7-1 Final Project Part One Submission: Critical Analysis Portfolio

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Introduction

I have chosen Virtual Reality technology for the topic of my paper. Virtual Reality technology is allowing us to vastly improve the quality and realism of our synthesized experiences, yielding the potential to fill the gaps in our personal experience that prevent us from leading a truly fulfilling life. Virtual Reality is being used to augment many things including training programs, educational media, and entertainment. Historical sites can be mapped using 3D imaging techniques, which can then be explored through Virtual Reality, thus forever preserving a architectural structure that might be lost to time otherwise. The same process can be applied to any number of historical artifacts such as sculptures or tools, allowing us to preserve cultural evidence far beyond the physical object's life expectancy. These examples not only preserve, but also allow nearly instant access to virtual versions of the record in question to anyone around the world. The natural sciences can benefit from documenting the fossil record in the same way, but have more impressive applications when dealing with environments that humans are not able to access such as Luna or Mars. Virtual Reality is also being used to great success in therapy for mental health patients suffering from a number of conditions, including PTSD and severe phobias. Virtual Reality is merely a technological vessel through which we can experience things in a controlled and physically risk free environment, from the comfort of our own home.

Lens Analysis

History

Virtual Reality has been a dream of mankind for many years, with depictions of holograms and programs indistinguishable from reality being a prominent topic in science fiction. The advancements in processing power and decrease in

manufacturing cost have allowed that fantasy to become reality, to an extent. We may not be able to plug our brains into a computer and be transported to a fully immersive environment as some of the earliest pioneers had aspired to in 1965 "Ivan Sutherland proposed the ultimate solution of Virtual Reality: an artificial world construction concept that included interactive graphics, force-feedback, sound, smell and taste."(Mazuryk & Gervautz), but we certainly can emulate the audio and visual elements with the correct hardware.

This concept may have seemed outlandish at the time, but there is evidence making it clear that the technical foundations for Virtual Reality were already laid out five years earlier. "In 1960 Rudolph E. Kalman published his now famous article describing a recursive solution to the discrete-data linear filtering problem. . . In recent years there has been an explosion in the use of the Kalman filter in VR/AR. . . at technical conferences related to VR these days, it would be unusual to see a paper on tracking that did not use some form of a Kalman filter" (Welch, 2009) While the full potential of the Kalman filter might not have been realized at the time, it makes it clear that Ivan Sutherland was not being entirely unrealistic with his proposition. Virtual Reality has been possible to develop for much longer than we may have assumed given the recent ascension to consumerism.

While Virtual Reality technology is still not the standard for media consumption, it has become far easier to access by the common citizen. A few hundred dollars, an above average computer, and an internet connection are all that is needed to begin playing free demos on Steam. The technology is still improving now, having gotten past the hurdle of ordinary consumer access. The main dictator for the future of Virtual Reality technology is public interest; advancements will only be made as long as the demand is greater than what the supply can offer.

Humanities

Technology influences individuals in many ways, often by creating connections between people and artifacts that might not be possible otherwise. An example of people connecting with artifacts through technology would be open access to free eBooks through the internet, where in times past individuals would need to buy physical books or rent them from a library. However, these are simply methods through which technology represents an existing artifact, usually in fewer dimensions than the original. The completed works of Shakespeare aren't in your hand, but you can look at scans of each page and read it as if it were. With cinema, the viewer isn't actually there, but we can see and hear what is happening, making it a powerful storytelling medium. However, both fall short of emulating the actual experience itself. You might be able to imagine that you are there in the book or movie, but when you stop and look around, you are still in the real world.

Virtual Reality aims to bring true immersion to media. While Virtual Reality is not typically used for cinema, there are often highly compelling cut-scenes within VR games that make excellent and creative use of the technology. Nothing necessarily new is happening in regards to the story being told, but everything that was already being done with media is amplified. By using Virtual Reality technology, we are able to convince our subconscious that we are in fact within the virtual environment, allowing us to more deeply experience and consume art.

