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Advancing STEAM learning through virtual reality

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Advancing STEAM Learning Through Virtual Reality

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An Honors College Project Presented to

the Faculty of the Undergraduate

Honors College

James Madison University

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by Kimberly Anne Hearn

May 2018

Accepted by the faculty of the Honors College, James Madison University, in partial fulfillment of the requirements for the Honors College.

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PUBLIC PRESENTATION

This work is accepted for presentation, in part or in full, at the Honors Symposium on April 18, 2018.

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I. Introduction

In Spring 2018, I was enrolled in the Honors Capstone Kickoff class in CHBS with Dr. Lucy Malenke. I had originally planned to do a project in the Political Science Department. However, I had just switched into the major, and so did not really know what the relevant topics in my major might be. That same semester, I had a conversation with Dr. Philip Frana, professor of IDLS and associate dean in the Honors College about my capstone project. I had taken his class in my sophomore year on The Artificial Other, which is a class that covers material related to the social impacts and future of robotics, automation, and artificial intelligence. We had to write a speculative research essay in that class. The paper was entitled "Space, Not the Final Frontier: Discovering Virtual Worlds in the 21st Century." The paper covered the past, present, and future of Virtual Reality (VR).

Dr. Frana mentioned that there was an upcoming opportunity to help create panels for the August 2017 Escape Velocity Conference put on by the Museum of Science Fiction in Washington, DC. I decided to switch my project over to the Honors Interdisciplinary Studies minor and do a creative project introducing VR to a public audience. My project would involve gathering together and organizing VR professionals and academic faculty members and creating panels as a valuable contribution to the Escape Velocity Conference.

I have been interested in VR for a very long time. I share my personal story and interests in Section II. I have played massively multiplayer online role-playing games (MMORPGs) since I was eight years old, and wished they could be more immersive. I started researching new

developments in virtual worlds and learned about VR and the Oculus Rift earlier than most people. I hoped that there would be a Virtual Reality MMO (short for MMORPG) on the Rift or some other technology, because to date it still does not exist. I feel like a lot of people play MMOs because the "real world sucks," but I simply wanted to have fun and make friends in a virtual world that could become real friends. Immersion makes you feel like you are in a world with friends that you will not encounter or connect with in the real world. These relationships are just as real as my relationships in the real world, but they exist at a distance. Without virtual worlds, I would never meet these people. And in some ways, you can trust someone in an MMO or a Virtual World better than you can trust a person who is right there in front of you. It is easier to share secrets and form relationships that are deep and enduring. Sometimes in real life, people feel like they have to be guarded or not make mistakes, or they will tell your secrets to mutual friends. The secrets you share can more directly impact your physical real life in a way that they do not in VR.

In Dr. Frana's Artificial Other class I wrote about the history of VR and the different uses for it in society. These topics are covered in Section III. Military uses, healthcare uses, and entertainment purposes are all outlined. This research allowed me to later come up with three separate topics for panels at Escape Velocity, though I eventually condensed them into one panel later. In my ideal vision of VR the technology produces something akin to a dreamlike state -- it can enhance the possibility of having a lucid dream. You could pop in a game and then experience it, like in the show *Sword Art Online*. It is fun to read online how far we really are from these type of VR experiences.

In Section IV I summarize the tasks I completed for the Escape Velocity Convention. I was given assignments by Executive Director Greg Viggiano. He had to approve the topics and the panels. I spent most of the Summer of 2017 sending out emails and communicating with potential participants on the panels. I started with three panels, but eventually had to combine them into a single VR panel. There were some other challenges in the run-up to the Convention on Labor Day weekend in 2017, but I overcame them and the panel was a success.

In Section V, I reflect on the process and share what I have learned about event planning and managing people in the context of a national conference bringing together the public and experts in the fields of science fiction and science fact. I learned that creating panels can be challenging, that new conferences can have trouble creating a unique identity and sustaining an audience. The logistics of conference management can also be challenging. Conventions are much like living organisms, they grow and mature, need regular care, and demand enormous amounts of time and attention.

II. How I Became Interested in VR ...

I have played online games, MMORPGs since I was 8 years old. I had two older siblings who also played and that is why I got started so early. The first one I ever played was *Everquest 2*. I played that for years and when I was 14 I started playing *Aion*. Then I played *TERA Online*, and then *DC Heroes Online*, and several other free-to-play online MMORPGs. Then I played *World of Warcraft* (WoW) with one of my older brothers for a while. When we got bored of that I played *Final Fantasy XIV* for a bit, but it was a huge flop and I was really disappointed. It pushed me all the way back to *TERA*.

They remade the entire *FF XIV* game as FF 2.0 a few years later, and referred to the original as 1.0. It was interesting because they worked the remake of the game into the game's lore. In the story there was a dragon named Bahamut who was imprisoned in a red moon. As two factions in the game were about to wage war, the dragon broke free of his imprisonment and caused a calamity and destroyed the realm. That was the "destruction" of 1.0 so that they could remake the game into 2.0. If you were playing at the time, you could witness this destruction in the game for yourself, which I found really cool. When 2.0 released, I started playing again in my junior year of high school, and I am still currently playing it today. Since its remake, the game has been very successful and there have been two expansions, and they are currently on version 4.25.

I remember back when I played WoW I wished MMORPGs could be more immersive. I wished the screen was at least curved, or there were goggles that would allow you to play as your

character and feel like you are in the game. Then I saw the Oculus Rift and that was exactly what I was thinking about. I followed the Oculus Rift from the very beginning of its announcement to the reviews of it after it released. MMOs are not currently compatible with the Oculus Rift, but I own one now. The Oculus Rift is just as immersive as I thought it would be, but I want to be inside the MMO environment. When they make an MMORPG for virtual reality, that is when my dream will have come true.

