Novum: A Study in Interactive Science-Fiction

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Thesis

Abstract

Novum, named in homage of Darko Suvin's writing on science fiction, is a short, interactive, multi-user, sci-fi augmented reality experience. Referencing "The Aliens", a story by Murray Leinster, Novum explores a brief narrative that is intended for two participant at once. It brings forth topics of xenophobia, bias, and personal feelings of exclusion and non-conformity, while utilizing the capabilities that alternate reality (and augmented reality) bring to the table.

This research looks into science-fiction entertainment, and how group-oriented, interactive experiences will influence the rest of the entertainment industry within the next ten to twenty years. In part, a study of historical entertainment trends and tropes will provide a basis for extrapolation, as well as what current developments have been made in general entertainment. To provide further information, a case study will be conducted and utilized as a primary resource, studying science-fiction entertainment with a group of participants. This study will be conducted on a multiplayer, augmented reality experience that pays homage to the story "The Aliens" by Murray Leinster. Secondary resources being referenced include other relevant case studies, like the work of Gochfeld et al., as well as statistics currently available on lateral media fields. Likewise, impacts on controversial topics such as approaches to preserving media, was also be considered.

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Initial Background and Research Questions

Digital entertainment media is a lucrative industry, bringing in 13.66 billion dollars in the United States on home video content alone (Digital Entertainment Group) in 2017; in under 20 years, spending has risen to almost 20 times what it had been in 2000, when spending hadn't even hit a billion dollars yet (see Table 1, *U.S. consumer spending on digital home entertainment 1999-2017*). With only a small stall in the 200Xs, for the past decade this has only been an upward trend, with no signs of slowing. This indicates that there is a market that is willing to pay a great deal for the luxury of entertainment, and there will always be investment in areas where there is a large amount of cash inflow, due to the appeal of highly profitable business. That being said, 'digital entertainment media' encompasses a broad range of media types, beyond just video content, and some of such entertainment is not even located inside people's homes!

U.S. consumer spending on digital home entertainment 1999-2017

Consumer spending on digital home entertainment in the United States from 1999 to 2017 (in billion U.S. dollars)

Year	Consumer spending in billion U.S. dollars
1999	0.6
2000	0.7
2001	0.7
2002	0.7
2003	0.7
2004	0.7
2005	0.8
2006	1

2007	1.3
2008	1.6
2009	2.1
2010	2.5
2012	5.22
2013	6.49
2014	7.65
2015	9
2016	11.43
2017	13.66

Table 1 Digital Entertainment Group. "Consumer Spending on Digital Home Entertainment in The United States from 1999 to 2017 (in Billion U.S. Dollars)." Statista - The Statistics Portal, Statista, www.statista.com/statistics/188941/us-consumer-

External media seems to be even more lucrative, to a point. The revenue of movie theaters in the United States is estimated to be $16.62 billion in 2016 (US Census Bureau), compared to the $11.43 billion in home content. Yet, while consumers seem to like entertainment in both facets, many major types in the past have been either passive, or 'solo' experiences; these experiences are entirely valid, and provide a meaningful market on their own! However, only pointing to industries, like film or television, does not give the entire picture of 'media' as a whole. Video games come closest to providing digital 'group' experiences, but often people are separated by physical distance; likewise, the same issue arises with digital streaming, such as what Twitch and similar services cater to. There is an unfilled niche when regarding entertainment as a whole in digital experiences that are both geared towards group use that are also participatory, instead of passive.

