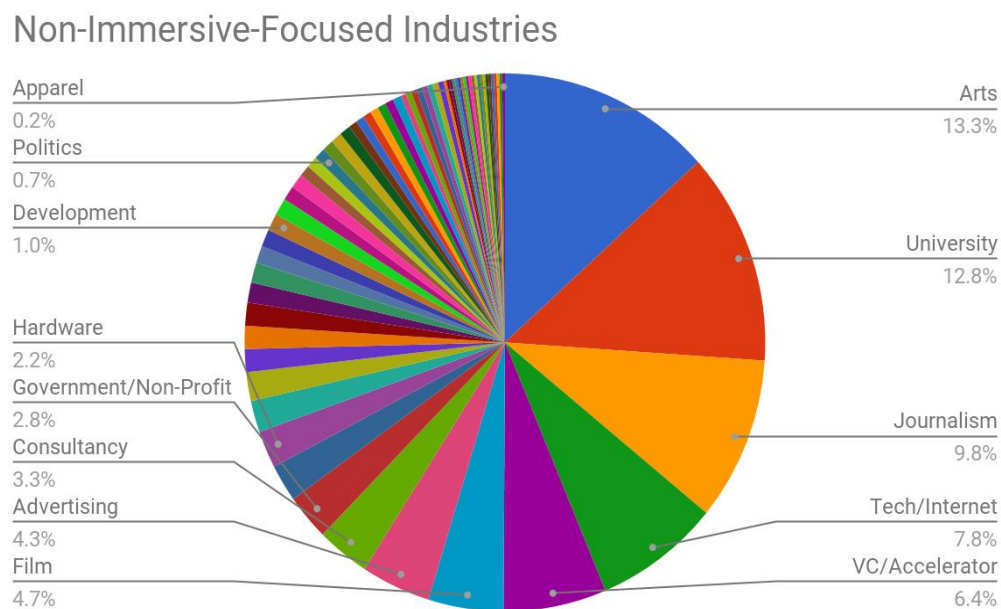
Figure 5.5. Industries Without an Explicit Focus on Immersive Technologies at Observed

Meetups, 2016 - 2018.

While there is no single dominant industry, the Arts, Universities, Journalists and finally Tech companies lead.

Additionally, some companies are repeatedly represented in meetups. The following chart lists the top ten companies that presented at multiple meetups:

Company	Number of Appearances at Meetups
The Glimpse Group[13]	10

---

[13] The Glimpse Group is an immersive tech incubator, which they describe as "cultivating entrepreneurs in the VR/AR industry. Our unique business model simplifies challenges faced by entrepreneurs and creates a robust ecosystem, while simultaneously providing investors an opportunity to invest directly into the emerging VR/AR industry via a diversified platform." Some of their companies are featured in the Crunchbase list, and the Group has

Microsoft[14]	10
New York Times[15]	8
Datavized[16]	8
Unity	7
Sketchfab	7
Samsung	7
HTC/Vive[17]	7
Google	7
YouVisit[18]	6

Figure 5.6. Top 10 company appearances at observed meetups, 2016 - 2018.

Overall, at the meetup level, the most common industries do not encompass traditional

"tech" companies. They do have some representation—evangelists from Microsoft, HTC,

YouTube and others have made appearances and even host events—but game studios, officials

from Silicon Valley and larger film studios rarely interface with meetup attendees. In their stead,

a close connection to the meetup community; Co-Founder DJ Smith actually runs the New York Virtual Reality (NYVR) meetup group. "The Glimpse Group," The Glimpse Group, accessed March 9, 2018, https://www.theglimpsegroup.com/.

[14] Microsoft hosts meetups in their offices, thus keeping up a major presence in the local scene.

[15] *The New York Times* experimented throughout 2016 and 2017 in 360° Video and VR.

[16] Datavized, which specializes in data visualization and VR was connected to the Women in VR New York City meetup group through its CEO, Debra Anderson. Samsung also houses meetups.

[17] Vive and HTC was a constant presence through sponsorships and their evangelist Dario Laverde.

[18] Similarly, YouVisit and Sketchfab both headquarter in the city and specialize in VR tourism and development respectively.

the void has been filled by more established local media industries, particularly advertising and journalism. Even startups veer toward the same industries that are present in NY—specifically advertising, film, or real estate. as opposed to games, gaming, and hardware innovators.

Seeding NYC Innovation

For an even deeper picture of immersive technology in New York City, I analyzed the leading startup companies, their rounds of finance and industry relationships. I found that investments leaned toward startups rather than the more entrenched IT and game companies, and that the companies which received the most funding concentrated on software and other services, but not hardware.

To do this analysis, I extracted a sample of startups from the website Crunchbase, a database made from "contributors, the largest venture partner network, and in-house data teams armed with powerful machine learning."[19] Based upon my four main classification of immersive technology, I pulled the top fifty results (where possible) from each on January 21, 2018. This left a sampling of 113 NYC companies.

The "CB Rank" is derived from "Crunchbase's intelligent algorithms, which take into account variables including Total Funding Amount, an entity's strength of relationships with other entities (e.g. Company, People, Investors, etc.) in the Crunchbase database, and how many times the entity has been viewed recently."[20] For almost all the companies, their scores are relatively low in contrast to the top startups in New York City, including crowdfunding site Kickstarter (CB Rank: 3), online digital news and information site *BuzzFeed* (CB Rank: 5) and

---

[19] "About Us | Crunchbase," Crunchbase, accessed March 9, 2018, https://about.crunchbase.com/about-us/.

[20] "Crunchbase Rank (CB Rank) - Crunchbase | Knowledge Center," Crunchbase, last modified February 23, 2018, accessed March 9 2018, https://support.crunchbase.com/hc/en-us/articles/115010477187-Crunchbase-Rank.

financial services firm Goldman Sachs (CB Rank: 16). By contrast, the top-ranked companies in

Silicon Valley are dabbling with immersive content: Apple, Nvidia and Google appear in the top

fifty. One such company, Cappasity (CB Rank: 314), explicitly mentions VR in their tag:

"Cappasity is a cloud-based platform that lets online stores easily create and deliver 3D, VR and

AR shopping experiences."[21]

The New York VR and immersive technology list is decidedly different. First, these

companies are generally ranked significantly lower, with a median CB Rank of 64,384. The top

firms include marketing firm Uru (CB Rank: 3,888), Venture Capital firm Eniac Ventures (CB

Rank: 3,968), 3D Object distribution platform Sketchfab (CB Rank: 4,161), VR platform for

viewing professional sports LivelikeVR (CB Rank: 4,836) and interactive video platform Eko.

Of these top five, only LivelikeVR focuses primarily on VR. The top twenty companies are

displayed in the table below, along with the industry focus of each:

Company	CB Rank (1/21/2018)	Industry
Uru	3,888	Marketing
Eniac Ventures	3,968	Venture Capital
Sketchfab	4,161	Social Media
Livelike	4,836	Sports
Eko	5,132	Studio
Lampix	6,281	Tech
Drone Racing League	6,607	Drone
IrisVR, Inc.	6,674	Architecture
Littlstar	6,907	Distribution
Woofbert	7,162	Museum

---

[21] Cappasity is a cloud-based platform that lets online stores easily create and deliver 3D, VR and AR shopping experiences.

GeoCV	7,346	Real Estate
Flyby Media	7,514	Social Media
Augmate	7,840	Enterprise
Membit Inc.	9,323	Social Media
EEVO	10,172	Distribution
Texel	11,579	Sports
The Glimpse Group	12,385	Venture Capital
Byond	12,609	Distribution
Vidcode	12,839	Education

Figure 5.7. The top 20 immersive media companies in NYC based on "CB Rank" from

Crunchbase.com.

This list does not include any household names, but does feature a wide array of

industries, ranging from social media to sports to real estate. Hardware, software and services

offered within my larger sampling is illustrated in the following figure:
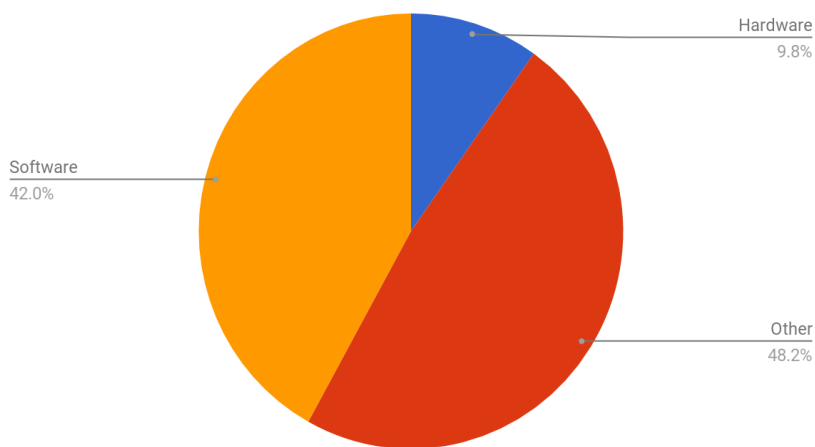

Figure 5.8. Proportion of hardware, software and other services provided by top

immersive media companies in NYC on Crunchbase.com.

Merely 9.8% of companies exclusively focused on hardware. 42% on software

innovations and roughly half provided other services and content.

Exploring Future Reality

On the one hand, specific industries who attend meetups clearly have dominance in NYC. These include VR-Specific venture capital, software development and the arts. On the other hand, there is a large group of enthusiasts exploring all aspects of the technology in the form of startups, which do not have the same cachet as their more entrenched counterparts, as represented in my Crunchbase analysis. However, rather than traveling down separate paths, in practice, these enterprises interact with each other as witnessed at any number of functions that regularly occur throughout New York City.

A detailed description of the annual "Exploring Future Reality" conference, sponsored by the NYC Media Lab, discloses the complexity and depth of relationships. I attended the 2016 public conference, which took place in a large presentation hall at television conglomerate Viacom, located in midtown Manhattan. The talks were later posted on YouTube and the Media Lab published four interrelated articles summarizing the activities. One article described Viacom's location as being "in digitally-saturated Times Square. As nearby LED-billboards continued to loop headlines regarding 'fake campaign news' and 'shockingly real' election results, the first session of the day pondered a 'future reality' that may exist somewhere between the virtual and the physical, lived and imagined worlds" (Avedisian, 2016a).[22]

---

[22] Viacom and the NYC Media Lab have partnered for the last two years to sponsor fellowships between VR artists and the media industry. Their "Viacom VR Fellowship" called for students to rapidly prototype original experiences that tied into their music library. The fellowship partnered students with the small Viacom NEXT team, which is tasked with making immersive content across all the company conglomerates. It was in part responsible for the Open Your Eyes campaign by MTV, which paired traditional artists with VR to make 3D immersive virtual sculptures about major issues in the 2016 election (Di Venuta, 2016).

Describing the Future

The following italicized section is a thick description of my attendance of the Exploring Future Reality Conference in 2016. It also quotes the *Medium* posts about the event.

The Exploring Future Reality conference with about two hundred in attendance brought "faculty researchers and industry experts" together to discuss "the impact of VR/AR on the media and technology industry, including best practices for storytelling, prototyping, and distribution."[23] The event took place in a large Viacom conference room. A speaker's dais dwarfed by a massive screen dominated the room with food service on one side and demos by students from the New School and Columbia Computer Science Professor Steven Feiner's class on the other. Throughout the day, event sponsors gave presentations—Verizon Labs showed their "Envrmnts" platform; Codebreakers, a podcast on technological innovation, passed out T-shirts to new subscribers.

Casual conversation amplified the clamor. Attendees networked; academic luminaries in VR and AR research chatted with media makers and enthusiasts. Debra Anderson, the head (at the time) of the Women in VR New York chapter and CEO of Datavized, a VR data visualization firm that documented VR's history in 360° Video, conversed on one side of the room. In the back stood independent game designer and leader of the local Unity User Group meetup Michael Calvert, who had recently worked on "a VR Jam, which brought together 140 people—80% of which had never used Unity—to create over 30 projects in 48-hours" (Avedisian, 2016b). I exchanged pleasantries with another organizer whose meetups I had attended since their

---

[23] "Exploring Future Reality — NYC Media Lab," NYC Media Lab, accessed March 9, 2018, http://nycmedialab.org/events/2016-exploring-future-reality.

inception early that year. A fan of VR scholarship, he introduced me to a professor in perception

I had wanted to meet, before we were all called to our seats.

       The opening session with representatives from media, university research and VR began.

Led by the host of the APM "Codebreaker" podcast, the panel, whose topic was "What is

Reality?" included professors from Columbia University (Steven Feiner) and NYU (Ken Perlin),

a member of the Viacom NEXT team and Isabelle Bourduas, SVP of a VR Content Studio. They

speculated about the integration of virtual objects and activities into ordinary life, the problems

with empathy and the need for social VR, and concluded by challenging the 2D developers in the

audience to grasp a 3D perspective.

      After a coffee break and brief exchange with an investor skeptical about VR's future, I

returned to my seat. Justin Hendrix, head of the NYC Media Lab, talked about business

initiatives. In a follow-up Medium *post after an announcement by the city to build a $6 Million*

VR/AR lab, he contended that "Virtual and augmented reality applications have the potential to

impact a wide range of industries that are crucial to New York City's economy, including but not

limited to media and entertainment, real estate, education, tourism" (Hendrix, 2016). He touted

NYC's third place listing, just behind Los Angeles and Silicon Valley (Hendrix, 2016), of nearly

4,000 "Virtual Reality" profiles in LinkedIn, the professional social media website, and the

benefits of regional university research into the technology.

      Following his talk, a panel of content creators from digital marketing agencies and

studios, including R/GA, Digitas, Framestore and Ryot spoke about "good content" (Avedisian,

2016c), using examples from their collaborations with "Time Inc., Viacom, NBC Universal, The

New York Times*, Verizon and more… " who composed the very next panel. Directed to non-VR*

experts, Jessica Lauretti (from Ryot) emphasized the differences between filmmaking and 360°

Video production. David Lui (from the Viacom NEXT team) discussed wanting "to work with more people beyond film and game pillars of VR" (Avedisian, 2016c).

After a single-speaker "master class" from Verizon, lunch and demonstrations, the conference reconvened. The first afternoon panel on development involved a diversity of interests and a number of familiar speakers: members of NYU's X-Lab, Michael Calvert and two associates of Mettle, which added 360° capabilities to Adobe Creative Suite for filmmakers. Their advice centered around inclusive development. Calvert advocated the meetup model, unsurprisingly, while the NYU and Mettle representatives underscored international immersive research.

Investment was the theme of the last two panels. After the VR holding company Glimpse Group's DJ Smith spoke, companies both in and outside New York made lightning pitches—Anderson was among them. I left by the cocktail hour when significant networking took place.

There is hardly a column of industries in lockstep leading the VR charge in New York. Instead, larger entertainment companies, such as Viacom and Verizon, are working intimately with universities. They, in turn, employ young studios that specialize in the technology to realize concepts—making them de facto leaders in the budding VR industry. During conferences, meetup groups and smaller companies interface with larger players. Industry leaders, innovators, researchers, and enthusiasts intermingle.

While educational, media and governmental institutions may host the events, they recognize the community of grassroots startups, who are not as optimistic as might be expected. A *Medium* post raised the challenges regarding investment: "There are hardly any daily active users for virtual reality. A lot of the reluctance is due to cost—headsets are expensive, and experiencing the best demos often means paying to attend exclusive conferences in major cities"

(Avedisian, 2016d). The article advocates that openness and prototyping as a potential solution, quoting Natacha Merritt of West Summit Capital, "'We've all come together and realized it's better for everybody to help the community grow and diversify as quickly as possible, and worry about hiding our secrets later.' Remaining open to collaboration will help startup founders move on to the next wave of iteration. Rapid prototyping and seeking fast microinvestments should be leveraged as an advantage, alongside a healthy appetite for risk" (Avedisian, 2016d). Beyond this, mitigating expectations, controlling for VR sickness and fostering more creative content (Avedisian, 2016b) were all other nagging problems impeding VR's success.

A Layout of VR Industries in NYC

As illustrated, there is a complex interplay between the established institutions, startups and individuals all of whom are vying for VR leadership roles in the professional, technological and cultural sectors of New York. The following subsections will first address investment and its relationship to the VR industry in the city and the second will highlight how this affects enthusiasts as they approach the medium.

VR Investment in New York City

VR investment is linked to the current NYC "tech" landscape. The de Blasio administration has stressed the importance of tech as an avenue to new jobs for the middle class, and partnered with educators and companies to make a "Tech Talent Pipeline" for high school graduates.[24] The New York City Economic Development Corporation (NYCEDC) proclaims that

---

[24] "NYC Tech Talent Pipeline," NYC Tech Talent Pipeline, accessed March 9, 2108, http://www.techtalentpipeline.nyc/.

the current tech sector accounts for over 291,000 jobs and has grown 18% over the last decade.[25] Such figures are clearly spouted to illustrate that New York is an appealing center for both tech activity and entrepreneurs.

NYCEDC, the official not-for-profit development corporation for the city follows a long tradition of city-funded public development corporations going back to the 1960s and is run by James Patchett, a former de Blasio chief of staff. It has played a pivotal role in fashioning how tech will develop in the five boroughs. The team promotes competitions and conferences such as NYC BigApps, which is a civic innovation contest to build applications for city life.[26] It also maintains websites about New York City tech such as Digital.nyc[27] and is a key figure in the NYC Media Lab.

Furthermore, the corporation and local government support the transformation of various areas into tech hubs. These include Grand Central Tech, located in a skyscraper next to the Midtown train terminal, which is an accelerator for New York's entrepreneurs;[28] an area in the converted Brooklyn Navy Yard (which has yet to be completed) (Anuta, 2016); and a $250 million center for the industry near Union Square (Harris, 2016). Although the intent of such initiatives is to increase the economic power of the city and create jobs, they are often met with

---

[25] "Creative & Applied Tech | NYCEDC," NYCEDC, accessed March 9, 2018, https://www.nycedc.com/industry/media-emerging-tech.

[26] "NYC BigApps | NYCEDC," NYCEDC, accessed March 9, 2018, https://www.nycedc.com/program/nyc-bigapps.

[27] "Home | Digital.NYC," Digital.NYC, accessed March 9, 2018, http://www.digital.nyc/.

[28] "Mission | Grand Central Tech," Grand Central Tech, accessed March 9, 2018, https://grandcentraltech.com/mission/.

resistance because they reshape the nature of historic districts and neighborhoods, both in terms of real estate values and in displacing longtime residents.[29]

VR and AR have been included with these initiatives. The first set of startups accepted at "Grand Central Tech" in 2015 included Augmate, which makes software for AR devices.[30] Another hub, the Made in NY Media Center by IFP—which partners with NYCEDC—regularly houses and incubates VR startups, and hosts an annual VR Pitch Night; the best VR project wins free membership to the Center.[31] The largest investment from both NYCEDC and the New York City government into the medium's development is a $6 million VR and AR Lab within the Brooklyn Navy Yard Tech Hub. This initiative is a joint project between NYCEDC, the Mayor's Office of Media and Entertainment, New York University's Tandon School of Engineering, and CUNY Lehman College's VR/AR Training Academy and Development Lab.[32] NYU Tandon will be responsible for management and operations of the lab and will rely on the NYC Media Lab for partnerships.[33]

Tasked with the goals of supporting new VR ventures, expanding training in VR development, providing a space for research and building the VR/AR local and corporate

---

[29] For an example to the concerns of residents in building the Union Square Tech Hub, see Litvak, 2018.

[30] "Augmate Corporation | Putting IoT to Work," Augmate, accessed March 9, 2018, https://www.augmate.io/.

[31] "VR Pitch Night: Submit Your Project," Made in NY Media Center, last modified February 15, 2018, accessed March 9, 2018, http://nymediacenter.com/2018/02/vr-pitch-night-submit-your-project/.

[32] "NEW YORK WORKS: NYCEDC AND MOME RELEASE PLAN FOR VR/AR LAB, OVER 500 NEW VR/AR JOBS," NYU Tandon School of Engineering, last modified June 27, 2017, accessed March 9, 2018, http://engineering.nyu.edu/press-releases/2017/06/27/new-york-works-nycedc-mome-release-plan-vrar-lab-over-500-new-vrar-jobs.

[33] "NEW YORK WORKS: NYCEDC AND MOME RELEASE PLAN FOR VR/AR LAB, OVER 500 NEW VR/AR JOBS," NYU Tandon School of Engineering, last modified June 27, 2017, accessed March 9, 2018, http://engineering.nyu.edu/press-releases/2017/06/27/new-york-works-nycedc-mome-release-plan-vrar-lab-over-500-new-vrar-jobs.

community, the lab clearly manifests government's belief that the sector will increase local jobs.

Despite opposition to such hubs by local residents, in a press release for the lab, the NYCEDC

president vowed: "By fostering the industry's growth with a central hub, we can support startups,

fuel innovation, and connect New Yorkers to the training and opportunities they need to access

good jobs."[34] Promotional material from the NYCEDC further brags that VR/AR positions have

grown 750% from 2012 to 2016 inside The City and $26 million has been invested in NYC

VR/AR startups in 2016 alone.[35]

Such enthusiastic promotion by the government is a result of the general rise of startups

within the New York economy. One article found that The City was the most highly-funded

region in the third quarter of 2017, slightly outpacing San Francisco with $4.227 billion from

venture capital (Peterson, 2017). However, New York tech companies are not localized around

hardware innovation. Instead, they represent an array of industries and professions. These

include "fintech" and "edtech." An industry report found that New York City educational

technology companies received $567 million in funding between 2008 and 2014 (Khilko &

Matsumoto, 2015), while financial technology companies received $464.3 million in 2014

(Marks, 2015).

Despite investment by the NYCEDC, VR is not a major presence in startup culture.

Community website *Built in NYC*'s annual lists of new companies to watch in 2017 (Majewski,

2017) and 2018 (Warren, 2018) only mention one VR startup: the streaming service Littlstar,

---

[34] "NEW YORK WORKS: NYCEDC AND MOME RELEASE PLAN FOR VR/AR LAB, OVER 500 NEW VR/AR JOBS," NYU Tandon School of Engineering, last modified June 27, 2017, accessed March 9, 2018, http://engineering.nyu.edu/press-releases/2017/06/27/new-york-works-nycedc-mome-release-plan-vrar-lab-over-500-new-vrar-jobs.

[35] "New York Works Industry Spotlight: Creating Good Jobs in VR/AR," NYCEDC, accessed March 9, 2018, https://www.nycedc.com/sites/default/files/filemanager/Resources/Economic_Data/New_York_Works_Industry_Spotlight/New_York_Works_Industry_Spotlight_-_VR-AR.pdf.

which is described in the article as the "YouTube, Hulu and Netflix of virtual reality" (Majewski, 2017). Other startups, however, include Juno, a ride sharing service similar to Uber and Stash, a fintech platform for micro-investing. Similar hype has persisted around Manhattan as a hub for "Insuretech" which provides novel platforms for the insurance industry (Barzilay, 2017).

VR/AR innovation instead emanates more from the universities and colleges. NYU's role is significant when it comes to VR. In addition to running The City's forthcoming lab, it cossets avid and longtime promoters such as Ken Perlin, professor of Computer Science and head of the NYU Future Reality Lab, which assumes a future where all computation will be done through VR/AR glasses.[36] The lab also employs Michael Gold as an Entrepreneur in Residence. Perlin, Gold and David Lobser, another NYU alumnus, not only regularly host their own meetup at the lab, but also have founded the company "Holojam Inc." for making immersive multiplayer VR experiences.

NYU-X, another lab housed in the nursing school, has received a NSF grant to make a full room immersive computer environment. Perlin collaborates on this project along with professors in informatics, music technology, digital media and learning sciences, among others. He is also a member of the Media and Games Network (or MAGNET) which houses the Game Studies program at NYU with its VR lab led by Javier Molina.[37]

Other NYC university research institutions have done meaningful work in immersive technology. Columbia University's Steven Feiner, a professor of Computer Science, has spent

---

[36] "Future Reality Lab — Where the Future is Happening Now," Future Reality Lab, accessed March 9, 2018, http://frl.nyu.edu/.

[37] "About — To Be With Hamlet," To Be With Hamlet, accessed March 9, 2018, http://hamletvr.org/about/. Other departments around NYU also experiment heavily with new innovations. The Interactive Telecommunications Program in particular has acted as an incubator for novel uses of technology, particularly in the Arts. See "ITP and IMA," NYU, accessed March 11, 2018, https://tisch.nyu.edu/itp.

decades working in Augmented Reality. Feiner sits on the board of AR startup Meta,[38] which

launched from the school. Many businesses either enlist faculty and students or come out of local

universities. The NYC Media Lab sponsors a number of important companies explicitly

connected to education including Medivis, whose founders were researchers at the NYU Medical

Center (Hendrix, 2017).

Partnerships between technology, education and industry certainly exist beyond VR/AR.

The investment firm Two Sigma will be operating a space for "students, startups, and established

tech companies" at the Cornell Tech Campus on Roosevelt Island with the goal of reviving the

"Bell Labs" experience where a mixture of research, entrepreneurship and education, like the

famous facility in New Jersey, will spur a revolution in computing (Reader, 2017).[39]

Much of the investment that comes to VR stems from a combination of education, local

government and media. Take for example the Verizon Connected Futures Challenge.[40] This

initiative, sponsored by the NYC Media Lab, is a collaboration between the lab and media giant

Verizon. In 2017, they backed the development of 12 team projects, all of which hailed from

different city universities including Columbia, NYU, Pratt, and the School of Visual Arts. The

Verizon Envrmnt team, which develops immersive content for clients including *Cosmopolitan*,

Elle and *Sports Illustrated*, then managed and shepherded the teams through the development

process.

---

[38] "Meta | About Us," Meta, accessed March 9, 2018, http://www.metavision.com/about.

[39] The original Bell Labs was responsible for, among other things the transistor, the laser, Unix operating system and C computer language.

[40] "Verizon Connected Futures III," NYC Media Lab, accessed March 9, 2018, http://nycmedialab.org/verizon-challenge-2017-2018/.

Beyond leadership, Verizon Ventures, the corporation's venture capital wing, invested in New Zealand-based 8i, a developer of 3D hologram technology.[41] 8i is also financed by TimeWarner, which has funded quite a few VR companies including location-based entertainment company Dreamscape Immersive and 360° live video producer NextVR, both located in California.[42] This reflects another important fact: capital flows from both coasts, across the country and internationally. Local VR streaming service Littlstar is stereotypical. Initial investments came from the Disney Accelerator in Los Angeles, and Techstars, which has offices in New York, but originated in Boulder, Colorado. Later, City investors, specifically 645 Ventures and A+E Networks, made capital contributions.[43]

Despite this, major venture capital firms investing in VR are not headquartered in New York. In an analysis by CB Insights, nine firms, Rothenberg Ventures (San Francisco), BoostVC (Silicon Valley), Vive X (San Francisco and International), The Venture Reality Fund (San Francisco), Presence Capital (San Francisco), Techstars (Boulder), Colopl Next (Japan), Intel Capital (San Francisco) and Y Combinator (Silicon Valley) invested most heavily in VR. The listed companies, in which they are invested, with one or two exceptions, are based outside of The City as well.[44]

---

[41] "Portfolio of Innovation | Portfolio | Verizon Ventures," Verizon Ventures, accessed March 9, 2018, http://www.verizonventures.com/portfolio/.

[42] "Time Warner Investments | Time Warner Inc.," Time Warner, last modified December 20, 2017, accessed March 9, 2018, http://www.timewarner.com/company/time-warner-investments.

[43] See investment stages at Crunchbase: "Littlstar | Crunchbase," Crunchbase, accessed March 9, 2018, https://www.crunchbase.com/organization/little-star-media--inc#section-investors.

[44] "The Most Active Investors In Augmented/Virtual Reality And Their Companies In One Infographic," CB Insights, last modified June 1, 2017, accessed March 9, 2018, https://www.cbinsights.com/research/active-arvr-investors-infographic/.

This isn't to say that New York venture capitalists aren't interested in digital technology. Companies like Union Square Ventures have impressive portfolios. The company has stakes in sound-sharing application SoundCloud, education platform Duolingo, social media application Foursquare, Meetup.com, and perhaps most famous of all, Twitter. However, it has not subsidized VR or other immersive technology as of this writing. A *Medium* article highlights some of the companies enriched by New York investors. Among them is everything from NYC-based gym application ClassPass to glasses company Warby Parker and food service Blue Apron (Garbarino, 2017). The post does note the loyalty of New York investors to local startups, but makes no mention of immersive media. In such a complex and rich environment, it seems that it is just one option of many.

Another sphere of West Coast influence is major "tech giants" such as Google and Microsoft, which have opened up large office complexes in New York. Microsoft has a center near Times Square[45] and its own space in Grand Central Tech.[46] Google has headquarters in Chelsea (Bagli, 2018) which includes a separate YouTube creator studio.[47] All four of these locations, by accommodating contests and meetups, offer a place to connect with West Coast developers and investors. However, it is rare to encounter hardware makers from these companies. Instead, events sponsored in main offices support filmmakers, artists or developers.

Investment in New York, while enthusiastic, does not match the largesse of the West Coast. Furthermore, it issues from a commingling of educational, local governmental and media

---

[45] "Microsoft Technology Center - New York," Microsoft, accessed March 9, 2018, https://www.microsoft.com/en-us/mtc/locations/new-york.aspx.

[46] "The Hub @ Grand Central Tech," Microsoft, accessed March 9, 2018, https://blogs.microsoft.com/newyork/tag/the-hub-grand-central-tech/.

[47] "YouTube Space - New York Location," YouTube Creators, accessed March 9, 2018, https://www.youtube.com/intl/vi/yt/space/newyork/location.html.

sources, all of whom view the development of VR as part and parcel of a growing New York economy.

VR Work within New York

When it comes to VR adoption in The City, most enthusiasts work within a very specific set of industries, each of which carries significant sway in the local economy. It is easier to find work within these existing industries—namely journalism, advertising and filmmaking—than to garner the resources and freedom to experiment with the technology. Furthermore, the local business environment in general demands quicker returns on investment than in Silicon Valley. This does not preclude startups from producing novel content, but they must navigate with tighter margins, higher rents and with the explicit support of agencies like the NYC Media Lab or the state and city governments to pursue their work. Such a labor model favors established industries, which deploy an army of freelance developers to flourish.

Media producers in fields like journalism, advertising and film neither care to realize the potential of this technology from the ground up, nor are they enmeshed in the cyberculture of the West Coast. Instead they desire to fit immersive media into their own businesses. Their vision is very much a pragmatic one. In an interview with Marcelle Hopkins, who worked on making 360° Videos every day for a year for *The New York Times*, the takeaways were industry-focused and included the importance of location, the difficulty in doing traditional profiles of newsworthy characters, the importance of context and, ultimately, that while a helpful learning experience, daily VR was something the *Times* would not continue in the future (Willens, 2017).

NYC's artistic culture includes among its members freelance producers in television, filmmakers and independent game designers. Creative industries drive the urban (Currid, 2008) and tech economy (Neff, 2004). However, as Milkman & Ott (2014) acknowledge, precarious

labor is common in all strata of New York society and devote a whole section of their thirteen case studies of labor movements in The City to gig and freelance workers.

And what of the game industry? It was absent in the discussions surrounding investment in New York City VR. When it comes to gaming, there are few major studios with footholds in New York. Instead, the scene is "Indie," and led by artists and smaller studios. The NYU Game Center, a hub for game development in The City, accedes to this. Its "About" page describes a community brimming with university-sponsored "Indie Tech Talks," where independent developers can display work; the "East Coast's IndieCade Festival," which highlights "the biggest names in independent games;" and the International Game Developers Association (IGDA).[48] It makes little mention of the AAA industry.[49] Many indie game designers work explicitly on assignment, with the expectation of being contracted for their diverse set of creative and practical skills.[50]

Not yet discussed are VR arcades. Because of their exclusive focus on VR, they face their own challenges such as the high cost and scarcity of large commercial spaces. Quite a few have been unable to find stable locations. Jump into the Light has moved three times since its founding in 2016, and presently occupies a two-floor space that is part of the Hotel Indigo. VRBar also relocated frequently. These companies must attract an abundance of customers to earn enough to cover rent in the exorbitantly expensive New York real estate market.

---

[48] "The New York City Games Community," NYU Game Center, accessed March 9, 2018, http://gamecenter.nyu.edu/about/new-york-city-games-community/.

[49] It briefly mentions the local AAA studio Avalanche, which describes itself as independent: See "Avalanche Sutdios | Home," Avalanche Studios, accessed March 9, 2018, http://avalanchestudios.com/.

[50] Duffy (2017) describes this as a larger trend in the current economic environment (p. 10).

The enthusiast scene on the West Coast is quite different. I remember during one meetup a wistful participant described how a movie studio had given his friend a 360° camera rig, at the time worth at least $10,000, to "mess with." A similar situation, he conjectured, just couldn't happen here. Instead, the environment is more tightfisted. One organizer told me that he advises companies when acting as a consultant to "feed the geek. Just give 'em a corporate credit card and then go buy whatever they need…" but then mused about the absence of this in New York: "One thing that companies, many companies still haven't figured out… how to do that, kind of, just creative technology play."

New York City's Challenges and Opportunities from Adopters' Perspectives

This is the environment in which New York City's early adopters find themselves. Beholden to established industries and their conventional thinking, how do they come to and adopt a nationally promoted novel technology?

The City itself affects adoption in both simple and profound ways. Only a few months into my study, I started to investigate what head-mounted display I might purchase both for learning development and making content. There were already a number of options available and I knew that my primary one—an iPhone—restricted what I could make. Like many others, I was interested in "Room Scale" VR which allows the user to navigate around a space. I looked into the cost and realized that with a bit of belt-tightening I could afford a device in the $800 range. However, I then ran into an immediate dilemma: I had no room for the device in my Queens apartment, which was only about 650 square feet in area. I even took out a ruler and attempted to measure how it might fit if I rearranged the furniture. I moved the coffee table into the little hallway between the kitchen/living room and the study/bedroom… no, that did not work. With the stands necessary to get the "Light Houses" for room scanning, I would have less than a

square foot of movement—hardly worth it. I could drill them into the wall, but it would only give me a few inches before I started walking into the couch. Ultimately, I settled on purchasing a smartphone—a Samsung Galaxy S6 which was compatible with the "Gear VR" headset. It didn't have the same graphic fidelity or freedom, but had to do. Without a doubt, this purchase had significant effects on my development trajectory. I had to consider the limitations of the technology, which were severe. The project I initially wanted to work on—a graffiti painting app—shifted to a more static virtual recreation of the graffiti mecca 5Pointz in Long Island City.[51] In other words, bounded by both economic and geographic concerns, I had to change the very way I adopted.

My experience was not extraordinary. Many of the interviewees had to balance purchases of equipment with rent, or find office space to fit gear, or simply had no room to experiment at all. For them, the city constricted the development of content for VR and other immersive technologies. Based on my interviews with enthusiasts and developers, I identified a number of city-specific advantages and disadvantages.

Advantages of New York City

The advantages of New York City for adopters were mostly based on enduring assumptions about the metropolis: it was a world cultural and financial center; a city teeming with diverse professions and interests; and finally an environment where the arts have and will continue to exist in tandem with emerging media.

---

[51] This will be discussed in more detail in Chapter Nine.

NYC as a Cultural Hub. Although enthusiasts convened within New York City, many of them were not residents. Interviewees came to meetups from around the tri-state area, the country and the globe to learn more about VR.

One member of my lab commuted weekly from DC. "I think a year ago was when I started going to DCVR - DC Virtual Reality meetup—and… I wasn't seeing a lot of people focused on film or an art application. It was more enterprise and games, which is great and consistent with the industry trends… [but] It was different if you were trying to learn." She then saw a post of a New York VR lab on the Women in VR Facebook group. She would regularly go to the Facebook group to keep up not only with industry trends, but also the many companies and names signed up to the page. She stated that there were "900 names of people who are either in VR or interested in VR who are open and willing to talk to you or at least field an email from you…" It was here where someone posted: "Hey, this lab is looking for some more people." She proceeded to take the train to New York each weekend, normally the time when she would see her long-distance boyfriend, to learn VR. She added that her boyfriend, who she met during a startup event in DC, had always been supportive of the decision and there had been no question of her ever having to choose between him and the lab. The latter always came first.

 She was not alone. One interviewee discovered VR meetups in New York while traveling with his family to New York City from India. "And so I decided, let me just go there and see what is happening, feel the pulse of the industry, virtual reality in terms of the creative people, the filmmakers, and the big studios." From his perspective, New York provided a diversity of meetups compared to India: "I was pleasantly surprised, because the kind of meetups which are happening in New York for Unity, for Virtual Reality, for Augmented Reality… you name it and there is a specialized group just for that."

Still another came to VR haphazardly. After arriving in New York to run a media company building "apps and websites," he stumbled upon a startup doing virtual tours. He brought the idea to the company he was managing where it was rejected, but thought it would have application back home in Melbourne, Australia. His plan was to bring the technology back with him and become the de facto retailer in the area: "If there's some sort of cool new technology and Australia hasn't seen it yet, I feel like, well hey, I want to be the dude to bring it… I would love to start meetups down there in Melbourne… Underlying, it would be as a business development tool to get my own company's name out there as a company that's in this space, and for producing content."

Many attendees traveled to the city in order to gain access to information about VR unattainable where they lived. One meetup organizer started his meetup specifically in Manhattan, as opposed to his home town in Connecticut: "In New York… you don't have to try that hard to get people to come. You still have to have content and all the rest of it, but getting people to come is a lot easier just because of there's so many people. In a place like Connecticut you really have to work hard, and even then sometimes there's not enough people around." While their own towns might be relative technological deserts, New York City and specifically its meetups were oases where these nomads share interests, network with others, and get exposure to evolving equipment. He added, "In New York, it's all community. It's actually really cool to see, and very different."

Meetups served as the de facto entryway to the larger industry. New York City was the destination where enthusiasts needed to travel in order to discover the technology, find industry practitioners and ultimately (potentially) spread the technology to their own home towns.

NYC as a Site of Opportunity. New York was considered a professional and personal land of opportunity beyond a geographic hub. Interviewees reiterated versions of an old adage, explicitly stated by one interviewee: "But in my experience… it's harder to be a startup in New York City because it is a market that does not suffer fools lightly… But the truth is, if you can make it here you can basically make it anywhere."

The presumption was that in order to "make it" in New York was challenging, but accomplishment deeply rewarding. If one could overcome the financial hurdles, create a product rapidly and get a quick return on investment, they could find success. The same interviewee compared the startup cultures of New York and the Bay Area: "New York startups tend to be concrete, very quick. Bay Area startups wander about in the woods, get some incubator money, figure out target fit… before they start actually building a real business."

However, few interviewees came to New York explicitly to "make it" in VR. Instead, most had been settled in existing industries. They saw their previous expertise as a leg up in finding opportunity. A tour guide who I interviewed in meetups in 2016 stated that her years of experience were actually what drove her to explore AR. "In the tourism industry, a lot of people… [think] they create an app, and the app is going to be successful. But… they don't know… psychology." Tours, she went on to say, have "so many moving parts… I'm coming into the [tourism] industry with this knowledge specifically. I'm not like moving into VR."

NYC as City of Diversity. New York is more open-minded and tolerant, both professionally and socially, than other hubs of innovation. A number thought the intermixing of professions as being an asset to VR's development in the city: "… New York is not a one industry town. It's not Hollywood. It's not Silicon Valley, which is all tech… it's the most diverse town in terms of industries. And so, I think it brings a level-headedness." This is reflected in the

robust support of non-white and non-male groups in the city generally. "[I]n New York I notice that the people who are working in VR, in emerging technology are a wide array of backgrounds, a wide array of ethnicit[ies], a wide array of genders. And when I say a wide array of genders I mean men and women and everything in between. Because that's what is attracting people to this media right now. We can tell stories in these weird ass ways." While Silicon Valley and indeed the industry in general might be predominantly male, New York offered more ingress to women and other minorities.

In contrast to the West Coast, New York City was not considered a place where significant expertise in VR existed. Enthusiasts didn't need to have a professional background in the medium in order to find success within the local labor market, but could learn along the way. An interviewee compared the environment to Los Angeles, which is shaped by its own indigenous industries: "[T]he LA stuff is all built up already. So, there is a lot of people, already established… Whereas, New York, since it's building up, I see it as a good development point and a good place to stand out for people… who are trying to break into this without all that experience that would technically be needed sometimes, though with a fresh perspective."

Proficiency in VR was viewed as a way to bolster one's resume in other industries. One interviewee, for instance saw VR as a means of finally realizing his dream of entering into film: "I had my evangelical experience with VR. And I decided, 'Oh God, I absolutely have to be a part of this…' So, I tried to figure out what my niche could be because I had very limited skills at that time… I thought, 'Well, what work is being done on scriptwriting?' And I literally could not find anything on it being done…" Particularly in these early stages, he saw it as a way of taking him eventually to Los Angeles. Engaging with VR in New York not only allowed professional cross-pollination and surmounting social siloes, but also the possibility to dominate a particular

longstanding industry niche, such as advertising, journalism, or fashion. As one informant, in reference to journalism, said "doing this sort of immersive tech has some opportunities here, if only for purely practical reasons, like every major newspaper is pretty much on the East Coast, if not in New York… Similarly, you have Viacom here, you have A&E here, all these TV networks that are putting money into this, so I can see that entering into those spaces is being a little bit easier, a little bit more funded… than say being in Hollywood and doing the same thing."

NYC as a Space for Artists. Another major theme that emerged from interviews was the unique situation for artists within The City. Given the size of the creative community, interviewees conjectured that development and content creation within New York City would be more dynamic and inventive than other locales, though such assumptions are almost impossible to prove. There was an impression that New Yorkers were more inventive with the technology in general. While other places were renowned for gaming, creativity engendered by New York artists was a force in itself. One interviewee, an artist in his own right, predicted that the future of VR was as a creative tool rather than a medium for entertainment: "But, specifically designing VR in VR is actually some of the most gratifying experience. So, when I want to tell a story… I'm… able to tell the story in this kind of great, spontaneous, wonderful, kind of, vibrant way that this new technology gives me."