An MMORPG for virtual reality probably will not exist for a long time, because it is a large undertaking. I was playing a game called Rec Room with my brother. In that game you can see other people when you play, but what we need for an MMO is a way bigger scale than Rec Room. Part of the problem might be that MMOs are played in third person. It could be really difficult to set up an MMO in first person, and playing VR in third person will be a real challenge. You would also need a lot of space for an MMO. Something I noticed with the Oculus Rift is that an action-packed game is difficult to play in a small space. I have whacked my controllers a couple of times playing games with my brother.

If you have a large amount of space to dedicate to VR, there are some things like the Virtuix Omni and Cyberith Virtualizer treadmills that can make the experience much better. They allow you to move in real life to move in the game. There are also gloves that allow you to use your hands in VR in more specific ways than you can with touch controllers. The Oculus Rift's controllers only allow you to grab items, make a thumbs up, and point in VR so they are somewhat limited. All of these items would make a VR MMO more immersive, but you would

probably have to dedicate an entire room to VR, or most of a room in order to use this equipment.

Another issue preventing the creation of a VR MMO could be the headsets themselves. I can wear the Oculus Rift for an hour and a half or two hours at a time. I get pretty sick over time and need to give my senses a break. The Oculus Rift can lag in certain games and that can really mess with your brain. It can give you a bad headache. Most people who play MMOs like to play for several hours at a time. Personally, when I log on I plan to play for at least 3 hours, if not an entire evening. A VR MMO on the Oculus Rift would not be suited for long periods of play like a typical MMO. If one were released today this would need to be taken into account.

III. Personal Research on Virtual Reality

   In the past few years I have done my own research on virtual reality in order to learn more about it. Virtual reality is a concept that has been developing since the 1800s, and in the past several years is finally becoming mainstream ("History of Virtual Reality"). VR is hard to confine within a single definition, as there are multiple understandings of it. For some people it strictly means being immersed in a computer simulated environment with a head mounted display (HMD). Others have a simpler definition where virtual reality involves being immersed in any environment other than the one in which they are physically present, which includes things like dreams and 4D films. For the sake of fully exploring the origins of virtual reality, I am going to use the second definition.

   People are surprised to learn that virtual reality can trace its origins back to the 19th century, about 100 years before the term "virtual reality" even existed. When using the broad definition of VR, the first example that we see in history is 360 degree panoramic murals ("Virtual Reality"). These murals were designed to fill the viewer's entire field of vision, and make them feel like they were really there. Another 19th century example of VR is the stereoscope. A stereoscope is a device that is held up to the face and has one lens for the left eye and one for the right that allows the user to view images in 3D. The stereoscope precedes the View Master, which I will discuss in more detail later.

   In the 20th century virtual reality technology took more leaps and bounds. In 1929 the first flight simulator was developed by Edward Link. These flight simulators were completely

electromechanical, and allowed the US military to train pilots more safely ("History of Virtual Reality"). Shortly thereafter, Stanley G. Weinbaum wrote the short story "Pygmalion's Spectacles," in which a person could wear a pair of goggles that would allow them to experience an alternate reality through holograms and their senses of touch and smell. The similarity between this idea and the modern idea of VR in 2015 is uncanny.

In the 1950s, Morton Heilig came up with the idea of an "Experience Theatre." This theatre would stimulate all the senses, and immerse the viewer in the film. In 1962 he built a prototype named the Sensorama, which still functions to this day ("Virtual Reality"). Also in this decade, Philco Corporation created a head mounted display that is very similar to the ones being developed today. It was called the Headsight, and had head tracking and a video screen for each eye. Although closely related to today's concept of a head mounted display, it was not meant for virtual reality as the term still did not exist.

An even closer relative to today's virtual reality headsets is known as the Sword of Damocles, developed by Ivan Sutherland in 1968. Sutherland designed this HMD with the goal that the user would not be able to tell the difference between the simulated reality and actual reality. Of course, this was not achievable due to the lack of technology at the time, but the Sword of Damocles was an important milestone for VR, as it was the first time that a headset was connected to a computer generated image, rather than a live camera feed. Because of this, it is widely recognized as the first real VR headset ("History of Virtual Reality").

The next big milestone for virtual reality occurred in 1987, when Jaron Lanier actually coined the term "virtual reality." Until this point, the name for the concept did not exist. Lanier also worked on a glove that allowed hand movements to be translated into virtual reality, which is a tech that has evolved and is still being refined for use with VR headsets like the Oculus Rift ("History of Virtual Reality"). The 1990s brought virtual reality to the public market, but it failed due to the fact that the technology still was not advanced enough. In 1995 Nintendo released its product the Virtual Boy, but it ended up being one of Nintendo's greatest failures.

Despite its lackluster introduction into the public sphere, VR became mainstream in 1999 when *The Matrix* was released. In this film, the characters all live in a virtual world without even realizing it. Due to *The Matrix* raising awareness of VR, and the ever increasing speed at which technology improves, virtual reality has come a long way in the 21st century ("History of Virtual Reality").

In the last several years, VR HMDs and additional technology that add immersion have become widely popular. One of the most well-known virtual reality headsets is the Oculus Rift, which the company released on March 28th, 2016. The Oculus Rift was dreamt up by Palmer Luckey, who was 18 when he put together a prototype in his parents' garage in 2011 ("The Inside Story of Oculus Rift"). Luckey said in the Rift's Kickstarter video that he wanted a headset that could provide a deep level of immersion that looking at a screen simply could not provide. But there was nothing on the market. Luckey took matters into his own hands and started developing the Oculus Rift.