Virtual Reality also possesses seemingly high potential for educational purposes, leading scholars to weigh in on the viability and approach required. "The effective use of 3D content in the classroom is contingent on having tools that promote an engaging and meaningful experience." (Szabo, 2019). Executed properly, Virtual Reality could make massive bounds in educational experiences; handled

poorly, and the technological alienation between generations might only worsen with time.

Some promising concepts that allow iterative feedback outside a classroom include virtual museums, serving as a concept that can inform the public and guide the future. These could offer a way to experiment with the potential of Virtual Reality education without fully committing to a curriculum and risking scrutiny should it yield disappointing results. This holds a reasonable degree of merit since people are naturally interested in both Virtual Reality technology and historical aspects of the humanities, as shown in a study conducted earlier this year, "Virtual Reality also has an undeniable appeal for the general public. . . Ubisoft's productions. . . (such as) Assassin's Creed, highlight the public's enthusiasm and the links that can exist between the world of classic video games and the practice of mediating history and archaeology." (François et al., 2021). The potential for Virtual Reality as a medium is difficult to grasp, especially as the technology continues to improve in the future.

Natural Sciences

The natural sciences benefit greatly from Virtual Reality technology in a very specific way. While I am unaware of this technology's benefit to the experts who study various aspects of the natural sciences, Virtual Reality does offer an impressive new way for those who do not formally study such topics to explore their interests and become literate on the subject. Models of high performance engines that can be manipulated and taken apart will likely be of some benefit to engineers who specialize in those types of engines, but for someone who is simply curious about the topic, Virtual Reality becomes the ideal medium to experiment through. Not only does it offer an intriguing way to more thoroughly experience a given topic, it has also shown to promote higher rates of conceptual retention. ". . .utilizing Virtual Reality (VR)

technology and Augmented Reality (AR) on science subjects . . . accompanied by teacher explanations in the learning process showed an increase in understanding by 24% (as compared to 8% with e-learning and 12% with conventional education)" (Anggara et al., 2021).

With the easy access to game engine programs that allow for Indie games to be created, some individuals have taken to virtual simulation. Simulation technology is used for various training programs in fields such as aerospace and healthcare, but alternative simulations that rely heavily on mathematical outcomes or emulate ecological models are on the rise. While we can represent 3D objects and environments using 2D images, perhaps we will be able to properly represent a 4D object (such as a tesseract) through a 3D medium. Virtual Reality is the only realistic option for such an application, and the kind of insights that could be gleaned from such an understanding are difficult to envision. Regarding the natural sciences, "Visualization of the study material makes its perception and memorization easier. Natural sciences require a decent illustration of the theory. The properly-selected demonstration material helps understand various processes and phenomena . . . in a better way." (Midak et al., 2019). If the common citizen can better learn these subjects through immersive visualization, then what feats could the greatest minds of our time accomplish if they had access to the same?

Social Sciences

One of the most important aspects of social science is how humans interact with each other, and interaction is impossible without any type of contact. Technology grants us a number of ways to connect with each other that wouldn't be possible otherwise. An example of people connecting through technology would be the cell phone, where in times past a hand written letter would have taken days or

weeks to reach the recipient. While many celebrate and embrace these advancements, it is also realistic to fear that we might forsake meaningful physical connections in favor of technological ones. An example of this would be a parent who is upset with their child for spending too much time on their cell phone, urging them to spend quality time with their family or friends instead. While it is not uncommon for members outside of the younger generations to view technology as a deeply antisocial medium for entertainment, "this study demonstrates that adding social network services can promote VR acceptance and confirms that social interactions are an essential element in the entertainment industry, not an optional one." (Lee et al., 2018). We can see that technology is augmenting-or possibly replacing-the need for social interaction, and in increasing doses as time goes on.