The ingenuity of artists in the city was seen as an asset in advancing the medium and pushing it to the mainstream: "There's that kind of creativity… I think that that's where the interesting breakthroughs are gonna happen… because everyone's saying, what's… going to be the gateway experience to VR… don't know which metaphor you use… the *Citizen Kane* or

even… *Pokemon Go*… but I think in New York you have this combination of… different elements with the arts and the storytelling [to find it]."

Challenges to VR Development in New York City

While there are positives, the city possesses distinct challenges for entry into VR. These primarily surround the costs of access to hardware and the funds needed to sustain innovative work with the medium.

NYC and Cost. New York City's cost of living is a major hurdle for enthusiasts. Paying escalating rents, sustaining a VR business and finding space to do work were shared concerns for advancing one's career. It is easy to get held back by the practicality of making rent, "I think that people want to have access to equipment, but… a lot of people don't allocate their income towards acquiring certain goods because so much is taken out of everybody's regular life towards rent and commuting costs…" This was a pronounced issue for artists and startups. In contrast, for those in more established industries dabbling with VR, this was less of an obstacle.

However, they expressed frustration with the sluggish movement of businesses to explore VR and a lack of encouragement from the companies that sustained their livelihoods. A group of architects vented about the hesitancy of architecture and real estate firms in New York to embrace new technologies. They described NYC architecture firms as "well behind" their national and international counterparts technologically despite the broader adoption of the Revit software system.[52] "Here it's still 2D. Even if they are using 3D, it's sort of older 3D software… … Stuff that's … [f]ine if it works for you, but it's definitely time to [at least build in 3D]" Since

---

[52] "Revit Family | BIM Software | Autodesk," Autodesk, accessed March 9, 2018, https://www.autodesk.com/products/revit-family/overview.

their interest in the medium primarily stemmed from their own occupational background, the likelihood of such professionals to abandon their careers to start new ones in immersive media was low.

There was a slight difference between the perspective of artists and business-oriented adopters. For artists, the challenge of entry into VR emanated from endemic issues with New York City—that it no longer supported creatives with its high rental costs and increased gentrification. As one artist/labmate related, "Last fall I went up to Portland [Oregon]… [and] stayed in this place called Xhurch which [is] this kind of art squat… They bought two Vives and a motion capture suit and had a bunch of speakers and analog [synthesizers]… just general heaven… I did have a moment where I was like, 'Shit, should I move to Portland?'" He speculated this was because of cost: "When you don't have to worry about the real estate then getting Vives becomes something that's feasible." This afforded freedom to Portland artists: "[I]t might just be that Portland folks have more affordances to play whereas us, it's like sell out or die."

NYC and Access. Generally, in New York City, accessibility to equipment and industry is problematic. One member of a meetup I attended constantly updated attendees on his slow transition to upstate. One of the greatest advantages of the move, for him, was the acquisition of a space that he could devote to Room Scale VR. He expounded on how he converted an anterior garage and spent hours with the device. Inside the city, this wasn't an option. Another interviewee described his own situation: "[I]t's harder in New York with the space issue, so I am kind of waiting till I freelance and ever since I came back from having a kid… I haven't been as steadily as employed as I would like to be, so once I am… then I can… bring [VR] home and say honey we are putting this in our apartment."

Adequate space for equipment was not solely a personal issue, but also a business one. The struggles of arcades, such as Jump Into the Light and VRBar testify to this reality. This may, in some ways, explain why so many enthusiasts travel into New York City, rather than live there. Lack of access to technology is burdensome. While standard devices are easy enough to get, it is more laborious to find specialized equipment, such as treadmills for larger VR projects.

These issues pale in comparison to the search for talent and experts. An interviewee, who was starting a company focused on immersive technology and fashion, spoke to me numerous times about how difficult it was to find talent within New York City. In our formal interview, he stated: "So I think the more I familiarize myself with the gaming industry, the more I realize that the people who work in the gaming industry want to work in games. So the challenge of them coming over into… professional VR… is going to be I don't want to say impossible because obviously there are people… making that transition, but… most people who work in games, especially AAA games want to work in games, right?" Along with the dearth of expertise was a general perception that the city was not a tech hub and California and the West Coast were the headquarters of the biggest players. As one meetup organizer said, "every other good developer would go to Cali… Where the pay is better… And the weather is better. Why would you ever stay in New York?" This was echoed by one interviewee who had moved from San Francisco to New York to start her own company. Generally positive about New York's artistry, she still demurred: "I think a lot of [content creators] were artists first. I do think that the content coming out of New York is amazing in terms of VR films and documentaries, capturing content. Where in [San Francisco]… I think the more impressive stuff have been the games, honestly. So, I think here there is a more artsy vibe."

Whether looking for a mentor with years of experience in the industry to help build a business, or competent developers to troubleshoot problems, there was a belief that neither reside in New York. This is exemplified in a common scene at meetups. In a majority, where announcements are allowed, inevitably someone, sometimes from the same company, again and again, stands up and asks if there are any Unity Developers available to work on a temporary project.

NYC and Lack of Investment. When it came to venture capital, there was a fraction of the investment in the technology that there was on the West Coast. One interviewee, the head of an investment meetup, expressed concern over the state of financing "It's hard in New York," he said, adding that there were roughly half the VR-focused companies here than in San Francisco. Later in the interview he added, "And then there's the VCs… they don't make any big bets, nothing in VR."

There are fewer startups in NYC heavily investing in VR compared to counterparts on the West Coast. The types of investment popular in the city are not dedicated to these sorts of innovations, but instead work within the confines of industries that have already found success within the city. Another interviewee summed up the general belief when he said "[I]n New York, what's missing is access to capital for venture capital… West Coast… kingmakers haven't really looked at any opportunities from New York… [T]heir money is showing up in LA."

Conclusions

There are advantages and challenges in pursuing VR and immersive development in New York. A coterie of industries is deeply-rooted in the city—a truism that can be found in any major city worldwide. An adopter of new technology must accede to the goals and philosophies of these prominent industries. New York's avenues for experimentation with new technology are

narrow. Most VR adopters do not have the support, freedom and expertise to start ventures. Instead, they are in the employ of the city's established professions, such as journalism, television media, advertising, fashion, education and web development. Rather than breaking away from their occupations, they seek success within them. This is not to say that the constraints of industry on VR companies in New York negatively impact the quality or creativity of their output. Local industry delimits and sets the rules by which startups and early content creators must work, imagine creating for and ultimately produce content.

Restraints on creativity ultimately weigh on adopters. According to my interviews, many viewed The City as at once a land of opportunity and a technical wasteland. As long as an adopter was passionate about their profession *and* VR, they could find a way to make it, though finding the talent, investment and space to endure in New York was arduous. Still, in many cases, desire was not enough. Professional and industry constraints prevailed. In order to find success in VR alone, many would need to head West, where hardware and software development is much more favorable.

New York is not unique. Every locale has implicit industry restrictions. In Silicon Valley, tech giants and hardware manufacturers dictate the forms and areas of experimentation. In Los Angeles, the film industry predominates. Montreal is also delimited by its own industries. One transplant, who had been involved in the VR scene in Austin, described it as such: "Montreal is a great city for game development, you've got great talent here, great pipelines to the big studios and the game design schools, there's tons of big studios here but if you want to market your game, you've got to leave Montreal because it's not happening here." When it came to VR development, the city had deaf ears. "The VR scene in Montreal is almost non-existent, very, very small." The notion that indigenous industry inhibits the practices of adopters can be more

broadly applied. That adoption is shaped by power brokers within a geographical area is

universal.

CHAPTER 6: MEETUPS AS SITES OF VR ADOPTION

"My friends thought I was crazy—I didn't think I was crazy—but they just weren't as interested, not nearly as interested as me, and they didn't want to hear me talk about [VR] forever and ever. You know, you talk to somebody and they start to act like they're dozing off… That's how it was when I talked to anybody who was not part of the Meetup."

For this devotee, the Meetup was an "outlet for me to get all these crazy ideas out of my head and talk to people who were as crazy as I am." Meetups make sense in a city upon which EB White (1949) bestows the "queer prizes" of loneliness and privacy, where "the residents of Manhattan are to a large extent strangers who have pulled up stakes somewhere and come to town seeking sanctuary or fulfillment or some greater or less grail." Meetups, organized through the Internet, coordinate and bring "strangers" with common interests together at designated locations.

Their importance for this research lies in their enthusiasm. The meetup is the ideal place to identify supporters, find out how and why they organize, and work out common understandings about shared pursuits.

This chapter scrutinizes meetups as sites of VR adoption. First, it defines meetups and situates them within the broader Communications literature. Within this body of work are studies of "Quantified Self" affinity groups. The Quantified Self movement is a loose conglomeration of followers who promote "lifelogging," in which digital technology is employed to collect quantitative data on everyday activities in the belief that it will improve physical and mental health. Started by *Wired* contributors Gary Wolf and Kevin Kelly, the movement took shape in meetups on the West Coast.[1] Research in the movement found that meetups were used as a way to propagate common concepts of the technology (Choe, Lee, Lee, Pratt, & Kientz, 2014) and

---

[1] "Quantified Self," Antephase, accessed March 8, 2018, http://antephase.com/quantifiedself.

labor practices surrounding the community (Till, 2014), primarily through the sharing of personal narratives (Butterfield, 2012).

The essential draw for a meetup is that it is amicable and supportive as well as informative. Its main activity is the playful development of VR, illustrating Duffy's ideas of aspirational labor and the concept of Playbor, both of which erode the artificial boundaries between productivity and non-productive play. Meetups are for the giving of gifts (Mauss, 2000) or expenditure (Bataille, 1991), as opposed to marketplaces which are the privileged sites of capitalist life. They advance the medium through the efforts of uncompensated and passionate users.

What are Meetups?

Meetup.com began in 2002 shortly after the deflation of the Internet bubble. Its founding was somewhat centered around making connections in New York City: "It was after September 11, and people seemed suddenly aware of each other. There was a yearning for community" (Jeffries, 2011). Meetup found success fairly quickly. Jeffries continues, "Meetup scoured the Internet for groups–Yahoo groups, blogs (they were called 'weblogs' back then) for pug lovers, beer lovers, Wiccans, hockey moms, the works. They sent out emails notifying these groups of an upcoming made-up holiday–International Pug Lovers Meetup Day and International Witches Meetup Day, for example–and instructed them to go to the website to find out where to meet in their cities. 'We got back a very enthusiastic response… '"

Meetup's most famous and formative moment involved politics, specifically when it was used to galvanize supporters for the Howard Dean presidential campaign. As Jeffries (2011) put it, the campaign's patronage of meetups garnered the Democrat praise for "pioneering the use of the Internet for grassroots political organizing. The deluge of press won Meetup national

attention." Kreiss' (2012) analysis of the use of meetups by the Dean campaign not only details the symbiotic relationship between attendees and the nominee's political infrastructure, but also recognizes the difficulty in defining this relationship: "Meetups were a particularly vexing new aspect of campaigning, given that these self-organized supporter meetings cut across so many domains of campaign practice and organizational activity" (p. 52). Kreiss writes that many Dean staffers saw the potential "revolutionary power of online communities" (p. 57) and imagined them to have embedded notions of "self organizing"(p. 57). Similarly, Armstrong (2007) focused on the meetup's influence on the campaign, rather than its lasting influence in politics.

In the early literature there were no long-term studies of the generative effects of meetups on users.[2] But by now, some meetups have persisted year-on-year for almost a decade. The oldest immersive meetup in New York—Augmented Reality New York (ARNY)—has run continuously since 2009. As a consequence, while scholars have recognized that meetups germinate ideas, understanding how those ideas foment over time and diffuse beyond narrow communities, remains conspicuously absent.

However, research into the relationship between meetups and the Quantified Self movement do provide some insight into idea formation and diffusion. One article, primarily analyzing the Bay Area Quantified Self meetup group, concluded that meetups bolstered the movement and specifically gave room for personal stories (Butterfield, 2012, p. 14) through a "show and tell" model of speakers. QS enthusiasts "present novel ways they develop to track, analyse and interpret their bodies, moods and other aspects of their lives" (Till, 2014, p. 447). Similarly, I found the VR meetups I attended provide a structure for enthusiasts to discuss and promote specific ideas about VR through personal stories and showing off of their products.

---

[2] Subsequent studies such as Lai (2014) are focused primarily on longitudinal studies of 18 months.

These studies too are short-sighted. They neither take an extended view of idea formation within the Quantified Self movement, nor take account of the personal experience of attending meetups. Chih-Hui Lai (2013, 2014), who has produced significant work on meetups over time, recognizes that the ecology of the meetup and in particular the "group age," "profit orientation," "experience of leadership" and "external ties" have major effects on the community (Lai, 2014, p. 839). Lai is focused on the efforts to sustain such associations, but less on industry influence and the personal experience of attendees.

The literature reveals some common features of meetups: They are built around particular affinities. The meetings usually are highly personal. Attendee narratives facilitate the understanding of new technologies. They are sites for self—and product—promotion, for networking and for the evolution of ideas. Attendees disseminate concepts either through collaborations with fellow meetup members or by integrating them into their own circles. Whether the meetups are sponsored by Meetup.com, Eventbrite or Patreon, they share a similar ethos.[3]

Furthermore, VR meetups comprise a network of interrelated evening activities which many of the developers in my study attended. Most were connected to multiple meetup groups. The interplay in this network constitutes a microcosm of the diffusion process: businesses market their wares; enthusiasts network, socialize and find potential work in VR; and ideas coalesce and codify around the technology, its potential and future.

---

[3] Furthermore, this ethos extends beyond the meetup organization. The recent acquisition of Meetup by New York startup WeWork (Hempel, 2017) precipitated a few local VR meetups to pull from the site, but to continue to host meetings under other websites, such as Patreon.

A Who, What, Where, When, Why and How of VR Meetups

Not all meetups dwell on politics or new technologies, despite the leanings of the academic literature. Meetups serve all sorts of purposes. In New York, for instance, there is a local "Corgi Meetup" where owners and their pets meet monthly in different parks. There was a short-lived Bike and Beer meetup, which organized rides to breweries in the area. However, as I began attending meetups for VR, I quickly discerned fairly predictable patterns.

As mentioned earlier, New York City's VR meetups are interconnected. Many of the same attendees travel between them. A number of the most connected participants have started groups of their own around niche interests or to fill voids in the network. When doing this, they model their meetups after those they attend and thus perpetuate a recognizable pattern.

Answers to the "Five W's" (and one How) of journalism provide a holistic view of VR meetups, a "sense" of what occurs and the commitment of attendees. For each subsection, I will provide a short thick description in italics.

Who Attends Meetups

Over the last two years, while it has grown in size and stature, most sessions of MEETUP VR remain the same. The group convenes at Microsoft's headquarters, located across the street from the Port Authority Bus Terminal. Approaching the building usually involves scurrying through crowds of countless commuters on their way home. After receiving a badge and passing through security, attendees head to a large conference room, which is cavernous and completely bathed in the hazy, sometimes off-putting glow of office lights. Row after row of around 200 chairs oriented toward the speaker's podium are spread out across the long room. Usually the

earliest attendees congregate toward the middle for a good view, with seats filling out toward the

peripheries.

Attendees seem to organize according to who knows whom. The most loyal devotees

assemble in the center. Heads of the VR meetups greet and chat with each other. Many own VR

businesses or are developers. This core of enthusiasts have known each other for years, when

MEETUP VR, as they tell it, consisted of a handful of people in the back of a coworking space.

Overhearing this group and maybe interjecting when they can are entrepreneurs, associates

from small businesses and freelance programmers. Infrequent, but calculating, visitors, they're

brimming with ideas for new enterprises and immersive platforms. Outside of this group, and a

little more quiet, or with a friend for support, are newcomers. Having tried out The NYT VR app,

or experienced VR at a film festival, they're ready to find out more. They usually chat with the

person next to them, asking about their experiences or the medium generally. In the outermost

circle are the programmers. They sit in the back on a long row of built-in cabinets, eschewing

chairs. A few bring out computers and start to show their most recent VR projects to friends.

Aware of their technical prowess, they can give off a "too cool for school" vibe, and stay in their

clique until occasionally interrupted by an entrepreneur who wants to know if they're available

to work.

Certain attendees are regulars, as is apparent to anyone who has gone to meetings for

more than a few months. One interviewee, a volunteer administrator at a local meetup, observed

the groups as I did:

> There's been the people who… decided, just like I did… "I'm gonna be a VR developer
> from here until I croak." There's the people that [think]… I just come here because I like
> the kind of people that go to a VR Meetup. It's interesting. They're like the social Meetup
> people… And then there's the people who just like to try different VR experiences. They
> have no interest in actually building any of them. They just like VR… [like] the video-

gamer that wants to stay plugged into the latest and greatest in video games… And then there's the entrepreneurial types, [who]… try to take advantage of the latest little fad.

There is a common hierarchy in most of the VR meetups. At the top are the meetup promoters. They know each other, speak on panels together, and coordinate festivals. They often cross-promote at each other's events. Generally, the organizers have technical backgrounds. Many are developers themselves. They attend to tout VR and look to further their professional skill set.

Next are the regulars. One attended many meetings because she wanted to enter film, but thought that "because filmmaking in general is hard to get into… I think…[VR and 360° Video] is easier to get a foot in the door." She joined "to really learn about the scene." Like others, she felt a strong and enduring excitement about the medium.

Some attendees are entrepreneurs with business interests related to VR. Some are would-be investors. Some are seeking work within the field. Others are looking for professional community, education and mentorship. An interviewee cited the importance of the meetups for professionals seeking to understand how VR would affect their business. In all cases, business interests are the catalysts for their enthusiasm.[4]

Finally, there are neophytes, who make up most of the participants. At one meetup, leaders asked how many attendees had never used VR before. While that number decreased with each meeting, at least one-third consistently lacked any VR experience whatsoever. They are attracted by media hype. Some learn better in groups than by reading and researching on their own. Their interests are diverse. This was not always the case—in the early 2010s, the meetups

---

[4] These attendees exhibit what has been referred to as a "compulsory sociality," in which the expectation of contemporary work culture is not only associated with always needing to work, without the promise of relaxation and off-time, but also built around constantly using social time to network and interact with coworkers. See Gill, 2010; Gregg, 2010.

were limited to eager developers trying out the DK1 and other headsets. "[B]ack then," one participant told me, "almost everybody would bring in their computer and their development kit, and show what they were working on, or show the demo that they thought was really cool. And now, people just… bring themselves, and they want to see what the presenters have to say, and they just want to talk to other VR enthusiasts." Today, there are new arrivals at almost every meeting.

What Happens at Meetups.

The VR meetup venue, at the time called Samsung Accelerator NYC (now Samsung Next), offered free pizza and beer. Starved, I grabbed two slices and a place on one of the wooden benches that lined a wall. Guys started to walk in, so I began to converse with someone who had been to VRLA, the Los Angeles VR meetup. I was curious to hear his take. He told me that there were a slew of movie production people and not as much depth as he found at this meetup. Another person chimed in that just as 3D television hadn't found success, VR might be riding the "Hype Cycle" just now (in the summer of 2016). There was a consensus that a lot of VR enthusiasts were "lurkers:" maybe ten percent were developing and doing.

A half hour passed. The room was filling up nicely, maybe thirty men, mostly white, representing any number of " techie" stereotypes. A long-standing developer in the community was the evening's presenter. I took notes on a laptop while others watched, rapt in attention. One or two even took pictures. The speaker was very casual. Beer in hand, he cavalierly launched Unity and began his demonstration of "baking" in light and making vivid backgrounds in a scene. He detailed the steps of setting up a secondary virtual world which could be filmed by a virtual camera and projected into the main screen to look like a background—a trick he had picked up making first-person shooters in the early 2000s. Peppered with questions, he adjusted

the scene in way of explanation. After awhile, the demo started to malfunction. The speaker in

disgust called himself a "moron." Moments later, when he got it working, we all stared through a

virtual window at a lovely background. As he whispered, "watch the magic… watch the magic,"

the computer died and the room erupted with laughter. Unfazed, he told the group, "That's where

you guys can play around" and directed us to the Unity forums for further information.

 The main event over, we returned to networking, exchanged business cards, asked and

bragged about development projects and complemented the presenter on the graphic fidelity of

his scene.

 The VR meetup structure is somewhat predictable. Most are organized around a talk or

presentation. Starting and ending this event is significant "networking," which connects people

both professionally and socially. It is during this time, according to one interviewee, where

potential collaborators and teachers can be found. At these sessions, the most common question

to ask also served as a de facto introduction: What brought you here? Usually, this led to a

discussion about an individual's interest in VR and other immersive technology and became a

way to size up each other's abilities and expertise.

 A presentation or set of presentations then occurs. These are the drawing cards. After

each talk, a question and answer period ensues.

 The subject and shape of the meetups vary. In Chapter Two, I distinguished four types of

meetups—promotion, information, education and fun. Each follows a slightly different format.

The informational and promotional include formal PowerPoint presentations and demonstrations,

with networking before and after the talks. Promotional meetups tend to showcase novel

products and innovations, as well as content, while informational sessions, such as the one

described above, detail the development or research process. ARNY, of which I recorded a live

stream at the behest of the organization, is an example of a more promotional meetup. In the

June 2017 meeting, there were four presentations, consisting of a Skype call with a

representative of Cyclopus from France, who presented the company's new camera technology,

artist Ryan O'Koren who showed his latest Mixed Reality experiment, Abishek Singh who

demoed an experiment where he had recreated the game Mario in Mixed Reality and finally a

representative of Bravr Labs who promoted their own meetings involving immersive

technology.[5] Meetups are so predictable that the ARNY website has a default template for future

meetups consisting of "Networking" followed by live demos, followed by the organizers giving

"The latest and greatest from around the world of Augmented Reality" and finishing off with

"member announcements and Networking."

Finally, after the talks, besides networking, there are demonstrations of various

experiences. As publicized on their meetup page, the February 2017 NYVR featured demos of

the recently announced "Vive Tracker," which could be attached to any object so that it could

appear in VR, a number of headsets including PSVR and the Oculus Rift with touch controllers,

and two developers' works, the "Dream Cube," a puzzle game, and a Discover VR experience.[6]

Usually a queue forms for each demo so that an enthusiast can don a headset and try the content

for a few minutes. There are plenty of ad hoc demos from meetup attendees as well.

At more "fun" meetups, demonstrations are primary. Some meetups consist of only

demos, with lines of people chatting with each other while they wait. Specific events often

prompt demos—one meetup prepared an event to attend *The Void*'s "Ghostbusters" VR exhibit at

---

[5] "ARNY Augmented Reality Meetup," Meetup, last modified June 27, 2017, accessed March 9, 2018, https://www.meetup.com/ARNY-Augmented-Reality-New-York/events/pscvzywjbkc/.

[6] "February (NYVR Meetup), Meetup, last modified Feburary 16, 2017, accessed March 9, 2018, https://www.meetup.com/NYVR-Virtual-Reality-NYC/events/235327119/.

Madame Tussaud's. Still another meetup asked for volunteers to help and attend a VR show at

Sotheby's auction house.[7] Meetups for fun are mostly about playing and experiencing VR.

Educational meetups also share the same basic structure, but, in this case, specific

tutorials take center stage. These are sometimes recorded online. Unity VR && AR Education

has videos for some of the tutorials they carry out during the meetup. In "VR Bootcamp - Basics

of Unity," an instructor guides attendees, both online and off, through setting up the basics of a

virtual world in the game engine and then populates that world with a number of simple

geometric objects.[8] Similarly, one of the educational meetups I attended began with brief

announcements and encouragement by the organizers who then split the group into beginner and

intermediate developers. I went to the room for intermediate developers who wanted to produce

AR content. Within the hour, we had set up an account with the AR tool "Vuforia,"[9] which

allowed us to upload an "Image Target" to their servers. We then placed the target into a scene in

Unity and placed an object on the target, in my case a small virtual corgi, which could appear if

the camera of a smartphone was hovered over the target. By the end, I was testing out the corgi

while even more advanced developers were animating and making their target objects more

interactive.

Educational meetups often require a lot of guidance. Attendees must download certain

software, troubleshoot problems as they go, etc. In one meetup, I became, by default, an

assistant, answering questions participants had. Networking and Q&A still occur, though usually

---

[7] "Volunteer for Art in VR," Meetup, last modified June 22, 2017, accessed March 9, 2018,
https://www.meetup.com/NYCVRU/events/240868200/.

[8] "VR Bootcamp Beginner 1 - May 27th - Part 1," YouTube, accessed on March 9, 2018,
https://youtu.be/EbZ3L3qufso.

[9] "Vuforia | Augmented Reality," Vuforia, accessed March 9, 2018, https://www.vuforia.com/.

in a much more informal manner. Some of the same unscheduled activities are inevitable: lines of people demoing their work and the exchange of business cards. Conversations constantly entail speculations on the future of VR, hunts for information and plans to work on projects together.

There are other exceptional meetups. Hackathons and project-building events occur with a fair amount of frequency. One I observed, based around Google's Project Tango Augmented Reality tablets, commenced with a series of talks by the organizer, succeeded by two days of project building, with people networking in between and asking each other to troubleshoot problems.[10] Also, larger events and festivals are cross-promoted and featured by meetups such as the New York VR Expo and the Future of Storytelling Festival.

Where Are Meetups Held?

One favorite locale of the EDUCATIONAL MEETUP is the Media and Games Network at NYU, commonly called the NYU Game Center, in Brooklyn Heights' "Metrotech Plaza." The entrance to the Game Center, on the eighth floor, is a naturally lit, somewhat empty room able to accommodate at least 100 people and all sorts of play from large, independently developed arcade games like Killer Queen,[11] to student made projects.

Around one corner is a more official lecture space, equipped with a podium and a projector, which EDUCATIONAL MEETUP occasionally uses for talks. It also acts as a staging area and a place to serve refreshments and pass out swag when the meetup ends.

---

[10] I discuss this hackathon more in Chapter Eight.

[11] "Killer Queen | The world's only 10-player arcade strategy game," Killer Queen, accessed March 9, 2018, http://killerqueenarcade.com/.

Down a main hall, past a kitchen with large cabinets where students are often chatting or eating, there are classrooms. At times, the organizer will hold the meetup in one of the larger classrooms. Attendees, sitting at rolling desks, can plug their laptops into the floor while the organizer takes them through a detailed demonstration on a wall-mounted projector screen. "This is a community," he says, adding that one of the benefits of the meetup is how it brings together people with all sorts of "special skills" and he encourages us to share.

Table 6.1 displays the specific locales of the 157 meetups I attended.

Meetup Locales

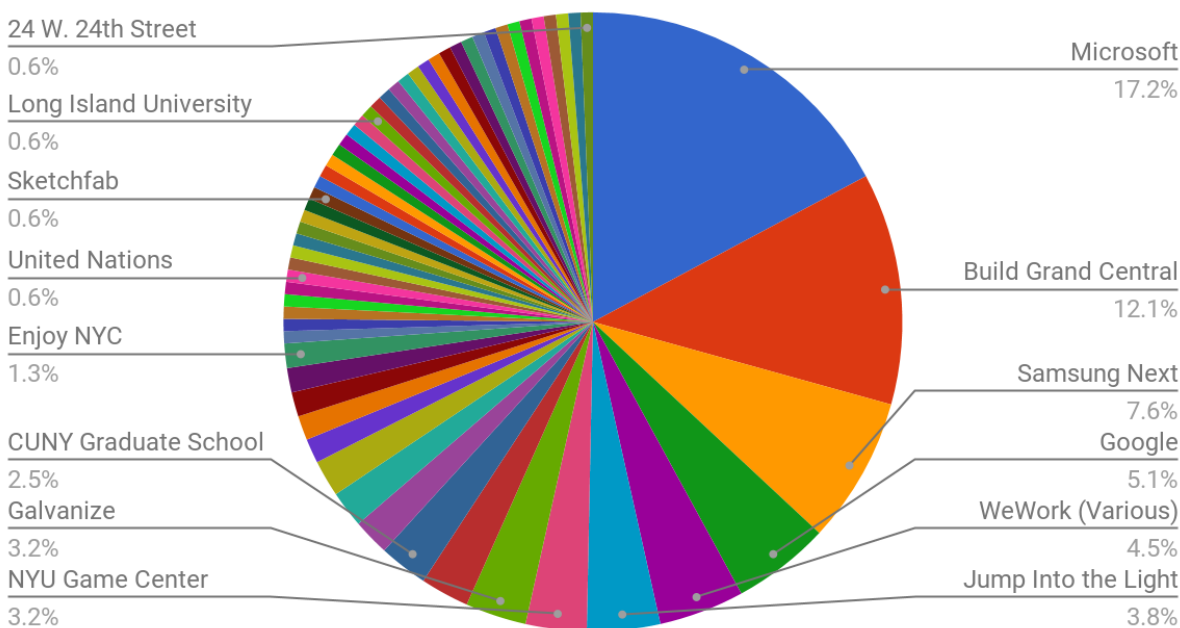*Figure 6.1.* Locations of NYC immersive meetups attended from 2016 - 2018.

While there is a wide variety of locations, the top three are Microsoft, Build Grand Central, a tech incubator and office space in Midtown, and Samsung Next.

Many of the meetups take place in a few specific locales. The first is headquarters of corporations who heavily invest in the software or manufacture hardware. Unsurprisingly,

Microsoft and Samsung top the list: Microsoft is producing a number of Windows-compatible

HMDs, including the $3000 HoloLens. Samsung's "Next" accelerator fosters companies that

build software and technology which can be bought for, and, in theory, incorporated, into their

business. The sponsorship of meetups are an extension of these efforts and a mode of cultivating

goodwill in the community. Beyond these larger players, there are companies like Galvanize,

which pursues all modes of development and coding, and Littlstar, a 360° Video streaming

platform, which also accommodates meetings.

Most other listed sites have vested, or potential vested, interest in the medium.

Coworking spaces, which comprised 8.9% of the meetup locations I attended, often house

startups in VR and other technology. WeWork has a worldwide "VR" channel on its internal

social platform. Universities and colleges housed 7.6% of the meetups and are hubs for

innovators and young entrepreneurs, not to mention research into the technology. Finally,

conferences and exhibition spaces play a key role. In all cases, each space, whether at a small

company heavily invested in promoting its own products, or a larger conference is a supportive,

yet self-serving, zone for meetups.

When Do Meetups Occur?

It felt a little colder than usual as I approached Build Grand Central for IMMERSIVE

MEETUP. Nearing 6:30 PM, it was already dark this February evening. I searched for a stand

toward the northern part of the building to lock my bike. No time for dinner, I was hungry and

knew it would be a long night.

I entered into Build and noticed that the Starbucks at the entrance was already closing.

Scurrying past me were people heading home. Build is a block away from Grand Central

Terminal and I imagined that many were rushing to catch trains. I greeted one of the organizers

who had set up a card table lined with tags in a corner of the gigantic lobby, which rose up several stories.

I arrived at the floor for the meetup, which was bustling with conversation. Most people were in work clothes, button-down shirts and khakis or suit pants. Lugging bags and briefcases, they had clearly come straight from their jobs. My mind wandered. I knew the organizer lived in Connecticut. How late does he get home after these events?

Shortly after 6:30, the meetup started and proceeded as normal. By around 8:30 PM, talks wound down and announcements from the audience were made. After looking at my watch, I insinuated myself into the group of people lingering at the back of the room to say goodbye. It was likely they would stay out till 11:00 PM. At one of the meetups, an unofficial after-party at a nearby bar lasted until midnight. People became fast friends during those late hours. It was nearing 9:30 PM. I had a long bike ride home, at least forty minutes. I headed out the door and into the cold.

Meetups do not convene, in most cases, during the day. Instead, a majority take place in the evenings, usually from 6:30 to 9:00 PM, decidedly outside of work hours. Most attendees drop by before heading home, or consider them a social event for the evening. At almost every meetup, attendees have to skitter away right as they end, to catch trains out of the city. Others, who are city bound may spend time with each other late into the evening. As one organizer put it: "There were a lot of very fertile interaction there outside of the presentation itself… I really found the spirit of the people who come to be very open and curious and a little more gregarious. That… meetup that I was mentioning, after… a bunch of us went out … Actually, we wound up at City Winery's bar area and stayed there until, I don't know, 11:30 or so at night. We were all talking. It was just a lot of fun."

Some meetups also happen on the weekend, particularly hackathons. These leisurely events can take on the form of competitions, replete with prizes.

The only meetups that consistently transpire during the day are conferences and other larger festivals, which are not organized exclusively by meetup leaders and usually involve demos, talks and other activities, which attract a national, if not international, audience.

Why Go to Meetups?

When I asked interviewees reasons for going to meetups, I received a surfeit of responses:

"You do Meetups… to meet people. They're called Meetup for a reason."

"In a very short amount of time, I could meet a lot of people from different areas of life. I met programmers, I met filmmakers, I met some hardcore business people. So, I met a lot of creative people."

"I value community."

"[I attended meetups because they were] a place where people with projects could meet people with skills and find each other and learn about how to do this. But there was definitely that very specific employment related goal."

"You can play with [VR] on your own but what you've been enjoying is that you can show it to others and see what others have accomplished and that is a kind of social play."

"[T]he reason I originally went to meetups was the social aspect… it's a different experience to be around people who are excited about it, and who… want to do the same types of things with VR… having that social network was… supportive."

"[I]t's a very raw, organic way of understanding the pulse and what's going on in the scene. At least New York City specifically."

Members' goals differ. For loyal attendees, and those who represent a core group, the experience is both social and technical—a venue in which to show up, catch up and show off their latest VR content creations. By contrast, entrepreneurs and freelance programmers and designers hope to capitalize on the scene.

Despite the differences, a few impulses are common. Probably the primary motivation is networking. Most meetup attendees seek connections, for future projects, or businesses or just to pursue ideas. They aspire to further advancement and this will get their foot in the door. Another, less entrepreneurial drive, is community building and sustainability. Meetups are social gatherings. Many of the most devoted in the group go week in and week out to check-in on each other, and happily greet those they haven't seen in a while. Talk about personal life and family accompanies professional and VR-related commentary. A series of strong ties exist, particularly within the core network of meetup enthusiasts, which act as bridges for newer attendees and a robust network of connections.

Learning and problem solving also attract attendees. Some come with a specific problem they hope another member of the meetup may solve, or guide them to an answer. One developer said this directly: "When I go to meetups, I'm trying to find developers that try to solve the same issues as I do. I want to figure out what their stack is, the tool kits they use. I want to see what kind of challenges they face and how they solve issues, and maybe I can collaborate with them." More generally, many attend meetups to gain a better understanding of the state of the medium and the potential they can find in it. Meetups encourage learning. "I'm a 'lifelong learner'" said one interviewee in an email, "Meetups are my classes… Meetup's free flowing, social, and a la carte menu of a multiplicity of events agrees with my curious learning personality." They are free, after all, or low-cost.

Finally, a major motivation is fun. These meetups are playgrounds chockablock with new toys. Excitement is palpable as members wait in line, rave about an awesome demo, or rhapsodize over their latest VR experience. One interviewee told me that attendance sometimes "felt like a backdoor pass… You feel like it was opening doors that maybe wouldn't be opened…" The space is electric with demonstrations, new VR releases, bombast about accomplishments and futuristic fantasies. "These crazy early adopters… Every time there's new hardware or software, or new SDKs [software development kits], there's always cool discussion and… workshops or attempts at workshops," said one meetup organizer/attendee.[12]

How Do Attendees Act in Meetups

After the official talk at MEETUP VR, the room became a frenzy of activity, but as in an ant colony, there is order in the chaos. The organizer fielded questions from his left and right, distractedly whirling around. Each presenter was engulfed by one or two groups of people who carried on rushed conversations, pitched ideas, exchanged business cards or asked questions.

In the room's corners were stations where VR demos were given to one person at a time. Each experience usually took a minimum of five minutes, so getting on line early was important.

That month, there was a demo I was especially excited to try: a stationary bike matched with a headset, ideal for an avid cyclist like myself. By the time I got on line, I knew I was in for a half-hour wait. I chatted with someone I knew a few spots ahead of me. He shared the story of how he had to tear his son and his friends away from their first VR arcade visit. Finally, my turn

---

[12] It is interesting that these different motivations map onto similar player types from Bartle's (1996) analysis of MUDs. These he categorized as killers, socializers, explorers and achievers. Frith (2014) also found these in his study of users of the gamified application *Foursquare*. In both cases, it shows that the pursuit of fun can have wide application and types involved.

came. I hopped on the bike. The demonstrator quickly adjusted the straps of the HTC Vive to my head and made sure I was oriented.

I slowly pedalled. The bike wasn't particularly sturdy. I wouldn't exercise on it, but it was fun. In the first scene, I had the avatar of a cowboy. With each stroke of the pedal, my horse galloped forward in pursuit of bandits. A scene later, I was in a tank. It was actually quite bewildering and I worried my stomach would lurch—luckily it didn't—as I somehow maneuvered my tank over a cliff. The demonstrator laughed and said he hadn't seen anyone do that before. Shortly after, I was put into another scene. I was Pegasus flying through a forest! My pedalling caused me to rise and fall. It was actually quite exhilarating. I meandered through the space excitedly. When the time ran out, I hurriedly dismounted knowing there were others waiting.

I wandered to the back of the room. Here developers clustered around unofficial demos that they had brought, thrilled to show their improvements and get feedback from spectators.

What is the etiquette at meetups? There are the demonstrations, talks packed with PowerPoint presentations, or "decks," networking and casual conversation. Slides often are incorrect, demos may break or not quite work, but errors are taken with good humor. One organizer elicited sympathetic laughter when he consistently confessed mistakes happen with live presentations. They are never perfect.

Attendees have few explicit obligations. They are not compelled to fill out extensive surveys or commit to multiple meetups. People often run in late or leave early. While certainly an air of respect and camaraderie imbues meetup activities, the stakes for all are decidedly low. Instead, the meetups are an opportunity and place to experiment with VR rather than devote a lifetime to it. One interviewee wrote this directly in an email to me: "I would like to see what others create… I may be going to the… meetup once a month to experiment with VR apps on

their various headsets." Others discuss how meetups fulfill the need for a "space that allows new

VR users and early adopters to kind of commingle especially with experimentation." Meetups

are not serious work venues, but rather a hangout for fun, or even play.

This is reflected on an economic level. Meetups are, in general, cheap to attend. Some

impose nominal entry fees to discourage people from signing up and not coming, or to get

accurate head-counts in order to confirm that the size of venues will be adequate. While some

meetups, such as weekend hackathons, do charge higher fees, these usually come with specific

benefits. The NY WebVR meetup's Hackathon promised a first prize of a "Sketchfab pro"

account, a blog feature, press release and some swag. Overall $650 in prizes was awarded to the

top three projects.[13] The low cost, easy access and laid-back attitude of meetups is unusual. The

New York Film Academy and International Center for Photography both started training

programs for VR development during the time of my study. These, however, came with a greater

set of expectations. They were eight weeks long. "The Narrative VR workshop provides a hands-

on introduction to the tools of cinematic and interactive VR. VR Game Design is an advanced

course for students with a background in 3D animation or game development to translate their

skills into this emerging medium."[14] But for those trying to find their footing in VR, or looking

to expand their social and professional networks, meetups provide an inexpensive pathway into

the medium.

---

[13] "NYC WebVR Hackathon 2.0: Create WebVR awesomeness with SketchFab, Amper music, other APIs, - Devpost," Devpost, accessed March 9, 2018, https://nycwebvr-hackathon2.devpost.com/.

[14] "Virtual Reality Courses & VR Design Classes | NYFA," New York Film Academy, accessed March 9, 2018, https://www.nyfa.edu/vr/.

The Blurry Lines Between Play and Labor

I conclude that VR meetups are universally designed for fun and propelled by passion, not pay.[15] Whatever its purported objectives—community, support system, gateway to future VR development and diffusion—the meetup is primarily an arena for play as opposed to labor. To fully understand this distinction, it is important to situate these two concepts.

In Chapter One, I pointed out that within Marx's ideology of production is an implicit distinction between play and labor. It is through the endless cycle of labor by which industrial societies discern themselves, their citizens and ascribe all "serious" activity. As Arendt (1998) states, there is a "trend to level down all serious activities to the status of making a living… which almost unanimously define labor as the opposite of play" (p. 127).[16] Play exists outside productive activity: "All serious activities, irrespective of their fruits, are called labor, and every activity which is not necessary either for the life of the individual or the life process of society is subsumed under playfulness" (p. 127).

I presented three models complicating the boundaries between play and labor. The first is Georges Bataille's assertion of "depense" or expenditure. He interprets "play" as a kind of waste—or utilizing one's excess time, resources and abilities in non-utilitaritarian activities. For him, play is enjoyable precisely because it can be expended, rather than saved like capital. Bataille sees play as a natural outgrowth of the alienation of capitalist production, even a form of resistance.

---

[15] This isn't to say that meetups make no money. Quite a few organizers charge marginal fees of $5 - $15 to enter the meetup. This usually is a way to get a real sense of who might attend, which is necessary for venues to know in advance. Still others accumulate significantly more funds. One meetup charged upwards of $95 per person for exclusive training. As example, see "VR Weekend - Boot Camp - Day 2 - Featuring Epson Moverio," Meetup, last modified October 23, 2016, accessed March 9, 2018, https://www.meetup.com/NYCVRU/events/234585744/.

[16] Arendt in a lengthy footnote ascribes the play-labor division to the difference between necessity and freedom.

However, contemporary labor seems to defy Bataille's hopeful notion. The rise of gamification, which explicitly aims to join "non-game contexts" (i.e. work) with play elements, exemplifies a capitalist desire to subsume play into work and vice versa.

Two additional interrelated concepts particularly highlight the melding of boundaries between play and work. Playbor, first established in modding communities Kücklich (2005), and revived in Rey (2014)'s critique of gamification, theoretically frames the relationship between the passion of enthusiasts and control by the AAA game industry responsible for the world's most expensively produced "traditional" video games. Modders commit their own act of "depense" or expenditure, as they devote extra time and effort to "mod" the games they feel so passionate about. In Kücklich's example, this excess fun becomes unpaid labor which directly benefits AAA game publishers. Similarly, "Aspirational Labor," which Duffy (2015, 2017) studies in the online fashion community, requires unpaid laborers to appropriate certain attitudes, tools and items of an industry in order to succeed in it. Once again, this is an act of expenditure in and of itself: Duffy's aspirational laborers must commit excess energy and funds for even the possibility of gaining entree into the online fashion community.