With the technological advances of the 21st century, the Oculus Rift achieved a level of immersion that no VR headset before it could. The article "The Inside Story of Oculus Rift and How Virtual Reality Became Reality" from Wired.com notes how the Oculus Rift works into words perfectly: "By combining stereoscopic 3-D, 360-degree visuals, and a wide field of view – along with a supersize dose of engineering and software magic – it hacks your visual cortex." In other words, the Oculus Rift tricks your brain into thinking the virtual reality is reality, even though you yourself know better.

For people dedicated to achieving the most immersive VR experience possible, the Oculus Rift itself isnot enough. The Oculus Rift started a revolution of sorts. Several other companies started developing devices to increase immersion in VR. Examples of this include the Cyberith Virtualizer and Virtuix Omni, which are devices that allow the user to move in the virtual world by moving their real body. These devices work like altered treadmills that allow you to move 360 degrees. There is a circular space where the user moves their feet, and arms that stretch out of the bottom and connect to a circle that surrounds the user's waist and contains a harness so that they will not fall down ("The Virtuix Omni").

In addition to devices that allow the user to move in the virtual world, equipment to trigger the user's haptic senses has also been developed. Examples of these haptic devices can be seen in the KOR-FX and Gloveone. The KOR-FX is a haptic vest designed to let the user feel things like gun shots and explosions, and which direction they came from ("The KOR-FX Haptic Vest). Gloveone are gloves that "enable the user to feel sensations such as rainfall, heat, flitting of a butterfly, shapes (and even weight of an object) when interacting with virtual objects,

according to the article "Gloveone Smart Gloves will Let You Feel Virtual Reality" from Techtimes. Through all these devices, developers are trying to create a sense of immersion that goes far beyond sitting in a chair with an Oculus Rift and a controller.

The Oculus Rift did not just start a revolution in regard to immersion. As it became more popular, other companies began to produce their own virtual reality headsets. The Oculus Rift originally started being developed with gaming as its main focus, which left room for variety in the purpose of other VR headsets. Google came out with Google Cardboard, which is a low-cost VR headset that a smartphone can be inserted into ("Cardboard, Google Developers"). All that is needed to use the Google Cardboard is the headset, a smartphone, and apps that are compatible with the headset. There is no need to plug into a computer like there is with the Oculus Rift, making for a much simpler experience. In addition to Cardboard, Google also partnered with GoPro to create the Odyssey, a VR video capturing device. Google also launched Jump, which is a platform for viewing VR video ("GoPro's 16-camera Rig"). Jump also stitches the video files together so that they can be viewed seamlessly, and the video can be viewed both with and without Google Cardboard.

Despite partnering with Google, GoPro developed its own 360 degree video capturing rig called the GoPro Spherical. GoPro acquired Kolor, a company that specializes in spherical media, and worked together to create a more amateur-friendly device than the Odyssey ("GoPro Spherical Gives You Eyes all Over"). GoPro recognizes that to increase the popularity of VR, there needs to be more content than just gaming. To that end, they are developing the Spherical to be more readily available than the Odyssey, whose cameras alone total $8,000.

Similar to Google Cardboard, the company View-Master released a VR headset that has few requirements for use. All that is required is the headset, a smartphone, and at least one experience pack. To use the View-Master VR, you simply download the app that goes with your experience pack, scan the pass card that also comes in the experience pack, and put your smartphone into the headset ("Open Your Eyes to Virtual Reality"). After that, you can explore and learn facts about all sorts of things, like space, famous landmarks, animals, and the ocean. The View-Master is different from other VR headsets in that it was always intended to be for a younger audience, rather than adults ("View-Master is Waking"). It was designed to be an educational tool, and because of this it is perfect for classrooms. Introducing VR to schools as an educational tool is a great way to make learning more fun, and Google actually already has a program for introducing this technology into schools, called Expeditions.

In the Expeditions program, Google basically sends teams that travel around the world to selected schools to deliver Expeditions kits for free. These kits include a tablet for the teacher to direct the lesson, a smartphone paired with either a Google Cardboard or View-Master for the students, and a router that lets Expeditions run without requiring an internet connection ("Google Brings Virtual Reality"). When creating Expeditions, Google worked with both teachers and content partners to create over 100 tours for the students, so there is a lot of variety with the program ("Expeditions Pioneer Program").

Expeditions is only one example of the variety of uses virtual reality can have in society. In addition to enhancing educational experiences, VR is also being used in the medical field for a

variety of treatments. One example of this is exposure therapy. By using VR, patients can learn to deal with their fears in a safe, controlled environment. People that suffer from PTSD can also be treated in a similar way with VR. However instead of facing their fears in a virtual world, they are learning to deal with situations that could trigger harmful behaviour ("10 Ways Virtual Reality")

An interesting discovery was made when the military did a study on pain management and virtual reality. The University of Washington created a virtual reality game called SnowWorld, in which the player listens to music from Paul Simon while throwing snowballs at snowmen and penguins. It sounds very simple, but they found that it was more effective than morphine at reducing pain in burn victims when they were getting their wounds taken care of. ("10 Ways Virtual Reality").

In addition to improving medical care, virtual reality is also being used today to improve training for the military. The US Army uses a virtual world called the Dismounted Soldier Training System to prepare for combat. The DSTS uses a back-mounted computer to deliver visuals to an HMD, while audio is delivered through headphones that are included in the helmet ("The Gulf Between High End Military VR"). The soldiers' positions are tracked by inertial measurement units (IMUs), which use accelerometers and gyroscopes to keep track of movement. Using this technology, soldiers can receive realistic training without being put in real danger.