Due to the outbreak of covid, many people are becoming more physically isolated. While we have augmented our lives with technological connections, none of those connections are deceptive to our senses in terms of our experience. Our brains do not believe the person is in the room with us when we use video calling services such as Skype or Facetime; we are consciously and unconsciously aware that there is a technological medium. There is a fundamental part of us as living things that requires physical experiences, and Virtual Reality attempts to emulate that. Using this technology as a form of therapy or even coping mechanism is hardly the norm, but perhaps it should be. A study focused on Virtual Reality as it relates to PTSD stated: "Virtual Reality exposure therapy (VRET) facilitates the emotional engagement of patients with PTSD during exposures to the multiple sensory stimuli made possible by the virtual environment, bypassing symptoms of avoidance and facilitating control on the part of the therapist." (Gonçalves et al., 2012) Being able to convince your mind that you have left your home and traveled to an amazing world where you can interact

with other individuals might be the key to feeling fulfilled while remaining isolated for our own safety.

Conclusion

Impact

The four lenses of Humanities, History, Natural Sciences, and Social Sciences allow us to better understand technology in many of the ways detailed above. As it relates to the individual in personal and professional contexts, there is more to be gleaned.

In a professional context, analyzing technology through the lens of the Humanities grants insight into the actual content that people are enjoying and creating. Using Virtual Reality as an example, one might conclude that the most popular content being consumed involves game experiences, episodic experiences, and creative mediums, in that order. This information would anchor future development in reality as it relates to what consumers are demanding and will continue to demand. This lens is beneficial in the personal context for two primary reasons. Firstly, it is unlikely that any single individual preference is totally unique, meaning that an observation of the Humanities will have a high probability of exposing the individual to media they enjoy and might not otherwise discover. Secondly, it offers a way for those with exceedingly rare taste to forcefully consume media they might not prefer in order to gain common social ground with their peers. As it relates to all of the lenses, understanding technology is highly beneficial as scientific literacy can vastly improve one's ability to properly articulate themselves and responsibly address new knowledge.

Looking at the same context through the lens of History might be able to reveal technologies that the public or limitations of the time were not ready for. It

might also reveal similar technologies that were exceedingly popular for a time, only to be abandoned after the initial surge of excitement passed. As this lens relates to Virtual Reality, one might realize how far back the origins of Virtual Reality go and conclude that there are other technologies long ago deemed nonviable waiting to be revived to great effect. One might also conclude that Virtual Reality is an unsustainable technology, much like Guitar Hero, and will not be able to maintain increasing sales. Both of these conclusions (which are not necessarily my actual conclusions; just example conclusions that seem plausible) would inform the professional of potential future issues, allowing development to adapt as time continues. This lens is also beneficial in a personal context since it allows for more informed decisions as a consumer, maintaining a healthy reality based skepticism that can ward against short lived fads and overly dramatic claims.

Analyzing technology through the lens of the Natural Sciences grants remarkable insight into the capacity to simulate exceedingly complex systems. The massive progress made regarding computational power and memory storage allows for many possibilities involving digital preservation of fossils and geodata, while also offering staggeringly powerful options when computing the predictive equations based on that data. As it relates to Virtual Reality in a professional context, one might conclude that the simulation of complex systems through data acquisition and the study of said systems through virtual means could lead to discoveries that would be otherwise impossible. One might also be able to examine the current limitations of manufactured circuitry compared to the physical limitations of circuitry and project the absolute limits of our computational power in the future, being able to preemptively determine which programs will exceed the realms of possibility in the future. This lens is also beneficial in a personal context as it allows nearly any

individual to learn about a scientific topic they might be curious about. By following technology as it develops in relation to the Natural Sciences, one can expose themselves to all kinds of exciting information that might have previously only been available to academia.