The discretionary and fervent exertion surrounding meetups resembles Playbor or aspirational labor and in its own way obscures the line between play and labor.

Meetups as Play

Meetups are playful, but they are also prologues to, or training in, labor. Presenters and attendees practice their pitches through talks, networking and demonstrations. This is an iterative process, common in game design, where presenters receive user feedback and refine their

products.[17] In an interview with a company that roped in attendees of meetups to test their experience, one of the co-founders explained that he used meetups as playtesting and research in order to figure out "psychologically, how can I get those people to play and enjoy it and keep playing."

For attendees, there is a similar aspirational labor. As they network, chat and ask questions, they learn the "rules" for entering into the industry. One interviewee recalled a meetup we had both attended a few months earlier, which started with downloading a trove of materials in the morning. Participants were then given a choice "to reconstruct a koi pond… as a VR exercise" or to discuss making a promotional 360° Video experience for the coworking space where the meetup occurred. The group chose the latter. He then added, "I think what was good about it was learning more about what was out there, like the different technologies, getting kind of more of an overview," and figuring out what was needed to make a rudimentary VR experience. This example is on the more technical end, with the interviewee becoming exposed to new hardware and software to enter into the industry over a weekend-long hackathon. Promotional meetups similarly present what it takes to make a viable company in VR.

Meetup activities require the "depense" (Bataille, 1985) necessary for Playbor and gamification and do not fit conceptions of "productive" labor. People expend excess time and energy to attend meetups—going after work hours in order to participate and enter into the culture. The regular meetings provide a free and financially unconstrained way to experience VR and see *how* the industry functions. As in gamification and Playbor, the exchange of calling

---

[17] This once again conforms with compulsory sociality found in most media work. Gill (2010) in her interviews with creative workers extracts ten key features including the love for their work, entrepreneurialism, insecure work (which caused them to constantly hunt for more), low pay, long hours, keeping up with new innovations in their fields, learning online and through other "DIY" means, persistent inequalities for underrepresented groups and genders, and a lack of a perceived future. Certainly, much of this aligns with my own findings. However, in part because VR technology remains in an inchoate state, my interviewees could instead approach it playfully, with low expectations that it might supplant their occupations, or other creative labor.

cards and information by entrepreneurs is not for play alone, but for the possibility of getting a job. Just as Playbor and gamification obscure the lines between labor and play, attendees play for productive reasons, whether for education or finding employment in the VR industry.

Yet, there is tacit acceptance their work will not necessarily lead to tangible rewards—at least not in the short run. One meetup whose focus was investment struggled in part because it never got venture capitalists to back any VR product. The organizer of the meetup compared one of his presenters, a local VR business, to more financially viable West Coast equivalents: "But that's small potatoes compared to Jaunt or Chris Milk [two major West Coast content creators] or something like that. So you really don't have much here." The only companies he saw investing on the East Coast were media companies, specifically *Vice*, *The New York Times* and news networks like CNN.

The only true economic benefits of meetups are promotional. People advertise their companies and market their wares, businesses and practices to a captivated audience. One VR company was described as incentivizing people at every meetup: "[The head of a VR company] kind of bundles [his software] with a Google Cardboard [a cheap smartphone-powered headset] and tries to pedal those at each of the meetups. And gives away free little handouts to entice people to go to his website and sign up for a newsletter, or whatever it is. He's trying to do something entrepreneurial with it, and he's at every meetup doing that." Early adopters enter into the meetup voluntarily, but then put forth significant effort, either through networking, demonstrations or participating in the excitement of the meetup. All of these activities are modes of expenditure, not done for pay, but out of passion for the technology, or are "aspirational" in the hope of gaining entree into VR professionally.

The extra effort has immediate consequences. In the process of devoting excess time and energy to immersive technology, most devotees of meetups become ad hoc evangelists. I found myself often being asked about the state of the medium, or about specific products and felt compelled to study them in order to knowledgeably respond to newer attendees. While I always attempted to remain neutral in my own perceptions of VR, even this necessitated an investment of emotion and energy. I became imbued in the VR ecosystem, thus helping diffuse the technology by exposing it to new audiences and deepening the commitment of newcomers and habitual enthusiasts alike.

What motivates meetup participants is a faith that new-found knowledge, experiments, creations and networks will lead to personal and financial achievement—and the sum of all the individual faith is the enlargement of a zone of technological innovation. Not to say financial success is impossible. When an inveterate meetup attendee announced the acquisition of his company by a software giant, the meetup broke out into applause. But such outcomes are rare. In the end, for most enthusiasts, the meetups are a way to remain optimistic about VR's destiny. They are crucibles of deepening belief. For those who are not adherents, their attendance isn't mandatory and they may go rarely or cease going all together. But for the die-hard attendees, they keep passion for the device and its diffusion alive.

CHAPTER 7: THE RHETORIC OF EARLY ADOPTERS

New York City meetups create solidarity among a diverse set of adopters through a common language about the future of the medium. This vision imbues most meetings, but is not exclusive to them. Media representation and coverage circulate at the gatherings and make their way into online posts.

My interviews reveal a prevailing rhetoric for adopters about the potential of the technology. The language originates in part from the adopters themselves and from VR gatherings; it does not only echo external sources.

Chapter Seven scrutinizes adopters' language for VR and immersive media. Their discourse provides insights into how they imagine the capabilities and limitations of the technology, its future and their function in its diffusion. They also address specific issues, in particular the role of the game and IT industries, and how playful labor practices manifest and shape VR, AR, MR and 360° Video's development.

How do enthusiasts define the technology of VR and its communicative potential? My interviewees imagine it as "the Wild West"—full of potential and limited by few rules. This optimistic viewpoint aligns with the techno-futurist posture embedded within "cyberculture" (Turner, 2008). Developers are quick to suggest that VR, along with other emergent media, advances us toward a technologically brighter tomorrow.

Stories of awe-inspiring first-time experience are common and the expectation of novelty spurs meetup attendance. The transformative power of VR not only inspires ideas for new careers, but contributes to beliefs about social change. Interviewees imagined how VR will affect their own occupations and open up worlds of medicine, tourism, and education. Women, who have their own VR and AR meetups, experience VR as an alternative to misogynistic gaming

and tech cultures. Optimism about VR's future is balanced against its present "realities." Many

express practical concerns, especially the limitations of technical hardware and the tools for

building VR. Also mentioned, in frustration, is the inhospitality of the very fields that could be

reshaped by immersive technology.

VR Adopters have a conflicted relationship with game-makers. On the one hand, their

tools, finances, and enthusiasm drive VR content. The game engine Unity is considered the de

facto mode of content creation. On the other hand, this industry stymies VR's potential. It

exacerbates gender conflict, dominates the genres, and limits how experiences can be

constructed.

In sum, the consensual vision of VR's future supports a playfulness, which motivates

adopters to push beyond their practical concerns. There is a feeling of conviviality when trying

the latest devices and evaluating new experiences that lightens adopters' spirits.

Conversation circulates around the promise of VR as a means to entertain, amuse, and be

cool, whatever the obstacles.

Virtually Limitless: Potentials of Immersive Media

VR stands for a number of different and integrated technologies rather than a singular

piece of hardware. As has been stated, it is an invented term, which has come to represent

different things for the institutions and individuals who use it, while still carrying important

rhetorical value.

The most common feature of VR in the language of most adopters is precisely its

inchoate and unruly state. One filmmaker flatly stated: "It's this new platform and no one really

knows what they're doing." Another, with an interest in gaming, declared: "People are just

cranking out games and playing around with different mechanics and user experiences and seeing what sticks. Right now there's no really defined rules."

Adopters not only wrestle with, but also relish the future possibilities of VR. In fact, the very lack of standards in content creation is taken to be a reason for VR's growth. "[Y]ou're playing around with tools that no one quite knows how to use yet." Another interviewee asserted: "If you look at the potential for VR in the widest sense—I don't know maybe it's cliche or naive to say—it's limitless…" The absence of constraints allows for infinite possibilities. One informant compares their work in VR to their childhood: "I spent a good hour, two hours just childlike… I think part of that is because it's fun and part of it is because it's an exploratory period."

Invocations frequently compare VR in its current state to the Wild West, or its more recent metaphorical incarnation, the "Electronic Frontier" of the early Internet. "It was a free-for-all, the wild, wild West. There [were] no rules or regulations. If you come in early and you figure out a practical application and you capitalize on it you're not going to deal with the regulations that eventually come and sort of hinder your ability to further progress." These assertions are hardly original, but instead are customary refrains for novel technologies, ranging from photography to television. There are, however, a few distinctions in the case of VR's diffusion. First, as pinpointed in Chapter Three, the size, scope and interconnectedness in media coverage of both VR's lawless state and the formation of conventions is astronomic. It is easy and not uncommon for media to spread quickly across the city, state and country. Second, despite its supposed untamed state, VR's content creation is tempered by a very specific set of industries, particularly games and gaming, which circumscribe the rules and expectations for the devices.

Finally, the relationship between consumers and producers in this wave of commercial VR differs from other novel technologies. Whatever the "rules" surrounding VR might be, the pathway to making commercial content is relatively unimpeded. This is implicitly understood by the community. An article on the urban blog *Technical.ly Brooklyn* asks five local experts what people should know about VR. Two of them mention how cheap it is for content producers, relative to other emerging media (Woods, 2017). Rather than being relegated to the ranks of hobbyist or armchair consumer, users can easily make and widely distribute commercial content. With this facility comes a persistent belief that the release of unique products will give them a toehold in shaping the industry.

The possibility of *immediate* commercial, if not widespread social, impact on VR sets the medium apart, at least to a degree, from historical precedents. Murray (2008) chronicles in a brief history of Kodak how the class of photographers that rose with the company's invention of roll-film in the 1880s started off at varying levels of amateur, from dilettantes merely taking snapshots to would-be artists (p. 151). It was not until the 1950s that these rookies were solicited to market their prints for mass distribution—when popular photography magazines capitalized on their avocation. In the age of VR and AR, enthusiasts consider themselves as laying claim to unknown profits from quarries that have yet to be explored within the medium. A digital gold rush, the commercial possibilities for their content are hardly indistinguishable from their passion for the medium.

The metaphor of the Wild West also conveys an idea of manifest destiny. The implication is that when no rules apply, anyone can commandeer technology in some way, and the sum is predestined as glorious. One interviewee stated that early adopters "experiment with new technology and come up with the principles. Everyone wants to be… the John Carmack [chief

officer of Oculus] of VR and define what a good VR experience will look like." But the sense of manifest destiny is also tied to a fantasy of a fruitful future. One enthusiast stated, "As with all new technologies, I hope that we can harness the power and capabilities of these tools to improve human understanding and lives, look more towards building tools that bring people together as opposed to just another thing to numb ourselves from real life." Turner (2008) shows that this language is elemental to early cyberculture, which was built on the back-to-the-land counterculture movement and rose to prominence throughout the 1980s and 1990s. Adherents, as Turner wrote, believed that "small-scale technologies… could open up a window on the hidden patterns that connected humans" (p. 245). Part of the appeal of techno-futurist and cyber-utopian mindsets is the ability to imagine personal freedom within new technologies.

In the techno-futurist psyche, VR is not considered an end-all technology, but rather a component of a broader sweep of emerging media that includes AI, robotics, self-driving vehicles, 3D printing and blockchain, a combination that will ultimately configure the future. Long-standing cyber-utopian beliefs are replenished with speculation about a sort of posthuman future "virtual reality" or cyberspace in which all humans and machines are connected by technology. As Kurzweil (2006), the creator of singularity "theory," fantasizes: "They will live out on the Web, projecting bodies whenever they need or want them, including virtual bodies in diverse realms of virtual reality, holographically-projected bodies… and physical bodies comprising nanobot swarms and other forms of nanotechnology."

Without doubt, couched within the rhetoric of adopters is a strong strain of cyber-utopianism. VR and related technologies offer a passageway to a future in which people transcend the limitations of the present. Enthusiasts rave about its ability to immerse, which

includes telepresence and even three-dimensional computing (as opposed to working on traditional computer monitors) as future benefits.

One enthusiast summed up the issues that are deeply connected to an ideal of "telepresent immersion," or when a VR user is so embedded in a space that they can't distinguish it from reality, what he described as "the physiological experience of actually being immersed." It was this goal he imagined that commercial retailers like Oculus were aiming to achieve: "How do you fix the peripheral disconnect of knowing that you're not actually here?" Once the technical hurdles are overcome, telepresent immersion would ultimately lead to widespread diffusion of the devices.

On computing in three dimensions, an advocate stated, "I think the next gen of phones and capturing 3D is going to be really interesting because people are used to taking pictures, of course. But then imagine if you're seeing it in a headset, or whatever feature, and you can move around someone's face, just like you would do if you're actually with someone. I think it's gonna be a layer deeper than anything we've seen." Another mirrored this language: "I really do believe that what we're going to see in the future is that location-based entertainment is going to play a bigger role for this technology than has ever happened in the history of mankind." For many enthusiasts, the idea of an Internet-connected three-dimensional space was the next evolution in personal computing.

Virtual Reality is still envisioned within the context of science fiction, even while being worked on in the present. Many enthusiasts endorsed Ernest Cline's (2012) *Ready Player One* and insisted each other read it. The book depicts a dystopian future where economically ravaged Americans seek refuge in "The Oasis," a Virtual Reality they can access via a variety of headsets

and other accessories, and where their wildest dreams can come true. The book seemed the closest analogy to what most enthusiasts wanted the technology to be.

One young transplant from Florida said this was exactly the reason he came to The City. "My friend and I, we read this book called *Ready Player One*, and I'm sure you've heard [about] this book like 1,000 times already, but we were fantasizing about that… type of world. I remember I looked at him and I said, 'When Virtual Reality becomes a thing we have to go out there, we have to meet people, and we have to create this open world,' right?" He then came to New York because he "wanted to find people who wanted to create that *Ready Player One* environment…"

One developer described his online WebVR platform as "a very vague idea and mostly very biased from books like *Neuromancer, Ready Player One… Snow Crash*."[1] Science fiction was the origin for his interest in all emerging technology: "My interests in emerging technology, probably like most people in the field, date back to… sometime in the late 80's, early 90's… [B]eing a tremendous fan of science fiction, I would love to imagine the future and being a fan of the indie… sub-genre… led me down the VR rabbit hole." Still another pointed to film and television: "I mean I've always been interested in VR since… the holodeck in Star Trek and when I was a teenager reading *Snow Crash* and watching movies like *The Matrix*, just the pop culture phenomenon. In the nineties… VR was the promise of technology."

For these sci-fi connoisseurs, VR is a testament of potential as much as a technology of the present. It partakes of—or perhaps it is—an optimistic belief that VR has the *possibility* of being a transformative medium for computation, industry and society at large.

---

[1] *Snowcrash* (Stephenson, 2014), written years before *Ready Player One* shares a dystopian future and an escape to Virtual Reality, in this case called the Metaverse, for happiness. The actual plot involves the main character in the novel stopping a virtual virus.

A Revolutionary Medium

While the rules of VR are unset, interviewees were firm about its revolutionary potential. About this, despite myriad professional backgrounds, adopters were surprisingly in accord.

For many, this was an outgrowth of their first experience, usually a formative moment, with the technology. They describe it in a rather uniform way. One depicted his as such: "I don't think I've ever had an experience with technology quite like VR… I was blown away… Just the fact that you're in another space. When I first tried it out I thought to myself, wow, this has applications beyond imagination." Another described how he got his hands on the technology through a business: "[I] first experienced VR at this startup… I was working on a mobile game, and they had just gotten the DK1, the Oculus development kit. I first tried Tuscany," a relatively simple VR experience where the user meanders around a Tuscan villa.[2] "I put it on, and at first it was really blurry. Then, all of a sudden it came into focus, and you're like, 'Wow.' I wanted to just take it home and work with it right away. "

The word revolutionary came up: "… I got in a headset and then it was, of course, like they say… evangelical, *revolutionary* [emphasis added]. 'Oh, this is what I should be doing. This is the natural next step.'" Another interviewee: "I just experienced this new, revolutionary medium."

The idea of VR and immersive media as unparalleled was cited repeatedly. One interviewee portrayed his experience with the Vive "High-End" tethered VR headset: "The device that basically broke my brain was the Vive. When I first tried the Vive, there was no turning back… I just realized that this is something completely new… I want to spend my time

---

[2] "Sixense Tuscany Demo," Internet Archive Wayback Machine, accessed March 7, 2018, https://web.archive.org/web/20160305121401/http://sixense.com/sixensetuscanydemo.

working with… I'd never felt… so excited about what a computer can do or produce." Wonder

gave way to bemusement as he started building what he called a "goofy" game for VR, which he

described as being very rough and lacking the polish, like a title screen, of classic games. Still,

he kept pursuing content creation realizing that the production tools weren't as difficult as he

imagined.

VR was not only unprecedented and seminal, but also iconoclastic. It was the next natural

step in computation. "First you had computers and then you had the Internet, then you had the

social Internet, then you had the mobiles, and the next big platform is AR/VR." For many of

those I observed and interviewed, this is what drew them to the technology from careers in

coding and other development platforms. Some compared VR to the rise and fall of Flash

technology in the early 2000s.[3] With each invocation, the implication was that VR would

transform the computer industry in fundamental ways. Just as smartphones have touched almost

every major field, VR would do likewise. Most revelatory, enthusiasts refused to think of VR as

limited to entertainment, gaming or computing. They perceived it as an instrument of change in

their professional and personal lives as well as the larger industrial setting.

Industry Impact

For most adopters, it was inevitable that VR, or immersive computing, would alter

commerce. They conjectured about a wide array of affected businesses and professions. One

interviewee surmised that the change would encompass nuclear physicists, fashion models,

---

[3] Flash was a player program that allowed for simple animation and games to be played on browsers via a plug-in. Starting in the mid-1990s, it became the go-to application for doing animated work, designing online games and showing video online. Its rise in popularity was meteoric, prompting Adobe, the design company, to acquire the software along with a number of other animation tools in 2005. However, the iPhone, famously, didn't support Flash, which along with the release of the HTML5 protocol that allows video and animation to be programmed directly into sites, precipitated the downfall of the application. See Rocheleau, 2015 for a popular history.

investment bankers, "[p]eople that know coding, people who don't… It's literally every field you can imagine…" Many were thrilled by the prospect. A tour guide envisioned AR as a new way to experience cities: "I've heard a couple of people talk about the industry, like the tourism industry, fashion industry, industries that are native to New York…" Similarly, one developer built a business around a platform for museums to make VR and immersive content: "VR does certain things that a museum cannot otherwise do. Like, for example, bring a museum to somebody who can't necessarily physically come visit the actual museum itself… VR provides for an extension of the experience that the museum can provide… If I go and I see a skeleton of a T. Rex in the museum itself, that's one thing. I can read the label, I can listen to an audio guide, I can get some insight. I step into a VR headset and I can actually explore what the T. Rex's habitat in the Cretaceous Period might've looked like, sounded like."

Medicine, education, and the military are frequently invoked. "For VR… the first thing that comes to mind is the medical field," said one interviewee. "For training, it's gonna be huge, [specifically] education, military," said another. A third concurred: "I think we've been having the medical and military [uses] for [VR] since the 1940s… I think it will help education. I think it will help medicine…" He even went so far as to suggest, "once we get 3D printing associated with… VR we'll be able to put things in [outer] space, repair them, and bring them back out." Their hopes affirm the pervasiveness of media coverage, as discussed in Chapter Three, and its influence on the general rhetoric of adopters. The media ecosystem very much informs interviewees language and discourse surrounding the revolutionary impact of VR on industry.

VR and Education

Education was mentioned most frequently as a realm most vulnerable for disruption by VR and other immersive technologies. In some ways, this may be a reflection of my sample set.

As stated in the previous chapter, meetups often served an educational function. Many attendees considered themselves as lifelong learners, enlisting in meetups to study new technologies. Some had contentious relationships with formal education as well. One interviewee depicted his educational background as fraught with emotion. A founder of a VR company consciously decided to get into VR while being bored in college, which he left early. Another was bouncing back and forth between Florida and college, trying to use his time in New York as a way of launching a career rather than finishing school. The traditional educational route was incompatible with their lifestyle.

VR offered these enthusiasts a novel career path. It afforded the opportunity to achieve goals within a desired industry without expensive institutional education and training. As one interviewee bragged, "This whole breadth of knowledge that I have now… I got in two years for no cost other than the hardware cost, which if you can partner with people you can minimize." Another described pursuing a career in VR while working a full-time job: "I spent the next… four years, with most of my free time dedicated to learning game development, programming, 3D modeling, art, all that kind of stuff. When I say most of my free time, I really mean it. I worked at [a large multinational business], which is a very demanding job, but outside of it… I probably spent something like 40 to 60 hours a week on just game development on top of my job for four years straight."

At the same time, many interviewees saw VR as a unique tool for learning. VR could fix the failures in education which had plagued their own learning process and set them on alternative paths. They cited that immersion offers a more intimate and personalized mode of engagement than prevailing class and lecture formats: "The first thing that popped into my head was education. You know, in education you're taught [with] textbooks… Here education could

be interactive. I think that children with their short attention spans, [interactive learning is] going to be much more enjoyable and much more effective."

Such suggestions about the transformative power of new technologies in education are hardly new. Toyama (2011) states there has been a consistent "repetitive cycle of technology" where each new innovation has been touted as fixing the ills of classrooms, which never seem to fully live up to its promise.[4] For instance, an experiment where American Samoans received 80% of their education through telecasts was a complete failure.

The computer has perpetuated this fallacy. Starting in the 1990s, a techno-utopian perspective was advanced about the possibility of computers closing the gaps in inequities in education.[5] One of the most visible proponents was MIT Media Lab founding director Nicholas Negroponte (1996) who believed that the interactive and the exploratory nature of the web, what he describes as "Hard Fun," would engender a more sophisticated and individuated educational environment. Negroponte tested his theories with the One Laptop Per Child (OLPC) program, which provided tablets and low-cost computers to students in the global South. However, Toyama (2011) highlights that in study after study, computers in poor performing classrooms make little difference and only yield marginal benefits. Even the inexpensive OLPC laptops were too costly for most schools. A literature review of the efficacy of Information and Communication Technologies (ICT) in international classrooms (Fu, 2013) similarly concludes that competence is driven more by students, teachers and school administrators than any

---

[4] Toyama highlights two histories by Cuban (1986) and Oppenheimer (2003) about the use of new technologies in schools. Starting with the motion picture, moving to radio and television, there have been assertions that innovations could supplement and enhance the classroom experience, but almost always have fallen short in practice.

[5] See Dertouzos, 1997; Negroponte, 1996; D. S. Robertson, 1998; Tapscott, 1998.

particular innovation. Likewise, Muir-Herzig (2004) finds that the technology had minimal impact in a K-12 US school system.[6]

Only recently have literature reviews of the actual educational effectiveness of VR begun. For professional training and simulations, the results have been somewhat favorable, but for younger students the data is inconclusive due to the headsets' negative side effects such as sickness and disorientation (Freina & Ott, 2015). Exploration of virtual worlds also seems to have slightly positive effects on K-12 students (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014), but is necessarily relegated to two-dimension screens as a precaution—not to mention the overall cost of devices. As a consequence, the hype of VR overhauling education seems, like its predecessors, to be part of Toyama's (2011) repetitive cycle. It may complement classrooms, but certainly not reform them. No one technology can "fix" the social and financial ailments that plague an education system.

However, underlying much of this enthusiasm was an assumption about the monetary benefits of reformatting education. VR could accelerate the learning process—therefore driving down education's overall costs—and for some obviate formal instruction altogether. According to interviewees, VR has the potential to alleviate access, cost, and elitism that inhibit not only traditional education, but also personal careers. "I have real world skills that I didn't learn in school. My school doesn't teach me what I need to know to be a successful developer." It could rehabilitate financially, culturally and structurally educational norms.

When pressed, however, few could substantiate these assertions, in part because commercial VR hasn't been extensively integrated into the classroom. Some pointed to specific

---

[6] The study of ICTs in classrooms is incredibly complicated and certainly warrants its own extensive research. A variety of factors impact the efficacy of ICT in classrooms, rather than it being a "simple fix."

initiatives, such as Google's "Expeditions" project, which provided at its inception six hundred 360° Video tours of historic and famous landmarks to be used as ancillary material in school (Matney, 2017). However, no one acknowledged the corporations' profit motives. A majority were more philosophical—either speculating on the potential effects of immersive media on the brain, or pontificating on emerging media as an agent of needed change in education. In either case, their predictions and fervor fall within a long tradition of unsubstantiated cyber-utopian beliefs that technology can cure all societal ills.

VR as Barrier Breaker

All genders saw VR as an opportunity for women to enter into male-dominated fields. Structured for and by men, the game and tech industries, along with software engineering, to a degree, are notoriously misogynistic. Many have documented the industry's male-centricity and stereotypes (Shaw, 2011; Williams, 2003). Kirkpatrick (2013) describes how the industry built a "gaming imaginary" directed towards young men and codified through journalism, advertising and gaming. Only since the "Casual Revolution" (Cote; 2016; Juul; 2010) have critics challenged this imaginary. Juul (2010) suggested that proliferation of games for novel systems like the Nintendo Wii, mobile phones and browsers led to the revolution, where "video games are fast becoming games for *everyone"* (p. 152), or as Cote (2016) put it, "The success of casual games… demonstrates that diverse individuals and audiences will buy games, which should fundamentally alter the structure of the game industry and its products" (p. 7). While this revolution has not upended the dominance of the large, and male-oriented, AAA game industry, it has popularized digital games for all genders and ages.

Games and gaming need social reform, which VR, although in its infancy, could aid. Immersive technology is rife with opportunities for female developers to influence its destiny

and culture. One interviewee said: "I started pursuing VR in the classroom as an avenue to improve learning, to maybe even increase attitudes or change attitudes towards technology, especially among female students." The advantage of VR's current mercurial state is that history does not dictate the rules of development, the admissions requirements and target audience.

A few of my female interviewees came from various programming backgrounds, stating that they had coded as children, during adult life, or had participated in women's coding initiatives. One went to the all women's "Code Liberation,"[7] a New York non-profit founded and run by female independent game developers, for a summer. Another had competed at HackHolyoke, which she claimed was the first 50% women/50% men's hackathon, hosted at Mount Holyoke College.

VR itself presented a number of unique inducements for female developers. One interviewee thought that "more women are drawn to VR versus other computing platforms because it has this creativity to it, because it's very visual." For her, the type of programming that occurred in VR was naturally more attractive. Part of the appeal also stemmed from the empathy which the medium, at least in theory, engendered. Both male and female enthusiasts cited the allure of experiences where they switched genders, which helped them to identify with the plights of others.

More women developing VR could potentially disrupt IT and game industry conventions, according to my interviewees. A veteran female developer and teacher explicitly saw VR as a means to combat what she called the "toxic" culture of games, gaming and tech. If more women entered into this field, she speculated, "I think in fact, VR could be a great way to sober that culture up." It could surmount rampant problems of sexual harassment and discrimination. Her

---

[7] "Code Liberation," Code Liberation, accessed March 9, 2018, http://codeliberation.org/.

feeling was mirrored by another enthusiast who reminded me that, at least in New York, diversity was usually beneficial, especially when applying for grants. There were personal, professional and cultural boons for women in VR.

Meetups had a somewhat convoluted relationship with these interviewees. For those who had spent more than five years in the space, meetups were considered predominantly male. Several interviewees described these early gatherings as containing hundreds of men and a handful of women. However, this circumstance was evolving. One female developer described her attendance at a recent VR meetup as containing a "free flowing vibe." She said that she saw all genders, identities and ages at the meetup, concluding with how normal the demographics looked: "First thing I was like 'Wow there are so many women.' But then I was like, 'You know this actually just looks like my everyday.'"

This isn't to say that women didn't still feel some sense of a male-dominated culture within the meetup scene. Interviewees expressed difficulty communicating with a certain type of man, whom they described with terms like "frat boy," "dude," or "dude-bro," and was the quintessential chauvinistic "gamer" who was attracted to VR along with other types of digital technology. However, the presence of such men was steadily declining at the meetups. A number of interviewees saw them as being evenly split—something I rarely observed in my own attendance—or at least veering towards more gender equity. This was viewed as a positive by all: a male VR enthusiast stated, "I like the idea… [t]hat you're not in a room with 40 other guys." A benefit of women in VR was their diverse backgrounds. One interviewee mentioned marketing, tech and hobbyists as part of the "spread out" quality of women entering the business.

The most named meetup by female interviewees, and one that was held up as the paragon for gender equity, was the NY Women in VR meetup,[8] which explicitly dealt with both the gender gap and shortage of women. Along with the Women in VR Facebook group, my interviewees cited the meetup as a key community for learning about the medium. Not only were these safer spaces for enthusiasts, but also powerful ones, to which both men and women flocked. Men, in fact, were encouraged to join. After being invited to the meetup by the organizer, one male interviewee asked "Is it weird that I'm a guy?' She's like 'no, it's not.'" The meetup profiles and showcases the work of female developers to a wide audience. If other meetups had past memberships dogged by a gamer bro, this particular meetup realized a more equitable future in tech. Although not directly stated, the idea of a clean slate in games, play, and gaming underscored much of the conversation.

Interviewees did not broach issues of income and race, to name two other social hurdles, to the same degree. The reasons are unclear. Although the composition of the enthusiasts was diverse, African-Americans were not as equally represented as other groups by my observation. Income is quite complicated and will be discussed in more detail in Chapter Nine. In general, most need a fair amount of funds to even gain access to the technology for personal use.

Generally, the opinion was that VR was a game-changing technology, with the ability to reshape industries, social practices, the way we think, learn and interact. The belief was that this would happen soon, once the technology disseminated to the wider public.

---

[8] "NY Women in VR," Meetup, accessed March 9, 2018, https://www.meetup.com/NY-Women-In-VR/.

Coming Back to Reality: Limitations to VR in the Present

While all acknowledged the *future* potential of the technology, they described present day VR by its limitations. There were practical and endemic issues, ranging from ignorance on the part of the very professional fields that would benefit most, to cost and even the difficulty of the creative tools. These impediments hinder VR's progress and erect barriers that inhibit its true potential.

Barriers to Most Industries

Enthusiasts felt handicapped in promoting their products and getting the attention of industries outside of those already invested in the technology. However, they felt it was necessary for VR to diffuse beyond its current audience. One content producer said, "But this is not a mature market. A lot of the early adopters with early successes will fail or be acquired." Another source said of potential businesses entering VR, "They don't know exactly how they want to get involved, you know?… It's still so rapidly evolving, they're all a little bit afraid to jump in right now because they want to see where it goes and jump in once it's more established." Another vented that work was hard to find because the only companies sponsoring projects were advertisers who wanted the PR of showing that they could make 360° Video and VR, but after having proved it, weren't hiring content creators or studios for subsequent projects. In both these cases, there is dissonance between relaying the transformative potential of VR to more mainstream industries and cultural institutions.

Furthermore, to showcase content was not easy. Interviewees complained that setting up the HTC Vive was time-consuming, difficult and buggy. A related limitation involved the cost of products, "… [I]t's just so much. You have to drop like $2,500 to get a new computer, and like

the whole set up with all the controls that really take it and stuff…. And then they'll come out with V2 next year." Throughout my research, the start-up cost for equipment decreased, but still required a minimum of $1,000 to generate any serious work. "The technology's so expensive that you can't, as a kind of indie, make… content, right? The reality was that Spielberg was able to get his hands on these cool cameras to create these creative expressions of what he wanted to do. It wasn't stop frame anymore." This also applied to businesses. One head of a company making immersive content said what was holding his platform back was getting customers to purchase the hardware, not the software which he had spent two years refining.

A final limitation stemmed from the influence of the major hardware manufacturers: "[I]f it's supported institutionally by Google, or by Apple, or by these companies that do have a profit motive, that's fine, so long as all the tech isn't locked up, and there's a way to access the code. If there's not… It just slows down the progression. It slows down the experimentation, because it becomes about a branded, sponsored, siloed experience." The major computer and software manufacturers—like Apple, Google and Microsoft—were poised to profit most from the technology—as well as potentially shape its direction. The concerns of interviewees echo notions of "lock-in" by tech giants in cyberspace. As VR pioneer Lanier (2011) stated in his manifesto *You Are Not a Gadget*, "Lock-in removes ideas that do not fit into the winning digital representation scheme, but it also reduces or narrows the ideas it immortalizes, by cutting away the unfathomable penumbra of meaning that distinguishes a word in natural language from a command in a computer program" (p. 10). Similarly, the medium, according to my interviews and observations, could quickly become locked-in both in terms of imagination and finances by established IT companies. Ultimately, the interviewees disdain being on the threshold of a new

technological age feeling beholden to some of the largest and most dominant industries in this world, most specifically the game industry, to advance.

Limitations of VR in New York: Redux

As discussed in Chapter Five, there is a major economic stumbling block involving New York City itself. One interviewee said: "[W]hat we have here in New York is we have a culture that is… so privileged by the entertainment industry and by the big vendors of that industry, the conglomerates, and they want to see an ROI really fast… It sort of reminds me of where e-commerce was in the 90s or mobile apps around 2000, it's the same thing, that's all anybody wants." Because New York's primary industries are slow to embrace new technologies, many felt that VR needed to develop beyond this exploratory phase to really take hold in the city, and, thus, they could only dabble in it for the foreseeable future.

Gaming the System: The Problems and Opportunities of the Game Industry

The game industry was undoubtedly the most invested in VR, according to most enthusiasts. Interviewees consistently conceded that it currently dominated VR in all parts of commercial release, which included not only the hardware, but also creation tools, software, content, and distribution. The equipment was derived from digital game computers and systems. PlayStation VR, the cheapest of the High-End headsets, works only with PlayStation 4. The expectation was that gamers, who already owned the console, for a few additional dollars could get access to VR. Similarly, most High-End VR only worked off of computers designed for gaming—which usually required advanced hardware and graphics cards.

Adopters directly addressed the relationship between the cost of this equipment and gaming. "Well, I would say that it was definitely a headache in terms of trying to buy the right

computer just because there are so many moving parts… Essentially, everybody just has to get a

gaming computer, but even still, people aren't putting in the right graphics cards so it can support

future gaming, or future AR/VR stuff." Another didn't start developing because he didn't have

the right computer for it: "This is the realization I had, was I just couldn't… I wasn't able to find

the time investment to learn Unity. I didn't have a gaming computer… Doing Unity on a

MacBook sucks." One interviewee considered the predominance of gaming the norm: "The

gamers in general drive tech in my opinion. They definitely drive the VR market initially. They

were the first group to be excited and to drive this technology, you know?"

For most adopters, tethering VR to gaming was in some ways a guarantee to its greater

success. Gaming was an important source of revenue: "The kids that grew up on video games

have come of age and can now afford to buy these products for their kids and for themselves. I

think that's a big part of it. It's the Nintendo generation that's consuming this stuff." It also

provided the support and enthusiasm necessary to sustain development:

> And they'll sit for 12 hours and plow through to try and figure that out as a bit of a game
> unto themselves, and I think that that is the gasoline to this whole industry for the past
> four years… because you have these people that are not monetizing it, and they're sitting
> in their basement and they're playing around with it, and what a wonderful world we live
> in that they're able to figure that stuff out, and post it on the forums, or having a YouTube
> video, a tutorial that shows how to do it, and then that exponentially shares that
> knowledge with all the other developers.

Of course, for those who came from a game and development background, their

enthusiasm about gaming is palpable. As a consequence, since "VR is essentially synonymous

with gaming" as one interviewee asserted, it assured VR's future direction.

However, this connection was not always perceived as positive. A member of the lab,

upon her first day, commented on this barrier. Although she noted that there were a couple of

other middle-aged women in attendance, she said "A lot of people are coming from gaming and

coding… I was absolutely terrified to go there." At very least, it was considered the norm: "I

think that the vast majority of people in the VR scene, who are building VR experiences, come at it from a gaming perspective." Another, interviewee stated that in their mind VR is "chained" to the game industry. For her, games came first and truly innovative experiences were put on the backburner. Her assertion spotlights three inherent drawbacks that come from this close affiliation: first, VR experiences were judged by gaming standards; second, the prejudices, and particularly male-centered view of games and tech carried over to VR; and finally, the ways of building VR were being shaped by gamemakers and more difficult to access for the general public. These constitute the game-industry-oriented thinking which overshadows VR.

Other interviewees reaffirmed that gaming was often the basis upon which VR experiences were assessed, "So, I think right now, we're at a point where it's still a lot of VR experiences are still made in the image of films and games, and I think that that's not necessarily what it's going to be." Even when making VR in this style, the content was judged in terms of graphic fidelity and ease of controls, hallmarks of game reviews. Such criteria caused developers consternation. One interviewee disapproved of the general obsession with latency, an issue of graphic fidelity when an image starts to "clip," or visibly skip as a viewer moves their head around a scene. This usually causes motion sickness. "Who cares if there's a little latency, or if someone gets sick. I don't care if someone gets sick. People get used to it. People that were driving the first cars got sick because they're driving cars."

VR entrepreneurs found that expertise for content creation was confined to the game industry, which still does not cater to a wide demographic, despite the Casual Revolution in gaming. A meetup founder said that this was precisely why she started her meetup. When she saw numbers of users of VR increasing she thought "this is a real testament to there having been a gap. A kind of gender gap… in tech as a broad sector. But then more specifically VR and… the

gaming community. And therefore, just making something like a… community locally to me was very important… so that we have a real voice." Others, however, as stated, saw the meetup scene as retaining these biases, although they were in the minority. Another developer confided that past years' VR meetups, in contrast to today, were "deeply…. hostile towards women. In fact, I was with a Swedish female investor at… [a] meetup and she was enraged by the way she was treated by the men in that meeting. She walked out of there just livid. She said this would never happen in Scandinavia and I just didn't go back because it was so hostile." As much as VR could represent a clean break from the sexist tendencies which have haunted the game industry, in reality, male gamers and content catering to them still dominated VR platforms.

Finally, to make a production-worthy product inevitably required a game developer. "More people now will have to learn about what good game design means," one game developer, whose company was producing content in VR and for smartphones, said. VR developers need to plan out their projects via "game mechanics," or the features by which a user interacts with the game. For instance, the "game mechanics" in chess can be understood as the specific rules governing how each piece moves and can defeat another. Generally, this premise was accepted since the most ardent group of enthusiasts hailed from the industry. "So I think the first group are obviously people from the gaming industry, predominantly. They know Maya. They know Unity or Unreal." This remark relays not only *who* was building content for VR, but also *what* tools they were using.

The Unity engine epitomizes the constraints within the technology. Because it originated with games, unlike software for web development or programming languages, it makes game-oriented suppositions about how to create virtual space. This happens at the most elemental levels of the engine. For instance, our lab was instructed to use a prefabricated asset or "Prefab."

The name of this particular prefab camera was FPSController—standing for First-Person Shooter—and requires using the standard "W, A, S, D" controls of first-person shooting games to operate. While this came naturally to most game developers, befuddled non-gamers at both meetups and the lab needed assistance to understand the controls. It is small but pervasive features like this that render *any* experience game-like. Until a non-game-oriented engine is assembled, this will be the convention and "lock-in" will continue. In fact, despite enthusiasm about the engine, "lock-in" caused consternation for early adopters.

United We Stand: The Limits of The Unity Game Engine

The Unity engine is integral to the process of VR development. In many ways the democratization of game engine software made possible the abundance of content necessary for commercial diffusion of the headsets.[9] Developers understood this: "I think Unity wants [VR] to be their platform…"

The enthusiasm about Unity was quite obvious. It was lauded for its ease of use and capabilities in creating a virtual world. Often mentioned was how developers used the "drag and drop" function of the engine to just place 3D objects in virtual space. "[T]here are so many assets that you can download and scripts that are prebuilt and… once you begin to familiarize yourself with the environment… it's pretty amazing how quickly you can build… a relatively complex application. " Another interviewee admitted that Unity was "an easy engine to get into… You have a lot of drag and drop feature[s]… [and] a widespread [online] community that has active involvement." The drag and drop metaphor was also used consistently in one of the educational meetups, with the organizer getting the entire crowd to chant it together.

---

[9] See Chapter Four for more information.

Along with the evangelists who lauded the engine, I also came to appreciate it.[10] Most experts were much more sardonic and resigned about it rather than excited. As an interviewee conceded, "Yeah. I'm using it. It's definitely not the best it can be, but for what it is, and what I'm doing, I wouldn't be able to do what I'm doing without it." Another compared it to other developmental software: "With Flash to some extent, one could jump in at some sort of simplistic level if you were familiar with video editing." By contrast, Unity had a "higher learning curve," requiring some knowledge of a coding language—namely C#—to add any complexity to the environment. No one denied the significant effort to master Unity.

As a result, to refine a product requires a considerable expenditure of labor: "You know, I mean it's a pain… to learn … Sometimes you learn the coding and have to learn, you know, just pushing around dots and… There are tedious tasks, but overall it's… all about play; it's a huge playground." This developer, who was proficient with the game engine, as well as related programs, not only enjoyed the playful possibilities of creation, but also equated Unity to a playground where free and somewhat unstructured and unlimited play occurs. Yet, in reality, the engine is decidedly un-playful and dreary. She went on to say: "So, what I did for two years was I ramped up in Unity, I ramped up in Maya. What did I do? I did 100 online tutorials… I read books, I read manuals, I… made 20 million games. You know I just did the work."

The engine was hardly as easy as "drag and drop" suggested. One developer stated: "For me there's still some barriers with VR, I think it's a little bit more complicated than some of the stuff I've been doing with web development, Javascript, things like that. Even if you do Unity, C# eventually becomes something you need to know…" Despite the joy that arises from

---

[10] This will be discussed in Chapter Nine.

manipulating the game engine, the actual process of making virtual worlds is tedious and demanding.