Virtual Reality is also being used to protect our country through the National Geospatial-Intelligence Agency. According to the article "5 Things from Inside the U.S. Intelligence War" from CNN, the NGA has an "immersion lab" in which they use satellite images to recreate virtual models of sites like the compound in which Osama Bin-Laden was killed. They create these models to learn more about an area, and share them with the "people planning a mission – or soldiers executing one."

Through all these examples, it is obvious that virtual reality has many uses in a large variety of fields. However, despite its current practicality, virtual reality is far from perfect. As I have previously stated, virtual reality's popularity exploded when the Oculus Rift started production as a VR gaming platform. This sounds great at first, but the cost of an immersive gaming experience is far outside the average consumer's price range ("Oculus Rift's PC Requirements").Just the Oculus Rift headset and a computer powerful enough to use it is expected to cost around $1500 ("Oculus Rift will Cost Over $350"). Then, if the consumer wants an experience that is as immersive as possible, they must factor in the cost for all the other gear. The Virtuix Omni is $499 ("Virtuix Omni"), the KOR-FX is $135 on sale ("KOR-FX Gaming Vest"), and Gloveone costs 199 Euro excluding shipping, which equates to roughly $216 ("Shopping-cart Summary").

So an immersive VR experience as of 2016 would cost about $2350, which is a price the average consumer is not willing to pay. And it is not just VR in the gaming industry that is affected by cost. GoPro's Odyssey costs $15,000, ("Go-Pro's 16-camera Rig") which is part of the reason they began developing the GoPro Spherical as an alternative.

Aside from cost, VR also suffers a serious side-effect: motion sickness. The Oculus Rift was in production for years in order to remove the threat of motion sickness from the device, and the technology used to do so is part of the reason that the cost increased from the original expectation. However, with products like Google Cardboard, motion sickness is still a problem which is partially related to the cost of the device ("Google Cardboard is Disappointing").

The Google Cardboard is meant to be for everyone, but because the cheapest headsets cost around $20, latency is a big issue. Virtual reality needs to be viewed at 60 frames per second (fps) or more. Anything below that threshold can cause motion sickness. But since Google Cardboard headsets are relatively cheap and can be used with practically any smartphone, not all of its apps run at 60fps ("Google Cardboard is Disappointing"). And if many people purchase these headsets and experience motion sickness, it could create a wave of negativity for VR.

The Oculus Rift and other VR tech could also have negative effects on people socially. There are already people that get addicted to 2-D online games, and in some cases their addiction has extremely negative impacts on their social lives. People have even died because they could not move away from their game to take proper care of themselves ("Man Dies after 3-Day Internet Gaming Binge"). By making gaming seem even more realistic, the Oculus Rift could worsen this problem.

Virtual Reality could also affect peoples' social interactions through the wide variety of pornographic content that is being developed for it. Palmer Luckey has already stated that "[t]he

Rift is an open platform," so Oculus Rift will not be banning any of this content. As a result, there are now things for the Rift like a robotic arm that assists in simulating virtual sex with a 3D avatar, and an MMORPG (Massively Multiplayer Online Role-Playing Game) in which a player creates an avatar and can have sexual relations with other peoples' avatars ("Oculus Rift Founder").

Because of this kind of content being developed for the Rift, it is entirely plausible that people may end up choosing robot-assisted masturbation over a real partner for a variety of reasons. An article "The Robot That Makes Virtual Sex Feel Real" by a Motherboard.com writer even opens with: "In the future, some people will choose to spend Valentine's Day alone, having virtual sex with a 3D avatar with the help of a fully responsive robotic assistant." It is easy to imagine this content hurting marriages, retarding social interactions, and harming the marketability of the Oculus Rift. Some parents may decide against having the device in their household.

Even though virtual reality has these problems right now, I do not think that they hurt it overall. With regard to the cost, all cutting-edge technology starts off costly. It is predicted that within five years, the cost of the Oculus Rift and other VR devices will drop to an affordable rate as technology advances and competition arises. Kevin Ohannessian puts it well in his article "Oculus Rift's PC Requirements are Virtual Reality's Achilles' Heel" when he says "at one point, few people had HDTVs or smartphones. Now they're ubiquitous, and 4K TVs and smartwatches are on their way to becoming everyday gear. It's just a matter of time."

And even though motion sickness is still a problem for some HMDs now, in the future it will become a thing of the past as higher frame rates become more accessible to the average consumer. Just like with the HDTVs and smartphones mentioned in Kevin Ohannessian's article, as time goes on and technology advances, cutting-edge tech with higher frame rates will become cheaper, and eventually motion sickness will be a thing of the past. Plus, Google is developing many models of the Cardboard ("Cardboard"), so it is not like they are mass producing a motion sickness inducing device.

Also, although there is a variety of pornographic content being produced for the Oculus Rift, I think that it is not something that will become widespread, and parents will not have to worry about it. In Brian Merchant's article "The Robot that Makes Virtual Sex Feel Real," he talks about how creepy it felt to test out the machine and his disgust with it is apparent throughout his writing. I think that pornography has a niche audience, and that it will stay that way with VR pornography. It is likely that parents will not have to worry about their kids accessing pornography through the Oculus Rift because the content will not be readily available for minors. For example, there is a lot of pornography on the internet, but there are ways to block minors from seeing it so that they can still use the internet, like Google Safesearch ("Google's Safety Tools").

That said, I do not think it is something we will have to worry about in the immediate future. I think that over the next five years VR will develop slowly, despite its rapid growth in the last several years. As I pointed out earlier, in his article "Oculus Rift's PC Requirements are

Virtual Reality's Achilles' Heel" Kevin Ohannessian stated that it will take time for the cost of VR to get down low enough for the average consumer to afford it.