Analyzing technology through the lens of the Social Sciences allows professionals to better understand how their technology is affecting the users who employ it most frequently. Depending on the results, the technology might be modified or refined in order to improve the benefits or minimize the consequences. As it relates to Virtual Reality, one might determine that motion sickness and eye strain are being experienced in a portion of users, leading them to abandon the technology altogether. This knowledge could guide development regarding the intensity of the experience and the nature of the headset display itself. More complex issues may present themselves as well, such as an increase in detachment from reality and depression or the decrease in desire for meaningful real world relationships (both hypothetical situations). The development of this technology isn't necessarily obligated to attempt to solve issues such as these, but keeping them in mind can guide development decisions. Furthermore, any development team that does attempt to solve issues such as these and succeeds in a way that consumers appreciate will gain a notable advantage over competitors within the market. This lens is also beneficial in a personal context in that it allows individuals to make more informed decisions about the technology they employ. Understanding not only what technology is most popular and effective for various purposes, but also the psychological and cultural impact of those technologies grants a great deal of agency to determine what they wish to be influenced by.

Social Practices

The impacts of technology on social practices in modern culture are extensive. The digital era has brought about a platform for connecting with nearly anyone else on the planet. This, along with the ability to travel nearly anywhere on the planet in a matter of hours, has eroded away the sense-and physical necessity-of proximal community that humans have relied on for hundreds of thousands of years. In this hyper connected world, a sense of community is pursued on the digital landscape. This leads to a number of resulting effects, not least of which is the exceedingly troublesome prioritization of group identity over individual identity. One of the most prominent effects on social practices is the seemingly secular variants of religious experiences, the prime example being superheroes in cinema. To worship is to imitate in pursuit of meaning, and there is a great deal of analysis that could be performed regarding this topic. The main points are that the individual can now experience archetypal ideals from anywhere they like without needing a communal service, leading to an increased split between the secular conscious and spiritual subconscious, and the erosion of reliance on communal groups for religious experiences.

However, this entire phenomena is experienced by individuals through a clearly synthetic medium; cell phones, tablets, computers, etc. The progress made towards affordable Virtual Reality technology will most likely collide with this digitally communal landscape, offering a far more immersive way for users to participate in digital communities. The main questions that will determine the future of technology and modern culture ask whether the increased immersion Virtual Reality offers will offset or amplify the negative mental health effects of the digital landscape. In either case, the continued alienation of our social practices from conventional interactions and communities is something that must be taken seriously.

It's entirely possible that we must literally evolve as a species before we are truly capable of conducting ourselves in this manner without unknowingly harming our psyches and communities.

Benefits and Challenges

Technology is the result of innovation, and innovation is historically driven by the desire to solve a problem. In more recent times-the last two centuries perhaps-a significant portion of problems that need solving in developed nations are the side effects of technology that has already been implemented. That's not to say that technology is the problem, quite the contrary. The problems we face that are by products of technology are far less severe than the problems we would have faced without those technologies. The reason this is a noteworthy observation is two fold: Firstly, technological innovation within the private sector is a fundamentally reliable way to improve the lives of many people. Secondly, the technological problems we are now facing within the last two centuries are unlike the problems our species has faced since we evolved. This means that a very decided and careful approach is required, as we are venturing into totally unknown territory.

How does all this relate to Virtual Reality? The kinds of problems that Virtual Reality could solve and generate are extremely difficult to predict with precision. The only remotely applicable data we have involves social media, which has not existed for long enough to make long term predictions. Technologies like social media, video games, and Virtual Reality do have addictive properties, which can lead to less than healthy lifestyles being built around them. Social media and video games have other downsides as well, but it's not unrealistic to consider that these technologies are benefiting a significant number of people by augmenting their experiences and improving their sense of fulfillment. The question becomes: will a more immersive

experience like that available with Virtual Reality lead to an increase in that positive feedback, or lead to additional addictive behaviors that consume individual lives? As far as I can tell, the answer is uncertain, and the only responsible path forward is to continue developing with a close eye on the effects of this and other technologies.