Unity is burdensome primarily on a technical level. To learn and code in the engine is onerous and even when mastered, developers then run into other obstacles—particularly financial ones, like buying a gaming computer, HMDs, or even 360° camera rigs. The significant time investment in learning Unity has two interrelated consequences. First, those who do conquer it, become devotees of the software. One informant theorized, "[W]ith Unity, it's easier to get into to see results right away and to have a project right away. So it's more gratifying at first, which helps inspire imagination. That's why they've seen a lot of people who don't have programming backgrounds get really inspired. I think that's the big part of VR." Second, by dedicating valuable time and energy in a game engine, they further proselytize game-industry-oriented thinking:

> Games have a… defined set of rules around what makes a game… It becomes the dialog, you know, the vocabulary of how we communicate within things. If that's the vocabulary that people use on blog posts or in conferences, then… I know what that represents… in gaming, but I [don't] know that that's kind of a component of what I want to put into my retail experience. I'm still going to call it the game mechanic even though I know it's not a game mechanic.

The interviewee, who is working on a retail application, still needs to think through his logic based on game mechanics and rules. The engine dictates how the experience is made.

The overall implication is that the people who are leading the charge in VR come to it with a gaming mentality, use game development tools and produce game-oriented work. And those *not* coming from such a background, when mastering the tools for creation, ultimately succumb to the rules of digital games.

Revisiting Playbor

Discursively, enthusiasts feel a tension between what they take to be VR's vast future potential and the realities of actually building it. Their enthusiasm is tempered by established industries (and most specifically the game industry) which ultimately set the parameters for how VR is constructed and consumed by the larger public.

How is this tension resolved in the actual lives of adopters? How do enthusiasts justify the sweeping rhetoric about VR's future with the reality of working within a constrained toolset and an industry that favors a very specific type of digital game?

I contend that the answer is playbor. It is an ethos to make the dreariness of labor fun and passionate; it helps to sustain enthusiasts' optimism.

> What I said is I love the word gamify. I do try to make everything fun… I think that when you're doing something that you're not paid for… and you're taking ownership and you're doing it, if it's not fun you're not going to do it. You're doing it because it's exciting to you. That's what these early stages have been for most of us, is that we're doing this stuff because we love it and it's fun and it's exciting. We're innovating… how I get to that point a lot of times is just through iterations of trying something and finding these little happy accidents that happen and incorporate them into the project in an exciting way if possible… The more times you do that, the more chances you have to come up with something that's maybe innovative.

This quote is a lens into the motivations behind the work and efforts of adopters. The informant begins with an allusion to gamification. In his approximation of the term, he *doesn't* refer to the design strategies usually associated with it, but instead to labor. He then acknowledges that the goal of his labor is not pay, but fun. Fun is also a necessary component to declare ownership. Play and fun are aspirational attitudes. Just as Duffy (2015) describes aspirational laborers—for her, fashion bloggers—who assume specific expenses, actions and activities to gain entree into the fashion market, enthusiasts of VR need to appropriate a mindset of fun in their quest for success.

This goal differs somewhat from Duffy's analysis. The interviewee is not only seeking entree into a market, but also hopes to innovate, or configure the market. He then alludes to traditional game design playtesting and iterating in his conclusion that play will ultimately lead to innovation. For this interviewee, aspirational labor has quite lofty ends: to shape the potentials of the budding VR market. Although it requires unpaid labor, and significant effort, play (through fun) offers a palliative for such exertions as well as a means of innovation.

This elision between the tedious labor of VR development and the play contained in shaping the potentials of the medium is thematic. One interviewee noted that he saw no contradiction between work and play time: "I think play is important. Not because play is leisure time and work is this binary thing where you make the money so that you can go on the cruise or something. But I think play helps conceptualize our work because otherwise, it's just meaningless." Another suggested that the passion and efforts of developers drove him to the business: "[A]lmost anything I've done in recent years. I've just learned new techniques and met new people. I've done things that previously… would have been crazy, or difficult, or challenging, or not worth the time. But all of that kind of goes to the back burner when you see it in the sense of… play." He didn't consider what he was doing as labor, but merely play. Finally, the dream of marrying work and play becomes the impetus for the creative act all together in this interview: "But generally, in terms the way one interacts with or sees the world, the lens of play is incredible. Somewhere along the line it gets turned into work. If you can find a way to make your work play, then that's the dream. That's what ultimately led me back down this path of creative exploration."

As part of the diffusion process, playbor serves two functions. It spurs the user to devote excess time, money and energy to create for VR and other emerging media. Since the potential

future seems so nebulous, a developer can devote as much time or energy as he or she wants in order to influence the medium's destiny. Secondly, playbor is a real world system that circumscribes the activities of developers and adopters. While aspiring to a future where VR will have broad scope, the actual labor reifies the rules and ideas of the current industry leaders and particularly the game industry.

Conclusions

Early adopters have a unifying rhetoric. While representing a variety of backgrounds, genders and incomes, the group possesses a common vision and hope for the prospects of the technology. Being at the forefront of a potential revolution excites these adopters. Forged by an optimism for VR's future, they embrace it either for their own professional advancement, or as the next natural progression in computation.

Yet, hope is counterbalanced against today's realities. They begrudge the tedium of learning game engines, the limitations of working within its logic and the dominance of the game industry.

However, rather than discouraging adopters, these antipodes feed their enthusiasm. The optimistic rhetoric about VR, spread through meetups and media and incorporated into the personal philosophies of adopters helps mitigate the monotony of development. Developers passionately pursue their goal through banal and often joyless tasks which are associated with game production, not to mention learning the rules and limits of game engines like Unity. Ultimately, it is this common rhetoric, along with an odd mixture of aspirational labor and playbor, which helps rationalize their actions, whether to others or themselves.

CHAPTER 8: PLAYFUL ADOPTION

The previous chapter scrutinized the rhetoric of VR adopters, who ardently believe their efforts will pay off eventually. The chapter concluded that this faith helps them cope with the rules and limitations of the software they encounter along the way by blurring the boundaries between labor and play.

Play not only undergirds much of VR, from the game industry's predominance, to the activity of meetups and the rhetoric of early adopters, but also is central in the diffusion process. Despite the many play types and ambiguity of the terminology, play serves several key functions in the adoption of new innovations.

There is evidence of all sorts of play, much of which falls within many of the traditional typologies (Caillois, 2001) and rhetorics (Sutton-Smith, 2006), as documented with other forms of digital media use.[1] Play is also commonly associated in the literature with certain aspects of game design, including, but not limited to, iteration, experimentation and refinement based on user feedback (Salen & Zimmerman, 2003). As "depense" or expenditure outside of the regular labor of "work," playful waste is prevalent. Developers labor outside of their regular jobs in order to advance their knowledge and abilities within the VR community. These producers— similar to those described by Mauss and Bataille—are not striving exclusively for economic gain, but also for glory, or "the most brilliant form" of "personal or social loss" (Bataille, 1985, p. 128).

---

[1] Christopher Moore (2011) expands on the influence of accompanying technology in "The Magic Circle and the Mobility of Play." He demonstrates how the shifting nature of play via mobile devices has broken down traditional ludic notions as espoused by Huizinga, Juul and Zimmerman. He points out that mobile "play in these instances is not set apart, but usually found in the margins" (p. 378) as we wait in lines, distract ourselves during lectures, or fill time in waiting rooms (p. 378) producing what he labels the "gameur" (p. 384), who intentionally appropriates different playful identities throughout his day, meandering from one personality to another.

Scholars promote the notion that play is the basis not only of creativity, but of an alternative economy. I argue in addition that play is the glue that binds practitioners to industry leaders, sustains their place within the budding VR economy, and helps disseminate the medium overall. Play fuels diffusion, but often at adopters' expense. *How* this relationship manifests will shape the overall perception of VR and other immersive technology *and* who profits from its advancement.

Defining Play

The concept of play remains obscure, particularly within Game Studies. In its earliest days, debates between "narratology"—games narrative content—and "ludology"—the role of players and how they engage with that content—helped define the field (Frasca, 1999). While these arguments have largely been resolved and deemed as simply too reductive (Frasca, 2003), play endured as intrinsic in the formative study of digital games.

Scholars, however, came to disparage the archetypal metaphor of ludology: the "magic circle," which confines play to a specialized time and place. Most critiques point to the porous boundaries of play, in which the player fluidly steps in and out of a play state (Juul, 2008; Taylor, 2009). Consalvo (2009) assails the "static" and "formalist" quality of the magic circle that ostensibly defies the contexts in which gameplay occurs. This led Zimmerman (2012) to denounce overdependence on the idea: "When we use one schema to understand, analyze, or design games, other schemas may need to be ignored or repressed." Zimmerman appreciated and hoped to foster "contradictory points of view" in his own work, so that the magic circle, even if a hyperbolic metaphor for the play experience, still informed other practices.

When disregarded, or marginalized, play is sometimes considered frivolity, or the term is used to describe common activities—especially regarding digital and networked media (Jenkins,

2006; Phillips, 2015; Turkle, 2004, 2011). In studies of Internet culture, the "play" of users is presumed, but not investigated. Phillips (2015) called the activity of Internet trolls playful (p. 130), though it is a nasty sort of competition, where activity online is circumscribed as an "adversarial play space" which prizes "victory, and more importantly, dominance" (p. 125) and where trolls "beat" their rivals at the expense of being "soft" (which for trolls also implies being feminine). Turkle (2004, 2011), in her discussions of identity formation online, routinely returns to the notion of "serious play." Jenkins (2004) contends that through online play new modes of civic engagement can occur (p. 233). These scholars recognize the value of play, but do not say what play actually *is*.

Since play encompasses a number of different interpretations and is contested in Game Studies, it is exigent to define and parse the term. Foundational thinkers in ludological tradition articulated a specific time and place of play (Huizinga, 1971, p. 5), different types of play (Caillois, 2001; Sutton-Smith, 2006) or the benefits of play—either in gameplay (De Koven, 2013; Salen & Zimmerman, 2003) or more generally to mind and body (Csikszentmihalyi, 1997).[2]

Most comprehensive is the work of Sicart (2014) who dissociates play from the "magic circle" (p. 113) and identifies it instead as "autotelic," "an activity with its own goals and purposes, with its own marked duration and spaces and its own conditions for ending" (p. 15). For him, then, there need not be a "clear demarcation between the world of the game and the world at large" (p. 15). Although, like me, Sicart looks at play within a broad context, including systems theory and game design, and considers play as an activity, he neither examines play

---

[2] As discussed in Chapter One, Goffman (1959) strove to contextualize play within performative presentation and encounters (Goffman, 2013). More recent work, such as Giddings (2014) examines children's play and everyday activity.

within the mores of the game industry, nor articulates play as an expenditure in part because he is trying to situate it more intimately within culture.

Not to deviate too extremely from these disparate and disconnected definitions, I suggest that the literature brings to light three manifestations of play, which explains this phenomenon especially within the cultural and social milieu of Communications and Media Studies.

First is the activity of play as embodied by the concepts that began with "magic circle." Despite the attacks, the notion of play as a distinct activity still carries value. This, along with the subset of play forms (Caillois, 2001) and rhetorics (Sutton-Smith, 2006), appears within the VR adoption process. Second is trial and iteration, both components of game design, or "a cyclic process that alternates between prototyping, playtesting, evaluation, and refinement" (Salen & Zimmerman, 2003, loc. 249). Third is expenditure (Bataille, 1985, 1991). Play acts as a means of wasting time and energy in opposition to traditional cultural, political and economic norms.

These three manifestations converge to describe play as a communicative form. They do not necessarily work for every form of play, nor are they exactly present in the views of those I interviewed. Their opinions did conform occasionally to the rhetorics of play, specifically "play as imaginary," (Sutton-Smith, 2006, p. 305). But the three phenomena are apparent in the VR adoption process.

To reiterate, this threefold definition only captures some of the processes and associations of play. For instance, it does not include visceral and carefree enjoyment which might be associated with some forms of play. Instead, these definitions suggest play in relation to culturally and technically imposed rules, which players can at once understand, relish, capitulate to and subvert as they see fit. However, like other definitions of the term, these modes should not be taken for granted.

Furthermore, as suggested in Sicart's (2014) manifesto on play, I see it as contextual and compatible with other "serious" activities (p. 5) and pervasive within the meetups and daily activities of adopters. Furthermore, these manifestations often surface simultaneously, overlap and even incite each other. Three case studies depict such play.

An Overview of Play in the Adoption Process

Play is not only ubiquitous in the adoption process, but also fleeting, as in gamification behavior where play punctuates and becomes integrated into users' activities.

Play as Activity

The traditional forms of play are most apparent in the initial exposure to VR products. Like a child after unwrapping a new toy, an enthusiast eagerly plays with the recently acquired gear. Adopters endeavor to figure out what the apparatus can do through little experiments and exploring demos. Such activities are spontaneous, or as Salen and Zimmerman (2003) recount about traditional gameplay: "They are suddenly playing a game, a game that guides and directs their actions, that serves as the arbiter of what they can and cannot do" (loc. 1546). The idea of playing with VR devices, tools and concepts is customary. In portraying his own process of learning the Unity game engine, one interviewee compared it to solving puzzles.

The activities of both adopters and meetups quickly encroach upon Caillois' (2005) classic typologies. He argues that embedded within each game is a specific mode of play (p. 129). Agon, his first classification, involved agonistic games, or games of competition, such as sports (p. 131). Competition is a quintessential activity of meetups. Often some light competition ensues over which devices people have purchased: Have you gotten the HTC Vive yet? How about the new Oculus touch controllers? Similarly, experiences become the substance of playful

contests—when The Void's "Ghostbusters" exhibit debuted at Madame Tussaud's wax museum, a constant inquiry was who had "forked over" the $55 to check it out.

Questioning, bragging about and assessing the best computer for making and playing VR is perpetual. As one informant put it, you are "competing with new people… [a]nd no one really knows what they're doing, so there's not really that much pressure, and it's just, like, a lot of fun." The unknown nature of VR corresponds to Caillois' game type of Alea, or chance. The very act of "immersing" oneself in a VR environment requires a certain amount of acquiescence to chance. Just as a gambler gives themself up to the arbitrary rules of the slot machine, VR players must relinquish their sense of reality when they put on the headsets and accept the rules of the virtual world which they enter. However, the notion of Alea can be extended more broadly to the adopters' perspective about the medium's success: both developers and meetup attendees have no distinct plan for the future of the medium and thus leave their professional activities to fortune. There is even an element of chance in learning VR development: many online tutorials issue specific instructions, but because they are pre-recorded, there is the possibility that students may or may not find success from the guide.

Some of Caillois' play formats are less apparent when it comes to VR. Mimesis, or mimicry, is an implicit part of the medium. "The main things I talk about are being able to tell a story from a first person perspective in a new way so you can put somebody else, someone, a viewer in someone else's shoes in a new way," a journalist told me. Mimesis is an aspirational goal for him. It is also present at the meetups themselves. The meetups allow users to try out and learn best practices of being developers and startups. They can try on the still-evolving role of being a professional VR content creator. Finally, Ilinx, or a game that induces vertigo, is unavoidable in VR. Part of the fun of VR is testing the limits of "VR sickness" which is caused

by stretching the graphic limits of devices. Inducing nausea is part of the fun of VR. I met a

developer on a plane in 2015 who told me the story of how his team put a 360° camera on a cat,

and let it loose to test their own personal limits when watching the shaky footage later in a HMD.

Much has been written about the long-standing relationship between VR and psychedelic

experiences, another form of Ilinx (Terndrup, 2015).

Caillois' typologies emerge within meetups and have nothing to do with thinking of VR

exclusively as a game system.[3] All sorts of activities, including development are inherently

playful, a fact that is reinforced in the rhetoric of play during adoption. Informants specifically

followed the seven rhetorics of play which Sutton-Smith (2006) enumerated. His first rhetoric,

that of progress, is associated with development. Sutton-Smith's second and third rhetorics, play

as fate and as power, are tied to the aleic games of chance and agonistic competition

respectively. Similarly, meetups affirm the "play as identity" and "play as the self" rhetoric

which are associated with the construction of identity formation through play and the self

through hobbies. It is the act of coming together for a singular cause that helps shape a common

vision of VR content creators. There is also plenty of rhetoric surrounding the frivolity of play.

Usually associated with foolishness, a certain self-deprecating attitude pervades the adoption of

VR: "You're asking somebody to put on this kind of clunky headset and have these hand

controllers and be tethered to a PC and it looks kind of ridiculous to watch, so there is something

magic about it that you wanna embrace." Finally, the rhetoric of play as imaginary, which is

---

[3] Frith (2014) found similar typologies in his study of the gamified application Foursquare as the four player types—achievers, explorers, socializers and killers—Richard Battle discovered when analyzing online game players. He stated that understanding the application through this taxonomy "is important because it shows how different interpretations of the best uses of the application affect its utility as a tool for mobile coordination" (p. 901). Additionally, he found that users generally have "one dominant reason, and the different types of uses" (p. 901) of the application still overlap and make its overall purpose unclear.

associated with creativity and innovation is very much how developers perceive their own activities.

Play from Adopters' Point of View. Play cropped up quite naturally in the rhetoric of development and exploration. "So once I got that, [I] started playing around, thought it was amazing," said a developer about their first use of the Oculus Rift's DK1. Another discussed his earliest experiences of using a headset this way: "I played around with his degrees of freedom, basically how he can move around and stuff." Developers also applied such language to their experiments: "I was more just playing around, seeing what are some of the interesting things you can do with it," said one informant regarding the process of building content during a meetup hackathon. Some expanded upon the overlap of play and work: "And the developers that sit in their basement and are trying to create an experience are not working, they're playing around with how to create something, and in a real broad sense, as you play around… [you] try and hit a certain goal." This language reflects the paradoxical nature of their play, at once bound to their jobs as developers, while at the same time achievement-based fun.[4]

Many invoked play in the context of imagination. One interviewee encapsulated the overall ethos: "I think in any creative field, play is the essence of creation." Another stated that play was "a discovery thing as much as it is gameplay." This aspect was affirmed by others as being at the core of VR's excitement. Ultimately, it was the ability to create with truly innovative tools which was at the heart of "playing" with this technology. It also perpetuated their adoption. "[T]he way you figure [VR] out is by experimenting… Any time we get a new camera… we

---

[4] The issues with this dichotomy and what it ultimately means for the role of play in adoption will be discussed further in the concluding chapter.

basically play with it," explained a journalist and professor about the process of working with the ever-changing group of 360° cameras being released and acquired by him for his work.

This rhetoric illuminates the perceived role of play in the development and creation of VR content. By describing play through the lens of the "imaginary," developers acknowledge the value of play. The adoption process is fun because they can play, experiment, innovate and realize their potential through learning about and making VR. They get to conceive their version of what VR can be. It is a sandbox or playground in which they can create.

One interviewee summed up that play draws in early adopters, adding that "they can do something that basically [nobody has done before]… That's exciting…" Through play, adopters create something new.

Play as Design

As Game Studies recognizes, play and design are at the crux of games. A game's design dictates the rules by which people play. This has much broader implications beyond gaming into cybernetics and systems theory. Once designed, if designed well, a game begins to predict the activity of users. It comes as no surprise then that Game Theory, though hardly focused on play, took its name in part to describe the predictable quality of human subjects.

Salen and Zimmerman (2003) espoused these principles in their foundational textbook *Rules of Play* where they scrutinize game design through systems, interactivity, sets of rules and ultimately user experience. They state that "design is the process by which a designer creates a context to be encountered by a participant, from which meaning emerges" (loc. 772). It is this meaning which is what they hope to achieve in making "good" games. In other words, "meaningful play" for the scholars occurs when the rules and actions of the game are not only at

once "discernible" to the players, but also integrated into the game itself. It is a definition which reflects their design-oriented thinking rather than carefree enjoyment.

More importantly, such play manifests best through iteration which the two authors assert is necessary for game design: "Iterative design is a play-based design process… in which design decisions are made based on the experience of playing a game while it is in development" (loc. 245). In order for iteration to be productive, "playtesting" must occur, a term Salen and Zimmerman use almost interchangeably with the iteration process. They argue that playtesting "becomes the core activity of game development. The fun and excitement of playing cannot be calculated in an abstract fashion: it must be experienced" (loc. 439). Good design is contingent upon user feedback, which is elicited through play in order to refine the game. After all, a game is only good if it is played. This process applies to other non-game contexts, such as journalism (Foxman, 2016).[5] Iteration is integral to development. In his study of AAA developers, O'Donnell (2014) states that the ability to "'iterate' on a problem with a team is productive" (p. 133) by all considerations of the industry. Human Computer Interaction and the rise of "Lean" and "Agile" startup culture embodies many of these practices on an organizational, as much as a project, level.[6] Suffice it to say that Agile Design has utilized rapid iteration as a core component of the development process and similarly game development has integrated Agile Design as a vital method (Keith, 2010).

Not only has playtesting grown beyond software and computer design, but it also holds sway in the culture of startups, "lean" businesses, software companies and game development

---

[5] In this context, much of the play was observed both in the process of designing newsgames and within specific activities meant to generate article ideas.

[6] This is discussed in more detail in Chapter One.

studios that predominate in the VR meetup scene. Through hackathons, educational bootcamps and demos, developers publicize, test and iterate their products. It isn't unusual to see the slightly altered versions of exhibits from meetup to meetup. In this way, the group's structure acts as a breeding ground for this type of play, where producers can receive feedback and improve upon their innovations. This view is generally supported by scholarship on meetups, which recognizes both the spontaneous and iterative quality with which membership and topics develop (Lai, 2013). One regular attendee showed various iterations of his work from meetup to meetup to gain insights on his progress, "We were trying to get people to give us some feedback, so we're doing user testing… on our early prototypes… And we're getting really great feedback. No one got nauseous, and no one was like, 'No, I'd prefer to use my thumbs.' Like everybody seemed to be yeah, this seems like a no brainer…" Exhibiting prototypes is common. In a celebratory end-of-year meetup, a regular demonstrated his innovations in "pass through" technology. With a small set of spectacles, he used his smartphone to display a very simple scene including a tree, which could keep its position in the room based on where you stood. He had created "Room Scale VR," something which usually can only be done on high-end headsets, on this cheaper device. Users flocked around him to offer feedback. Most responses were banal, with a few people saying "how cool" it was or asking him questions, but it allowed him to clarify his explanation and thinking. This ad hoc form of playtesting was more common than not.

However, it is in the development process itself where iteration is most clear. Developers add versions to their projects over time. Each version gives other enthusiasts the opportunity to see and comment on the work. Furthermore, the process of coding for VR is inherently iterative: users put on and take off HMDs constantly to play with and tweak their experiences. A few interviewees advocated that this was part of the creation process: One said, "specifically

designing VR in VR is actually some of the most gratifying experience[s]." Another elaborated, "I think I can iterate things really fast in Virtual Reality. I can come up with an idea and iterate with it really quickly… I learn faster the more I play. The more I play, the more I'm interested in playing, the faster I learn." Another used an iterative compositional strategy to describe his workflow: "[A] three-part process where you have ideation then you have play… that is in dialogue with your ideation. And then you go back and say, 'Alright, this work let me formalize that.' And then you take what you formalized and then you sort of play with these on the next meta level and that's the template of how… a person composes with media or electronic media."

In order to finalize a project, a prototype must be built and iterated upon with feedback from others. This process may not only apply to specific projects, but also to the overall process of VR diffusion. In other words, it is only through the creation, public release and feedback of *many* different types of VR experiences that the "killer app" of VR as many enthusiasts put it, can be found.

Play as Expenditure

A final mode of play stems from "depense" or waste as articulated by Georges Bataille. Play as expenditure shares some concepts with the rhetoric of "play as frivolity." As Sutton-Smith (2006) writes, the rhetoric is associated with "persons who enacted playful protest against the orders of the ordained world" (p. 306). However, Bataille uses these acts of expenditure to underscore a political act, in which the power of play is that it defies utilitarian needs and capitalist modes of production. Only a few scholars have explicitly connected Bataille's notion of depense to play. Leibovitz (2013) declares: "[T]he realm we enter when we grab the controller and turn on the machine is that of dumb pleasure, governed by the sweet mindfulness— solipsistic, sensual, nearly orgasmic—that is common, indeed, to war and to trance and to other

exalted phenomena that we can never fully understand but can only experience. This is more than blowing off steam, or vegging out, or any other imperfect term frequently associated with playing electronic games; this is a necessary part of the cycle, a safety valve that keeps us from overheating" (p. 74).

The relationship between games and expenditure has been central in my study of gamification as a mode of pursuing glory and waste. I discuss the origins of this research in the concluding pages of Chapter One and have touched upon it within other chapters. For Leibovitz, Bataille (1985, 1991) and early anthropologists studying the potlatch (Mauss, 2000), the guiding notion is of an "alternative economy" based upon expending excess rather than conserving it.

For Bataille (1985), glory was the most extreme version of "the creation of unproductive values" (p. 128). The reason was simple: glory was a driver for allowing waste and expenditure by "humiliating, defying, and *obligating* a rival" (p. 128). The desire for glory acted as a motivator for expending energy outside of regular economic production, and at the same time would obligate others to try to outdo each other. Expenditure, the act of devoting excess energy outside utility, is central to play. Many of the rhetorics of play described above can be understood as justifications for expenditure, with only the subversive rhetoric of "play as frivolity" directly engaging with this concept. Whether one is "playing" for the sake of innovation, for competition, or frivolity, one is investing excess time and effort.

In fact, thinking of play as expenditure recasts a number of arguments within this text. Playbor and aspirational labor can then be interpreted as a novel means of capitalizing on the excess expenditures of players. Similarly, "early adoption" takes on a new valence because it suggests that in order to be an adopter of an innovation, some excess or expenditure is necessary. The extracurricular activities of adopters and the enormous dedication of spare time to acquire

skills strikes me as particularly playful. Given that VR is not widely accepted, adopters' devotion and efforts to the medium for both the fun of the experience and to realize its potential correspond to much of Bataille's theory of expenditure.

Meetups offer moments of glory when participants brazenly brag about their work and new gear. Adulation, praise, and other forms of direct feedback, spur developers. However, such expenditure can go to extremes. One consistent attendee of the meetups described to me more than once the "early days" of VR only a few years earlier. Since he had started developing before meetups proliferated in New York, he had to drive from New York City to Boston, where the closest meetup was, every month. He also traveled to various conferences, where he set up the demo of his latest game on any empty tables rather than getting a formal booth. Most conferences disregarded his presence, so he happily demonstrated his product to anyone who showed interest.[7] The modes of expenditure for this developer were manifold, from his initial investment into the gear, to the many hours he spent driving to and from Boston, to the euphoria he felt as he showed off a game of his own creation.

Glory and expenditure also occur in some meetup formats. Hackathons take on the role of competitions, usually with winners and losers. They and other forms of VR experimentation inevitably occur after work hours. One developer told me: "Because I have a full-time job. The only time I get to do some of this is between 9:30 PM and 10:30 PM at night when my son is asleep." And such efforts were often celebrated and a source for glory in and of itself. Finally, that most meetups are free, or cost little, is a kind of expenditure—the meetings run on the

---

[7] He wasn't alone. In fact, the purpose of many meetups is to get attendees (for free or at discount) into exclusive events.

expenditure of others, often individual organizers, rather than specific corporations or for-profit businesses.

Play as expenditure is complicated by the political economy surrounding current VR diffusion. While adopters expend their free time, money and energy on the technology, their work directly benefits the larger VR industry. Adopters believe that their personal investments— their labor—will result in future careers, income, and success, despite the fact that it mainly benefits corporations who look upon enthusiasts first and foremost as consumers. The process of adoption in this way is linked to ideas of modern entrepreneurship and the larger "gig economy" (Friedman, 2014), which promotes freelance work rather than job security and where corporations such as AirBnB or Uber derive profits from platforms that act as intermediaries between service providers and consumers. If indeed adopters' play serves a similar function to VR businesses, the question remains whether it is fostering an exploitative activity. This concern was not considered in interviews, because, according to informants, VR products had not reached a "consumer" level of interest yet, even though they were consuming it themselves**.**

<div align="center">

Three Moments of Play

</div>

The following case studies represent often recurrent moments of play that transpired over the course of the research and were emblematic of a larger trend. After each thick description, presented in italics, I briefly summarize in what way the case manifests play as activity, design and expenditure.

Case Study 1: He Speaks

I've seen him speak so many times at this point that I hardly have to listen to his spiel any more. Before almost everyone of his meetups starts, E., who runs and showcases a VR education

meetup all by himself, preaches. Typically, people filter in late, get out laptops and begin to download Unity as he talks. Often his opening monologue, which he has assured me in an interview is not developed with any forethought, raises the same rhetorical tropes each time.

At the very first of his meetups I attended in March 2016, he exclaimed, "We are in the future." At a meetup a year later, he concluded, "This is the future, welcome!" I met him at a summit sponsored by the former tech giant AOL, and we spent some time together eagerly surmising about the future of VR. At the time, I was still very much a VR novitiate and appreciated his guidance about the importance of the meetup scene in New York City and for developing VR.

A few weeks later, I go to one of his extemporaneous expositions of the Unity Engine and the latest in VR and AR hardware. Put together to educate true beginners in how to develop for immersive technology, he invites friends, other meetup members and developers to give talks, workshops and promote their own wares. The cost to attend his meetup is relatively high—on average about $20—but it promises specific results. More than a one-man circus, the meetups promise to show neophytes how to make content for every VR/AR platform. E. boasts that he can inspire anyone to create VR/AR in twenty-five minutes or less!

He hypothesizes that VR is going to be the next evolution of entertainment: "How many of you have watched a black and white film recently?" he asks. That's not the norm anymore. Soon, he says, 2D film and entertainment will be a relic of the past as well.

Then he sets up a 360° camera and happily proclaim that what he is about to show on his YouTube channel will resemble a 25-minute cooking show. He'll give you the ingredients to make great VR content and by the end of the show, you'll have a finished dish.

First, he'll project a clip of a recent Unity announcement or developer conference, explaining how this or that innovation is going to change the world. He'll also promote. Sometimes it's a food or drink. Companies give him samples of their product to do with as he pleases. On occasion, he pitches businesses just because they give him swag. Still other times, the giveaways are VR related—for a few meetings he distributes cardboard headsets as prizes to those who tweeted about the meetup, and even has us all sign a blank one, claiming that this would be a priceless heirloom in the future.

E. arrives at another of his talking points: the community. The community is what is pushing this, he says at one particularly long conference. At another, he emphasizes that each attendee has their own community that they could bring into VR for mutual benefit. Another time, he suggests that while most Unity meetups are just people giving speeches, "this is a workshop. You can be part of a community." He often encourages us to "get to know each other and each of you have a unique skill set." At around this time, it isn't unusual, particularly at the smaller meetups (of 20 or less), for each participant to explain our interest in VR. Usually the skill sets vary wildly, with only one or two seasoned developers.

Then, his "cooking lesson" begins. Greeting the camera with "Hello Friends," he attempts to make VR content on the fly using the Unity engine. He's a fan. In at least three meetups, he sermonizes about the engine in divine terms. The ability to swoop and pan and control the world is inherently godlike, he says. He is critical of some novel devices: he isn't wild about the cheap Ricoh Theta 360° camera he purchased, saying that the image quality is not great, but that it gets him away from behind a phone when taking pictures or video of his young children. However, it is for Unity that he evangelizes the most.

Why? Well first, it's free. At the last meetup I attended of his in late 2017, he used a metaphor that he had brought up a number of other times, having us close our eyes and conjure up a great store, a dream store with everything we could imagine. Now, envision an aisle of that store where everything is for free! That is the Unity Asset Store, a never-ending supply of free 3D models, as he describes it.

From there, he has audience members call out what they want from the store. Often a dinosaur or some other fantastical creature is requested, and he searches the stock, pulling out the 3D object to put in the scene. On more than one occasion, this doesn't quite work out. The actual dinosaur desired costs $45, so he settles for something free. Unfazed, he adjusts and shows attendees how to grab the item and import it into Unity.

Then he goes on to the engine's second great benefit: the ability to "drag and drop" the dinosaur into the scene. It's that easy—drag and drop. He will have us all say it as he pulls in other objects. Here we go, he asks, what do we do now? And the audience, sometimes more excited, sometimes less, follows along with a chorus of "drag and drop."

Soon, he begins to improvise. He is "getting into the zone." Sometimes he continues eliciting feedback from the audience, building a scene around their particular requests. Sometimes he deviates to his own interests, tinkering with code details, narrating aloud. He also notes that skills can lead to jobs. People have paid him to make similar projects.

In the most successful cases, he builds a fully complete scene on his Android phone. In less successful instances, something goes wrong. He rolls with it, remarking that such mistakes are inevitable when you are demoing live. Eventually, he takes a break and attendees gather around him with questions, or ask to use his augmented reality headset, which he has said is the

"future" of such devices because of its small size. He will inevitably encourage others to tweet
about the headset to advertise it further.

Play as Activity. I have interviewed a number of attendees of this particular meetup who
cannot refrain from overstating its fun. Through his playful activity, the organizer creates a
positive atmosphere. His language matches the enthusiastic rhetoric of play as not just
"imaginary" but achievable. Anyone can innovate and shape the future with his free tools. His
attitude encourages attendees to play, too. Consequently, many of his meetups end with small
experiments and demos by the users.

Play as Design. This organizer's process is inherently experimental and iterative. Quick
to get the "community" involved, he spends much of the time building content based on their
requests and revises his projects based on their feedback. Failure is an accepted part of the
process, with the idea that if this version didn't work, with a bit of tweaking, it can be
successfully turned into a prototype, or iterated upon to eventually become one.

Play as Expenditure. The expenditure within this speech is embedded with notions of
glory. By entering into this revolutionary community, sharing and giving to one another,
attendees are part of the future of technology. Their efforts will one day lead to jobs and work,
but for now, they require the training, learning and support of the community. That the organizer
charges for his meetups, and thus benefits economically from them, is an irony in light of his
belief in community and open sharing.

Case Study 2: Lab Iteration

On the second day of the lab, I went into a room with one of the more advanced
developers. While the rest of the group was going through a VR boot camp, where they learned
the basics of Unity through a tutorial. Z. had already attained the requisite skills for building

content. He was moving to what was the next natural phase: iterating on an idea. I had been tasked with helping him brainstorm using a tried and true method of game design: the game design document.

In a classroom covered in white boards, we started our exercise. I had to slightly adjust it for him, but the basic premise of the procedure was the same: in a game design document, you begin as if you're pitching a film: a title, logline and short synopsis. From there you expand, adding ideas about the market, the controls and other game mechanics. You highlight other games you are referencing and align with a genre. It's common with design documents to pull pictures from the Internet, and utilize them to illustrate characters, features and other mechanics you hope to emulate. The idea is not to start from a completely original place, but instead build from existing content and improve it.

Z. was trying to construct an application, which made the game design document particularly challenging. All he knew was that he wanted it to involve fashion. We started drawing and writing out thoughts on the whiteboard to make it work. He threw out ideas, ranging from the practical—he had done research on the lack of fashion applications in VR—to the more ambitious… maybe something involving telepresence. He showed me his other work, a 360° Video he had made. In the end, we came up with three ideas that he planned to show the head of the lab the next week.

The use of such documents was emblematic of the ethos of the lab. In my earliest days of observation, its leaders had emphasized that in order to have success in VR, rapid prototyping was necessary. They had worked with interactive media and art for many decades and had held this philosophy throughout. Given the inchoate state of VR, they felt that documents were especially necessary. The lab's leaders frequently repeated the mantra, "test early and test

often." Get the minimum working. This approach was also pragmatic, I learned. All development time was vital, and rather than throwing out material and starting from scratch, prototypes had code and other material that could be recycled.

As a consequence, rarely a session went by where there wasn't some form of prototyping and iteration. In one week, at the behest of one of the directors, the attendees were encouraged to construct a prototype in VR, using the application Tiltbrush to paint the user interface they planned to make. Another week, we were instructed to devise a MVP—a minimal viable product—of at least one scene to show to everyone. A director explained it made the whole process easier for him. Once he got the core mechanic down in his MVP in the first weeks of the lab, he was essentially fine-tuning his project before the showcase weeks later. At one lab meeting, we formed official teams by pitching our ideas and then meeting with those who liked them to flesh them out. Still another time, we had to construct short paragraphs of our experiences to use as a framework to solidify what we had been working on.

While these specific tasks were assigned fairly regularly, the lab was a hub of prototyping and testing on a more mundane level. The directors of the lab were perpetually interrupted with questions about projects and would jump off their own work to help attendees. The spontaneous troubleshooting often led to new developments and more questions. This happened with such frequency that most of the directors' own projects weren't addressed until after the attendees had gone home for the day at 5:00 PM.

The head of the lab was perhaps the embodiment of this sort of iteration. Almost weekly, she came in and set up a Vive on a table. Whenever she hit a benchmark, she happily called anyone and everyone over to try out some aspect of the program. She asked us questions about the experience. For instance, she asked me what I thought of the movement around a truly

cryptic scene with bodies on pikes. Another time, I heard her conferring with someone regarding whether giant spiders which jumped on the main avatar were distracting. She wasn't alone in seeking feedback. Another attendee, who constructed abstract art scenes on an old Oculus development kit, asked people to try out his experience on a weekly basis, even though it ran incredibly slowly, and then he would comment on the changes he had made and the improvements to each scene.

Such sharing happened virtually as well. On the Slack channel for the lab, there was constant querying about the minutiae of projects. The lab leader encouraged us to post everything on Slack and social media to see the work that had been done. She and others reported small accomplishments, such as fashioning high-quality masks in Maya, or posted code to get some feedback about a problem, and then the lab, on its best days, would rally round to improve it. On its worst days, nobody would respond and more often than not, a question or two was directed at the poster, so that they could find a way to improve the project on their own.

Weekly improvements were usually met with enthusiasm. Any change was seen as a positive and part of the process. A common ploy was for people to couch their work in the amount of time it took to do it and when they had finished it. For instance, on a Slack post: "Went to sleep 3am yesterday and work at 7am. trying to finish 3rd level, but no success." The poster had spent the whole night completing a maze in her experience and tried to get a "script," or piece of code, working that allowed people to look at specific objects and pick them up with their gaze. "Could[n't] get it working. The one I used kept creating errors. Any suggestions?" Every week, inevitably someone would come in and describe a near sleepless night they had spent developing with a distinct sense of accomplishment, frustration and self-satisfaction.

Play as Activity. Play as a creative activity is less obvious in this case. Certainly, there are moments of it. Prototyping lends itself to playful creation, whether adding images and features to a game design document or creating a user interface with Tiltbrush. One must physically create, innovate and alter their ideas as part of this development process.

Play as Design. The iterative process of play is integral to the lab. The community provides feedback and playtested projects. That there are willing and available participants who generally supported all aspects of development is a motivating factor for joining and progressing each week. It not only creates a sense of camaraderie among developers, but with daily contact, as well as formal and informal tasks, makes the process of development less solitary, and more a response to and dependent on the feedback of others. Furthermore, it maps with the philosophy that rapid iteration ultimately produces better work than isolated content creation.

Play as Expenditure. Compliments are concomitant to development. There is celebration when tasks are completed in the lab. With each post on Slack of an improved model, an emoji would instantly appear—thumbs up and horns to celebrate a job well done. However, as was illustrated in the final paragraph of this case, this celebration is in part because of the expenditure of individuals. Working till the early hours of the morning becomes a point of pride rather than an excess of work.

Case Study 3: Tango Hackathon

Perhaps no meetup event seems more playful than a hackathon. Throughout my research period, I observed three hackathons, but also interviewed and observed many attendees of these affairs. With prizes and teams, these events are explicitly competitive and usually involve contests to make and show a product within a prescribed time period. Work can go till all hours of the night. During one hackathon I observed, from which I had to leave early, I noticed posts

on the hackathon's Slack channel going until 3:00 AM with updates on work that needed be

concluded by 12:00 PM the next day.

The hackathon I attended in full was sponsored by the aforementioned meetup organizer, E., as a weekend to build products for Google's "Tango" Tablets, which are designed for spatial scanning. In his opening statement, the organizer told attendees that hackathons were a microcosm of the real world. He explained the process of coming up with ideas, developing a project and showcasing it. After playing some videos, he proceeded to quickly demonstrate a scene. The goals of this hackathon were clear—and slightly different from others—to produce as many projects as possible and post them to a website which features other experiments.

By noon, most attendees had started to assemble into groups with ideas. There were about a dozen Tango tablets for them to try; participants began to test the Tango's functions and play with the existing applications, which did things like scan a room and supply real-time measurements of it. A few formed into teams. It is usual in hackathons for groups to quickly organize based on interest. In another hackathon, I experienced this more intimately; I watched conversations about a project's potential split groups into smaller ones. This time, I found myself paired with a seasoned developer. He had to leave early in the evening, so we worked frantically to create a "graffiti" application for the Tango, which would virtually spray paint buildings through the camera of the tablet. I had found a few tutorials online but had hit some roadblocks until I started to talk to him. We eventually got a simple prototype working that shot one color of ink in little virtual balls which splattered against the wall. While we worked out these details, I heard cries of frustration around me. Some people couldn't get their applications to work. Some were having trouble even downloading the program. I complacently meandered from table to table showing off my project to anyone who would look. The work lasted until around 9:00 PM,

when, unlike other hackathons that allow attendees to be locked into the venue, we were ushered out to reconvene the next day.

By the next morning a certain calm descended upon the hackathon. Many were focused on the time: the projects needed to be completed by the late afternoon and the daunting task of producing them by then had started to set in. The organizer worked on his own project, narrating aloud his process to those who were listening. I became, admittedly, distracted by my own work. My colleague from the previous day had not shown up, so I abandoned the previous prototype, and instead worked on recreating a scene I had made weeks before. I wanted to make it navigable using the Tango spatial scanning. In two hours, I got it to work and then spent a good amount of time wandering around the hackathon's cavernous coworking space/incubator to test it out. Eventually, once again I exhibited it to others, who gave me warm smiles for my work.

Unlike other hackathons I had observed or heard about from interviewees, this did not end in a grand showcase of final products and presentations by their authors. Participation had been inconsistent over the two days, perhaps because we were prevented from staying through the night. As a consequence, the organizer showed us postings of our experimental projects online and gave rewards—swag, health bars and cardboard headsets—to those who were there and had participated. Many left with the beginnings of projects and experiments to pursue in the future, as well as a couple of tokens attesting to their 48 hours of perseverance.