Some media, like the anime *Sword Art Online* depict us achieving the ultimate level of immersion in VR by the year 2022, but unfortunately that estimate seems unrealistic with the technology we currently have today. In *Sword Art Online*, there is a helmet called the NerveGear, into which the user inserts a game disc, and puts it on. Then they simply lie down, and are completely immersed within a virtual world. This is achieved by the transceivers in the NerveGear tricking all the brain's senses into believing it is somewhere else ("NerveGear"). According to the article "NerveGear" from the *Sword Art Online* wikia, in addition to inducing fake sensory signals, the NerveGear "can also block every movement command from the brain to the body, preventing the player from moving their body while in FullDive to avoid injuries." It is for this reason that I do not see us achieving this level of VR in the near future like the show predicts.

Even though we may have the graphical capabilities, proper frame rate, and CPU power to support something like the NerveGear, we lack the knowledge to manipulate our brain's senses in the way that the NerveGear does. And even if we do figure out how to do such a thing, that technology would be incredibly costly when it releases, so it would not be common for people to own one like it is in *Sword Art Online*. I think it is more likely that in the next ten years, the cost of technology like the Oculus Rift will have been driven down, and HMDs that use smartphones will have high frame rates that eliminate motion sickness.

With virtual reality becoming widespread in the future, it will bring many virtual worlds with it for people to explore. As long as we can dream of it, any world will become available to us. There is a whole virtual universe at our fingertips, and we are only beginning to discover what it holds. Humanity has explored the Earth, and begun exploring space. Now it is time to go where no man has gone before: into virtual space.

IV. Work on Escape Velocity

Dr. Frana told me about Escape Velocity, and suggested that I make contact with its
director Greg Viggiano. I called him and began the process of event planning for VR panels at
the conference.

On November 8th, 2016 I spoke with Mr. Viggiano on the phone. He is the executive
director for the Museum of Science Fiction. In this call he told me to meet again with Dr. Frana
within ten days. He also told me to come up with 3 discussion panel ideas, one
demonstration/presentation idea, and a workshop. He recommended that for one of these areas, I
figure out something to relate video games and what virtual reality might mean for entertainment
and science fiction.

Following this phone call, I came up with ideas before I met with Dr. Frana. At this point,
my ideas were very rough. For my three panel ideas I had virtual reality and health, virtual
reality and its impact on tourism, and virtual reality and business. For my demonstration and
workshop ideas, I came up with having the HTC Vive demonstrated to an audience, with a
workshop on using it to follow.

On November 14th, 2016 I had a phone conversation with Dr. Frana to go over my ideas.
He approved of all of them, and suggested ways to make them better. So later that day I sent Mr.
Viggiano an email describing all of my ideas.

My first panel I titled "Virtual Reality and Public Health." I described it as follows, "as a side effect of virtual reality targeting gamers, companies have popped up to try and make the gaming experience even more immersive. One of these companies created the Virtuix Omni which is a sort of circular treadmill that allows a player to move in virtual reality. These treadmills were meant to create a more immersive experience for gamers, but in addition to deepening immersion they provide an opportunity for physical fitness. Instead of spending hours sitting on a couch playing video games, these treadmills allow gamers to move when they otherwise wouldn't be. I think the repercussions that technology like this could have for peoples' health is an interesting topic for discussion."

I titled my second panel "Virtual Reality, Good or Bad for Tourism?" As its description I said, "I've seen several demos for more common VR headsets where the user is put in a widely renown tourist destination like Paris, France. If people are immersed enough in this sort of experience, what kinds of repercussions could it have on the tourism industry? Could it be argued that this sort of experience is just as good as being there? There are 3D videos, what if someone just watched a 3D video of being at the Colosseum on a VR headset, with a good pair of headphones? Could this replace the experience of actually going to the Colosseum? All these questions are up for debate, so I think this topic would be very interesting."

I titled my third panel "Virtual Economies." Its description was "imagine a future where people put on their VR headset and go to Target to complete virtual transactions to purchase their goods. Or they have an avatar of themselves and try on clothes in a virtual fitting room. This type

of future doesn't seem far off from being possible with the virtual reality technology that we have now. If this became the case what would happen to business in the future? Could we just complete our shopping and have drones deliver our goods to us? How would this impact society? I'd be very interested to see how people answer these questions, and how they think virtual reality could affect transactions in the future."

Regarding the demonstration/presentation I said this, "for my demonstration/presentation I'd like to have a demonstration of the HTC Vive. I think it's a really cool piece of VR tech that's a front runner right now, and they just recently created a wireless headset that would make the experience that much more immersive and convenient. I tried the demo at the Microsoft Store in Tysons, and I thought it was great. I'd like to tie this demonstration in with my workshop, which would be to have multiple HTC Vive demos going that people can try. If HTC and Valve were willing to let the Microsoft Store set up a demo, they should be willing to let us set up one as well. The audience at the convention is essentially their target audience, and they would get great exposure for their product. Also, there is a Microsoft store roughly 20 minutes away from the hotel where the convention will be, so maybe HTC and Valve could send demos there, and then have them sent to the hotel to set up for the convention."

On November 27th, 2016 I had another call with Mr. Viggiano. He told me that he was going to speak with others and have a meeting. He said that he wanted to figure out how many slots we could do and see what the best ideas for each section would be. He said that he would want two sections for virtual reality, and to give him another call on December 5th or 6th.

On December 8th, 2016 I got in touch with Mr. Viggiano again. He told me to meet with Dr. Frana again and figure out who we can approach about moderating and being on the panels. He instructed me to come up with a list of 6-7 people per panel to ask, and then we would touch base again the following week.