Interactions

Understanding technology, especially through a historical lens, is to understand where we are in relation to where we used to be as a species. Technology has a massive influence on our modern culture, and understanding that influence is critical when attempting to interact with members of other cultures. In the case of a culture that is equally advanced in terms of technology, it is important to know where the cultural differences actually stem from. Technology might be employed in ways that seem alien at first glance, but analyzing the situation might reveal a small cultural difference from before the digital age that was merely amplified by technology. Understanding and sharing the insights regarding technology that have been made without our own culture might be the responsible thing to do, while observing the insights regarding technology in a vastly different cultural landscape might grant us insight previously unavailable to us.

If the other culture is not as technologically advanced, then the differences become more extreme. While the cultural gap increases, therefore becoming harder to bridge, the amount of actionable insight that can be gleaned may remain the same or even increase. With the advent of the digital age, many elements of our culture were amplified, while many others were abandoned entirely. Understanding a culture that exists outside of the digital landscape might offer insight into which cultural elements are of the most value. Perhaps there are some elements we elevate to the highest standard that seem to be of no benefit to pre digital people, and perhaps there are

elements of our culture we foolishly abandoned that are critical to meaning in our lives. The greater the difference between people, the more there is to be learned.

References

Mazuryk , T., & Gervautz, M. (n.d.). *Virtual Reality History, Applications, Technology and Future*. Institute of Computer Graphics Vienna University of Technology, Austria. Retrieved November 4, 2021, from https://www.cg.tuwien.ac.at/research/publications/1996/mazuryk-1996-VRH/TR-186-2-96-06Paper.pdf.

G. F. Welch, "HISTORY: The Use of the Kalman Filter for Human Motion Tracking in Virtual Reality," in Presence, vol. 18, no. 1, pp. 72-91, 1 Feb. 2009, doi: 10.1162/pres.18.1.72.

Szabo, V. (2019, January 31). *Collaborative and Lab-Based Approaches to 3D and VR/AR in the Humanities*. Council on Library and Information Resources. Retrieved November 18, 2021, from https://eric.ed.gov/?q=VR&ff1=subEducational%2BTechnology&id=ED597662.

François, P., Leichman, J., Laroche, F., & Rubellin, F. (2021, March 10). *Virtual Reality as a versatile tool for research, dissemination and mediation in the humanities*. Virtual Archaeology Review. Retrieved November 18, 2021, from https://hal.archives-ouvertes.fr/hal-03164820.

Anggara, R. P., Musa, P., Lestari, S., & Widodo, S. (2021, June 23). *Application of electronic learning by utilizing Virtual Reality (VR) and augmented reality (AR) methods in Natural Sciences subjects (IPA) in elementary school students grade 3*. JTP - Jurnal Teknologi Pendidikan. Retrieved December 2, 2021, from http://journal.unj.ac.id/unj/index.php/jtp/article/view/20203.

Midak, L., Kuzyshyn, O., & Baziuk, L. (2019). *SPECIFICS OF VISUALIZATION OF STUDY MATERIAL WITH AUGMENTED REALITY WHILE STUDYING NATURAL SCIENCES*. Open educational e-environment of modern University, special edition. Retrieved November 3, 2021, from http://lib.pnu.edu.ua:8080/bitstream/123456789/6069/1/%d0%a1%d1%82%d0%b0%d1%82%d1%82%d1%8f_207-1160-1-PB.pdf.

Lee, J., Kim, J., & Choi, J. Y. (2018, December 19). *The adoption of Virtual Reality devices: The technology acceptance model integrating enjoyment, social interaction, and strength of the social ties*. Telematics and Informatics. Retrieved December 2, 2021, from https://www.sciencedirect.com/science/article/pii/S0736585318306415.

Gonçalves, R., Pedrozo, A. L., Coutinho, E. S. F., Figueira, I., & Ventura, P. (2012, December 27). *Efficacy of Virtual Reality exposure therapy in the treatment of PTSD: A systematic review*. PLOS ONE. Retrieved December 2, 2021, from https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0048469.