Play as activity: By design, hackathons are playful. Built around agonistic principles, their mission is for developers to create a product quickly and then compete to determine the best one. Even in this more relaxed hackathon, the activity of play was set in its rules. We had to use Tango tablets and to post our content. There was the reward of swag or a prize. Those who were able to produce better content received recognition from the organizer. There were other

moments of playful activity. Many used the hackathon as an excuse to play with the Tango tablets, which were not available commercially. As part of the discovery process, they were able to play with existing applications for the tablet for hours at a time, in part for fun and in part to learn.

Play as Design. As in the lab, the hackathon had many moments of iteration based on feedback from the community. Much of the hackathon involved building projects and showing them to other teams. This generated feedback about what was working and what was not working and also acted as proof that the demos actually performed. Furthermore, the website to which the projects were posted was built purposely for iteration beyond the hackathon.

Play as Expenditure. The primary mode of play in this case was expenditure. Hackathons require the expenditure of time and funds to participate. This hackathon, at a bare minimum, took up an entire weekend. Many other hackathons charge admission fees. For these strenuous efforts there were no cash awards—in this case, one prize was a health bar. The excess time spent to develop was for glory—self-satisfaction and the accolades of peers. Furthermore, the act of playing with the new technology is another kind of expenditure. Beyond competing in the hackathon, participants spent time just playing with the new technology, abandoning the rules of the hackathon for some plain fun. There is an anarchy to the hackathon that allows anyone to compete as much or as little as they want. It is a special time and place where people can cast aside rules and play with the technology as they desire.[8]

---

[8] This is reminiscent of the carnival, which has been connected to play, most notably with the theorizing of Bakhtin (1984).

Play as the Engine of Industry

Play suffuses the meetup scene and the process of adoption I observed. Creativity, optimism and energy also imbue the media environment and rhetoric enveloping VR and its future.

The relationship between VR diffusion and its manifestations of play is not without complications. There are issues with play as expenditure that cannot be ignored. Expenditure resembles neither the frivolity of play, nor the gift economy. Instead, playful waste caters to very specific beneficiaries.

The organizer of the meetups collects fees for admission to his meetups. The lab, while free-flowing in the development process, culminates in a major showcase, at which developers make connections for future work. Even hackathon participants receive tangible prizes in the form of gift certificates, checks of a few hundred dollars, memberships to online services and/or swag from the events.

In each case, their experiments offer utility, even as they are supposed to be useless. This is obvious to most developers, who didn't label their expenditure as play, but rather as passion, fun, experimentation or work. Even while practicing such expenditure, they know they are taking part in overtly productive activities.

This fissure between play's manifestations and its consequences invites further questions about the function of play in VR's diffusion. As intimated in previous chapters, playbor undergirds much of the rhetoric and perspective of VR adoption. It motivates developers to produce work and sets the stage for Duffy's "aspirational" labor. Passion for the future of VR impels developers to devote their energies to the process of diffusion, not for their benefit, but for the industries who promote the medium. However, studies of "playbor," including those

investigating modding communities (Kücklich, 2005; Rey, 2012; Van Dreunen, 2010), stress the "bor" at the expense of "play." They recognize that play is a key reason modders choose to mod, but in their studies do not actually illustrate the process of play itself.

In contrast, this chapter captures the process of playbor. Playful activity, design and expenditure stimulate VR's diffusion. Play assures the devices' future and subsidizes the industries that manufacture them.

Playful activity—couched in the creative "play of the imaginary"—pervades the rhetoric of developers. Creative potential inspires them to continue to work and develop VR content. Play as design is the undercurrent of meetups. One interviewee described the community as vital because he could "[t]alk to people and see what's going on, show my demo, things like that, which is a critical part of our development… Everybody who comes is interested, whether they're new or they're seasoned VR people. And we wanted to be VR developers, so that's where you had to go." Play is also part of the development process itself. It generates iterations and versioning that consumers and developers can iterate upon. Iteration is equally elemental in the media ecosystem with tutorials, videos and content. Finally, play as expenditure prevails among developers who devote excess hours to learn tools, build content and write blog posts, all without anticipation of personal economic gain.

A proliferation of media and enthusiasm drives innovation diffusion. It also fuels consumption. Developers decide and discuss the best equipment to acquire, purchase it and replace it to keep up with a rapidly evolving industry. While they may justify their purchases for their creative potential, at least in part, some acquisitions are simply for play. Generally, riding the VR wave is more for fun than for wealth.

It takes money. SuperData's (2017b) report on "The Virtual Consumer" highlighted four main types. The "Immersed Console Player" earned an annual income of $68,000 and would spend $43 on each piece of VR content. "The High-Earning Virtual Tourist," had an annual income of $81,000 (p. 36). The average salary of a headset owner was just under $80,000. Clearly many people can be engaged with VR because they have the disposable income to spend on such novelties.

Play is an engine of diffusion. It increases motivation, experimentation and utilization of technology, even without any promise of functionality. This opinion breaks somewhat from the literature's traditional notions of innovation diffusion. Rogers (1995) implies that the process of adoption occurs when an individual first becomes aware of an innovation, seeks out information, weighs the advantages and disadvantages for its use, implements the innovation to personally assess its practicality and then confirms and finalizes his decision. However, I am suggesting that there is something in the adoption process of VR which is inherently irrational and born out of the optimism, not to mention the playful environment and media ecosystem supporting the new technology. For a non-productive reason, for play, adopters come, dabble and tussle with the frustrations of development.

In contrast to Mauss and traditional assumptions of a "gift" economy, this is not the pure type of "waste" to which Bataille and others ascribe. Instead, it sustains a specific set of activities and industries which dominate this ecosystem. With play as the engine, the following figure illustrates the vehicles, the industries and platforms it powers.
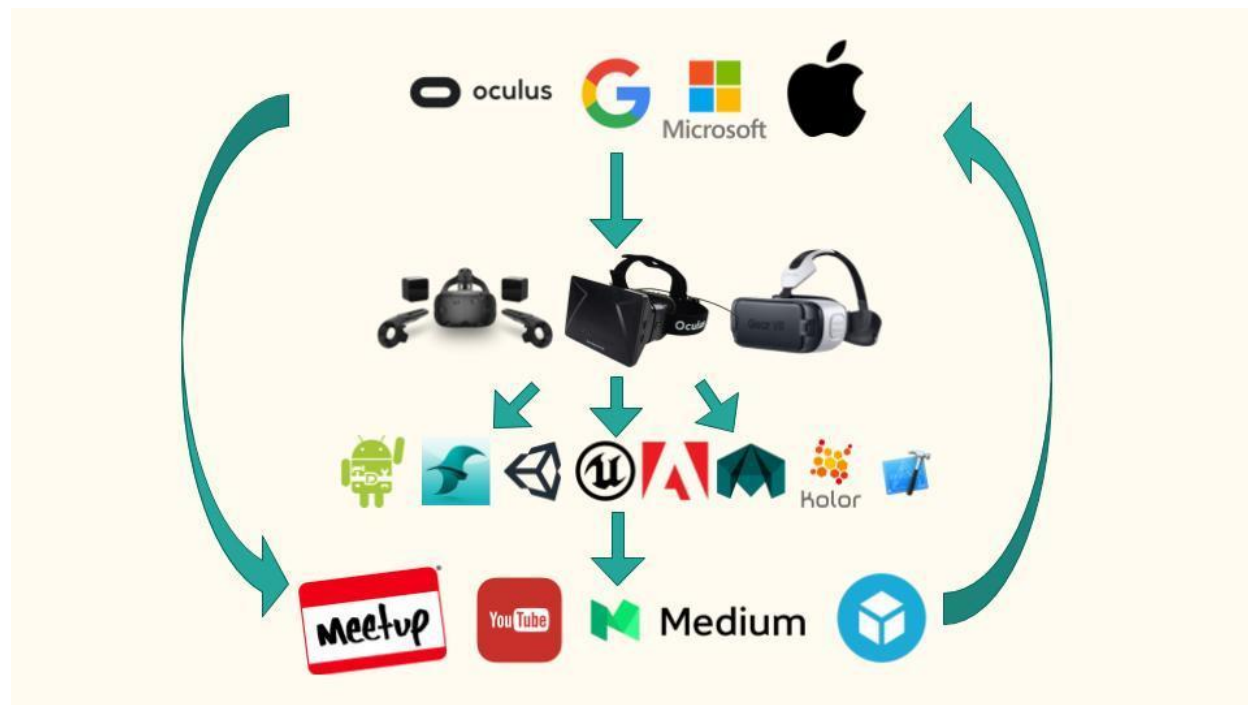
Figure 8.1. A Playbor Production System.

There is a fairly standard playbor production system. First hardware manufacturers release headsets to users as development kits. The hardware then goes through rounds of remediation made possible by already-existing game engines like Unity and Unreal and graphics platforms like Adobe Creative Suite and Maya. Trying to understand and obtain mastery, developers play within these prescribed systems and attempt to realize VR's potential through them.

Users proudly flaunt their accomplishments, through online tutorials and blogs as well as meetups. Their achievements then compensate the hardware manufacturers, providing feedback and opening directions previously unexplored.

Industry leaders in VR have set up a novel mode of production—primarily through playbor. Not only do early adopters eagerly spend money on the gear, but also freely give their time and energy to fulfill its potential. Play acts as a means of motivating this labor, intrinsically

driving users to persist even as they toil within a circumscribed development environment which is crystallizing around these devices.

This has significant implications for VR's economic future and the diffusion of innovations in general. A similar "playbor" economy already exists within the larger game industry. This research hints that the playbor production system of that economy is increasingly normalizing for other tech and software industries. One author bemoans the fact that the role of play is "losing its innocence" (Rey, 2012), paving the way for already entrenched industries to upgrade their economic position.

As a consequence, play serves a purpose divergent from both pure expenditure and creative opportunity. Instead, the excess and efforts put forth by a majority of users underwrite the industrial complex that will profit from dissemination of VR to the masses.

This is not to say that adopters do not benefit. There are companies which are prospering locally including arcades and small startups. A *New York Times* article spotlighted the rise of VR arcades in The City, touting in its headline "Virtual reality, long-promised, is finally gaining traction in New York video boutiques" (Robbins, 2018). However, within the broader economy of VR, these are less significant players. There are many more who will nourish this budding industry through their sacrifice, aspirations, exertions and play.

Finally, such a model reaches far beyond Virtual Reality. User-Generated content within a restricted platform is increasingly becoming standard in digital media. Yet, despite this, many are willing to follow their passions in playful activity without the prospect of compensation.

Conclusions

Play is more than an amorphous phenomenon. In VR diffusion, play possesses three manifestations—as activity, design strategy, and expenditure. These modes of play suffuse and

are instilled in almost all aspects of the meetups, the general practices of VR adopters and reaffirmed in the rhetoric about VR.

A somewhat forbidding production system surrounding the diffusion of VR and play emerges. Play is an engine that drives the enthusiasm and actions of adopters, even though they may not directly benefit from the excesses of their work. Adopters spend hours playing with the technology. Despite aspirations to be part of the VR economy, this play more likely bolsters VR institutions than changes the financial fortunes of developers.

The question then remains: Why do developers persevere in such an inequitable production system? Especially, since most come from more affluent backgrounds, why do they return to meetup after meetup? For playful expenditure. Where else can work end in waste without costly consequences, reprimands or fear of failure? But my interviews show that this is not the sole reason to participate. There is something in the experience of playful development which animates adopters. For play is not only cerebral; it is corporeal.

CHAPTER 9: WHY DO I PLAY?

This research reveals that play is fundamental in the process of adoption. But *why* do people play? Are adopters fun-loving dupes exploited by industry? Or are they savvy consumer/developers who revel in new technology with an eye to its future potential? What about the experience of adoption is so compelling? After elucidating the media perceptions of VR, the social organization of adopters and their process of adoption, I now address these questions and analyze the embodied adoption experience.

Whether in sports, board games, video games, or even a performance, play is a physical experience that requires conscious and unconscious bodily movements (Dreyfus, 1996). In digital technology, it is made up of "circuits" (Giddings, 2014) of activity looped between the physical body and devices. In order to fully comprehend the play that drives the diffusion process, therefore, an intimate record of the experience is appropriate. A growing body of research suggests that play can't be disconnected from the physical experience.[1] From the realm of digital games, and particularly massive multiplayer online games, there are recent affirmations of this concept. Ashley ML Brown (2015) and Jenny Sundén (2012) recognize the physicality necessary to engage in virtual worlds, spaces and communities: "[T]he understanding of cyberspace as disembodied was… dismantled by findings according to which the body was consistently reintroduced, represented, and even on demand in virtual worlds" (Sundén, 2012, p. 166).

This type of embodied play links games to VR. Development requires tools created for game production, which implies a familiarity with gaming and play. To navigate a world, Unity

---

[1] Goffman's (2013) microsociology of encounters employs a play metaphor to describe the experience of meeting another person.

has the developer move around a virtual space by maneuvering the "W, A, S, D" keys of the keyboard to pitch the camera forward and backward in space, which is standard in many computer games, where those keys are used in tandem with the mouse for movement. Certainly, a knowledge of *how* to play games makes the experience of developing with such engines much easier.

An autoethnographic approach begins to address what it feels like to incorporate these technologies into everyday life. It offers a vivid description of how the manifestations of play affect the experience of adoption and development. It confronts the limits of play, processes, social organizations and media environment, as adopters do. Beyond surveys, interviews and observations, an autoethnography presents a cohesive and qualitative narrative of how a new technology forms in a cultural imaginary, but also how an early adopter assimilates it.

Why Autoethnography?

Autoethnography's value is that it "unveils the subjective self as part of the process of doing ethnography and seeks to document feelings, thoughts, and experiences generated by research and embodied by the researcher" (Brown, 2015, p. 85).

There are several reasons why such a method is indispensable to dissect the process of adoption. One is my personal relationship with the software. To be candid, this research study was originally undertaken in part to fathom my own enthusiasm for adopting new devices and digital media. As revealed in Brown's (2015) discussion of ethnographic methods in gaming, this sort of personal investment isn't unusual for researchers.[2] One of the reasons Brown advocates such methods is that they create boundaries for the researcher:

---

[2] Embedded within this argument is the notion that games also engage the body and thus only through a deep analysis of bodily activity can meaning be attained. Sundén (2012) says this directly: "Digital games as media genre aim at and involve the bodies of players in intense ways. Games have a tendency to wind up the body—to rush its

For anyone undertaking an ethnographic project, accounting for emotions and adapting methodologies and methods to document them is integral to being an immersed member of the community being studied, but this is particularly the case for studying computer games… For a field of research which has been built on love and passion for the medium, we need to think critically about the ways in which we manage our emotions in game studies and employ adaptive research practices to allow the humanity in our research to shine through (p. 90).

Despite my proclivity for new digital devices, I decided to probe a technology about which I was somewhat skeptical. This led me to VR and other immersive media, where I could experience the sensation of it "winning me over" (or not), and thereby capture the ongoing process of adoption holistically.

Furthermore, Brown argues that "[b]y placing the ethnographer at the centre of research, autoethnography is able to provide a deep, rich account of social interactions and bonds in a community through first-hand knowledge" (p. 85). Autoethnography allows me to translate the common symbols, rituals and actions of the VR community while also attuning myself to the process of adoption more broadly.

Also, the perspective of an autoethnographic study is purposely mundane. It verges on an ethnomethodology with the daily assessment and reassessment that occurs as a technology normalizes into everyday life. However, personal involvement is particularly important since much of the "activity" of VR and digital media comprises micro-movements performed in relative isolation. Coding and editing content to make a virtual world are quite exciting, so I learned, but the actual physical experience consists of dragging a mouse by degrees and typing.

---

heart, to sharpen its senses, and to speed up its reflexes. Part of this acceleration is an enfolding of the physical body in game space in ways that expand or extend the body and its capacities through on-screen representations. Playing bodies are in this sense not only intensely involved in game scenarios but also most concretely propelled into the unfolding of the game, physically as well as symbolically" (p. 165).

Ultimately, I was able to use autoethnography, not only to give me the means to viscerally describe the adoption process, but also to help me measure the assumptions, observations and analyses I was discovering about the VR community. It also allowed for this in a somewhat dynamic and playful fashion as I tested ideas discovered in meetups and interviews.

Autoethnographic Details

I began taking notes and detailing my own experience of the technology at the onset of my study in January 2016 and concluded in September 2017, when I withdrew from the VR lab in which I had been a participant throughout that time period.

My aim was to create a holistic picture of adoption and to recount my decision-making process as I assimilated VR into my daily activities. This goal necessitated the incorporation and acquisition of the necessary skills for making virtual content. Discovering how to create content was not solely for ethnographic purposes, as it became the basis for discussions with members of meetups and developers.

A second benefit was the delineation of boundaries between this activity and my everyday life. Because of the nature of my research, this self-reflexive analysis consisted primarily of chronicles surrounding my attendance of meetups and development of projects. It was in these instances, at specific events and when seated at the computer developing, when I was most aware of my emotional, expressive and playful self. By homing in on these two types of activities, I ensured a clear demarcation from other ones.

This bifurcation of pursuits, however, did not prevent thoughts and feelings I had about VR adoption from permeating my day. When idle, I often toyed with a VR project I was in the midst of creating. In fact, there were times when VR-related activities directly affected and

imposed themselves on my everyday life. Discerning such moments is key for illustrating the boundaries between play and the process of adoption.

Much of this autoethnography's emphasis is on a single site—the VR lab I joined—which clearly partitioned the adoption process from my other activities. In this way, the lab was a microcosm to better apprehend the experiences my interviewees were describing, as well as what I observed in meetups. This short-term targeted exposure to content creation and workflow provided a framed window into the adoption process, which I could apply to my own personal experimentation.

The autoethnography ultimately showcases my first attempt to make content. In order to do this, I not only needed to familiarize myself with the VR community, devices, and applications, but to learn to program and make 360° films. As part of the lab, I also acquired the rudiments of Unity and other programs for creating VR.

A Playful Autoethnography

Since the goal of this autoethnography is to provide a thick description of adoption, I have contextualized my own process with five vignettes highlighting specific stages and activities that together convey my overall experience. These episodes represent a chronology of my VR education and a specific mode of play: the rhetoric of "play as imaginary;" the playful waste and expenditure; the "flow" (Csikszentmihalyi, 1997)[3] when engrossed in VR content creation; the glory of accomplishment and expertise; and the playful quality of the community.

Within my first hours of utilizing the Unity engine, I became captivated with testing its limits and exploring its possibilities. I began to appreciate the breadth of experimentation that

---

[3] Flow is discussed in detail in Chapter One.

interviewees talked about. Moreover, it was fun to bring random fantasies to life. My first vignette details one of these early experiences.

As I pursued development, economic constraints set in. I had to find and invest in an affordable VR device. Inspired by conversations, competition and need, I regularly reappraised the best ways to acquire equipment and quickly acquiesced to the economy surrounding the technology. In my second vignette, I also record my experience of the scope of time, energy and money that development requires. VR could be all-consuming if I let it. While I'm an avid television watcher and cyclist, even I was amazed by how much time I simply lost trying to find answers to problems.

For a complete novice, creating VR content entails a steep learning curve. While initially exciting, the third vignette relays my trials and errors. In the course of my training and struggle to code accurately, I journeyed down rabbit holes of chaotic testing. Seeking advice via online forums, I would hunt existing code, insert it into my virtual worlds and then play, tweak and change it in order to get my desired effect. This "play" was not fun, but strenuous, especially when I was on deadline. It is easy to lose oneself in the flow of building a section of code, or organizing a feature in Unity. Often, I was disoriented and bewildered. Still, minor successes granted pleasure, rewards, and incentives.

This is evidenced in my second project, a computer-generated version of the graffiti mecca 5Pointz. Flights of fancy and rabbit holes of research consistently altered my plans. At one point, I re-envisioned the straightforward daylight exploration of the outdoor museum as an eerie night scene where the player fumbled around with a flashlight to view the murals. I had to manipulate features of Unity in minute detail, determine where to shine and radiate the light, and

test the entire experience on myself and other lab members before declaring a successful outcome.

My fourth vignette recreates the lab's end-of-session showcase where each member displays his or her work. It is quite emotional, rewarding and glorious to unveil and share the product of one's labors with the general public.

The final vignette is a coda to the process of adoption. I reflect on moments of play and activity in and after a meetup, demonstrating how a sense of community impacts the process of adoption in counterbalance to solitary developmental work.

All vignettes are presented in italics and followed by short discussions.

King Corgi

In some ways, it's like going back to square one. I am in a big coworking space when I make the decision. I'm finally going to complete my corgi project. It's something I began the first day of the lab. At this point, months later, I know it will be a bit easier and I've been meaning to do it anyway, so now is the time.

The first moments, both then and now, are always the most exhilarating. You start to create the virtual space. With a click of a button, I lay out a virtual "plane," a paper white square that extends out in the main window of the game engine. With a few clicks of the mouse, I use a tab to adjust the terrain. When I hover my cursor over the plane and hold it down, the terrain rises quickly into the air. The first time I did this, months ago, I didn't quite have the pacing right, so I created gigantic, narrow peaks almost instantly. I had been rushing through the steps then, but now I have the speed down and feel much more confident.

First, I pull the terrain up, making gradual ripples along the colorless plane. Toward the back and left I let my hand linger a bit longer so that a much more mountainous set of ridges

occurs. At this point, I am looking down on the scene as if it were a chessboard, and I am happy with my sculpting of the space.

The next steps are fairly easy: I quickly add texture to the plane, converting it from the default bright white to something closer to grey volcanic earth with brown patches, which I conjured by finding a picture of terrain with a Google search and downloading it. The trees are part of the standard assets of the world creating tool in Unity, and can be scattered along the landscape, almost like taking a brush to canvas.

At this point, I deviate from my previous work. In that first lab, I found a 3D object of a corgi online, happily downloaded it and dropped it into my scene. Corgis are my favorite breed of dog, so it was natural for me to pick them as my first object to play with in Unity. But the corgi I downloaded then didn't arrive with any texture—like the plane, it was blank and white. It also had a huge pixel count, better for 3D printing than VR, and by the time I loaded it onto my phone to view, it caused so much choppiness that I could barely track around the scene without the camera pausing and skipping. This time, I will do it right. I need to find a better corgi and make a more interesting scene.

My obsession with scale has grown over the last few weeks, and now I want to see what it's like to view creatures much larger or smaller than they should be. As I ponder my options, the name comes to me in a rush—King Corgi. I will model him after King Kong and create a corgi that towers over the viewer in all his cuteness. The concept excites me to my core. Most of my social media is dominated by the diminutive dogs, and I try to surreptitiously include them in my academic presentations and classes. This will be fun! A great way to play around and test my skills, and I can probably get it done within a half hour, the maximum amount of time I have to revamp the project.

Before situating the corgi, I spruce up the scene a bit more. I click the "play" button in Unity, which allows me to preview what it's like to walk through the space in first-person via a "camera" I placed in the virtual scene. As I use the W, A, S, and D keys to walk around, the prefabricated "crunch" of footsteps comes through my speakers. I check over in the distance and see the ridge I made. It looks great and I relish it for a second. I jump in and out of the scene, adjusting the mountains, to make a ridge where King Corgi will be discovered.

My focus returns to my virtual ground. In its current form, it looks good, but not great. The picture I found resembles something out of a video game from the 2000s. I adjust the size at which it duplicates. Too big and it's too much like a video game; too small, it looks like polka dots. Eventually, it's just about the right size.

I shift my attention to the trees. Last time I used the default trees included in Unity. Maybe this time I can find something better in the Asset Store? I log in from the same window as my virtual world, do a quick search and find a palm tree. Much more appropriate for the jungle scene, but when I import it, it is way too big—"Kong"-like in its stature and pretty funny. When I walk up next to it in the "play" screen, I laugh out loud at the size disparity. I eventually reduce the size of the tree, but don't populate the landscape with too many of them.

This initial foray into my scene is almost done, but I still need to fill my lake. I remember the moment I was shown how to use the standard water asset, which you lay like a sheet over a divot to create the illusion of a watery surface. Computer-generated water is one of these ongoing marvels. There are even online museums devoted to it.[4] The first time around, I was fascinated by the water and actually stared at it for some time in VR. I take my chances with a

---

[4] "v r 3," Pippin Barr, last modified March 29, 2017, March 9, 2018, https://www.pippinbarr.com/2017/03/29/v-r-3/.

new maneuver and extend the sheet of water far across the virtual plane so that it comes to resemble a marsh, where the player can slosh through the softly rippling tide.

After a moment of marveling, I go back into "play" mode and spend some time just walking around looking at the world I created. There's a piercing blue sky and the sound of the thud of my virtual feet as I walk. I am reminded of the sort of fantasies I had as a child while playing with Lego bricks. I always desired to make lavish worlds with the blocks, but never had the imagination or mechanical know-how to do so. Here I was, in a virtual space that was as vivid as any childhood computer game, which I created in only a few minutes.

But I can't spend all of my time in "play" mode. Now is the big moment: I need to get my colossal corgi into the scene! I pop into the Asset Store and search "corgi." I don't have a ton of money to spend, but I find a few options, including a cute corgi for $5. This new canine creation is low in pixel count, meaning it won't crash my VR headset or slow it to such a degree that it makes me nauseous, like the last one did. By purchasing a corgi from the Asset Store, I can import it into my scene, textures and all. My credit card information is saved in Unity, so I hit the accept button and within seconds, the little guy is located in a folder in my Unity project. Oh? What's this? There are animations, too? GREAT! I test out a few choices for King Corgi. He can walk! He can run! In particular, I like his small hop up and down. Animations are based on playback, so after a few adjustments, I make him jump on a loop, infinitely and rapidly.

From here, it's into the scene and I begin to play with scale. I adjust a few parameters so that the corgi towers over me. It's thrilling being under him as he jumps up and down. I love it! I spend a little time in play mode just admiring the experience. I move him to the ridge and rotate him so he can face the camera correctly. Here's where he will be discovered by future visitors! I pop back into the scene, but it's a bit boring. Looking around in play mode, I don't see or hear

any indication of the monstrous corgi I know is waiting just over the mountains. What should I do?

So, it's back to playing with scale. I adjust the numbers in the "Inspector," a separate navigation bar populated with details about each object, so that my corgi is just big enough to see his head peeking up over the giant mountains as he jumps. That will catch everyone's attention!

My next step is to actually translate the program into VR. So far, I have only been working on the two-dimensional screen of my laptop. I quickly "build" the application for my device, a process that uses Unity to compile the code for me and set up the scene. I slip on a headset and test the scene. However, because I am using the "Google Cardboard" SDK for my camera, I can only look around. Everything's working and it's great, but I feel limited. I want to move!

I haven't quite mastered the code for moving, but at a recent meetup, someone shared her code for getting this to work in Google Cardboard. Her code allowed the user to move forward, wherever they were looking, with the touch of a single button incorporated into the headset. I search my computer for this scene and import her entire project into mine. I delete everything but her plane and camera, both of which are needed to get the scene to work, and test out a new build. I tweak a few parameters and soon I can wander around the space in VR. Eureka!

For the next few moments, I play with the scene. I meander around the world and proceed toward King Corgi as his head pops over the ridge. I am happy, but it all still feels a little dull, and more than that, directionless. If you don't see King Corgi over the ridge, you have no idea he is there. What I need is a guide!

I think back to the King Kong franchise. He was king of the apes, so why wouldn't King Corgi be king of the corgis? I drag and drop a new version of the same animated corgi at a realistic scale to act as the guide to the king. I add the walking animation, but he is just walking in place and I need him to move. The way Unity works, if you want an object to do something, it requires a piece of code written in C# to be placed as a script on the object. I am sure that I can get something to make my corgi move forward, so I search "move object forward Unity" on Google and immediately find results from various forums. The first few solutions are a bit bewildering, and some of the coding language is antiquated. I eventually find a set of Rigidbody video tutorials on the Unity webpage that show how to move an object through space.[5]

Using the code from the tutorial, I teach my corgi to move and then start to tweak the scene, which takes a bit longer than expected. I am still a novice, but after another half hour, I get everything working.

Now, upon entering the scene in the build, the corgi guide is set in motion, heading down the inevitable path toward his king. It isn't perfect. In Unity, objects need to be assigned physics, or else they float in space or can have other objects simply pass through them. The corgi has no physics, so he passes through objects. But I am satisfied enough and a bit drained after the effort of getting the code to work, so after few final adjustments, I have the build ready.

Pleased that I got King Corgi to function, I show my labmates the functioning prototype. I am met with amiable smiles—it isn't anything special. Still, they get a kick out of my enthusiasm. But King Corgi's debut doesn't end there! When I get home, I immediately show my wife, and I thrust the experience upon friends as quickly as I can. Even weeks later, I present

---

[5] "Unity - Rigidbodies," Unity, access March 9, 2018, https://unity3d.com/learn/tutorials/topics/physics/rigidbodies.

King Corgi as a bit of a calling card at meetups, giggling all the while that I have brought this

majestic beast to life.

Discussion. The above scene illustrates the potency of "play as imaginary." I am struck

by the sense of real power when manipulating content in a creative space. This is particularly

pertinent to VR. The software facilitates playful creation. I easily make adjustments to the

landscape, atmosphere and characters as I construct the scene. To create the world, obtain digital

assets and put them in motion is uncomplicated. And the results, especially at this early stage, are

fun. Rather than having to plan a detailed or sophisticated project, I play with something that is

both frivolous and personal. This play is joyful. Seeing the world come to life and getting into

the first-person perspective (either through a headset or the computer screen) gives me

significant pleasure. The experience is so gratifying I share it with other enthusiasts who provide

positive feedback and encourage me further. This delighted play justifies my decision to

investigate the technology. Intrigued and amused, I begin to be invested in the development

process.

Early Mornings of Expenditure

The alarm sounds and I silenced it before my wife woke up. I stumbled out of bed, made

my way out of the bedroom to our living room, sat at my desk and turned the light on because it

was still very dark outside. The street was quiet. It was 5:00 AM on Queens Boulevard. The bars

were closed, and people hadn't roused for work yet. Except for me.

I usually steal some early morning time, before I teach, to get extra work done. This was

day three of running on about 4 to 5 hours of sleep, due to a conflation of events that began

about a month earlier, when I took the plunge and bought a gaming PC. As I dove deeper and

deeper into VR development and learned more about the medium, I knew that my old computer

couldn't power most of the projects I wanted to make. No High-End VR devices ran on a Mac laptop, and I grew frustrated when my computer repeatedly slowed down. For weeks I had been told, every time I complained, that I needed a PC. If you are serious about development in VR, you have to make the move.

But I was just a researcher. Did I really need a new laptop? A few weeks earlier, a meetup attendee made the plunge and got a massive used PC he was sure would run an HTC Vive, if not an Oculus. The price seemed manageable and I was intrigued—if he could do it, so could I! So the negotiations with family began. I asked my mother and wife for a very, very early (about nine months) birthday gift: a new computer and a second smartphone so I could develop for the Gear VR, which only ran on Samsung smartphones. I couched it all in practical terms: the phone would prove handy on our upcoming trip to China, and the computer could replace my wife's aging laptop once my research was completed.

But in truth, I knew part of my craving for new equipment was simply for fun. I love new computers, and I research "smart" devices daily. I have to admit, I am a techno-junkie. If this scheme succeeded, I could satisfy my addiction and simultaneously jump head-first into VR development. Lucky for me, my family acquiesced.

During the first week or two, the new laptop was pure fun. Developing was a breeze, and when I immediately installed and played new games on it, they lit up in sterling clarity. I was struck at the time by the kind of excess in which I was indulging. I didn't truly "need" this giant computer that couldn't fit into most bookbags with its massive 17 inch screen, high-end graphics card and processors required to run tethered VR. In fact, to lug it around was so taxing that it almost never left my house. But it felt good to get on the same playing field as other VR developers. So many of them came to events with fancy laptops, their cases lit up in the futuristic

greens, reds, and blues characteristic of gaming computers. My new laptop, which glowed red with a large "Republic of Gamers" sign on the back, was a testament that I had made it in the world of VR. Even the heft set me apart from others using "ordinary" grey Macs.

Similarly, the purchase of the Gear VR led to a few nights of frivolous play. I downloaded numerous games from the Oculus store, spending $30 within the first few nights, and stumbled around my living room with the headset over my eyes, until I was asked politely by my wife if I could play in the bedroom instead. There, I sat in a revolving desk chair, playing a puzzle game, slowly spinning around and around as I completed each task.

But in the ensuing weeks, I was put to the test. I was working on an interactive 360° film set in office space and my job was fairly straightforward: getting the reticle (a small circle used as a pointer in VR which tracks with the viewer's head) to engage with various captions and trigger the audio.

I was able to do this fairly successfully over about a month, beginning with importing the Software Development Kit (SDK) for Google Cardboard, which came with a standard scene one can open up in Unity. That scene included a reticle, and a box that changes color when the reticle collided with it. I converted the box into three-dimensional letters and captions that triggered a sound—a humorous caw of a parrot in lieu of the dialogue to come. I did that in just a few hours.

The harder part, which took me a solid three weeks to figure out, was actually much more mundane. Since the film was in 360°, I needed the captions to "instantiate" (the language in Unity to explain when objects are brought into the scene) wherever the viewer was looking, so he/she wouldn't miss them. I began that task and promptly destroyed the captions, then furiously researched online before slowly hacking together a decent code. It wasn't perfect: each

instantiation of the code had to be timed down to the second, but it wasn't too hard considering that the film was only five minutes long and I had cues for when the captions needed to pop up.

My progress was slow but steady, and I was happy that everything was working on my end. However, the same couldn't quite be said for my group. Originally, the project was conceived by enthusiasts who were new to VR, like myself. One had suggested the concept, another had written up a draft, and we used ourselves and friends as actors. It was a purely amateur production, without any explicit goal beyond learning the filming process and showing off the finished product. As development proceeded, slowly the number working on it began to dwindle. A few members actually got full-time jobs, which prevented them from continuing to be involved.

Wouldn't you know it, I was the only participant left with a decent new laptop that could run the software for stitching video together, which is necessary in 360° filming. We filmed with a six camera rig and had used six GoPro cameras pointing in different directions that were filming our scene simultaneously. Once those videos were compiled, an expensive program, Autopano Video Pro,[6] for which I was able to obtain a PC license, was the only moderately easy way to stitch the different images together into an equirectangular image. I had watched others stitch films in demos and it looked tedious, but I wanted to complete the project, so I jumped into the task. I only had a week to stitch everything together and get it ready for display.

The first days were relatively easy. A search for "Autopano Video" directed me to a surfeit of basic tutorials about how to assemble the video. I had used video tutorials to learn Unity, including the "Space Shooter Tutorial," which was widely regarded by attendees as the

---

[6] The version as of this writing costs just under 600 €. "Kolor Store," Kolor, accessed March 10, 2018, http://store.kolor.com/.

best way to learn the basics of the engine, so I immediately gravitated towards these video

tutorials. The first Autopano tutorial I used was made by the rigging company "Freedom 360,"[7]

and it explained the process in about five minutes, so I was able to stitch everything together in

an evening. I followed instructions diligently, uploaded my videos, and synced them by what I

was told was a "clap sync,"[8] a loud clap during shooting that allows for the same spike in audio

to be caught by all six cameras and was used as an orientation point to stitch the footage

together. The next step was to adjust the horizon of the composite video to make the image less

warped. It was here that I started to run into problems.

The biggest issue arose because of how we filmed. Novices to the camera, we shot our

scene in a small meeting room at a corporate space in Brooklyn. It was a pretty and well-lit

space, which we knew was good for 360° film, and the large windows acted as a de facto

horizon. But the scene was static, mostly consisting of people chatting at a boardroom table. In

order to inject some action, we had people enter the room around the camera from all sides. The

problem was that in such close proximity, stitching of the images became very difficult. As two

people (one of whom was me) on the film walked by, their arms and body became incredibly

distorted or doubled. I wasted a good few hours trying to correct the image and wondering what

I had done wrong.

After even more hours of searching, I was able to at least identify the issue. It was

something called "ghosting," where the body on film has a kind of aura behind it that must be

removed. Now I had the language to query appropriate answers to the problem. I soon found out

---

[7] "Kolor Autopano Video Tutorial - Freedom360," Freedom360, accessed March 9, 2018,
https://freedom360.us/tutorials/software/kolor-autopano-video-workflow/.

[8] A reference to the use of a clapperboard in the early days of filming with sound.

that I was supposed to have included a "clap sync" at the beginning and end of the project. I labored well into the evening to try to correct the issue, and slowly got everything to work. I spent the next two days finding free moments to tweak the stitching, mostly early mornings and late evenings. With only four days left, I was feeling fairly confident. Everything was almost ready.

But that's when I ran into the second big complication. We filmed the scene with one person reading lines under a table—these were going to be the lines for the captions—and we needed to edit her out. We thought she would not appear in the scene, but after stitching the footage together, she was glaringly obvious. So I needed to know not only how to fix the stitching, but also how to remove her from the scene.

The remaining mornings were consumed with experiments and queries in this pursuit. On the first day, I merely tried to reduce her visibility in the stitch, which led to ghosting in all the other characters. I spent the next 24 hours rabidly searching forums to find relevant tutorials. I soon realized that to crop her out, I needed Autopano's companion program Giga, which I neither owned, nor could afford.

That final morning, a day before our showcase, I started up again at 5:00 AM for the third day in a row. I was truly desperate. I read about an animation program—Nuke— that I was able to obtain with a student discount, but the opening tutorial was three hours long and unbelievably convoluted. By 10:00 AM, I was out of time. I needed to head to work for the rest of the day and I still had to build the final version of the program. I was done for.

Lucky for me, my colleague knew Adobe Premier, and she quickly cut a version that cropped the narrator out, if poorly, and we were able to show the scene. I arrived at our showcase the next day exhausted, but happy to have something viewable.

I also experienced a brief moment of pride, boasting to anyone who would listen about

my early morning efforts. I had been inducted into the fraternity of the weary. I didn't quite get

the clamorous response I wanted, but I felt satisfied that I gave my all to bring this film together.

Discussion. A common refrain among my interviewees and labmates was that they labor

outside of work hours to further learn and master VR devices. For most, exploring VR was a

hobby. There are few entry-level full-time jobs in VR. Interestingly, those who did find

employment in the industry usually stopped attending labs. Excess was a point of pride for many

who bragged, as I did, about their late nights. This was not the only form of expenditure that

surfaced. Without a doubt, my decision to acquire an additional computer and smartphone had

the air of "depense." The outlay of money was not for a purely utilitarian purpose, despite my

justifications. Similarly, the hours I spent playing with the technology consumed my spare time

and soon became excessive. I did not plan to work so many hours on stitching, but my desire to

solve the problem overrode the best of intentions.

The wider community, whether in the lab or online tutorials, supports excess. There is an

ongoing expectation that almost any answer can be found online—it just needs to be hunted

down. The forums and tutorials, and the development community associated with them, can be

counted on to tackle any major issues that arise. Furthermore, if I reach a certain level of

competence, I can contribute to this knowledge base online. This underscores the motivation that

comes from what Jenkins (2006) once called "collective intelligence" or the "ability of virtual

communities to leverage the combined expertise of their members" in order to solve problems (p.

27). Collective intelligence is an important alternative to the "expert paradigm" (p. 50) found in

traditional institutions of knowledge (such as universities). In the VR community, expenditure is

one of the main incentives for contributing to such collective intelligence.

A Rabbit Hole At 5Pointz

Much of the development process happens on Google. A solid portion of my work came not from coding from scratch, but instead from querying about specific challenges and finding the closest answer via tutorials, forums and other online user-generated content. In some cases, this meant lifting code wholesale and copying it into my own. In other cases, it required significantly more labor, having to adjust minor problems when something didn't work.

But the type of googling I did was often fairly spontaneous and driven by a random set of interests and suggestions. This mixture of freedom and the endless pursuit to find answers result in a flow-like state that people in the lab referred to as going down a "rabbit hole." While this may seem like a fairly mundane part of the process, it very much shaped my second project.

Having a bit of background in music, I found the endeavor something akin to improvisation, but with the speed and certainty of classical composition. It's interesting that scholars have actually noted this tension in flow. Mazzola and Cherlin (2008) state, "Nothing seems to disturb that flow of information that is driven by our intentionality. And no information seems to inhibit our intentionality, we are in perfect equilibrium" (p. 102). They describe a condition where we acquiesce to rules and go on to discuss it in free jazz as "an alert body of knowledge and capabilities on the one hand and totally open goals and expectations on the other" (p. 106). I felt this very much throughout my project, where I aimed to recreate the graffiti mecca 5Pointz. While the most flow-like moments came to me in the final days of the project, the feeling pervaded the entire process.

In fact, the project began as a bit of improvisation. At the time, we each pitched an idea for a project to the lab. One member wanted to make a graffiti app, where someone could tag virtual walls. I immediately thought of 5Pointz, the former graffiti mecca in Long Island City

which was torn down in 2013 to make way for condominiums. At the time, I was heartbroken, having often gone to take photos of the factory buildings' facades covered with stories-high murals. With any mention of graffiti my mind almost automatically wandered there. Soon the other labmate and I were in deep conversation. I pulled up online pictures of 5Pointz to show her. We both started to do research, googling about graffiti. Over the next week, this sharing continued and we quickly came to two conclusions. First, given our own technical limitations (neither of us had easy access to high-end VR headsets), we couldn't easily make a spray painting app. Also, one already existed for the Vive.[9] So, we decided that recreating 5Pointz might be an alternative.

My partner was experienced with 3D modeling and so took charge of making the buildings. In the original 5Pointz, a series of warehouses, shaped in a rough "U" around an alleyway, made up the area. I recreated that space temporarily using a series of boxes in Unity, while she began constructing the actual buildings.

From there, the next natural step was to find images of graffiti from the location. Luckily, after a little more googling, I happened upon a site where I could, after digging into the HTML, download a treasure trove of old images. We assembled a few of the other components very rapidly. Next, I was able to procure the virtual 3D camera necessary for Gear VR to work. I put a walking script together fairly quickly, after a much longer google search, which eventually led me to a how-to tutorial. To make sure my camera was the right height, I tweaked and tweaked its parameters. If it was too short, the graffiti appeared unrealistic and stretched. Too tall, and it felt unnatural. I spent the first few weeks going back and forth, adjusting these settings. It was

[9] "Kingspray Graffiti VR on Steam," Steam, accessed March 9, 2018, http://store.steampowered.com/app/471660/Kingspray_Graffiti_VR/.

great fun. Even though I was only working with a prototype, crude boxes with images of graffiti pasted on, I felt it looked oddly real. Maybe that was because I had made it.