On December 12th, 2016 I met with Dr. Frana again. We came up with a list of people per panel, as Mr. Viggiano instructed. So on December 19th, I got in touch with Mr. Viggiano once more. We set up a call for the second week of January, and he asked me to resend the discussion panel descriptions though email so that they could be categorized and published on the Escape Velocity website.

On January 24th, 2017 I met with Dr. Frana. We went over the guidelines for the honors project proposal, and talked about what the final product of my project could look like. Throughout January I tried to get in contact with Mr. Viggiano like we had planned but it did not happen until January 31st. During our phone call, he told me that everything was starting to get organized and that we were where we needed to be at that point. He said that he wanted me to be able to participate in the next meeting to figure out time slots for the virtual reality panels. He concluded the phone call saying I would hear from him in two weeks.

On February 21st, I had another meeting with Dr. Frana. We went over possible project ideas again, and the specifics of the honors project. We also went over possible readers for my project. As a possible project idea, we talked about making a virtual reality YouTube video of my panels at Escape Velocity. Dr. Frana gave me the email of someone who I could contact to

do that. I reached out to her and she said it sounds like an interesting idea, and she would see what we could do closer to the convention.

On March 7th I participated in a teleconference. I met two people who I would go on to contact for much more of the process of putting the panels together. They asked me to describe every panel idea to them in depth. After I would describe each panel, they would ask some questions and give suggestions. Ultimately, they approved of all my ideas. They asked me to come up with titles and 3-4 sentence descriptions for each panel. They also instructed me to reach out to the people I found for the panels, after being sent the boiler plate information. They gave me some more technical instructions regarding reaching out to people, and then the teleconference ended.

On March 21st I had another meeting with Dr. Frana. During this meeting we just went over what occurred during the teleconference, since he was unable to attend it. On April 4th we had met again. Dr. Frana sent me the Honors Capstone Project Application Form and we went over it. We discussed everything I would need to do to finish up my project requirements for the semester, and concluded our meeting.

On April 18th, Dr. Frana and I had our final meeting of the semester. We went over the Senior Honors Project again, and what the final project should look like. He suggested writing a 40 page paper, and we discussed what could be written in it. Some of these ideas were to include all the planning, who I asked to participate, who signed on, etc. We also said the paper could include my work on Escape Velocity. Dr. Frana suggested I record the commentary from the

panels and summarize the content in the paper. He also suggested that the last section of the paper be reflection. I could reflect on what I would do differently with the panels, and what I would suggest be done for next year's convention in 2018. He said that the audience for my paper should be the people at Escape Velocity. This suggestion gave me the idea of making a section of my paper dedicated to possible artifacts the Museum of Science Fiction could include in a virtual reality display.

As previously stated, throughout the beginning of the process I spoke to Greg Viggiano several times over the phone. Greg seemed really outgoing, nice, and approachable for the leader of an organization of this size. He is the executive director, but he does not seem like the kind of person who is the big boss of an organization. I told him that I was interested in virtual reality and he told me to come up with three topics, a demonstration, and a workshop. I thought the demonstration would be the HTC Vive because we located a Microsoft Store that was near the convention center. We thought they could demo the equipment at the convention, and promote their product in the process. The idea was that Microsoft could demo the Vive, and then attendees could try it out in the workshop. We also considered the Hololense as an alternative.

The Hololense may have been a better demonstration for the near future of virtual reality. Nick at Escape Velocity thinks that AR is probably in the immediate future, and I agree with that. I feel like it is more applicable to everyday life. The AR glasses overlay everything in your environment -- reality. They do not get in the way, but instead they enhance your experience.

When putting the panels together, I contacted many potential panelists to serve on these panels. I needed 4-6 people for each panel, and I soon learned that it can be hard to even get an email response. Greg pointed me to other people to contact (Derek and Nico) about how to contact people for the VR panels, and they provided me with a boiler template:

[Hi Mr./Mrs.____,

My name is Kimberly Hearn. I am working with the Museum of Science-Fiction to put on an event called Escape Velocity. The purpose of Escape Velocity is to blend the fun of Comic-Con with the innovation of science and technology. We are a non-profit organization dedicated to STEAM education, and are aimed towards ALL ages.

We are reaching out to you because we would love to have you involved in a panel discussion called _____. This panel will be discussing _____. Please let me know if you are interested and available in participating in the event on September 1-3 in Washington, DC. You can learn more about Escape Velocity here.

Best,
Kimberly Hearn]

We tried to locate people who were in the DC area, thinking that they would have more availability. I sent an email with the boiler template to many people with expertise on the subject matter of my panel topics. One panel was on virtual reality and health, so I first contacted Melissa Napolitano. Among other things, she is researching virtual reality as a tool to prevent obesity in young adults going from high school to college. I also contacted Susan Toth-Cohen

who researched online virtual worlds and health. I contacted J. Carson Smith as well, because he was listed as the director of the VR lab in the University of Maryland's kinesiology department. He responded to my email that he is director in name only, and recommended I contact Tim Kiemel, Rodolphe Gentili, or Brad Hatfield. I reached out to Tim Kiemel but did not get a response. I also reached out to Clint Stevenson who helped develop "virtual reality training sessions that allow students and professionals to interact with…food manufacturing facilities, scouting for safety violations." He could not make the panel for personal reasons, but it was nice to get a response. I contacted F. Zeb Mathews who was an assistant professor at the University of Tennessee Health Science Center, but he could not make it.

My second panel was on virtual reality and tourism. The first person I contacted for this panel was Peter Kao, who was working on a virtual reality theme park named KingsLand. I also contacted Alex Saenger, who offered virtual tours for real estate professionals and businesses as a marketing tool. I reached out to Sarah Hill, the CEO of StoryUp, but she could not make it. I contacted Douglas Klahr who wrote about virtual travel, but did not hear back after he reached out to Derek. I also reached out to Iis Tussyadiah, who has written extensively about digital technology and tourism. She initially responded as well, but I also did not hear back from her after she reached out to Derek.