In this niche, there are only a few notable examples to point to, and fewer still could be commercial successes. While the company The VOID has built a business around creating what they call 'hyper-reality' experiences (THE VOID), there has only been one study done that could hint at what this means for entertainment as a whole; that singular study was dubbed *Holojam in Wonderland* (Gochfeld et al.), and even that has only studied a single, fantasy genre experience for a linear story. Yet while fantasy is undoubtedly a popular genre, it is surpassed by science fiction in terms of popularity. Six of the ten highest grossing films in 2017 for North American audiences were science-fiction films, with the Star Wars instalment *The Last Jedi* topping that list at number one (Box Office Mojo). In fact, Star Wars as a franchise comes in second as the highest grossing franchise worldwide, only measuring lower than the Marvel Cinematic Universe (See Figure 1, *Highest Grossing Film Franchises and Series Worldwide as of July 2018 (in Billion U.S. Dollars)*). Despite the proliferation of the science fiction genre in entertainment media, there is a lack of research pertaining to sci-fi and participatory entertainment.

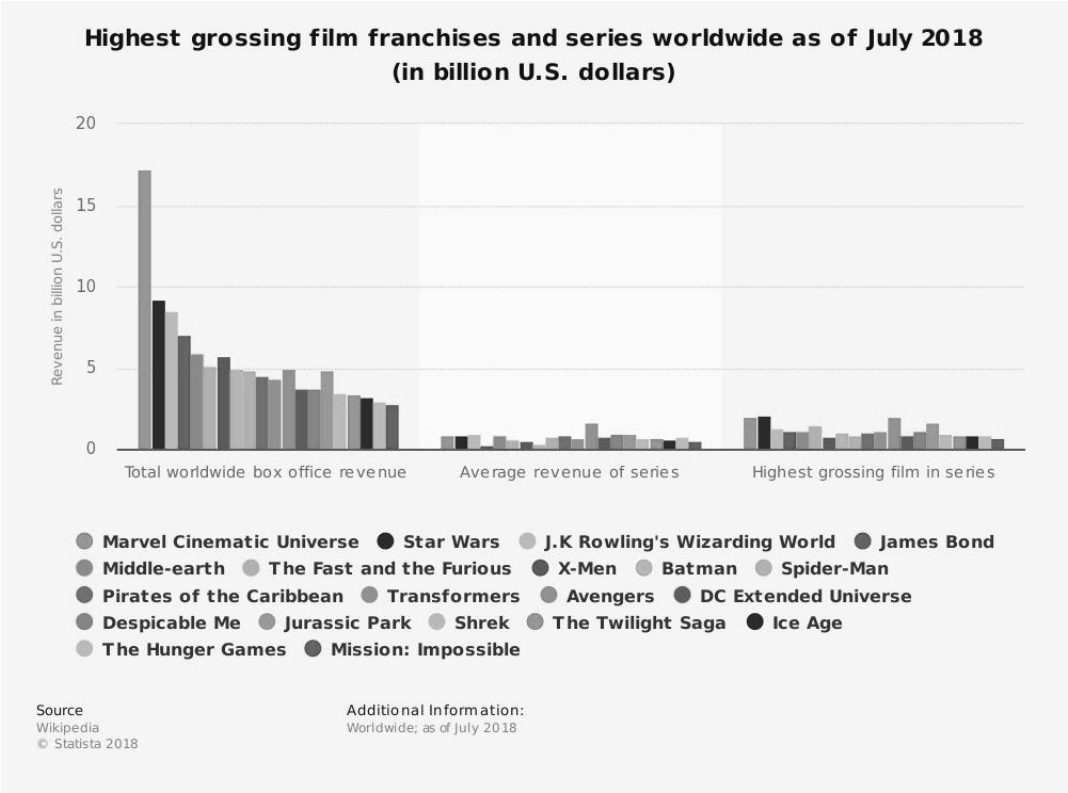


Figure 1 Wikipedia. "Highest Grossing Film Franchises and Series Worldwide as of July 2018 (in Billion U.S. Dollars)." Statista - The Statistics Portal, Statista,

Entertainment using alternative reality, such as augmented reality and virtual reality, also have merit in being researched; the Gartner hype cycle (see Image 1), which measures the 'hype' surrounding different technologies, has virtual reality slated to be in the 'plateau' – a productive period – in two to five years. While augmented reality is in the trough of disillusionment at present, that does not negate its effect on entertainment media either; some companies such as Jaunt are migrating from VR to AR development (Robertson). Between the technological future that is forecast, and current trends, such as broader adoption in other industries that can encourage the further advancement of the technology that can support entertainment (Higgins, 86), they must be accounted for in the future of entertainment development. This leads me to ask the question, what impact will participatory, group oriented science-fiction experiences have on entertainment media?