My first real rabbit hole involved the skyline. In Unity, a single large image can be used to wrap around your virtual world. When I wanted to deviate from the bare blue sky that came standard, I was perplexed. A labmate, who was showing me his work, steered me to a website that had very large images. For a solid two hours, I hunted for something that would fit 5Pointz. When the website he suggested proved fruitless, I was back on Google, searching terms like "Long Island City" and "5Pointz" and sending images to my developing partner. We couldn't find a good one. Eventually we settled, while prototyping, on an overly large picture of the LIC pier, completely inaccurate in terms of geography, with a gigantic smiling family awkwardly staring down at you from the horizon level. For the final product, I ended up buying an artificial horizon from Unity.

This sort of refinement bookended longer projects. At one point, I recalled that a few overhead subways existed around 5Pointz. I queried on the lab's Slack Channel for some advice and soon downloaded a free pack of computer-generated train tracks for a video game. I placed them overhead, along with a few light poles, scaffolding and fire escapes, just to add a bit of life to the space. I also placed tracks in the background. They became a wall for users, preventing them from falling off the virtual world because you couldn't "step" over them in any way. Many weeks later, I had another spontaneous idea to add audio to various parts of the scene. We decided to insert clips from radio and interviews about 5Pointz that would be triggered as the user encountered the art. I remembered that in the pack of computer-generated material I had there was a pay phone. I dropped it in the scene along with an audio track accessible only by

entering the phone booth. I gleefully boasted that I laid an "easter egg" in my experience, happy

to have this whimsical idea find its way into the final project.

Those were banal forms of exploration. Most of my rabbit holes were much more intense.

Another spontaneous decision caused a major expedition. After setting up the virtual space as

gigantic boxes, I was yet again struck by how empty it looked. It reminded me of a key fact about

5Pointz, that it was "whitewashed" overnight, leaving none of the graffiti that had been there for

decades. Was there a way I could invoke that? I immediately thought of fading. Perhaps, as

people encountered the graffiti-covered walls, the art could fade away to blankness.

I started googling. My first searches netted me projects where objects disappeared. I

tried this out. It wasn't quite what I wanted, so I went back online and searched deeper. I

stumbled upon an tutorial that had objects vanish and replaced by others. I followed the

examples to a T, manipulated the code, but the results were underwhelming. A third option was

keyframe animation, where transitions in the animation are manually "keyed" in over a specific

timeline, something I had only dabbled with in Unity. I slowly got that working, but then needed

to figure out how to trigger the animation change. Hours of lab time passed. At this point, I

started simply to mutter aloud about my problem, half-querying the group for advice, my eyes

trained on my screen as I tabbed between different Unity forums trying to put together a

coherent way of doing this.

A colleague of mine piped up. A coding expert, he said this wouldn't be too hard. He

looked over one of the bits of code I started and guided me. He took me through each function,

having me explain each piece and then code it in. The plan over time became clear. The

"material" of the graffiti needed to fade, using a function that controlled it, from full opacity to 0.

I could set the speed of that function as fast or as slow as I wanted, so that the material faded to nothing and then was replaced with a blank, new, white surface.

The effect was nice and satisfying for a few hours, but something kept nagging at me. I didn't just want fade out and replacement, so I went back over it for the next week, engrossed in cleaning up the code. Eventually, I made both a fade out and fade in function, using the logic of the code that my labmate and I worked on and essentially inverting it. As I tested it, hours went by. The slightest change in fade timing made the whitewashing look haphazard, so I adjusted and adjusted and adjusted. I tinkered with the code while in the office, at home, before bed and early in the morning. The desire to get everything just right was a bit overpowering and it was strange how a minor problem could distract me from the scene completely.

Eventually, persistence paid off. In fact, the project came together with weeks to spare. This gave me the opportunity to explore new rabbit holes. One week, I added a randomizer function, so that new graffiti would appear on the walls of the virtual 5Pointz each time the scene was experienced. At another session, a labmate sent me code so I could reset the scene with a click of a button.

But I kept returning, again and again, to the issue of the fade. When I finally started testing it in the headset, I noticed that the fade slowed down the entire scene. I decided I had to change it. This led me down a whole new search path. Suddenly, I was learning about brand new features in Unity. Labmates directed me to the "Profiler," which measures frame rate. It kept spiking every time I triggered a wall to fade and be whitewashed. I finally noticed that a particular function I was "calling" seemed to be the problem. I hacked together this bit of code from so many others that I didn't quite understand what it meant. It took me six hours straight to modify the code. It still didn't alter the slowdown from the fade. As my frustration mounted, I

suddenly realized that I had actually been testing the fade out on the wrong object. In other words, nothing had changed because I wasn't actually utilizing my revised code.

I was relieved. At least it wasn't me. I never got the code working. I simply prevented players from getting too close to the objects to notice. I also faded the images out quicker, which seemed to be less taxing on the processor.

That day also opened another rabbit hole. A colleague asked why I didn't have the 5Pointz scene at night. It was a good point. After all, wasn't that when most tagging occurred? First, I extinguished the daylight in Unity and it left me fumbling around in the near dark. The eeriness was interesting, but a light source was necessary. Unity comes with a package of different lights for scenes. I found a spotlight. I swiveled and shrank it to cast light down and out from the user. I attached it as a "child" to that camera, which allowed it to move with the user as they navigated the scene. I was now in the zone, happily adjusting the size of the light and its place on the avatar to make it hit just the right part of the graffiti. I wanted the user to see a good portion of the walls, but not everything. If the light was cast too far downward, it splashed on the ground distractingly. I eventually set it fairly far in front of the camera, as if the user had it strapped to their head. For a day, I made these micro-adjustments. I tested the scene, walked to a wall, then retooled in regular mode. Back into the Play mode to test. Back to adjust. But by the end, it looked cool. I even posted about it to colleagues on the Slack channel.

During the week, though, I vacillated between how to present the scene. I and others encountered 5Pointz during the day. The experience felt like an art gallery and being able to see full pieces of graffiti felt necessary. I decided yet again to do something completely different. Rather than placing the viewer into the scene, I would let them choose. So in the final week, I dove down my last rabbit hole to find out about how to make a user interface (UI) in VR. While

my partner animated a short tutorial, I placed it in the scene and put in code, after yet more

googling, that enabled users to look one way to enter in the day and look the other to enter at

night.

By the end of the project, so much had changed. What began as a graffiti painting app

turned into an art gallery/interactive documentary, where the user could meander around

5Pointz. During each experience, the walls of the graffiti mecca were replaced with new art,

culled from archives of pictures taken at the original location. As the user walked up to the

walls, they triggered audio interviews and coverage about 5Pointz' rise and fall. And in front of

their eyes, that very graffiti disappeared and was replaced with a haunting white. My labmates

gave very positive feedback. My partner found it cool and eerie. Like taking a riff of music and

running with it, each rabbit hole rendered a piece of the project I didn't expect, forming a

synchronous whole.

Discussion. In its early stages, so much of the process of developing content in VR feels

unplanned. Even in a lab, where a good amount of structure is imposed in terms of ideation, there

is the general tenet: build quickly and often. Our projects were often "hacked" together. With

inordinate amounts of information online, there is the expectation to delve into rabbit holes in

search of a perfect piece of code and then elaborate on it, which describes much of the activity of

early developers. These snippets of information are precious. I knew one coder/artist who kept

his essential scraps of Unity code in a Dropbox folder to apply whenever possible. Still, no

projects are perfect. None are assembled in a vacuum. Instead, everyone in my group went online

and consulted friends and Slack channels. This iterative and revelatory process creates a rich

design environment, where experts expend significant time and effort to help novices. In fact,

many of the more senior developers who came to the lab were so preoccupied troubleshooting

that they only got to work on their projects after the lab ended. However, this environment had its advantages. Fresh and open minds inspired new directions for projects. My re-imagined night museum was such a case. I remember it to be a headache at the time, having to reconfigure the scene, but it won everyone over on "Demo Day."[10]

The process of burrowing down rabbit holes is transfixing. When one solution doesn't work, it's easy to figure out what went wrong, but difficult to rectify. Other developers, whether online or in-person, only reveal a fraction of information. Consequently, it feels like solving puzzles for which you can't fully see all the pieces and the ability to cobble together fixes is the secret to mastery. To find answers involves a hunt for ad hoc knowledge, iterating and tweaking the small treasures that you discover. While there is plenty of frustration, the perpetual swings between problem causing and solving induce a mesmerizing flow-like state, when getting "involved in something so deeply that nothing else seems to matter and you lose track of time" (Csikszentmihalyi, 1997).

The number of hours devoted to resolving issues is another mode of excess. It was easy to lose myself in warrens of information, only to realize belatedly that I spent the entire six-hour lab trying unsuccessfully to relieve graphic strain on the processor, for instance. Time becomes less and less of a factor in comparison to the fulfillment of hacking together a working and interesting project. This is probably one of the reasons that, despite our best efforts, many of the lab's building days were oddly silent, with each person intensely focused on his or her construction, or enwrapped in the flow of a quest for knowledge.

---

[10] See the next subsection.

Demo Day

I get to the event site early. After taking the escalators up to the long room where the demo will take place, I am struck by the hosting company's classic photos that line the walls. Mostly in black and white, they memorialize the heyday of a very different type of visual medium, while their very presence implicitly positions VR as the heir to the next technological threshold.

I am there early for two simple reasons: I'm a student and a volunteer. As part of my participant observation, I agreed to help with setup, and on this Demo Day, my help is essential. The original date of the demo was postponed because of the holidays and some of the organizers and participants are at work. As someone with a fairly flexible schedule, I was available to lend a hand.

Within a few minutes, we begin to organize the long conference room for the demos. A basic diagram had been distributed in advance. With that in hand, the first step is to segment with tape portions of the space for each demo. In particular, the Room Scale VR needed six foot by six foot spaces to set up Light Houses. I spend some time assisting with this as labmates started to filter in. I direct each one to their respective slots for about a half hour. In between, I set up my own presentation; the night before, I made videos navigating various scenes of 5Pointz to loop on my laptop. Showcasing a short video of a VR experience was a tactic I saw in other meetups over the last year or so. It is particularly useful because lines inevitably form during VR demos and I only own one headset to show the work on. The setup is fairly quick. I just need to plug in a laptop and make sure the phone is charged and little else. Some carry in fair amounts of ancillary equipment. One brings in a handcrafted VR viewer. Another totes a separate server to run his project.

Not all exhibitors are regular attendees of the lab. The organizer called in some big guns to share the space, and they mostly set up toward the back with larger projects. Some are luminaries from the local scene and are exhibiting projects I first saw at other meetups. I'm surprised, and I'll admit, delighted, to be featured next to them considering the elementary state of my own project.

The next two hours are a blur. I run back and forth between venue organizers and labmates asking for plugs, surge protectors, adapters for equipment, etc. Everyone needs a minimum of four outlets for their projects and there are hardly enough in the room. I keep doing rounds with extension cables in hand and conveying new requests to corporate representatives at the front of the room. By the third or fourth time, they come back with still more equipment, and a few people to help set it up. I marvel at the sheer magnitude of computing power in the room. Each display, including my own, costs at least $1,500. Many brought their own computers, headsets and devices, and I couldn't help but think about the tens of thousands of dollars we spent collectively to create each project. In fact, the only major donations were Samsung Gear VR headsets, which arrived in the morning without phones and consequently were useless.

At 2:00 PM, when the event is scheduled to begin, a line is already forming outside. Despite the fact that many are still setting up their projects, attendees start to trickle in. The hall is arranged with three lines of projects, one along each wall and tables in the middle. My project is toward the very front and in the middle, where the "Mobile VR" projects are set up, about two to a table. Because of this location, we are one of the first to greet attendees as they enter. Since the mobile projects take less time to view compared to the High-End VR, we get people who meander over while waiting to see the more impressive work in the back.

A bit anxious about the number of views my project is going to get, I immediately become competitive. Along with my co-creator, I start to make little sales pitches to people as they pass. What do you know about VR? Would you like to hear about our experience? I also inquired if they ever heard of 5Pointz, a way to engage those who might be dubious about our relatively simplistic set up. After a half hour or so, I develop a little spiel, describing the project, what 5Pointz was and how they could experience it. I am reminded of the somewhat repetitive talks I heard from organizers of meetups. Was it really that easy to come up with a standard way of pitching VR?

At first, everything seems to be going smoothly. I position the headset on each viewer, tell them to look in either direction to start the scene and guide their hand to the side of the headset so they can navigate. However, after about only an hour, things that worked perfectly only a few days earlier when I went through the demo, start to go awry. My smartphone, which is powering the experience, keeps overheating. After a few tries, it simply shuts down and displays a notice that it needs to cool (which takes around 5 minutes—an eternity in demo time). Without a secondary phone, I must wait for it to recover and hope that people patiently stay.

There is also a little glitch I noticed in passing a day or two before. I had left a small piece of space open in the virtual world, which made it possible for people to fall off the plane into infinite space. I encountered it and brushed it aside, especially as it was near a fire escape in the virtual alleyway of my scene, not an interesting part of the landscape. Today, after a dozen demos, someone comes upon it. I laugh, mention I am aware of it and it isn't a big deal. But then it just keeps happening. Of the approximately 25 people who demo my project, around one-fifth stumble upon the bug. With the last two spectators, I am outright apologetic and keeping my fingers mentally crossed that they won't come upon it.

Despite these issues, people are receptive. Most thought it was interesting; a few know of 5Pointz and one person is incredibly enthusiastic, sharing memories of their time going to the graffiti mecca. Most follow-up with questions about the graffiti or the site, which helps allay my jealousy over the better projects at the rear of the room. As the day goes on, the overall success of the event starts to sink in. I look over at the more renowned names showcasing their work and they seem to be equally as happy. Having witnessed the frustrations of attendees at other meetups, I am more than a little amazed that everything seems to be proceeding smoothly given the early morning and afternoon chaos.

The event lasts a little over two hours, and attendees exit by 4:30 PM. A few of the labmates, including myself, rush over to each other's tables to congratulate each other for our work and experience some demos. Many of us have not seen each others' finished products, but only bits and pieces in the lab. As I wrote in my field notes only a few weeks earlier, I am amazed by the level of coding improvement and refinement that transpired over the weeks of the lab.

Still, I constantly check my enthusiasm. Both in these final moments and during the demo, I am torn between roles as a developer and researcher, and a touch uncomfortable. Should I feel so elated about the compliments people are showering upon my project? As a researcher, am I supposed to suppress my own skills? I feel conflicted. At once, I am salesman and scientist, struggling to make sure that each participant is aware of my background and interest in the subject, while taking proud ownership for the project my co-creator and I display. In the end, this is resolved when several attendees turn to my co-creator, who is looking for work anyway, to discuss future job possibilities and exchange cards with her.

As the last of the attendees drift out, we tear down our projects and bask for a few minutes in the setting sun of lower Manhattan after many months of hard work.

Discussion. Demo Day was the culmination of the lab. The presentation was always at the forefront of our minds as the finish line of our development marathon, though some continued to go the extra mile to refine their projects afterwards. In terms of excess, the wealth of VR on display on Demo Day is an amazing sight to behold. While this particular group of demo-ers were semi-professionals and professionals, they didn't have an abundance of equipment at their disposal, nor did the lab itself. Still, the room brimmed with expensive commercial hardware, with each project costing a minimum of $1,500 to display, including my own. The ostentation is obvious. When spectators amble from project to project to try them, there is both a possessive (it is our equipment) and braggadocious reaction. We have put our material and creative wealth on display, like it or not.[11]

Glory pervades the demo. We become salesmen hawking our products and reeling in customers. Positive evaluations from fellow exhibitors—because, of course, we all manage to find time to sample one another's work, even if briefly—are compelling rewards for the months of effort. However, like most demos, this one was far from perfect. Rarely have I attended a festival or VR demonstration where something *hasn't* gone wrong, even just temporarily. Part of the experience of showcasing this technology is to expect glitches and malfunctions.

Still, newcomers are awestruck, even while colleagues approvingly clap each other on the back and comment on the novelty and artistry of the pieces of work. People inquire about our next projects and insist on meeting in the future. It boosts the ego and validates our expertise. We aren't just hackers of random code. For some, this will be a portfolio piece, a stepping stone to a job. Others will be pleased with the heights they reached in their avocation. But for the moment

---

[11] Such ostentation might be understood as a mode of "conspicuous production" (Spigel, 2005) in which the performance of extra work and labor is valorized. However, this assumes the display of excess useful labor rather than the "depense" or expenditure suggested by Bataille.

we all, luminaries and amateurs alike, bask in the golden glow of our accomplishments. With impunity and approval from the New York VR community, we exult over our achievements.

Coda: The Afterparty

On Day One of what is supposed to be the most amazing week in VR history, (or at least that was how it was advertised), I am late. I take the train across the Hudson for the first day of a week-long meetup, a conference and semi-ad hoc festival organized by one of the groups I consistently attend. When I get there in the afternoon—I teach a full class in the morning—I am immediately put to work, hanging up banners for the festival while attendees mill around. The event hasn't quite started, and there are issues with the Internet connection. Although the event is sponsored by a local foundation, their locale is still being refurbished. The heat seems inadequate and it is a touch cold on this winter's day.

The goal of the event is essentially to teach: a series of lectures and workshops are to take place in the main space and side rooms throughout the week. At the main stage, plastic chairs are set up in long rows, and a large screen enables anyone in the room to see each speaker. E., the organizer brought his computer from home, on which to develop throughout the week: a gaming rig that glowed various colors. He is excited, and as I come in, he is starting one of his usual speeches with "this is just the beginning."

Throughout the day, another volunteer and I mostly just observe. We sit in the back where filming equipment for the event was already set up and take notes. On occasion, when the Internet completely crashes due to too many attendees trying to download Unity at the same time, we come around with a thumb drive containing all the necessary files to install. The other volunteer takes it one step further and escorts a few people who are very new to Unity into the other room to set it up with them, as well as begin a few projects.

I go back to my mom's house that evening by train, borrow her car and drive back to The City with the idea of cutting down on travel time the next day. But, with New York's usual traffic, I end up arriving at the conference by the mid-afternoon once again, missing all the morning activities.

I am frustrated and frazzled, as well as worried about how on earth I will be able to get useful notes with the day already half over. As I start typing, the first presenter, a long time VR advocate who started to become interested in the headsets in the early 1990s, recalls classics like Lawnmower Man *to an audience too young to remember it. His message is simple—we are still dealing with the issues inherent to a VR hype cycle. He says that the same thing happened back in the 1990s, and then takes us on a history lesson. He and his colleagues overcame the hurdle of prohibitive costs twenty years ago, and he predicts that costs will only decrease in time.*

But the real innovation, according to him, is what happened in Copenhagen in the early 2000s, when Unity came out. As he puts it, "software defines our tools and how rapidly we can get crazy ideas in our head to market." He then explains that much of the innovations in VR in the 1990s made their way into smartphones, such as gyroscopes. Now, he advocates getting rid of labels. Call it all immersive technology, he says, and encourages developers to structure their products around small areas of the industry to survive. Do not get fully sucked in by the hype, he forewarns.

His talk affirms my thinking and I listen, rapt. E. follows with some questions and then calls for a break. Next up will be a full-on workshop, led by him, to make content for an AR headset of which he is a fan.

During the break, many stretch and fan out to the other room, and I go with them. There are drinks and snacks, people exchange cards—the usual. Many of the attendees come from New

York or the surrounding New Jersey area in order to make VR content for the first time. They are excited. At the front, a few soldiers dressed in fatigues set up laptops.. We return to the main room and E. starts. His demo is fairly quick. He requires people to download the SDK for Google VR and install it onto their computer. Since no one else has the AR headset he's using, he mostly narrates, showcasing how Google Street view can be imported into the headset and overlaid onto the real world to create a more synchronous form of navigation.

The next talk is by a friend of the organizer, who spoke at other meetups and is one of the few people who bought the $3,000 HoloLens at its release. He shows us how it works, using the live feed that is part of the HoloLens to broadcast what he sees onto the projector. As I had seen with other HoloLens demos, he places virtual objects around the room, jokingly saying "bam!" each time, mimicking Emeril Lagasse's catchphrase, to applause and laughs. He outlines the basic features of the HoloLens, including the spatial sound built into the headset.

The developer tells the story of how his first encounter with the device at the E3 entertainment expo changed his life: He then started a crowdfunding campaign so he could become "Tony Stark," a super hero of VR/AR and save the world with the software. He raised most of the money through contributions from friends and has been developing ever since. It is a hopeful and happy story, and I'm sure I'm not the only one who ruefully wonders why I hadn't thought of his crowdfunding plan first.

After touting more features, and describing the HoloLens as providing a "seamless experience," he goes into more details about the device. My ears perk up when he describes how it changed the way he lives. In his house, he has a virtual statue of David, a tiger and a break-dancing kid positioned around his room to spruce it up. In his office, he put up several windows

and calendars. I remember how he told me months earlier that he even set up a virtual

workspace in the stairwell of his office, where virtual screens sat ready for his use.

A question and answer session follows. I desperately need a cup of coffee, as it's getting

close to 7:00 PM and I've been on my feet almost the entire day. I run over to a corner coffee

shop for about ten minutes, clear my head and come back.

As I walk in the door, I notice people folding the plastic chairs and moving the tables

directly in front of the projector. After a few minutes, I learn that the organizer changed tactics.

He wants to give the newcomers a chance to try Room Scale VR.

A line forms, everyone eager to try a game called Space Pirate Trainer. *In it, a player*

chooses a weapon for each hand and then must whirl around to shoot down vaporwave-style

robots who are attacking them with lasers. Some attendees start taking turns, while others call it

a day. We are all able to see what the player sees through the projector on the main screen, and

we yell out as each player gets attacked or makes a good shot. Of course, when someone gets a

high score, they are met with cheers.

Figure 9.1. Attendee playing *Space Pirate Trainer*.

The event seamlessly transitions to an after party. It feels like an arcade: a dozen or so people taking turns, vying for high scores and playing, a welcome release after the talks. Conversations are interspersed with recaps of the day. I talk to the final speaker about being self-taught. He encourages me and others around him that we can easily get to his near-professional skill level on our own.

The smoothness of the transition between meeting and play is remarkable. Some people brainstorm ideas. Others eagerly talk about the upcoming days of the conference. Still others focus on getting high scores and displaying their skills in Space Pirate Trainer. *When the organizer turns off the lights and the only illumination comes from the projected game images, the party atmosphere intensifies.*

I let myself go. It's late, I'm tired and I rarely get a chance to play with Room Scale VR. With the encouragement of the other attendees, I slip on the headset and take a defensive posture, a large shield made up of lasers in one hand, a gun in the other. I zip around fairly clumsily to fight the space pirates. When I am shot in the back, the screen flashes and I whip around. For a few minutes I am lost in the game. I hold the shield in a protective crouch and peer around its edge, tap the other controller and blast away at a few enemy waves. It feels great. I'm getting a handle on the game. But then as the hordes increase, I am overwhelmed and before I know it, I have lost, and my score is mediocre.

I don't want to go again. There are others waiting. I also know that the event might get crazier. More beer and more partying is in store, and some people are planning on staying overnight if possible. Academic that I am, I conjure mental images of Bakhtin's carnival and the suspensions of ordinary life that occur in it. Is that what's going to make this week successful? At very least, this feels like an event where networking cascades into carefree fun, without a specific

job or goal necessarily in mind. It feels wonderful. But I have another day of teaching tomorrow,

so I head to my car after an hour or so, to make the long drive home.

The carnival feeling continues almost every night, with the organizer and sponsor

planning games and experiments in the facility. On the final evening, the organizer brings

pounds and pounds of fried chicken from his favorite joint in town and invites us to dig in, a

gluttonous and greasy end to the week.

Discussion. Much of the development process involves time toiling alone; when one

works with groups, there is a certain comfortable silence. However, as the last two vignettes

emphasize, community plays an important role in fostering and rewarding this solitary endeavor.

Particularly in meetups, the lines between learning, labor and play are freely crossed, so that after

a few beers, enthusiasm bubbles over and discussions become passionate. It is precisely because

of this fervor about VR that adopters devote their excess time and energy to play with the

devices and relish the entertainment it provides. Since I didn't own Room Scale VR, I always

looked forward to getting my hands on the device for a few minutes. At the same time, these

gatherings cement long-term relationships and ideas. It is the camaraderie that makes spending

time at these events so inviting.

Conclusions

This chapter showcased the embodied process of adoption through a number of personal

narratives. It paints a picture of spontaneous play, which suddenly occurs and just as quickly

dissipates. More importantly, it reveals how VR's tools, community and development ethos all

spur play in different ways. Learning to code comes easily to those predisposed to digital games.

It is empowering to create imaginary worlds and uplifting to show off experiments. Those with

the financial resources for new gear squander hours diving into rabbit holes, justify their

expenditures by solving sticky problems and proudly broadcast their findings. And the VR community's enthusiasm bestows glory on its adherents and embraces a fun environment.

Almost every developer and labmate I encountered improved his or her knowledge over the course of the workshop. However, this doesn't happen by a standard learning process. Because of both the community and inchoate state of the medium, the curriculum isn't formalized, but ad hoc, experimental and playful—more of a wild grab bag of testing out ideas until something clicks. The process of learning to make content resembles jamming with a punk band more than sitting at a desk distinguishing the nuances of formal composition. And like a punk band, the output can be rewarding if somewhat rudimentary. Entering into this novel space felt so good that it drove me to spend extra hours behind a computer, to assume extra responsibilities within my groups and to spend my savings on the latest and greatest in digital media. I relished the creativity; wonderment often powered me through some of the more tedious development tasks.

Part of this feels inherent to the digital media itself. With its simple ability to undo, edit, delete and replace objects, I felt like I could easily build something worthwhile from nothing. I could reuse code (and did). I could reuse objects (and did). I could remix the work of others through purchases in the Unity Asset Store to make my virtual worlds come alive. It felt like I was playing even when I was working.

Of course, this is a singular experience. The fact that I come from a gaming background (albeit mostly with an interest in casual games), am white, male, suburban-raised and a student has affected my perspective. Other developers, such as some of the women in the lab, relayed different experiences. One developer flat out rejected my theories. After stating she believed games came from a military industrial complex, she said "I do not work with games or gaming or

play, because, honestly, my perception of creative practice comes from reflection, vision, and dreams. That's what I look to for my indicators. People may engage in play. I don't focus on it in my own practice or in holding creative workshops. I'm pretty ignorant about it, and I feel that American culture specifically is obsessed with it in a way that other cultures are not. Honestly, I find it troubling… "

In my interviews, she was in the minority. Instead, the idea of play as a kind of creative freedom persisted. One interviewee said that she used to play around with technology as a child, and stated that she included play in her process: "because it is a new medium, it's very important to learn to experience it as if it was the first time." Another said to me that for her generation, (she was in her 50s), joy was a better word than play. She added, "There was extraordinary pleasure in seeing your work function, seeing your work speak to people. Some of that pleasure was just like old dog's still got it…. It was joyful." For her, play involved the joy of vivifying her own fantasies. Other interviewees mentioned the fun of interacting with others. An interviewee confessed that during filming, an unexpected moment of play occurred: "I was trying to hide behind a planter, and all the people on the street stopped and were gathered around, and were laughing and everything. I said, 'You know what? This… stuff is fun.' Yes, it's very playful and fun in terms of interacting with people, too." These playful moments outweighed the "cost" of labor for those I interviewed.

Most importantly, there is a feeling of power and freedom which seems to elucidate *why* adopters play and labor with the technology. Few of my subjects, including myself, were unaware of their sacrifice of time and effort, and the disproportionate benefits of our collective work to the game and tech industries. And yet, it was precisely this extra effort that drove us forward. I wasn't solving problems or mastering a skill in VR for anyone else but myself. The

affirmation I received from the community was great, but I didn't imagine my work would drastically change the industry. Instead, it was the little rewards of self-discovery, of artistic creation, and the slow improvised way I built experiences that compelled me to return to the lab week after week and work at home early in the morning. For most content creators and developers, this is the true compensation for their efforts. They are self-driven. The tools and the medium have tapped into something intrinsically motivating: play. This is the benefit that occurs in the playbor production system. For those with the money, time and effort to devote to innovation, their relaxation is derived from excess labor. While the VR industry certainly has capitalized on this model, if my experience is at all indicative, this drive will continue to defy traditional modes of labor precisely because it is an act of expenditure with intrinsic rewards.

CONCLUSION

I have been writing about the subjectivity and sway of media ecosystems, the importance of sites, and the purpose of play in the diffusion of innovations. After suggesting future areas of research, I underscore the ways in which play is pivotal in the relationship between early adopters and emerging forms of digital media. Lastly, I consider the future of VR as it continues to normalize and commercialize.

Review

The first chapter's literature review disclosed the difficulty of defining this moment of VR diffusion. Considering the pervasiveness of the technology in the popular imagination, its repudiation, and its past commercial failures, VR's second coming to market, after a first bumbled release in the 1990s, is unique. Games and play have an outsized role in its current rise and development. This circumstance necessitated a multimethod and novel research approach, as explained in Chapter Two, which included autoethnography as a method to viscerally apprehend the process of adoption.

A media ecosystem is instrumental in today's VR diffusion. Chapter Three described how that ecosystem defines VR, recognizes the technology's important players and economic value, and its promotional objectives.

Chapter Four mapped VR's interconnected content classifications. Each has attracted specific industries, but, at the meetup level, were of mutual interest to adopters.

As seen in Chapter Five, demography and economics tinge VR adoption in New York City. While often seen as a land of opportunity, with a diverse population and an economy

buttressed by publishing, advertising, the arts and entertainment, The City's high cost of living and modest hardware manufacturing base make it inhospitable to digital innovation.

Chapter Six found meetups to be playful sites of adoption that allowed participants to explore all aspects of the budding VR industry. Similarly, play is featured in the language of VR enthusiasts, which was the focus of Chapter Seven. Play resolved the tension between VR's limitless rhetorical potential and its circumscribed reality.

Play is central in the adoption process. Chapter Eight uncovered it in the design of VR content, the activity of and ultimately the expenditure made by early users. Finally, in Chapter Nine, I personally probe the adoption experience to better discern participants' motives to play with this technology at all.

Diffusing and Definition

Unlike armchair consumers, early adopters came to commercial VR with an explicit interest in the medium and creating content for it. Because of their business bent, their approach was shaped by and for industry. Their perspective was also highly mediated and influenced by the coverage surrounding the technology—how-to tutorials, promotional material, and news articles reviewing the latest, greatest VR offering.

While commercial ambitions drove adopters, their process was intimate and aspirational: they were inspired by science fictional imaginings; hoped to have a stake in the inevitable revolution potentially precipitated by VR's diffusion; or wanted to cash in on the latest sales of commercial headsets. As much as a desire for wealth and fame, a more idealistic, and often less rational, mission enticed them to adopt the new technology in the first place.

As a consequence, contradictory definitions cloud the perception of the medium. It was, on the one hand, an emblem of popular imagination with limitless potential. On the other hand, it

was bound by the technical restrictions and economic realities, with neither truly winning over the other for most enthusiasts. Ultimately, the early adoption and diffusion of commercial VR was the product of industry, media, market and personal forces.

Media Ecosystems

Media ecosystems consisted of a complex and often interconnected network of producers who covered, explicated and promoted the new technology. A vast number of outlets resided within this ecosystem—journalists of all ilks, promotional media, blogs, online groups, YouTube tutorials, developer manuals, "Let's Play" entertainment videos, conferences, festivals and arcades. This rich tapestry of entities fed each other information and served as the primary conduit for hype and promotion, extolling immersive technology's potential as well as anointing its leaders. They also were a first-line source of tutelage. As illustrated in my own autoethnographic account, it was usually through this media ecosystem that key features of *how to* develop for VR were discovered.

The ecosystem was not only driven by supporters, but also nourished them. As much as they learned from and were swayed by it, early adopters were also contributors. The case study of WebVR's ascendancy typified the routine use of media both to access and pass on information.

Media consumption fueled the process of adoption, directly affected the rhetoric and vision of adopters, and framed the potentials of the technology.

The Process of Adoption

Both before and after acquisition, VR adopters continue to find ways to integrate the medium into their work and life. This ongoing practice, bolstered and shaped by community,

location and the media, is not always easy or rosy, despite what the soaring rhetoric of

enthusiasts might imply. Paths to success with the technology aren't clear-cut; learning to use VR

is arduous. Yet, driven by the aspiration to be on the ground floor of a cool new medium or to

realize a childhood fantasy, devotees persevere.

This defies the norms of rational decision-making that Rogers first espoused. Adoption,

in this case, is illogical. Social, financial and professional incentives are indistinguishable from

the extra efforts, time and funds that must be expended in an attempt to find success with the

medium. This conglomeration of impulses more epitomizes play than serious calculation.

Games and Play

Digital games and the game industry loomed large over the commercial release of VR

and its subsequent diffusion. The original Oculus Rift was marketed to gamers and most headsets

were explicitly designed for the gaming community. Besides targeting an audience, the industry

controlled the rollout of the technology to the wider public and particularly developers. This

entailed a "Playbor Production System." Companies doled out VR hardware with Software

Development Kits (SDKs), pre-made code packages with samples of how to program for VR

with existing applications, that developers used to make content. While they got early access to

the technology, and, in essence, became unpaid beta testers, manufacturers were made aware of

flaws in their products. In the process of development, the industry set the rules of content

creation, sustaining their place within the nascent VR economy.

Developers abet the industry because of their passion to work on the devices and invest in

their broader commercial use. These activities can be explained as playbor: game publishers

capitalize on developers' spare-time expenditures—their "play"—without direct economic

benefit. Playbor permeates the adoption process: it frames the rhetoric of adopters, who play with

VR in the abstract while laboring over it in reality; it propels the diffusion and economy of the medium before it meets mass appeal; it occurs naturally when one is consumed in bringing a VR vision to life, as I can attest. In all cases, play both drives efforts and serves corporate ambitions.

Is this still play when it so time-consuming? For the most avid enthusiasts, the answer is a definitive no. Just as in any passion project or avocation, being fully engaged with the activity, losing track of, or expending excessive amounts of time is the norm. The playbor production system exploits this passion. The more energy expended for the love of the medium, the greater the manufacturers directly benefit.

Is there a point, however, when such playbor loses its veneer of fun, and adopters cease viewing their endeavors as play? Yes. Individuals may reach this point at different times. As recounted in Chapter Seven, many enthusiasts aspired to have play be the main feature of their work life. VR was a stepping stone for achieving this goal because of the playful relationship users had with it. Once it started feeling like "work," many put aside the technology. At least one newcomer I met was immediately intimidated by Unity, refused to take the time to learn it, and, even when interviewed several months later, had not committed money and energy to VR, compared to other interviewees. Some others, by contrast, always sought out the latest and greatest immersive hardware with which to develop. This kept them excited about the technology, like a child getting a new toy. Thus, it was precisely when play ceased be a motivating factor that early adopters lost interest.

Unlike Kücklich's (2005) and Rey's (2012) articulations, the "play" of playbor was very much integral to the experience of adopters. As an activity, in the design of VR content and as expenditure, play was a driver of creative energy and joy. For many, it did not feel like a major sacrifice, financially at least, to dedicate their time and energy to the devices. And because they

had no substantial material investment, but were "playing," this lowered the stakes of what they were doing and allowed them a certain amount of freedom. They could have fun and passionately labor without the cares and responsibilities of a day job. At the medium's debut, play and the VR industry were very much connected; play, rather than financial investment or the promise of direct returns, incited ardent enthusiasts.

Broader Contributions

While this study focused on VR, its findings have implications beyond that realm. First, the work underscores the value of media ecosystems as conduits of promotion. While past inventions have been hyped, ranging from the photograph to the personal computer, the level of media coverage pales in comparison to the intense buzz around contemporary innovations, which is ubiquitous online.

My research reveals, however, the pivotal role of media as a circuit of information with which early adopters engage. It was through media that most came to the innovation and many employed it to both learn and showcase their progress with the technology, as well as to market it and themselves.

The ecosystem serves a dual purpose. It drums up support and promulgates VR. Somewhat unscrupulous, many of the media entities producing work on innovations are obligated to the industry for access and devoid of the codes of ethics standard for traditional journalists. Despite this, it cannot be denied that this promotion sustains the interest of rabid enthusiasts. At the same time, the system acts as a repository of practical know-how and catalog of successes in the medium's evolution. In the current environment, people figure out the technology as much online as in their personal experimentation. This creates an important feedback loop between adopters and the industries distributing VR. A clear line can be traced via

online articles and websites from innovation, to early users, to subsequent hype and ultimately adoption.

A second contribution of this research is the relevance of site in the process of adoption. New York City delineated the paths of early adopters. Neither an IT hub primed by major capital investment like Silicon Valley, nor an insulated suburb, The City's entrenched cultural institutions, particularly media, education and government, treated VR as just another technological upstart horning in on their turf.

Meetups, another site of adoption, were more welcoming, a haven where people from varied industries could congregate and find common ground. At meetups there was a unified goal to celebrate the medium. In both cases, the locale where innovation is encountered ultimately tints, and sometimes taints, daily practices and decisions on how to incorporate and exhibit new technology.

Finally, the value of play in the diffusion process cannot be overstated. Beyond the playbor production system, play—manifested in activity, design and expenditure—has a wider application to the diffusion of innovations. Putting forth extra time in order to unravel the mystery of novel devices, along with playtesting and iterating content for them, is becoming the norm, particularly in the digital age. These exercises are often considered inherent to a rational experimental process. I contend that today's adoption is more of an embodied and irrational experience. The way we "play" with new technologies warrants further study and upends the assumption of gamification advocates that digital media should be designed to mimic games. Future research should instead strive to understand and articulate the play of users as they encounter new and old innovations alike.

Methodological Considerations

One intention of this project was to understand the process of adoption within the context of digital innovations. In an oversaturated media environment, it was hard to distinguish between learning from outside sources and learning from personal experience, let alone to assess the effect of each on the adoption process. To make the attempt required a deep dive, both intellectually and personally, into the media ecosystem, into enthusiast groups, and into the medium itself. Autoethnography offered a visceral and embodied way to dissect the process.

The interaction with interfaces is physical, emotional, and complex. Many of the applications I encountered called for interminable interplay: mixing, matching, editing, expending sleepless hours tweaking code and refining projects. With autoethnography, I accounted for this "playtime" in detail. Autoethnography enabled me to empathize with the subjects of my study, live their lives and explore the innovations more substantially.

Future Research

My research was a deliberate snapshot. It focused on a singular time, place and community to describe a specific example of adoption. It revealed the influence of the game and media industries and New York City's culture. However, other aspects of VR's diffusion justify further study. My analysis does not situate VR within computer science or military history. It also does not follow the acculturalization of VR by media entities, or the pressures and ethical compromises journalists face when having to integrate new technology into their mainstream field. My work also excluded the major hardware manufacturers responsible for VR's diffusion: the movers and shakers of the business.

The study defined a particular type of user—the early adopter—the first in line to wait for the new device, the person who wants to ride a wave of technological innovation and embraces it at the outset. The question remains how others will come to Virtual Reality and immersive media. As VR diffuses to the public, how they use it will likely change. Later patrons may repeat the pattern of early users and may also provide vital feedback to manufacturers. However, it is likely that their experience will be different—for one thing, not as playful as that of the early adopter. They may not have the time, wealth or interest to expend extra energy to test the limits of what VR can do. VR will continue to change and the experience of successive groups will likely change as well.

Concluding Remarks

Contemporary culture is creating novel circumstances for the diffusion of innovations. We read and hear about the accomplishments of innovators as well as early adopters and users to a greater extent than ever before. Online tutorials and other media flaunt VR experiments. Media coverage of the medium is no longer an aberration and the products of individual companies rise slowly and steadily in popularity. At one meetup I attended regularly, the organizer repeatedly asked how many people had never used VR, and the percentage of raised hands consistently decreased. I witnessed short-lived crazes like *Pokemon Go* where millions started to talk about Augmented Reality. I even publicly relished my own accomplishments: the demos I built from scratch.

Much of this change is due to the ease of access and creation of content for the device. Free tools, such as the game engine Unity, expedite the distribution and fabrication of immersive experiences. The current VR wave is as much a product of the proliferation of free game engines and the facility to receive instruction as of anything else, at least according to my interviewees. A

developer's major expenditure is less financial and more about time to find, access and absorb

the profusion of digital information. Both my adopters and I spent time learning after work and

on weekends. Few took a formal course or sought a credential. It is an empowering feeling, as I

realized, to find solutions online and dive down rabbit holes of discovery. It is also pleasantly

rewarding to produce something solely through one's perseverance and gumption.

This circumstance—a mixture of easy access, free tools and exposure to the

accomplishments of others—contributed to a feeling among numerous interviewees that they are

part of a revolution. They believe VR's future is limitless. For many this conviction was deep-

seated: the fulfillment of a childhood dream, a digital gold rush in a Wild West of opportunity

where they can lay claim. The Wild West metaphor also implies a situation where people have

unregulated freedom to do what they want, a lawless state where they can fulfill their own

potential. Whether coming to the technology because of the love of new devices, or the belief it

can lead to greater empathy and equity or just make them wealthy, early adopters felt part of a

sea change where technological dreams come true.

And yet, once ensconced within the VR environment, New York City's early adopters'

hands were tied. The playbor production system put up one of the barriers to entry. Local

businesses and industries also stifled content creation. Furthermore, without expertise in

production tools like Unity, a user was disadvantaged. At the same time, game engines like Unity

locked developers into a specific way of imagining how to make virtual worlds—one designed

strictly for the creation of digital games and reinforced by SDKs which are built exclusively for

the engines. Reality, it turns out, was far from the Wild West enthusiasts imagined.

This contradiction between theoretical freedom to lay claim to VR's limitless potential

and the actual limits of technology is the product of a complex manipulation. Particularly under

the playbor production system, adopters receive no direct benefits for acceding to the rules which ultimately dictate how they can make content.