My last panel was on virtual reality and shopping. The first person I contacted for this panel was Mark Blanks, who was the program director of Project Wings at Virginia Tech. I also contacted the company Brightline Interactive, since there was not one person listed who I could

reach out to. As stated on their website, "Brightline creates place-based digital interactive experiences for consumers to better connect with brands."

Due to the lack of response, I contacted Derek with my concern that I would not have enough panelists. They told me not to worry, and we condensed the three panels into one panel. After this, I found four people who could cover all of the original topics. Carrington "Canny" Weems came all the way from Texas to be on the panel. He is the founder of Virtually Anywhere, which is a company that creates 360 degree virtual tours, so he covered the virtual tourism topic. Nick Swayne is the director of the X-labs at JMU and teaches a class on virtual reality. He spoke about virtual reality and education, and how it is used in other fields, like health and the military. Phil Frana is the associate Dean of the JMU Honors College and spoke about the future of virtual reality and augmented reality. And lastly, Maria Schultheis is the department head for the department of psychology at Drexel and researches virtual reality as a tool for rehabilitation. She would have been an excellent perspective on virtual reality and health, but ultimately could not make it.

Looking back, I feel like the most difficult part of organizing a panel is getting a response from people. They may have thought my email was spam. They may have never heard of Escape Velocity at all. In general, I think all you can really do is find as many people as possible. It sounds like the organization had to condense panels frequently. Escape Velocity is for science fiction and STEM, and that is a pretty specific niche. And for America, science fiction is mostly about Star Trek and Star Wars, so it is an even narrower niche. Also, nobody has a Ph.D. in

virtual reality yet, so that makes it very difficult to combine all of those interests and find people who are experts on the topic.

V. Critique of the Process

While Escape Velocity was a fun event to work on, it was not perfect. Earlier in the summer I attended Otakon, an anime convention that usually hosts around 30,000 guests. I knew Escape Velocity was not nearly as big of an event, but I expected some logistics to be the same. However, when I first arrived at Escape Velocity I was not sure where to check in. The check in was not at the hotel entrance like I expected it to be. There were also two separate check ins for regular guests and panelists. I went to the regular check in first, and was sent to the check in for panelists, but could not find it so I asked a volunteer. That volunteer sent me back to the regular check in, where those volunteers pointed me in the right direction for the panelist check in. This was a minor setback, but something that could be improved.

While waiting for my panel to start, I also noticed that there was not a comprehensive list of activities that were occurring at the convention. There was a list of panels, but I was interested in finding other things to do before moderating my own panel. However, I could not locate a list of events, and volunteers could not point me in the right direction. There were events advertised on the website, but the schedule I was recommended to look at did not have any information on the events I was interested in.

Since I could not find events, I decided to check out what looked like the artist's alley. This was pretty cool, and I had fun walking around this part of the convention. After this, I went to prepare for my panel, where I experienced moderating and being on a panel for the first time. It was great to be sitting next to people who were much more educated on the topic than I was. One worked in the field of VR tours, one taught about VR in university, and the other was well

acquainted with VR and AR, and explored the implications for our society. They all discussed very different aspects of how VR can be utilized, and I felt like the panel went really well. As moderator my job was mainly to introduce the panelists, and then call on people for questions at the end, but it was a very different experience to be on stage instead of in the audience.

When preparing the panel during the summer, I originally had four panelists. With ten minutes until the panel started one was still not there. I checked my email, and realized I had missed one from her. She had a family emergency and would not be able to make it. As moderator, I had planned for how long each panelist should talk, so this made me quite nervous. In my head I tried to figure out a new plan for how long the panelists should talk, but was not sure how it would go. However, because my remaining three panelists were so well versed in the topic, they easily had enough to say to cover the fourth panelist's absence, and everything went smoothly.

Before the panel started, we waited about ten minutes for the equipment to be set up. Escape Velocity could have had people from the hotel set it up, but they chose to do it themselves. Because there was only about 15 minutes between each panel, they did not have enough time to solve the technical issues they were having, which is why it cut into 10 minutes of the panel. But because we were missing a panelist who was going to speak for 10 minutes anyway, this did not alter our original plan too much. Each panelist presented their topic wonderfully, and people had some great questions at the end. We did not go over our time, and I would say that the panel went quite smoothly, despite the setbacks.

With all this said, I noticed during my panel that while attendance was not terrible, it looked bad because of how large the room was. The size of the room made it seem emptier than it would have if Escape Velocity had chosen a smaller venue. I mentioned earlier that Otakon usually has an attendance around 30,000 people. Escape Velocity chooses venues around the same size as Otakon, although their highest attendance was around 2,000 people. A venue that is too large for the number of people attending can sap a lot of the energy from a gathering.

My last criticism would be that Escape Velocity says it wants to blend academia with a Comic-Con type atmosphere. But perhaps they are going about this in the wrong way. Otakon is a celebration of Asian pop culture, but the heart of its mission is to educate. Otakon is run by Otakorp Inc. which states that it is "an educational non-profit that promotes understanding and appreciation of Asian culture, by means of celebrating its popular culture." This means that Otakon educates the public through their celebration of Asian pop culture. Perhaps Escape Velocity's problem is that they are trying to blend two different types of conferences, instead of looking at it in this way. Escape Velocity could also attempt to bring in more celebrities, and the casts of popular science fiction shows and movies like Otakon and Comic-Con do. This would motivate more people to attend for a chance to see these celebrities.