With no other course, adopters play! I found play to be the modus operandi for navigating the situation. Industry set the social and technical rules which governed how people played and around which they maneuvered. Most understood these standards and sought to master their craft according to them, just as any player of a game does. They found joy in this type of play, from learning the ropes of developing for VR, and—after exhaustive efforts—achieving competency. Those purchasing VR headsets and developing content are wealthy enough to pay for their hobby. This means they have the stability and free time, at least in theory, to expend without financial incentives. Thus, for them, adoption is hardly "labor" in a traditional sense, but an avocation they can indulge outside work.

Rather than being manipulated or exploited by industry-imposed limits, knowing the "rules" and the system is implicitly part of the mastery that "players" aim to achieve. The rules actually provide an arena where one can play, test and frame the technology.

At the same time, their play gives early adopters agency. What they do at this early stage has real world impact, at least in how the commercial devices are utilized in homes and for entertainment. Consider modifications to HTC's Vive. Originally the device was designed with two hand controllers to be tracked in virtual space, following the arms of the players. Early developers immediately started experimenting. Companies like IliumVR[1] placed them in fake guns to simulate a more realistic "gun-like" feel for VR shooting games. HTC reacted to these alterations by making the "Vive Tracker,"[2] universal devices which could be attached to

---

[1] "Ilium VR -," Ilium VR, accessed March 12, 2018, http://iliumvr.com/.

[2] "Vive™ | Vive Tracker," Vive, accessed March 12, 2018, https://www.vive.com/us/vive-tracker/.

anything—from guns to golf clubs—and used for any of the developer's purposes. Similarly, over the past few years HTC amended the rules for access to their games. When so many ad hoc arcades popped up using the Vive, the company created an "enterprise" version of their hardware to be sold to arcade owners. In both cases, players and their play had the initiative.

An awareness of the playful relationship between innovators and early adopters is often overlooked. But it is necessary. The rules of play established by manufacturers frame the power and limitations of early users. To recognize that the potentials of the technology are circumscribed and set beforehand and that their efforts will probably be shaped by externally imposed rules is important for tempering hype. Learning this lesson gives insight into the constraints of the playbor production strategy, and even conveys how it works. At the same time, when early adopters consider their actions as playful, and that manufacturers will respond to (and edit) their products based on player feedback, it grants users a sense of agency within a rigged system. They are not completely powerless.

Further innovations will no doubt capitalize on this sort of development model. VR's diffusion is not anomalous; like VR, robotics and artificial intelligence cast early developers as both guinea pigs and architects of possible constructions. Indeed, this sort of playful relationship extends beyond IT. A-B testing by news organizations is increasingly playful—outlets are constantly trying out different versions of their content online, which based on reader response and engagement, they iterate upon and change.[3] Smart cities are similarly experimenting with residents. Everything from drones to self-driving cars involve comparable playful exchanges between early users and industry. While VR may be unique it how it has been positioned in the public imagination, and especially its association with science fiction, cyberspace and gaming, it

---

[3] For an example with push notifications on smartphones, see Brown, 2017.

is not exceptional when it comes to the relationship between media, early adopters and contemporary industry.

While a new device is in a state of early "interpretive flexibility," where its function is still not fully comprehended, is precisely the moment when the public gets to play with it most and where the rules of the manufacturers are meaningful. It is at this moment, and particularly in the case of digital innovation, when these early players can test industry-imposed limitations, subvert and change them as they see fit, and affect what the technology will look like in the future. Play has a valuable role in the social construction of technology which can no longer be ignored in considerations of future diffusion of innovations.

What of Virtual Reality?

There is one final point I would like to make. More times than I could count I would be approached by a newcomer to VR at a meetup. After hearing about my research, they would ask me the same question, something along the lines: "So what do you think is going to happen to VR? Where is it going?"

I was flattered by this question, though I rarely answered because I didn't want to color their perceptions; I felt speculation about the future fell outside my role as researcher. The queries were earnest and aspirational. Newcomers were hopeful about the future of the technology and envisioned the opportunity to ride the present, highly-promoted wave of success. They wanted confirmation that this tide would not ebb and their efforts would be rewarded.

And yet, their guarded optimism is revealing; many remembered the failures of VR's first commercial wave in the 1990s. They reasonably feared a similar crash. I could see VR going

through the infamous "Hype Cycle"[4] when new innovations crest with public enthusiasm,

coverage and hope, do not live up to the hype and plunge into the "trough of disillusionment,"

from which they often take years to recover.

Not only did VR as a technology endure the beginning of a Hype Cycle in 2016, but other

immersive technologies have done so as well. Articles are already declaring 2018 the "Year of

AR" just as VR's year was supposed to have occurred two years earlier (Forbes Technology

Council, 2018).

The gap between hyped expectations and VR's actual commercial products can be in part

attributed to issues of play. For many, the constrained process of playing in VR simply didn't

resemble what they imagined. Rather than experiencing exuberance that is the essence of so

much science fiction written about virtuality, early adopters and I were instead absorbed in the

play of the creative act and with the glories of success.

There were surprisingly few moments during my study when I felt a carefree, elated form

of play. Once was at a VR arcade where I encountered "TheWaveVR."[5] In this multiplayer

game, each player takes on the form of a geometric avatar and can interact with others from

around the world. I was situated in a crystalline cave, set up to be a rave dance party. The actual

activity was relatively simple—I could teleport around the cave collecting currency which could

be exchanged in a virtual vending machine for virtual drugs. Each had different shapes and

properties. However, the potions could only be activated in combination with another player.

Wherever this player was located, in virtual space we were together. I had to interact with other

---

[4] "Hype Cycle Research Methodology | Gartner Inc.," Gartner, accessed March 12, 2018, https://www.gartner.com/technology/research/methodologies/hype-cycle.jsp.

[5] "TheWaveVR," TheWaveVR, accessed March 12, 2018, http://thewavevr.com/.

avatars and touch them virtually. When our hands met, the drug would activate. I purchased

some hallucinogens and joined the cluster of avatars in the middle of the cave to sample them.

They were mostly male, I waved at them, trying to get them to "trip" with me. Eventually, one or

two did. The first time we tried it, as I stared at the other avatar, the colors in the display began to

change and slowly he and I started melting away. We both audibly "oohed!" I felt lightheaded

and forgot where I was. I lost track of time and felt truly immersed. I can't imagine what I would

have looked like to the people in the arcade—probably not dissimilar from Palmer Luckey on the

cover of *Time*, my arms outstretched and flailing in different directions, my face with a goofy

smile turned upward searching for something in the ether. However, the moment was fleeting.

VR seems to constantly aspire to, but never quite achieve what Brenda Laurel (1993) once called

the "Dionysian experience" of "being *in the living presence* of not only the artist but also huge

spiritual forces" (p. 196). Simply, a true and visceral experience of a virtual world remains

almost always out of reach as it was for me in TheWaveVR. Eventually I had to stop, and I never

felt compelled to go back and play again, and for purely practical reasons—it required a headset

I didn't own and another opportunity to play it again at the arcade never arose.

What I am suggesting is that VR players only rarely have such transporting experiences.

For Laurel, to accomplish this "intimate and powerful kind" of experience requires the

technology to bridge the arts and the act of creation itself: "we need continual and deep

involvement of artists in the ongoing process of understanding what virtual reality is for and

what it can be. We need convivial tools that allow artists to work in the medium in order to

influence its creation" (p. 196). As my study has illustrated, the tools for creation only partially

fulfill her desire. The enthusiasts I encountered were into a different type of play—learning rules,

performing and competing. They embraced the system imposed on them and worked within its

confines. They were not expecting ecstatic experiences, but rather enjoyed the play defined by the boundaries around them.

So, to return to the question of what will happen to VR, I answer that it doesn't really matter, at least for early adopters. Rather than riding the waves of a hype cycle, they are just navigating and playing with new headsets as they emerge. They will find ways to play with immersive media, whether VR, AR or something derivative of them. Ultimately, because they like playing with the technology, understanding it, and working within the constraints of the industries that make it, they will likely be the first to realize the true potential of Virtual Reality, whatever that may turn out to be.

Bibliography

admin. (2015, May 21). Superdata: Global Games Market Hits $74.2 Billion annually | Trade Media. Retrieved March 6, 2018, from http://trade-media.com.au/news/read/superdata-global-games-market-hits-74-2-billion-annually/

Aguilar, M. (2013, September 5). Ricoh's Weird 360 Camera Takes Mind-Bending Photos, But It's Expensive. Retrieved March 5, 2018, from https://gizmodo.com/ricohs-weird-360-camera-takes-mind-bending-photos-but-1256932963

Al-Obaidi, Z. (2016a, June 3). VR is Big at Sheffield Doc/Fest 2016 Alternate Realities Summit. Retrieved March 4, 2018, from https://www.vrfocus.com/2016/06/vr-is-big-at-sheffield-docfest-2016-alternate-realities-summit/

Al-Obaidi, Z. (2016b, June 7). A Guide to Samsung Gear VR Phone Compatibility. Retrieved March 4, 2018, from https://www.vrfocus.com/2016/06/a-guide-to-samsung-gear-vr-phone-compatibility/

Anderson, C. W. (2013). Media ecosystems: Some notes toward a genealogy of the term and an application of it to journalism research. In *Unpublished paper presented at ESF Exploratory Workshop on Mapping the digital news ecosystem: Professional journalism, new producers and active audiences in the digital public sphere. Retrieved August* (Vol. 8, p. 2013).

Anuta, J. (2016). City to invest $7.2 million in new hubs to bolster tech. Retrieved March 5, 2018, from http://www.crainsnewyork.com/article/20160211/REAL_ESTATE/160219969/new-york-city-to-invest-7-2-million-in-new-hubs-to-bolster-tech

Arendt, H. (1998). The Human Condition. with an introduction by Margaret Canovan. *Chicago and London: University of Chicago Press,*.

Armstrong, J. (2007). How a blogger and the Dean campaign discovered each other. *Zephyr Teachout & Thomas Streeter (et Al.) Mousepads, Shoe Leather, and Hope: Lessons from the Howard Dean Campaign for the Future of Internet Politics. Boulder and London: Paradigm Publishers*, 38–54.

Avedisian, A. (2016a, November 28). What is Reality? – NYC Media Lab – Medium. Retrieved March 5, 2018, from https://medium.com/@nycmedialab/what-is-reality-5da14a1ab544

Avedisian, A. (2016b, November 29). Two questions for VR & AR experts – Virtual Reality Pop. Retrieved March 5, 2018, from https://virtualrealitypop.com/two-questions-for-vr-ar-experts-14937f216bf0

Avedisian, A. (2016c, December 6). Pro-tips from advertising, marketing and media execs working with VR/AR. Retrieved March 5, 2018, from https://medium.com/@nycmedialab/pro-tips-from-advertising-marketing-and-media-execs-working-with-vr-ar-190d004dde33

Avedisian, A. (2016d, December 7). Investing in virtual and augmented reality – Virtual Reality Pop. Retrieved March 5, 2018, from https://virtualrealitypop.com/investing-in-virtual-and-augmented-reality-5ff3919067b0

Bagli, C. V. (2018, February 7). $2.4 Billion Deal for Chelsea Market Enlarges Google's New York Footprint. *The New York Times*. Retrieved from https://www.nytimes.com/2018/02/07/nyregion/google-chelsea-market-new-york.html

Bailenson, J. N., Blascovich, J., & Guadagno, R. E. (2008). Self-Representations in Immersive Virtual Environments1. *Journal of Applied Social Psychology*, *38*(11), 2673–2690.

Bakhtin, M. M. (1984). *Rabelais and His World*. Indiana University Press.

Barbrook, R., & Cameron, A. (1996). The Californian ideology. *Science as Culture*, *6*(1), 44–72.

Barrie, A. (2017, October 26). Powerful tiny tanks with VR and futuristic cockpits could revolutionize the battlefield. Retrieved March 4, 2018, from http://www.foxnews.com/tech/2017/10/26/powerful-tiny-tanks-with-vr-and-futuristic-cockpits-could-revolutionize-battlefield.html

Bartle, R. (1996). Hearts, Clubs, Diamonds, Spades: Players Who Suit MUDs. *The Journal of Virtual Environments*, *1*(1). Retrieved from http://www.mud.co.uk/richard/hcds.htm#1

Barzilai-Nahon, K. (2008). Toward a theory of network gatekeeping: A framework for exploring information control. *Journal of the Association for Information Science and Technology*, *59*(9), 1493–1512.

Barzilay, O. (2017, August 30). NYC Emerges As The Capital Of Insurtech. *Forbes Magazine*. Retrieved from https://www.forbes.com/sites/omribarzilay/2017/08/30/nyc-emerges-as-the-capital-of-insurtech/

Bataille, G. (1985). *Visions Of Excess: Selected Writings, 1927-1939* (1st ed.). Univ Of Minnesota Press.

Bataille, G. (1991). *The Accursed Share: an Essay on General Economy, Vol. 1: Consumption*. (R. Hurley, Trans.) (1st ed.). Zone Books.

Beckett, C., & Deuze, M. (2016). On the Role of Emotion in the Future of Journalism. *Social Media+ Society*, *2*(3), 2056305116662395.

Betts, R. (2016, October 7). Practical VR Design – Virtual Reality Pop. Retrieved March 4, 2018, from https://virtualrealitypop.com/practical-vr-ce80427e8e9d

Biocca, F. (1992). Virtual Reality Technology: A Tutorial. *The Journal of Communication*, *42*(4), 23–72.

Biocca, F., & Levy, M. R. (Eds.). (1995). *Communication in the Age of Virtual Reality (Routledge Communication Series)* (1 edition). Routledge.

Blascovich, J., & Bailenson, J. (2012). *Infinite Reality: The Hidden Blueprint of Our Virtual Lives* (Reprint edition). William Morrow Paperbacks.

Blythe, M. A., Overbeeke, K., Monk, A. F., & Wright, P. C. (2006). *Funology: From Usability to Enjoyment* (1st ed.). Springer Science & Business Media.

Bockholt, N. (2017, May). VR, AR, MR and What Does Immersion Actually Mean? Retrieved March 5, 2018, from https://www.thinkwithgoogle.com/intl/en-cee/insights-trends/industry-perspectives/vr-ar-mr-and-what-does-immersion-actually-mean/

Bonasio, A. (2017, February 12). How Teledildonics Will Create More Intimate VR Experiences - UploadVR. Retrieved March 7, 2018, from https://uploadvr.com/teledildonics-vr-sex-intimacy/

Bond, J. G. (2014). *Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#* (1 edition). Addison-Wesley Professional.

Bourdieu, P. (1993). *The Field of Cultural Production: Essays on Art and Literature*. Columbia University Press.

Boyer, S. (2009). A Virtual Failure: Evaluating the Success of Nintendo's Virtual Boy. *The Velvet Light Trap*, 23–33.

Brillhart, J. (2016a, January 12). In the Blink of a Mind — Prologue – The Language of VR – Medium. Retrieved March 4, 2018, from https://medium.com/the-language-of-vr/in-the-blink-of-a-mind-prologue-7864c0474a29

Brillhart, J. (2016b, February 5). In the Blink of a Mind — Attention – The Language of VR – Medium. Retrieved March 4, 2018, from https://medium.com/the-language-of-vr/in-the-blink-of-a-mind-attention-1fdff60fa045

Brown, A. (2015). Awkward. In P. Lankoski & S. Björk (Eds.), *Game Research Methods: An Overview* (pp. 77–93). Pittsburgh, PA: lulu.com.

Brown, P. D. (2017). Pushed beyond breaking: US newsrooms use mobile alerts to define their brand. Retrieved from https://academiccommons.columbia.edu/catalog/ac:h44j0zpcb4

Buckley, S. (2016, June 17). E3 was secretly terrible for the future of virtual reality. Retrieved March 4, 2018, from https://www.engadget.com/2016/06/17/vr-at-e3-2016/

Burawoy, M. (1982). *Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism*. The University of Chicago Press.

Burt, R. S. (2000). The Network Structure Of Social Capital. *Research in Organizational Behavior*, *22*, 345–423.

Butterfield, A. D. (2012). Ethnographic assessment of quantified self meetup groups. *Unpublished Doctoral Dissertation, San José State University*. Retrieved from

http://www.sjsu.edu/anthropology/docs/projectfolder/Butterfield-Adam-project.pdf

Caillois, R. (2001). *Man, Play and Games*. University of Illinois Press.

Caillois, R. (2005). The Definition of Play: The Classification of Games. In K. S. Tekinbas & E. Zimmerman (Eds.), *The Game Design Reader: A Rules of Play Anthology* (pp. 122–155). Cambridge, Mass: The MIT Press.

Carlson, M. (2007). BLOGS AND JOURNALISTIC AUTHORITY. *Journalism Studies*, *8*(2), 264–279.

Carpenter, J. (2015, August 16). Step Inside the Virtual Universe—How VR Will Transform the Web. Retrieved March 4, 2018, from https://singularityhub.com/2015/08/16/step-inside-the-virtual-universe-how-vr-will-transform-the-web/

Caudell, T. P., & Mizell, D. W. (1992). Augmented reality: an application of heads-up display technology to manual manufacturing processes. In *Proceedings of the Twenty-Fifth Hawaii International Conference on System Sciences* (Vol. ii, pp. 659–669 vol.2).

Cellan-Jones, R. (2016, January 1). 2016: the year when VR goes from virtual to reality. Retrieved April 14, 2016, from http://www.bbc.com/news/technology-35205783

Chadwick, A. (2007). Digital Network Repertoires and Organizational Hybridity. *Political Communication*, *24*(3), 283–301.

Chan, M. (2015). *Virtual Reality: Representations in Contemporary Media*. Bloomsbury Publishing USA.

Chess, S. (2017). *Ready Player Two: Women Gamers and Designed Identity* (1 edition). Univ Of Minnesota Press.

Choe, E. K., Lee, N. B., Lee, B., Pratt, W., & Kientz, J. A. (2014). Understanding Quantified-selfers' Practices in Collecting and Exploring Personal Data. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1143–1152). New York, NY, USA: ACM.

Cline, E. (2012). *Ready Player One: A Novel* (32089th edition). New York: Broadway Books.

Consalvo, M. (2009). There is No Magic Circle. *Games and Culture*, *4*(4), 408–417.

Consalvo, M. (2016). *Atari to Zelda: Japan's Videogames in Global Contexts (MIT Press)*. The MIT Press.

Consalvo, M., & Begy, J. (2015). *Players and Their Pets: Gaming Communities from Beta to Sunset*. University of Minnesota Press.

Cote, A. C. (2016). Changing the Core: Redefining Gaming Culture from a Female-Centered Perspective. Retrieved from https://deepblue.lib.umich.edu/handle/2027.42/133417

Csikszentmihalyi, M. (1997, July 1). Finding Flow. *Psychology Today*. Retrieved from http://www.psychologytoday.com/articles/199707/finding-flow

Cuban, L. (1986). *Teachers and Machines: The Classroom Use of Technology Since 1920*. Teachers College Press.

Currid, E. (2008). *The Warhol Economy: How Fashion, Art, and Music Drive New York City*. Princeton University Press.

Cusumano, M. A., Mylonadis, Y., & Rosenbloom, R. S. (1992). Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta. *Business History Review*, *66*(1), 51–94.

Damiani, J. (2016, August 29). The Great Semantic Divide: Virtual Reality vs. 360-Degree Video. Retrieved March 5, 2018, from https://uploadvr.com/virtual-reality-vs-360-degree-video-semantic-divide/

Davidson, J. (2016, December 21). PlayStation VR outsold HTC Vive and more than doubled Oculus Rift, Samsung crushed all 3. Retrieved March 4, 2018, from https://www.technobuffalo.com/2016/12/21/vr-headset-sales-2016-comparison/

De Koven, B. (2013). *The Well-Played Game: A Player's Philosophy*. MIT Press.

de la Merced, M. J. (2017, May 24). Unity Technologies, Whose Engine Is Behind Pokémon Go, Agrees to Funding. *The New York Times*. Retrieved from https://www.nytimes.com/2017/05/24/business/dealbook/unity-technologies-400-million-funding-round-pokemon.html

Dertouzos, M. (1997). What will be: how the new information marketplace will change our lives. *San Francisco: HarperOne*.

de Souza e Silva, A., & Sutko, D. M. (02/2011). Theorizing Locative Technologies Through Philosophies of the Virtual. *Communication Theory: CT: A Journal of the International Communication Association*, *21*(1), 23–42.

Deterding, S. (2009). The game frame: Systemizing a Goffmanian approach to video game theory. In *DiGRA Conference*. Retrieved from http://www.digra.org/dl/db/09287.43112.pdf

Deterding, S. (2014). The Ambiguity of Games: Histories and Discourses of a Gameful World. In S. P. Walz & S. Deterding (Eds.), *The Gameful World*. MIT Press.

Deterding, S. (2015). The Lens of Intrinsic Skill Atoms: A Method for Gameful Design. *Human–Computer Interaction*, *30*(3-4), 294–335.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. E. (2011). Gamification: Toward a Definition. *Chi 2011*, 12–15.

Deuze, M. (2001). Online journalism: Modelling the first generation of news media on the World

Wide Web. *First Monday*, *6*(10). Retrieved from http://ojphi.org/ojs/index.php/fm/article/view/893/802

Deuze, M. (2005). What is journalism? Professional identity and ideology of journalists reconsidered. *Journalism*, *6*(4), 442–464.

DiNapoli, T. P., & Bleiwas, K. B. (2014). *New York City's Growing High-Tech Industry* (No. 2). New York State Office of the Comptroller. Retrieved from https://www.osc.state.ny.us/osdc/rpt2-2015.pdf

Di Venuta, L. (2016, December 16). Open Your Eyes: MTV's Elect This Virtual Reality Experience Lets Fans Step Inside the Art of Change. Retrieved March 8, 2018, from http://blog.viacom.com/2016/12/open-your-eyes-mtvs-elect-this-virtual-reality-experience-lets-fans-step-inside-the-art-of-change/

Douglas, A. (2012, August 2). Execs In The Gaming Industry Are Going Crazy Over This Virtual Reality Headset. *Business Insider*. Retrieved from http://www.businessinsider.com/the-oculus-rift-virtual-reality-headset-is-the-future-of-3d-gaming-2012-8

Dredge, S. (2016, January 7). Three really real questions about the future of virtual reality. *The Guardian*. Retrieved from http://www.theguardian.com/technology/2016/jan/07/virtual-reality-future-oculus-rift-vr

Dreyfus, H. L. (1996). The Current Relevance of Merleau-Ponty's Phenomenology of Embodiment. *The Electronic Journal of Analytic Philosophy*, *4*(Spring). Retrieved from http://ejap.louisiana.edu/EJAP/1996.spring/dreyfus.1996.spring.html

Dubois, D. J., & Tamburrelli, G. (2013). Understanding Gamification Mechanisms for Software Development. In *Proceedings of the 2013 9th Joint Meeting on Foundations of Software Engineering* (pp. 659–662). New York, NY, USA: ACM.

Dubois, R. (2016, December 1). VR Gets Real with WebVR – Roland Dubois – Medium. Retrieved March 4, 2018, from https://medium.com/@rolanddubois/vr-gets-real-174fdafcad4f

Duffy, B. E. (2015). The romance of work: Gender and aspirational labour in the digital culture industries. *International Journal of Cultural Studies*, *19*(4), 441–457.

Duffy, B. E. (2017). *(Not) Getting Paid to Do What You Love: Gender, Social Media, and Aspirational Work*. Yale University Press.

Eadicicco, L. (2016, March 28). Review: Oculus Rift Is Expensive, Complicated, and Totally Wonderful. *Time*. Retrieved from http://time.com/4272506/oculus-rift-review/

Edwards, B. (2016, March 31). The Wacky World of VR in the 80s and 90s. Retrieved March 5, 2018, from https://www.pcmag.com/feature/343351/the-wacky-world-of-vr-in-the-80s-and-90s

Ellis, C., Adams, T. E., & Bochner, A. P. (2010). Autoethnography: An Overview. *Forum, Qualitative Social Research / Forum, Qualitative Sozialforschung*, *12*(1). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/1589/3095

Ellis, J. W. (2014, January 29). Recovered Writing: Undergraduate Technologies of Representation Essay on Past Technology, the Altair 8800, Sept 28, 2004. Retrieved February 18, 2018, from https://dynamicsubspace.net/2014/01/29/recovered-writing-undergraduate-technologies-of-representation-essaywebsite-on-altair-8800/

Eva, K. (2016, June 7). VR Vs. E3 And The Case Of The Phantom Announcement. Retrieved March 4, 2018, from https://www.vrfocus.com/2016/06/vr-vs-e3-and-the-case-of-the-phantom-announcement/

Eveland, J. D. (1986). Diffusion, Technology Transfer, and Implementation: Thinking and Talking About Change. *Knowledge*, *8*(2), 303–322.

Ewalt, D. M. (2016, November 2). Inside Magic Leap, The Secretive $4.5 Billion Startup Changing Computing Forever. *Forbes Magazine*. Retrieved from https://www.forbes.com/sites/davidewalt/2016/11/02/inside-magic-leap-the-secretive-4-5-billion-startup-changing-computing-forever/

Fabricius, C. (2016, July 15). Building Social VR apps in AltspaceVR with A-Frame – Immersion FTW – Medium. Retrieved March 4, 2018, from https://medium.com/immersion-for-the-win/building-social-vr-apps-in-altspacevr-with-a-frame-81cb1bbc3ec4

Feltham, J. (2017, April 13). Check Out Google's Awesome WebVR Experiments. Retrieved March 4, 2018, from https://uploadvr.com/check-googles-awesome-webvr-experiments-coming-soon-rift-vive/

Fink, C. (2016, December 23). VR, AR, MR Defined, Finally – Charlie Fink – Medium. Retrieved March 14, 2018, from https://medium.com/@CharlieFink/vr-ar-mr-defined-finally-ef255ba1002d

Fink, C. (2017a, October 20). War Of AR/VR/MR/XR Words. *Forbes Magazine*. Retrieved from https://www.forbes.com/sites/charliefink/2017/10/20/war-of-arvrmrxr-words/

Fink, C. (2017b, December 18). Will China Be The Winner In VR/AR? *Forbes Magazine*. Retrieved from https://www.forbes.com/sites/charliefink/2017/12/18/will-china-be-the-winner-in-vrar/

Fisher, H. D. (2012). *Don't Let the Girls Play: Gender Representation in Videogame Journalism and the Influence of Hegemonic Masculinity, Media Filters, and Message Mediation*. Ohio University.

Florida, R. (2003), Cities and the Creative Class. *City & Community*, *2*, 3-19.

Forbes Technology Council. (2018, January 24). Popular Trends Ready To Disrupt The Tech

Industry In 2018. Retrieved March 5, 2018, from
https://www.forbes.com/sites/forbestechcouncil/2018/01/24/popular-trends-ready-to-disrupt-the-tech-industry-in-2018/

Fowle, K. (2015, January 28). A look back at the doomed virtual reality boom of the 90s - Kill Screen. Retrieved February 17, 2018, from https://killscreen.com/articles/failure-launch/

Foxman, M. (2014). How to Win Foursquare: Body and Space in a Gamified World. In *Rethinking Gamification* (pp. 71–90). Leuphana: Meson Press.

Foxman, M. (2015). *Play the News: Fun and Games in Digital Journalism* (Tow Briefs). Columbia Journalism School: Tow Center for Digital Journalism. Retrieved from http://towcenter.org/research/play-the-news-fun-and-games-in-digital-journalism/

Foxman, M. (2016). The playful newsroom: Iterating and reiterating the news and its publics. *First Monday*, *22*(1). Retrieved from http://firstmonday.org/ojs/index.php/fm/article/view/7260

Foxman, M., & Nieborg, D. B. (2016). Between a Rock and a Hard Place: Games Coverage and its Network of Ambivalences. *Journal of Games Critcism*, *3*(1). Retrieved from http://gamescriticism.org/articles/foxmannieborg-3-1

Francis, B. (2016, May 26). VR has launched, so what now? Developers weigh in. Retrieved March 4, 2018, from https://www.gamasutra.com/view/news/273463/VR_has_launched_so_what_now_Developers_weigh_in.php

Frasca, G. (1999). Ludology Meets Narratology: Similitude and differences between (video)games and narrative. Retrieved December 21, 2013, from http://www.ludology.org/articles/ludology.htm

Frasca, G. (2003). Ludologists love stories, too: notes from a debate that never took place. In *DiGRA conference*. Retrieved from http://www.ludology.org/articles/frasca_levelUP2003.pdf

Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: state of the art and perspectives. In *The International Scientific Conference eLearning and Software for Education* (Vol. 1, p. 133). " Carol I" National Defence University.

Friedman, G. (2014). Workers without employers: shadow corporations and the rise of the gig economy. *Review of Keynesian Economics*, *2*(2), 171–188.

Frissen, V., de Mul, J., & Raessens, J. (2013). Homo Ludens 2.0: Play, Media and Identity. In J. Thissen, R. Zwijnenberg, & K. Zijlmans (Eds.), *Contemporary Culture: New Directions in Arts and Humanities Research* (pp. 75–92). Amsterdam: Amsterdam University Press.

Frith, J. (2014). Communicating Through Location: The Understood Meaning of the Foursquare Check-In. *Journal of Computer-Mediated Communication*, *19*(4), 890–905.

Frommer, D. (2017, March 23). Millions of Americans still play Pokémon Go every day. Retrieved March 5, 2018, from https://www.recode.net/2017/3/23/15039626/pokemon-go-daily-users-chart

Fuchs, M. (2014). Ludoarchaeology. *Games and Culture*, *9*(6), 528–538.

Fu, J. S. (2013). ICT in education: A critical literature review and its implications. *International Journal of Education and Development Using Information and Communication Technology*, *9*(1), 112.

Fuller, M. (2005). *Media Ecologies: Materialist Energies in Art and Technoculture*. MIT Press.

Fullerton, T. (2008). *Game Design Workshop: A Playcentric Approach to Creating Innovative Games* (2 edition). Morgan Kaufmann.

Gallagher, D. (2016, October 9). Where Virtual Meets Reality. *WSJ Online*. Retrieved from http://www.wsj.com/articles/where-virtual-meets-reality-1476027974

Game over for virtual reality? (2017, December 1). Retrieved March 5, 2018, from https://www.economist.com/news/science-and-technology/21731726-unimpressed-consumers-embrace-relevance-augmented-reality-instead-game

Garbarino, C. (2017, May 16). 5 Places New York City Startups Should Go for Funding. Retrieved March 5, 2018, from https://medium.com/startup-grind/5-places-new-york-city-startups-should-go-for-funding-b4746e16c0d5

Gardonio, S. (2017, October 11). What's the Difference Between VR, AR, MR, and 360? | IoT For All. Retrieved March 5, 2018, from https://www.iotforall.com/difference-between-vr-ar-mr-360/

Garner, T. (2017, January 3). Digital Trends: 2017 will be shaped by VR, AR, an internet for AI and digital assistants. Retrieved March 4, 2018, from http://www.newsweek.com/virtual-reality-virtual-reality-sets-phones-technology-537969

Gaston, M. (2013, November 26). Skyrim's Falskaar mod maker lands games industry job. *Gamespot*. Retrieved from https://www.gamespot.com/articles/skyrim-s-falskaar-mod-maker-lands-games-industry-job/1100-6416394/

Gaudiosi, J. (2016, January 5). Virtual Reality Video Game Industry to Generate $5.1 Billion in 2016. Retrieved March 4, 2018, from http://fortune.com/2016/01/05/virtual-reality-game-industry-to-generate-billions/

Gay, J. (2017, January 6). The World's Fastest Woman. *WSJ Online*. Retrieved from https://www.wsj.com/articles/the-worlds-fastest-woman-1483715969

Gehrich, G. (2012). *Build It Like A Startup: Lean Product Innovation*. Greg Gehrich.

Giddings, S. (2014). *Gameworlds: Virtual Media and Children's Everyday Play*. Bloomsbury

Publishing USA.

Gieryn, T. F. (1983). Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists. *American Sociological Review*, *48*(6), 781–795.

Gill, R. (2010). Life is a pitch: Managing the self in new media work. *Managing Media Work*. Retrieved from https://www.researchgate.net/profile/Rosalind_Gill/publication/265045026_Life_is_a_pitch _Managing_the_self_in_new_media_work/links/556f207108aeccd777410af3.pdf

Gingrich-Philbrook, C. (2009). From Paradigmatic Acts to Encounters along a Line of Flight. *Liminalities: A Journal of Performance Studies*, *5*(1). Retrieved from http://liminalities.net/5-1/paradigmsintro.pdf

Goffman, E. (1959). *The Presentation of Self in Everyday Life* (1 edition). New York N.Y.: Anchor.

Goffman, E. (2013). *Encounters: two studies in the sociology of interaction*. [S.l.]: Martino Fine Books.

Golding, D. (2017). Far from paradise: The body, the apparatus and the image of contemporary virtual reality. *Convergence*, 1354856517738171.

Graham, L. (2016, January 8). Virtual reality devices could transform the tourism experience. Retrieved March 4, 2018, from https://www.cnbc.com/2016/01/08/virtual-reality-devices-could-transform-the-tourism-experience.html

Graham, P. (2016a, June 7). HTC Vive Now Shipping Within 72 Hours from Ordering Online. Retrieved March 4, 2018, from https://www.vrfocus.com/2016/06/htc-vive-now-shipping-within-72-hours-from-ordering-online/

Graham, P. (2016b, June 12). Oculus Rift Ranked in Top 5 "Worlds Most Influential Product." Retrieved March 4, 2018, from https://www.vrfocus.com/2016/06/oculus-rift-ranked-in-top-5-worlds-most-influential-product/

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O., & Peacock, R. (2005). Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Social Science & Medicine*, *61*(2), 417–430.

Gregg, M. (2010). Workplace affects in the age of the cubicle. *The Affect Theory Reader*. Retrieved from https://books.google.com/books?hl=en&lr=&id=bl0udWQii48C&oi=fnd&pg=PA250&dq= Workplace+affects+age+cubicle+Gregg&ots=nqxa0Mg_4P&sig=pZrrgi5VqcmW2Hu3eSC jBq0mnQU

Gribetz, M. (2016). A glimpse of the future through an augmented reality headset. *Video File]. Retrieved from Https://www. Ted. Com/talks/meron_gribetz_a_glimpse_of_the_f*

uture_through_an_augmented_reality_headset.

Haas, J. (2014). A History of the Unity Game Engine. *Worcester, UK: Worcester Polytechnic Institute*. Retrieved from http://web.wpi.edu/Pubs/E-project/Available/E-project-030614-143124/unrestricted/Haas_IQP_Final.pdf

Hardawar, D. (2016, December 5). Oculus' Touch controllers are well worth the wait. Retrieved March 4, 2018, from https://www.engadget.com/2016/12/05/oculus-touch-review/

Haridy, R. (2016, August 26). How VR is rewriting the rules of storytelling. Retrieved March 8, 2018, from https://newatlas.com/vr-storytelling-darnell-brillhart/45010/

Harris, A. (2016, December 21). New York City's Tech Community Is Getting A $250 Million Home Base At Union Square. Retrieved March 5, 2018, from https://www.fastcompany.com/3066733/new-york-citys-tech-community-is-getting-a-250-million-home-base-at-union-square

Harting, J., Rutten, G. M., Rutten, S. T., & Kremers, S. P. (2009). A qualitative application of the diffusion of innovations theory to examine determinants of guideline adherence among physical therapists. *Physical Therapy*, *89*(3), 221–232.

Heffernan, V. (2014, November 14). Virtual Reality Fails Its Way to Success. *The New York Times*. Retrieved from https://www.nytimes.com/2014/11/16/magazine/virtual-reality-fails-its-way-to-success.html

Heine, C. (2016, May 10). Here Are the 10 Most-Viewed 360-Degree Facebook Videos by Brands. Retrieved March 5, 2018, from http://www.adweek.com/digital/here-are-10-most-viewed-360-degree-facebook-videos-brands-171372/

Helgason, D. (2009, October 29). A free Unity? – Unity Blog. Retrieved March 14, 2018, from https://blogs.unity3d.com/2009/10/29/a-free-unity/

Helmore, E. (2015, March 11). "Godmother of VR" sees journalism as the future of virtual reality. *The Guardian*. Retrieved from http://www.theguardian.com/technology/2015/mar/11/godmother-vr-news-reporting-virtual-reality

Helsel, S. (2016a, June 20). Israel Addressing Global AR and VR Markets. Retrieved March 4, 2018, from http://virtualrealitysummit.com/news/israel-addressing-global-ar-and-vr-markets/41167/

Helsel, S. (2016b, June 20). Lucasfilm Partnering with Magic Leap to Develop Star Wars Experiences in VR. Retrieved March 4, 2018, from http://virtualrealitysummit.com/news/lucasfilm-partnering-with-magic-leap-to-develop-star-wars-experiences-in-vr/41163/

Helsel, S. (2106c, June 20). OnePlus Launches New Smartphone Within The Loop, a VR Experience. Retrieved March 4, 2018, from http://virtualrealitysummit.com/news/oneplus-

launches-new-smartphone-within-the-loop-a-vr-experience/41169/

Helsel, S. (2016d, June 20). Retailers Using AR and VR to Engage Customers. Retrieved March 4, 2018, from http://virtualrealitysummit.com/news/retailers-using-ar-and-vr-to-engage-customers/41165/

Hempel, J. (2017, November 28). WeWork Is Buying Meetup Amid an Increasingly Disconnected World. *Wired*. Retrieved from https://www.wired.com/story/why-wework-is-buying-meetup/

Hendrix, J. (2016, December 16). Building a Virtual and Augmented Reality Lab in New York City. Retrieved March 5, 2018, from https://medium.com/@justinhendrix/building-a-virtual-and-augmented-reality-lab-in-new-york-city-cb4b0ea70ff1

Hendrix, J. (2017, April 2). MediVis: New York City startup promises augmented reality tools for surgeons. Retrieved March 5, 2018, from https://www.linkedin.com/pulse/medivis-new-york-city-startup-promises-augmented-reality-hendrix/

Herrmann, A. F. (2013). Daniel Amos and me: The power of pop culture and autoethnography. *The Popular Culture Studies Journal*, *1*(2), 6–17.

Hirschfeld, T. P. (1997). The Coming Showdown in Media City. *City Journal*. Retrieved from https://www.city-journal.org/html/coming-showdown-media-city-11971.html

Hjorth, L., & Richardson, I. (2017). Pokémon GO: Mobile media play, place-making, and the digital wayfarer. *Mobile Media & Communication*, *5*(1), 3–14.

Holmes, K. (2011, November 8). AR Occupy Wall Street: The Augmented Reality Sit-In. Retrieved March 5, 2018, from https://creators.vice.com/en_us/article/jpdnbp/ar-occupy-wall-street-the-augmented-reality-sit-in

Huey, J., Nisenholtz, M., & Sagan, P. (2013). Riptide: What really happened to the news business. *Joan Shorenstein Center on the Press, Politics and Public Policy Discussion Paper Series*.

Huizinga, J. (1971). *Homo Ludens: A Study of the Play-Element in Culture*. Routledge.

Hunter, A. (2016, November 29). How to Get a Job in VR – Virtual Reality Pop. Retrieved March 4, 2018, from https://virtualrealitypop.com/how-to-get-a-job-in-vr-fff5c9d56a13

Hurowitz, N. (2016, December 16). City Wants to Fund Virtual-Reality "Lab" to Propel NYC to Forefront. Retrieved February 1, 2017, from https://www.dnainfo.com/new-york/20161215/flatiron/virtual-reality-augmented-reality-companies-new-york-lab

Inc, V. (2016, December 6). Virtual Reality (VR) and 360 Videos 101 — A Beginner's Guide. Retrieved February 17, 2018, from https://medium.com/visbit/virtual-reality-vr-and-360-videos-101-a-beginners-guide-70bbade8e39

Indergaard, M. (2004). *Silicon Alley: The Rise and Fall of a New Media District*. Psychology Press.

Insider, B. (2015, December 21). New York Times CEO Mark Thompson says there will still be a print paper in 10 years, but he's really into virtual reality. *Business Insider*. Retrieved from http://www.businessinsider.com/new-york-times-ceo-mark-thompson-on-innovation-in-digital-media-and-advertising-2015-12

Jagneaux, D. (2017, December 15). The 9 Best Star Wars VR Experiences We've Seen So Far. Retrieved March 5, 2018, from https://uploadvr.com/best-star-wars-vr-experiences-so-far/

Jeffries, A. (2011, January 21). The Long and Curious History of Meetup.com. Retrieved March 5, 2018, from http://observer.com/2011/01/the-long-and-curious-history-of-meetupcom/

Jenkins, H. (2006). *Convergence Culture: Where Old and New Media Collide*. NYU Press.

Jenkinson, A. (2017, October 20). Why VR is dead. Retrieved March 4, 2018, from https://www.linkedin.com/pulse/why-vr-dead-andrew-jenkinson/

Jolly, J. (2017, July 28). Doctors are saving lives with VR. *USA Today*. Retrieved from https://www.usatoday.com/story/tech/columnist/2017/07/28/doctors-using-virtual-reality-breathe-new-life-into-technology/506437001/

Juul, J. (2005). *Half-real: video games between real rules and fictional worlds*. Cambridge, Mass.: MIT Press.

Juul, J. (2008). The Magic Circle and the Puzzle Piece. In S. Günzel, M. Liebe, & D. Mersch (Eds.), *Conference Proceedings of the Philosophy of Computer Games 2008* (pp. 056–067). Potsdam: University Press.

Juul, J. (2010). *A Casual Revolution: Reinventing Video Games and Their Players*. MIT Press.

Kait, C., & Weiss, S. (2001). *Digital Hustlers: Living Large and Falling Hard in Silicon Alley*. HarperCollins Publishers.

Karner, J. (2017, February 20). What is passthrough mode on Gear VR, and why should I care? Retrieved March 7, 2018, from https://www.vrheads.com/what-passthrough-mode-and-why-should-i-care

Keith, C. (2010). *Agile Game Development with Scrum (Addison-Wesley Signature Series (Cohn))* (1 edition). Addison-Wesley Professional.

Kelsey, T. (2010). *Social Networking Spaces: From Facebook to Twitter and Everything In Between*. Apress.

Khilko, I., & Matsumoto, E. (2015). *Industry Trends & Insights: Exploring New York City's Economic Sectors Education Technology in New York City*. NYCEDC. Retrieved from https://www.nycedc.com/sites/default/files/filemanager/Resources/Economic_Data/industry

_trends/EdTech_Industry_Trends_and_Insights.pdf

Kirkpatrick, G. (2013). *Computer Games and the Social Imaginary*. Polity.

K, M. (2017). *Top 10 Technology Trends to Watch in 2018*. Digital Technology review. Retrieved from http://www.mydigitalstartup.net/wp-content/uploads/2017/12/Top-10-technology-trends.pdf

Kohler, C. (2010, August 13). Virtual Boy, Nintendo's Big 3-D Flop, Turns 15. *Wired*. Retrieved from https://www.wired.com/2010/08/virtual-boy/

Komlik, O. (2016, October 13). Karl Marx on Free Time – Time for the Full Development of the Individual. Retrieved February 20, 2018, from https://economicsociology.org/2016/10/13/karl-marx-on-free-time-time-for-the-full-development-of-the-individual/

Kreiss, D. (2012). *Taking Our Country Back: The Crafting of Networked Politics from Howard Dean to Barack Obama*. Oxford, New York: Oxford University Press.

Kuchinskas, S. (2014, December 29). Virtual Reality Comes to the Web—Maybe for Real This Time. *Scientific American*. Retrieved from https://www.scientificamerican.com/article/virtual-reality-comes-to-the-web-maybe-for-real-this-time/

Kücklich, J. (2005). Precarious Playbour: Modders and the Digital Games Industry, (5). Retrieved from http://five.fibreculturejournal.org/fcj-025-precarious-playbour-modders-and-the-digital-games-industry/

Kumparak, G. (2014, March 26). A Brief History Of Oculus. *TechCrunch*. Retrieved from http://social.techcrunch.com/2014/03/26/a-brief-history-of-oculus/

Kurzweil, R. (2006). *The singularity is near: when humans transcend biology*. New York: Penguin.

Kushner, D. (2016, May 23). Will Virtual Reality Change Your Life? Retrieved March 4, 2018, from https://www.rollingstone.com/culture/features/will-virtual-reality-change-your-life-20160523

Lai, C.-H. (2013). Understanding the evolution of bona fide mixed-mode groups: An example of Meetup groups. *First Monday*, *19*(1). https://doi.org/10.5210/fm.v19i1.4681

Lai, C.-H. (2014). Can Our Group Survive? An Investigation of the Evolution of Mixed-Mode Groups. *Journal of Computer-Mediated Communication: JCMC*, *19*(4), 839–854.

Lang, B. (2015, December 16). Mozilla A-Frame: WebVR Starting With One Line of Code. Retrieved March 4, 2018, from https://www.roadtovr.com/mozilla-a-frame-webvr-virtual-reality-website-web-development/

Lang, B. (2016a, September 10). Microsoft is Bringing WebVR Support to Edge, Windows 10's Default Browser. Retrieved March 4, 2018, from https://www.roadtovr.com/microsoft-is-bringing-webvr-support-to-edge-windows-10s-default-browser/

Lang, B. (2016b, December 5). Oculus Touch Review: Reach into Rift – Road to VR. Retrieved March 4, 2018, from https://www.roadtovr.com/oculus-touch-review-reach-rift/

Langer, S. K. (1950). The Principles of Creation in Art. *The Hudson Review*, *2*(4), 515–534.

Langer, S. K. (1953). *Feeling and form*. Routledge and Kegan Paul London.

Lanier, J. (2011). *You Are Not a Gadget: A Manifesto* (Reprint). Vintage.

Lanier, J. (2017). *Dawn of the New Everything: Encounters with Reality and Virtual Reality* (1st Edition). Henry Holt and Co.

Lanier, J., & Biocca, F. (1992). An Insider's View of the Future of Virtual Reality. *The Journal of Communication*, *42*(4), 150–172.

Laurel, B. (1993). *Computers as Theatre* (Reprint edition). Reading, Mass: Addison-Wesley Professional.

Laurel, B., & Sand, M. (1994). VIRTUAL REALITY CHECK: AN E-MAIL INTERVIEW WITH BRENDA LAUREL. *Aperture*, (136), 70–72.

Lee, K. (2012). Augmented Reality in Education and Training. *TechTrends*, *56*(2), 13–21.

Leibovitz, L. (2013). Playing to Lose: On Video Games, Excess, and Expenditure. *The Velvet Light Trap*, *72*(1), 75–76.

Leonard, D. J. (2006). Not a Hater, Just Keepin' It Real The Importance of Race- and Gender-Based Game Studies. *Games and Culture*, *1*(1), 83–88.

Leswing, K. (2016, May 29). The inside story of Apple's forgotten project to change how we explore the world from our computers. *Business Insider*. Retrieved from http://www.businessinsider.com/inside-story-of-apples-forgotten-virtual-reality-project-quicktime-vr-2016-5

Lewis, S. C. (2012). THE TENSION BETWEEN PROFESSIONAL CONTROL AND OPEN PARTICIPATION. *Information, Communication and Society*, *15*(6), 836–866.

Lewis, T. (2017, July 24). Virtual reality helps reinvent law enforcement training. Retrieved March 4, 2018, from https://www.cbsnews.com/news/virtual-reality-law-enforcement-training/

Liao, T. (2016). Mobile versus headworn augmented reality: How visions of the future shape, contest, and stabilize an emerging technology. *New Media & Society*, *20*(2), 796–814.

Lichterman, J. (2016, November 1). The New York Times is launching a daily 360-degree video

series. Retrieved March 4, 2018, from http://www.niemanlab.org/2016/11/the-new-york-times-is-launching-a-daily-360-degree-video-series/

Lievrouw, L. (2006). New media design and development: Diffusion of innovations vs. social shaping of technology. *The Handbook of New Media*, 246–265.

Litvak, E. (2018, February 28). Community Board 3 Approves Union Square Tech Center Proposal, Calls For Zoning Protections | The Lo-Down : News from the Lower East Side. Retrieved March 6, 2018, from http://www.thelodownny.com/leslog/2018/02/community-board-3-approves-union-square-tech-center-proposal-calls-for-zoning-protections.html

Lotz, A. D. (2008). On "Television Criticism": The Pursuit of the Critical Examination of a Popular Art. *Popular Communication*, *6*(1), 20–36.

Lowrey, T. M. (1991). The use of diffusion theory in marketing: a qualitative approach to innovative consumer behavior. *ACR North American Advances*. Retrieved from http://www.acrwebsite.org/volumes/7230/volumes/v18/NA-18

Luong, M. (2017, August 23). Understanding Virtual Reality and its applications beyond Gaming. Retrieved March 4, 2018, from https://virtualrealitypop.com/understanding-virtual-reality-and-its-applications-beyond-gaming-2bfd92383f63

Lyytinen, K., & Damsgaard, J. (2001). What's wrong with the diffusion of innovation theory? In *Working Conference on Diffusing Software Product and Process Innovations* (pp. 173–190). Springer.

Mackenzie, T. (2012, May 7). App store fees, percentages, and payouts: What developers need to know. Retrieved March 5, 2018, from https://www.techrepublic.com/blog/software-engineer/app-store-fees-percentages-and-payouts-what-developers-need-to-know/

MacVaugh, J., & Schiavone, F. (2010). Limits to the diffusion of innovation: A literature review and integrative model. *European Journal of Innovation Management; Bradford*, *13*(2), 197–221.

Majewski, T. (2017, January 16). 50 NYC startups to watch in 2017 | Built In NYC. Retrieved March 5, 2018, from https://www.builtinnyc.com/2017/01/06/50-new-york-startups-watch-2017

Malone, T. W. (1980). What makes things fun to learn? heuristics for designing instructional computer games. In *Proceedings of the 3rd ACM SIGSMALL symposium and the first SIGPC symposium on Small systems* (pp. 162–169). ACM.

Malone, T. W. (1982). Heuristics for designing enjoyable user interfaces: Lessons from computer games. In *Proceedings of the 1982 Conference on Human Factors in Computing Systems* (pp. 63–68). ACM.

Manly, L. (2015, November 19). A Virtual Reality Revolution, Coming to a Headset Near You. *The New York Times*. Retrieved from https://www.nytimes.com/2015/11/22/arts/a-virtual-

reality-revolution-coming-to-a-headset-near-you.html

Marconi, F., & Nakagawa, T. (2017). *THE AGE OF DYNAMIC STORYTELLING A guide for journalists in a world of immersive 3-D content*. Associated Press.

Marks, K. (2015). *Industry Trends & Insights: Exploring New York City's Economic Sectors Fintech in New York City*. NYCEDC. Retrieved from https://www.nycedc.com/sites/default/files/filemanager/Resources/Economic_Data/industry_trends/Industry_Trends_Fin_Tech_Final.pdf

Martin, A. M. (2007). *Mapping the Technology Beat: Technology Reporting at the Chicago Tribune*. Virginia Tech. Retrieved from https://vtechworks.lib.vt.edu/handle/10919/32380

Masumian, A. E. (2015, December). *Medium.com as a contender in the participatory web*. https://doi.org/10.15781/T2Z79K

Matney, L. (2017, July 19). Google opens Expeditions VR education app to the public. *TechCrunch*. Retrieved from http://social.techcrunch.com/2017/07/19/google-opens-expeditions-vr-education-app-to-the-public/

Mauss, M. (2000). *The Gift: The Form and Reason for Exchange in Archaic Societies*. W. W. Norton & Company.

Mazzola, G., & Cherlin, P. B. (2008). *Flow, Gesture, and Spaces in Free Jazz: Towards a Theory of Collaboration*. Springer Science & Business Media.

McAlone, N., & Lynch, J. (2017, December 8). MEET THE YOUTUBE MILLIONAIRES: These are the 10 highest-paid YouTube stars of 2017. Retrieved March 4, 2018, from https://www.businessinsider.in/meet-the-youtube-millionaires-these-are-the-10-highest-paid-youtube-stars-of-2017/articleshow/61989809.cms

McCaffrey, K., & Matsumoto, E. (2013). *Industry Trends & Insights: Exploring New York City's Economic Sectors Advertising in New York City*. NYCEDC. Retrieved from https://www.nycedc.com/sites/default/files/filemanager/Resources/Economic_Data/industry_trends/ERA__Advertising_final.pdf

McCarthy, C. (2016, September 9). Backpack VR is here and it's real this time - Versions. Retrieved March 5, 2018, from https://killscreen.com/versions/backpack-vr-real-time/

McEnnis, S. (2017). Playing on the Same Pitch. *Digital Journalism*, *5*(5), 549–566.

McPollom, R. (2013, August 31). NYC Google Glass Explorer Social Recap #glassexplorer - Reva Digital. Retrieved March 5, 2018, from https://revadigital.com/2013/08/nyc-google-glass-explorer-social-recap-glassexplorer/

Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education*, *70*, 29–40.

Merriman, C. (2017, August 8). Firefox 55 follows Chrome and Edge with WebVR support | TheINQUIRER. Retrieved March 4, 2018, from https://www.theinquirer.net/inquirer/news/3015286/mozilla-launches-firefox-55-with-webvr

Metz, C. (2016, February 21). Inside Mark Zuckerberg's Big Bet That Facebook Can Make VR Social. *Wired*. Retrieved from https://www.wired.com/2016/02/mark-zuckerberg-plays-zero-gravity-ping-pong-president-indonesia/

Milgram, P., Takemura, H., Utsumi, A., & Kishino, F. (1995). Augmented reality: a class of displays on the reality-virtuality continuum. In *Telemanipulator and Telepresence Technologies* (Vol. 2351, pp. 282–293). International Society for Optics and Photonics.

Milkman, R., & Ott, E. (2014). *New Labor in New York: Precarious Workers and the Future of the Labor Movement*. Cornell University Press.

Mims, C. (2015, August 2). Virtual Reality Isn't Just About Games. *WSJ Online*. Retrieved from http://www.wsj.com/articles/virtual-reality-isnt-just-about-games-1438558372

Monllos, K. (2015, August 18). You Can Play Tennis Against Maria Sharapova at This Year's U.S. Open. Retrieved March 5, 2018, from http://www.adweek.com/brand-marketing/you-can-play-tennis-against-maria-sharapova-years-us-open-166445/

Moore, C. (2011). The magic circle and the mobility of play. *Convergence: The International Journal of Research into New Media Technologies*, *17*(4), 373–387.

Morris, C. (2015, December 4). 2016: The Year of Virtual Reality? - Fortune. Retrieved April 14, 2016, from http://fortune.com/2015/12/04/2016-the-year-of-virtual-reality/

Mourdoukoutas, P., & Siomkos, G. J. (2010). *The Seven Principles of WOM and Buzz Marketing: Crossing the Tipping Point*. Springer Science & Business Media.

M, S. (2009, February 12). Sony Concept Video Glasses. Retrieved March 7, 2018, from http://www.sonyinsider.com/2009/02/12/sony-concept-video-glasses/

Muir-Herzig, R. G. (2004). Technology and its impact in the classroom. *Computers & Education*, *42*(2), 111–131.

Murphy, M. (2016, March 30). Facebook has a lesson to learn from Nintendo's massive 1990s virtual reality failure. Retrieved February 17, 2018, from https://qz.com/649337/the-last-time-a-massively-hyped-vr-console-launched-in-the-us-was-in-1995-and-it-completely-flopped/

Murray, J. H. (2017). *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. MIT Press.

Murray, S. (2008). Digital Images, Photo-Sharing, and Our Shifting Notions of Everyday Aesthetics. *Journal of Visual Culture*, *7*(2), 147–163.

Nakamura, J., & Csikszentmihalyi, M. (2014). The Concept of Flow. In *Flow and the Foundations of Positive Psychology* (pp. 239–263). Springer, Dordrecht.

Neff, G. (2004). *Organizing uncertainty: Individual, organizational and institutional risk in New York's Internet industry, 1995-2003*. Columbia University.

Negroponte, N. (1996). *Being digital*. New York: Vintage Books.

Nelson, M. J. (2012). *Soviet and American Precursors to the Gamification of Work* (No. ID 2115483). Rochester, NY: Social Science Research Network. Retrieved from http://papers.ssrn.com/abstract=2115483

Nelson, R. (2017, April 12). Mobile VR Downloads Grew 276% in 2016, Topping 371 Million since Q1 2015. Retrieved March 5, 2018, from https://sensortower.com/blog/mobile-vr-growth

Nelson, R. R., Peterhansl, A., & Sampat, B. (2004). Why and how innovations get adopted: a tale of four models. *Industrial and Corporate Change*, *13*(5), 679–699.

Newman, H. (2015, May 20). Games poised to outstrip broadcast TV revenues, SuperData finds. Retrieved March 5, 2018, from https://venturebeat.com/2015/05/20/games-poised-to-outstrip-broadcast-tv-revenues-superdata-finds/

News, B. (2016, August 24). Why Pokemon Go may have passed its peak. *BBC*. Retrieved from http://www.bbc.com/news/technology-37176782

Ngo, K. (2016, March 3). Build the Virtual Reality Web with A-Frame – Mozilla Hacks - the Web developer blog. Retrieved March 4, 2018, from https://hacks.mozilla.org/2016/03/build-the-virtual-reality-web-with-a-frame/

Nieborg, D. B., & Sihvonen, T. (2009). The new gatekeepers: The occupational ideology of game journalism. *Proc. of DiGRA*. Retrieved from http://www.gamespace.nl/content/NieborgSihvonen09_TheNewGatekeepers.pdf

Nieborg, D., & Foxman, M. (2018). Mainstreaming Misogyny: The Beginning of the End and the End of the Beginning in Gamergate Coverage. In *Mediating Misogyny* (pp. 111–130). Palgrave Macmillan, Cham.

O'Donnell, C. (2014). *Developer's Dilemma: The Secret World of Videogame Creators*. Cambridge, Massachusetts: The MIT Press.

Oppenheimer, O. (2003). *The Flickering Mind: The False Promise of Technology in the Classroom and How Learning Can Be Saved*. {Random House}.

Orland, K. (2012, September 5). Virtual reality's time to shine: Hands-on with the Oculus Rift. Retrieved February 18, 2018, from https://arstechnica.com/gaming/2012/09/virtual-realitys-time-to-shine-hands-on-with-the-oculus-rift/

Pacheco, D. (2016, March 3). 3D Print Your Own 360 Camera Rig. Retrieved March 5, 2018, from http://www.vrstorytelling.org/3d-print-your-own-360-camera-rig/

Parr, B. (2009, August 27). EASTER EGG: Yelp Is the iPhone's First Augmented Reality App. Retrieved March 5, 2018, from https://mashable.com/2009/08/27/yelp-augmented-reality/

Pearce, C. (2006). Productive Play: Game Culture From the Bottom Up. *Games and Culture*, *1*(1), 17–24.

Pearson, D. (2016, December 14). 2016: Did the "Year of VR" deliver? Retrieved March 4, 2018, from https://www.gamesindustry.biz/articles/2016-12-09-did-the-year-of-vr-really-happen

Peres, R., Muller, E., & Mahajan, V. (2010). Innovation diffusion and new product growth models: A critical review and research directions. *International Journal of Research in Marketing*, *27*(2), 91–106.

Peterson, B. (2017, October 25). New York City has topped San Francisco when it comes to startups raising VC cash — but it may not last. *Business Insider*. Retrieved from http://www.businessinsider.com/new-york-beat-out-san-francisco-as-a-venture-capital-powerhouse-2017-10

Phillips, W. (2015). *This Is Why We Can't Have Nice Things: Mapping the Relationship between Online Trolling and Mainstream Culture* (Reprint edition). The MIT Press.

Pilar Opazo, M. (2016). *Appetite for Innovation: Creativity and Change at elBulli*. Columbia University Press.

Pinch, T., & Bijker, W. E. (2012). The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. In W. E. Bijker, T. P. Hughes, & T. Pinch (Eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (anniversary edition edition, pp. 11–44). Cambridge, Mass: The MIT Press.

PixelRouter VR. (2015). *Z0NE Boss Stage : Torroidal Boss Stage Rig*. Youtube. Retrieved from https://www.youtube.com/watch?v=49nFYaa3nO0

Plaugic, L. (2017, April 11). Gorillaz's new AR app is the band's latest attempt to try all the tech gimmicks. Retrieved March 5, 2018, from https://www.theverge.com/2017/4/11/15259702/gorillaz-new-album-humanz-augmented-reality-app

Polinchock, D. (2017, March 2). SXSW 2017 - Learning From the 1st VR Boom to be Successful Now. Retrieved March 5, 2018, from http://blog.polinchock.com/2017/03/sxsw-2017-learning-from-the-1st-vr-boom-to-be-successful-now.html

Prax, P., & Soler, A. (2016). Critical Alternative Journalism from the Perspective of Game Journalists. In *DiGRA/FDG*. Retrieved from

https://pdfs.semanticscholar.org/9993/4f122fdc42a7dc9aaa7f7bf859e6252e9145.pdf

Preciado, P. B. (2013). *Testo Junkie: Sex, Drugs, and Biopolitics in the Pharmacopornographic Era*. The Feminist Press at CUNY.

PressReader.com - Connecting People Through News. (2016, February 8). Retrieved March 4, 2018, from http://www.pressreader.com/thailand/the-nation/20160208/281788513101837

Reader, R. (2017, January 23). This Fintech Giant Wants To Recreate The Bell Labs Experience In NYC. Retrieved March 5, 2018, from https://www.fastcompany.com/3067440/this-fintech-giant-wants-to-recreate-the-bell-labs-experience-in-nyc

Reality, M. M. (2015, December 16). Introducing A-Frame: Building Blocks for WebVR. Retrieved March 9, 2018, from https://blog.mozvr.com/introducing-aframe/

Reede, E., & Bailiff, L. (2016, January 23). When Virtual Reality Meets Education. *TechCrunch*. Retrieved from http://social.techcrunch.com/2016/01/23/when-virtual-reality-meets-education/

Revers, M. (2013). Journalistic professionalism as performance and boundary work: Source relations at the state house. *Journalism*, *15*(1), 37–52.

Rey, P. J. (2012, October 15). Gamification, Playbor & Exploitation. Retrieved December 14, 2013, from http://thesocietypages.org/cyborgology/2012/10/15/gamification-playbor-exploitation-2/

Rey, P. J. (2014). Gamification and post-fordist capitalism. *The Gameful World. Approaches, Issues, Applications*, *277295*. Retrieved from https://books.google.com/books?hl=en&lr=&id=vDxTBgAAQBAJ&oi=fnd&pg=PA277&dq=Gamification+and+Post-Fordist+Capitalism&ots=mJUFHcgEXY&sig=8x6qituEexAO0WCxVOWIRhuvloM

Rheingold, H. (1991). *Virtual Reality: Exploring the Brave New Technologies*. Simon & Schuster Adult Publishing Group.

Riva, G. (1998). From toys to brain: Virtual reality applications in neuroscience. *Virtual Reality*, *3*(4), 259–266.

Rivera, J. (2016, June 18). A Quick and Dirty Guide to the Virtual-Reality Future. Retrieved March 4, 2018, from https://www.gq.com/story/virtual-reality-guide

Robbins, C. (2018, January 17). They Have Seen the Future, and It's Wasting Zombies at the Arcade. *The New York Times*. Retrieved from https://www.nytimes.com/2018/01/17/nyregion/virtual-reality-arcades-in-new-york-city.html

Robb, R. A. (2008). Medical imaging and virtual reality: a personal perspective. *Virtual Reality*, *12*(4), 235–257.

Robertson, A. (2016, December 5). Oculus Touch review: the Oculus Rift is finally complete. Retrieved March 4, 2018, from https://www.theverge.com/2016/12/5/13811232/oculus-touch-rift-vr-motion-controller-review

Robertson, A. (2017, May 3). VR was sold as an "empathy machine" — but some artists are getting sick of it. Retrieved March 4, 2018, from https://www.theverge.com/2017/5/3/15524404/tribeca-film-festival-2017-vr-empathy-machine-backlash

Robertson, D. S. (1998). *The New Renaissance: Computers and the Next Level of Civilization*. Oxford University Press.

Robinson, S. (2010). Traditionalists vs. Convergers: Textual Privilege, Boundary Work, and the Journalist—Audience Relationship in the Commenting Policies of Online News Sites. *Convergence*, *16*(1), 125–143.

Rocheleau, J. (2015, September 5). A History Lesson on the Rise and Fall of Adobe Flash. Retrieved March 15, 2018, from https://speckyboy.com/a-history-lesson-on-the-rise-and-fall-of-adobe-flash/

Roettgers, J. (2017, June 30). Watch: These Mind-Blowing iPhone Augmented Reality Demos Show the Power of Apple's ARKit. Retrieved March 4, 2018, from http://variety.com/2017/digital/news/iphone-augmented-reality-ar-best-demos-arkit-1202484395/

Rogers, E. M. (1995). *Diffusion of Innovations, Fourth Edition* (4 edition). Free Press.

Rosenzweig, G. (2017, January 11). Here's A Virtual Reality Check From CES 2017. Retrieved March 4, 2018, from https://uproxx.com/technology/virtual-augmented-reality-ces/

Rotolo, D., Hicks, D., & Martin, B. R. (2015). What is an emerging technology? *Research Policy*, *44*(10), 1827–1843.

Rowland, A. (2011, March 1). Unity Technologies Advances Game Development at Game Developers Conference (GDC). Retrieved March 5, 2018, from http://www.marketwired.com/press-release/unity-technologies-advances-game-development-at-game-developers-conference-gdc-1403841.htm

Rubin, P. (2017, October 11). At Oculus' Developer Summit, VR Progress Is a Game of Inches. *Wired*. Retrieved from https://www.wired.com/story/oculus-connect-virtual-reality-progress/

Rushkoff, D. (2002). Renaissance now! Media ecology and the new global narrative. *Explorations in Media Ecology*, *1*(1), 41–57.

Russell, C. (1999). *Experimental Ethnography: The Work of Film in the Age of Video*. Duke University Press.

Ryfe, D. M. (2012). Can journalism survive. *An inside Look at American Newsrooms. Cambridge*.

Salen, K., & Zimmerman, E. (2003). *Rules of Play: Game Design Fundamentals*. The MIT Press.

Sarkar, S. (2017, June 6). Valve shuts down Steam Greenlight, replacing it next week. Retrieved March 5, 2018, from https://www.polygon.com/2017/6/6/15749692/steam-direct-launch-date-valve-greenlight

Savvides, L. (2017, April 19). We took the $40,000 Nokia Ozo camera for a spin (hands-on). Retrieved March 5, 2018, from https://www.cnet.com/products/nokia-ozo/preview/

Schell, J. (2014). *The Art of Game Design: A Book of Lenses, Second Edition* (2 edition). A K Peters/CRC Press.

Schuster, D. (2014, July 15). The revolt against Google "Glassholes." Retrieved March 5, 2018, from https://nypost.com/2014/07/14/is-google-glass-cool-or-just-plain-creepy/

Schwartz, A. (2017, March 20). Confronting the "Shocking" Virtual-Reality Artwork at the Whitney Biennial. *The New Yorker*. Retrieved from https://www.newyorker.com/culture/cultural-comment/confronting-the-shocking-virtual-reality-artwork-at-the-whitney-biennial

Schwartz, D., & Vogan, T. (2017). The Players' Tribune: Self- Branding and Boundary Work in Digital Sports Media. *Journal of Sports Media*, *12*(1), 45–63.

Sessions, L. F. (2010). How offline gatherings affect online communities: when virtual community members "meetup." *Information, Communication and Society*, *13*(3), 375–395.

Shafrir, D. (2017). Women In VR Really Hope Their Industry Can Avoid Becoming Just Another Sleazy Tech Story. Retrieved March 4, 2018, from https://www.buzzfeed.com/doree/women-in-vr

Shaw, A. (2010). What Is Video Game Culture? Cultural Studies and Game Studies. *Games and Culture*, *5*(4), 403–424.

Shaw, A. (2011). Do you identify as a gamer? Gender, race, sexuality, and gamer identity. *New Media & Society*, *14*(1), 28–44.

Shaw, A. (2015a). Circles, Charmed and Magic: Queering Game Studies. *QED: A Journal in GLBTQ Worldmaking*, *2*(2), 64–97.

Shaw, A. (2015b). *Gaming at the Edge: Sexuality and Gender at the Margins of Gamer Culture* (1 edition). Univ Of Minnesota Press.

Sicart, M. (2014). *Play Matters*. MIT Press.

Singer, J. B. (2003). Who are these Guys? The Online Challenge to the Notion of Journalistic Professionalism. *Journalism*, *4*(2), 139–163.

Sivaraman, P. (2016, October 21). How women and men experience VR differently | The GroundTruth Project. Retrieved March 4, 2018, from http://thegroundtruthproject.org/women-men-experience-vr-differently/

Spigel, L. (2005). Designing the Smart House: Posthuman Domesticity and Conspicuous Production. *European Journal of Cultural Studies*, *8*(4), 403–426.

Staff, B. I. (2009, November 5). Epic Games Announces Unreal Development Kit, Powered by Unreal Engine 3 - IGN. Retrieved March 5, 2018, from http://www.ign.com/articles/2009/11/05/epic-games-announces-unreal-development-kit-powered-by-unreal-engine-3

Staff, Z. (1998, September 18). News Burst: IBM debuts wearable PC | ZDNet. Retrieved March 7, 2018, from http://www.zdnet.com/article/news-burst-ibm-debuts-wearable-pc/

Staley, D. J. (2015). *Computers, Visualization, and History: How New Technology Will Transform Our Understanding of the Past*. Routledge.

Stein, J. (2015, August 6). Why Virtual Reality Is About to Change the World. Retrieved February 9, 2017, from http://time.com/3987022/why-virtual-reality-is-about-to-change-the-world/

Stephenson, N. (2014). *Snow crash*. Bragelonne.

Strauss, S., Sundjaja, K., Robinson, P., & Chen, A. (2012). Media.NYC.2020. https://doi.org/10.2139/ssrn.2693843

Sudnow, D. (1983). *Pilgrim in the microworld* (First Printing). Warner Books.

Sundén, J. (2012). Desires at Play On Closeness and Epistemological Uncertainty. *Games and Culture*, *7*(2), 164–184.

SuperData. (2017a). *A 360 View of Immersive Technology*.

SuperData. (2017b). *The Virtual Consumer Sample Report*.

Sussman, E. (2014, March 29). The New Rules of Social Journalism: A Proposal. Retrieved March 4, 2018, from https://pando.com/2014/03/29/the-new-rules-of-social-journalism-a-proposal/

Sutherland, I. E. (1965). The ultimate display. *Multimedia: From Wagner to Virtual Reality*, 506–508.

Sutton-Smith, B. (1997). *The ambiguity of play*. Cambridge, Mass.: Harvard University Press.

Sutton-Smith, B. (2006). Play and Ambiguity. In K. Salen & E. Zimmerman (Eds.), *The Game*

Design Reader: A Rules of Play Anthology (pp. 296–313). London: MIT Press.

Sweeney, T. (2015, March 2). If You Love Something, Set It Free. Retrieved March 5, 2018, from https://www.unrealengine.com/en-US/blog/ue4-is-free

Takahashi, D. (2017, October 13). The DeanBeat: Optimism and despair over VR at Oculus Connect. Retrieved March 4, 2018, from https://venturebeat.com/2017/10/13/the-deanbeat-optimism-and-despair-over-vr-at-oculus-connect/

Tapscott, D. (1998). *Growing up digital* (Vol. 302). McGraw-Hill Companies.

Taylor, T. L. (2009). *Play Between Worlds: Exploring Online Game Culture*. MIT Press.

Taylor, T. L. (2015). *Raising the Stakes: E-Sports and the Professionalization of Computer Gaming (MIT Press)* (Reprint edition). The MIT Press.

Teachout, Z., & Streeter, T. (2008). *Mousepads, Shoe Leather, and Hope: Lessons from the Howard Dean Campaign for the Future of Internet Politics*. Routledge.

Terndrup, M. (2015, April 20). Psychedelics and Virtual Reality Have a Long Standing History - Here's Why - UploadVR. Retrieved March 6, 2018, from https://uploadvr.com/psychedelics-and-virtual-reality-have-a-long-standing-history/

Terranova, T. (2000). Free Labor: Producing Culture for the Digital Economy. *Social Text*, *18*(2), 33–58.

The Boston Consulting Group. (2015). *The Media and Entertainment Industry in NYC: Trends and Recommendations for the Future*. Retrieved from https://www1.nyc.gov/assets/mome/pdf/bcg-report-10.15.pdf

The Rise and Fall and Rise of Virtual Reality. (n.d.). Retrieved January 26, 2017, from http://www.theverge.com/a/virtual-reality

Till, C. (2014). Exercise as Labour: Quantified Self and the Transformation of Exercise into Labour. *Societies*, *4*(3), 446–462.

Tobin, S. (2013). *Portable Play in Everyday Life: The Nintendo DS*. Springer.

Toyama, K. (2011). There are no technology shortcuts to good education. *Educational Technology Debate*, *8*. Retrieved from http://edutechdebate.org/ict-in-schools/there-are-no-technology-shortcuts-to-good-education/

Tsukayama, H. (2016, December 6). Oculus Rift Touch controllers make huge difference in game immersion. *The Washington Post*. Retrieved from https://www.washingtonpost.com/news/the-switch/wp/2016/12/06/oculus-rift-touch-controllers-make-huge-difference-in-game-immersion/?utm_term=.3bb57ad49be7

Tunney, K. (2016, August 22). Virtual Reality Has a Female Mafia—and They're Looking for

New Recruits. Retrieved March 4, 2018, from https://www.marieclaire.com/career-advice/advice/a21978/women-in-vr/

Turkle, S. (2004). Our Split Screens. In A. Feenberg & D. Barney (Eds.), *Community in the Digital Age: Philosophy and Practice* (pp. 101–117). Rowman & Littlefield.

Turkle, S. (2011). *Alone Together: Why We Expect More from Technology and Less from Each Other* (Kindle). Basic Books.

Turner, F. (2008). *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*. University Of Chicago Press.

Usher, N. (2014). *Making News at The New York Times*. The University of Michigan Press.

Valente, T. W., & Bardini, T. (1995). Virtual diffusion or an uncertain reality: Networks, policy, and models for the diffusion of VR technology. In *Communication in the age of virtual reality* (pp. 303–322). L. Erlbaum Associates Inc.

Van Camp, J. (2018, January 11). At CES, Everyone Is Still Hunting for VR's Killer App. *Wired*. Retrieved from https://www.wired.com/story/vr-needs-a-killer-app/

Van Dreunen, J. (2015, July 4). User-generated content is the future of the games industry. Retrieved February 18, 2018, from https://www.linkedin.com/pulse/user-generated-content-future-games-industry-joost-van-dreunen/

Van Dreunen, J. X. M. (2010). *Social Gaming and Discursive Play: Video Games as Communicative Exchange* (PhD). Columbia University. Retrieved from https://market.android.com/details?id=book-55uSkQEACAAJ

Vaughn, D. N. (2015). *MeetUp and Social Capital: Building Community in the Digital Age*. University of Denver. Retrieved from http://search.proquest.com/openview/efb9bc71e395715d0446130e18f5b6ce/1?pq-origsite=gscholar&cbl=18750&diss=y

Veblen, T. (1899/2008, August 6). The Theory of the Leisure Class. Retrieved February 20, 2018, from https://www.gutenberg.org/files/833/833-h/833-h.htm

Volpe, J. (2015, January 27). Oculus Story Studio is the Pixar of virtual reality. Retrieved March 5, 2018, from https://www.engadget.com/2015/01/27/oculus-story-studio-is-the-pixar-of-virtual-reality/

Wang, S. (2015, November 9). News outlets left and right (and up, down, and center) are embracing virtual reality technology. Retrieved March 4, 2018, from http://www.niemanlab.org/2015/11/news-outlets-left-and-right-and-up-down-and-center-are-embracing-virtual-reality-technology/

Ward, J. (2008, April 29). What is a Game Engine?- GameCareerGuide.com. Retrieved March 5, 2018, from https://www.gamecareerguide.com/features/529/what_is_a_game_.php

Warren, L. (2018, January 16). Built In NYC's 50 Startups to Watch in 2018 | Built In NYC. Retrieved March 5, 2018, from https://www.builtinnyc.com/2018/01/16/50-nyc-startups-watch-2018

Webster, A. (2017, January 24). Resident Evil 7 in VR is a scary but compromised experience. Retrieved March 5, 2018, from https://www.theverge.com/2017/1/24/14369624/resident-evil-7-ps4-playstation-vr

White, D. M. (1950). The "Gate Keeper": A Case Study in the Selection of News. *Journalism Bulletin*, *27*(4), 383–390.

White, E. B. (1949). *Here is New York*. New York Review of Books.

Willens, M. (2017, November 14). One year in: What The New York Times learned from its 360-degree video project, The Daily 360 - Digiday. Retrieved March 5, 2018, from https://digiday.com/media/one-year-new-york-times-learned-360-degree-video-project-daily-360/

Williams, D. (2003). The Video Game Lightning Rod. *Information, Communication and Society*, *6*(4), 523–550.

Wilson, M. (2017, May 19). Google Has A New Favorite Phrase–Here's What It Means. Retrieved March 4, 2018, from https://www.fastcodesign.com/90125996/google-has-a-favorite-new-phrase-heres-what-it-means

Wingfield, N. (2013, February 17). Oculus Rift Headset Aims for Affordable Virtual Reality. *The New York Times*. Retrieved from https://www.nytimes.com/2013/02/18/technology/oculus-rift-headset-aims-for-affordable-virtual-reality.html

Wingfield, N. (2017, January 8). Sticker Shock, and Maybe Nausea, Hamper Sales of Virtual Reality Gear. *The New York Times*. Retrieved from https://www.nytimes.com/2017/01/08/business/sticker-shock-and-maybe-nausea-hamper-sales-of-virtual-reality-gear.html

Wohlsen, M. (2015, November 9). Google Cardboard's New York Times Experiment Just Hooked a Generation on VR. *Wired*. Retrieved from https://www.wired.com/2015/11/google-cardboards-new-york-times-experiment-just-hooked-a-generation-on-vr/

Woods, T. (2017, April 4). What you don't know about VR and AR that you should: 5 Brooklyn experts weigh in - Technical.ly Brooklyn. Retrieved March 5, 2018, from https://technical.ly/brooklyn/2017/04/04/what-you-should-know-about-virtual-reality/

Woolley, B. (1993). *Virtual Worlds: A Journey in Hype and Hyperreality*. Benjamin Woolley.

Yarow, J. (2013, May 3). The Verdict Is In: Nobody Likes Google Glass. *Business Insider*. Retrieved from http://www.businessinsider.com/nobody-really-likes-google-glass-2013-5

Yee, C. (2016, March 1). Introducing the WebVR 1.0 API Proposal – Mozilla Hacks - the Web developer blog. Retrieved March 4, 2018, from https://hacks.mozilla.org/2016/03/introducing-the-webvr-1-0-api-proposal/

Yee, N. (2006). The Labor of Fun How Video Games Blur the Boundaries of Work and Play. *Games and Culture*, *1*(1), 68–71.

Yip, G. (2016, June 22). Why i love VR – Gwan Yip – Medium. Retrieved March 4, 2018, from https://medium.com/@gwanyip/why-i-love-vr-b643ff5901f3

Yip, G. (2017a, February 9). VR Ideation – Virtual Reality Pop. Retrieved March 4, 2018, from https://virtualrealitypop.com/vr-ideation-5bc69a6f202a

Yip, G. (2017b, April 10). How I Am Applying What I Learned From UX For The Web to VR. Retrieved March 4, 2018, from https://virtualrealitypop.com/how-i-am-applying-what-i-learned-from-ux-for-the-web-to-vr-bb7daa428cb7

Yip, G. (2017c, August 8). Demonstrating VR is a pain in the @ss but don't let that deter you. Retrieved March 4, 2018, from https://medium.com/@gwanyip/demonstrating-vr-is-a-pain-in-the-ss-but-dont-let-that-deter-you-4128ab42353b

Zhang, M. (2010, May 24). Museum of London Releases Augmented Reality App for Historical Photos. Retrieved March 5, 2018, from https://petapixel.com/2010/05/24/museum-of-london-releases-augmented-reality-app-for-historical-photos/

Zhang, P. (2008). Technical Opinion: Motivational Affordances: Reasons for ICT Design and Use. *Communications of the ACM*, *51*(11), 145–147.

Zieniewicz, M. J., Johnson, D. C., Wong, C., & Flatt, J. D. (2002). The evolution of Army wearable computers. *IEEE Pervasive Computing / IEEE Computer Society [and] IEEE Communications Society*, *1*(4), 30–40.

Zimmerman, E. (2012, February 7). Jerked Around by the Magic Circle - Clearing the Air Ten Years Later. Retrieved December 10, 2013, from http://www.gamasutra.com/view/feature/6696/jerked_around_by_the_magic_circle_.php

Appendix

Meetups and Industries

Table A1 is a full list of industries represented at meetups I attended. I have not included the names of these industries for the sake of anonymity. For companies that primarily worked in Virtual Reality (VR), Augmented Reality (AR), 360° Video (360), or Mixed Reality (MR), I appended an appropriate acronym to the industry. Therefore, a VR-focused game developer would be marked "Game VR" in the following chart. VR Studios represent agencies working primarily in VR, but many worked in all forms of immersive media. They are organized from the highest number category to the lowest.

Table A1:

Industry	Count of Industry.
Game	105
Development VR	100
Arts	77
University	74
VR Studio	63
Journalism	57
Arts VR	50
Tech/Internet	45
VC/Accelerator	37
Hardware VR	28
Film	27
Advertising	25
Game VR	23
Film VR	23
Film 360	23
Development 360	19
Consultancy	19
Government/Non-Profit	16
Development MR	15

Arts AR	15
Museum	13
Hardware	13
Conference/Meetup VR/AR/MR	13
Journalism VR	12
Audio	11
Music	10
Hardware 360	10
Education VR	9
Architecture VR	9
Arcade VR	9
Social VR	8
Healthcare VR	8
Government/Education	8
Enterprise AR	8
Data VR	8
Conference/Meetup	8
Advertising VR	8
3D Printing	8
Tourism VR	7
Television	7
Research	7
Healthcare	6
Entertainment VR	6
Enterprise	6
Development	6
Comedy	6
Audio VR	6
Data	5
Coworking/Office Space	5
Arts MR	5
Video	4
Retail	4
Real Estate VR	4
Politics	4
Journalism 360	4
Hardware AR	4
Game AR	4
Food/Beverage	4
Fashion	4
Education	4

Distribution 360	4
Development AR	4
VR	3
Union	3
Sports VR	3
Software	3
Social Media	3
Social AR	3
Security	3
Search VR	3
Real Estate AR	3
Real Estate	3
PR/Communications	3
Hardware MR	3
Finance	3
Toys	2
Publishing	2
Other	2
Law	2
Internet	2
Information	2
Healthcare MR	2
Fashion VR	2
Distribution VR	2
Conglomerate	2
Agriculture AR	2
Accounting	2
Writing	1
Weather AR	1
Travel	1
Toys AR	1
Toy AR	1
Tourism	1
Television VR	1
Television MR	1
Television 360	1
Telecommunications	1
Storage	1
Sports	1
Space/Science VR	1
Space/Science MR	1

Space/Science	1
Social MR	1
Robotics	1
Retail AR	1
Real Estate 360	1
Promotion	1
Photo Production	1
Philanthropy	1
Music VR	1
Museum VR	1
Museum AR	1
Lawyer	1
Journalism MR	1
Journalism AR	1
Jewelry	1
Investment	1
Information VR	1
Food AR	1
FilmVR	1
Fashion MR	1
Entertainment	1
Enterprise VR	1
Education MR	1
Distribution Video	1
Development VR	1
Design	1
Crowdfunding	1
Criminal Justice VR	1
Consultancy VR	1
Beer Home Draft System	1
Audio MR	1
Artist 360	1
Architecture	1
Arcade MR	1
AR Studio	1
Apparel	1
Grand Total	**1247**