VI. Recommendations

My suggestions for Escape Velocity to improve its attendance are more on the logistical side, as I believe that the first thing Escape Velocity needs to do is revisit its mission. In order to be successful a convention must meet its goal. If a convention is held to raise money, its success would be based on how much was made. If a convention exists to entertain guests, its success would be based on their overall satisfaction. Because conventions are held for a variety of reasons, there is not one standard measure of success. This begs the question of why Escape Velocity is held. Is the goal to raise awareness regarding the Museum of Science Fiction? Do they want to educate? Perhaps they have multiple goals, so their purpose gets divided and is perceived from the outside as muddled. This could be reflected in their low attendance. Other conventions have much larger attendance figures. Otakon had around 29,000 people attend in 2016, while Comic-Con had around 167,000 people attend in 2015. In contrast, Escape Velocity had around 2,000 people attend. In all fairness, Escape Velocity is nowhere near as old or as well established as these other conventions. So maybe given time to try different things and work out the kinks, Escape Velocity's attendance could match Otakon's. But first, Escape Velocity needs to pinpoint exactly what it wants to accomplish by holding these events and, more importantly, communicate that purpose to attendees.

My next suggestion would be that Escape Velocity downsize to a venue appropriate for the attendance level that they are predicting. This will make it seem much less empty. If you have a venue that is suited for 30,000 people and only 2,000 people attend, it will make the convention look unsuccessful..

Third, Escape Velocity should reorganize the way registration is handled. There should be a registration desk at the main entrance. This desk could handle both regular guests and the panelists. There could be a separate entrance for artists and dealers. This would make registration less confusing for guests.

To help guests navigate the convention, there could be standing diagrams of the venue like Otakon has. This illustrated what building people were in and where events were located. Otakon also had large signs pointing to important rooms, such as the arcade, artist's alley, and dealer's room. In addition to this, Escape Velocity could use the guidebook app. This lists everything that is going on at the convention in an extremely user-friendly way. Guests can look at each day and star the events they want to go to.

Lastly, I recommend that Escape Velocity market itself as a "celebration of science fiction," rather than as a blending of science fiction and academia for a Comic-Con-esque experience. Comic-Con advertises itself as a celebration of comics and popular culture, and Otakon advertises itself as a celebration of Asian pop culture. Perhaps marketing the convention in this way makes it more accessible to a wide variety of people. Escape Velocity could even include science fiction in anime and manga to draw in some of Otakon's crowd to the convention.

If Escape Velocity implements these changes I believe that attendance will increase, and the convention will be even more successful than it currently is. I gained valuable experience

while working on this convention, and I would love to see it become increasingly successful with

every event.

VII. Conclusion

I learned several things from this process of planning a panel discussion on virtual reality. I learned more about virtual reality and its applications, the logistics of event planning, and how to organize and moderate panel presentations for Escape Velocity.

I learned the most about event planning by working with the Museum of Science Fiction. Putting together panels is a more difficult undertaking than it seems on the surface. Even if you find the perfect presenters, they might not reply to your requests for involvement. Or even if they do reply, problems can arise and they may not be able to make it. Due to the problems I experienced, I also learned about keeping calm under pressure. I had to help each presenter think about time and about their particular topic. I did not realize all of the things that could go wrong. Presenters can drop out; audiovisual problems can occur; the schedule can change rapidly and without notice.

Finally, I learned about the logistics of conference planning by comparing my knowledge of Otakon against Escape Velocity. I developed some comparisons in a prior section of this thesis. I found out through working with Escape Velocity that you do not always have experienced people that you can rely on. Sometimes, you muddle through processes right alongside your conference planners.

I did not learn a whole lot that was new about virtual reality in the process of creating the conference panel, but I think the audience really did learn things they did not previously know.

For that reason, I think the panel itself was quite successful.

Planning for Escape Velocity
Advancing STEAM Learning Through Virtual Reality

Kimberly Hearn

Escape Velocity is an annual convention held by the Museum of Science Fiction. From 2016-2017 I worked with them to create and moderate a panel on a variety of virtual reality topics. These topics ranged from medicine, tourism, education and entertainment to how VR will look in the future.

In the medical field, virtual reality is proving to be extremely useful. It allows doctors to practice surgical procedures in a more immersive and safe way. It has proved effective in multiple types of therapy. It has helped patients manage pain after injury, as well as conquer fears through exposure therapy. In some studies, virtual reality was found to be more effective than morphine at reducing pain in burn victims. There is also research being performed on ways in which virtual reality can benefit weight loss.

The tourism industry is also being impacted by the development of virtual reality. VR has allowed for the creation of virtual tours. Companies have used imaging software to create tours of different locations so that consumers don't have to leave their homes. There are tours for real estate, college campuses, business sites and more. VR also allows users to travel across the world. There is a virtual reality app for Google Earth, and other applications allow for a more specific experience. VR allows users to travel the world without leaving their homes.

Today, the military has some of the most advanced forms of VR to aid in training soldiers. The US Army uses Dismounted Soldier Training Systems to prepare for combat. DSTSs use a back-mounted computer to deliver visuals to the headset, while audio is delivered through headphones. Soldier's positions are tracked by inertial measurement units. In this way they can receive realistic training without being put in danger. VR can also be used to make virtual models of sites like the compound in which Osama bin Laden was killed.

Virtual Reality is transforming the world we live in. Although the changes will be subtle for most people, they are exemplified in the fields examined in this project. Most average consumers will only use VR for entertainment at first, but it is clear that VR will impact multiple aspects of our lives in the future. Through my panel for Escape Velocity I got the chance to not only learn more about event planning, but help educate the public on more widespread applications of this technology.

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