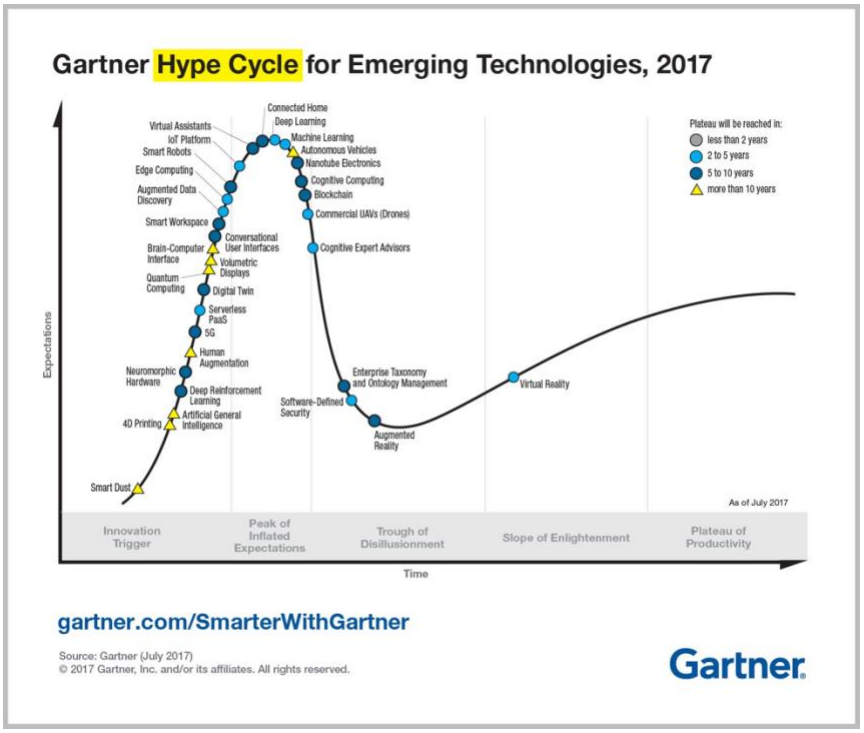


Image 1 This is the current version of the Gartner hype cycle. 'Top Trends in the Gartner Hype Cycle for Emerging Technologies, 2017'. Gartner, 15 Aug. 2017,

Project Objectives

There were a few smaller questions that need to be answered along the way to knowing what the impact of this type of media will have on the broader entertainment industry. Part of this included doing research on the history of entertainment media, to see prevalent tropes, themes, or patterns that have emerged when new media is developed. In tandem with this research, a case study was compiled around a newly created interactive experience for users to experience.

The framework used to outline the overall goals of this project was Sinek's Golden Circle, to define, loosely, why this project was created, and why it was important, how this was being accomplished, and finally, what the project was overall.

To encompass the why, I looked to what was currently being done with alternate reality, both in business and in research. The body of work surrounding alternate reality technology in entertainment is far smaller than its uses in what are considered practical spaces, such as medicine and healthcare.

With the newness of the technology, the planned and fast obsolescence of hardware, and the trouble seen keeping records in both entertainment, and alternate reality, adding a new record while exploring the affordances of the medium was key. This is further covered in the 'Significance of the Project' section of this paper.

The how narrowed down from this point. I decided to research science fiction specifically as a narrowed scope and provide a literary framework to study alternate reality entertainment from. Due to the prevalence and popularity of science fiction in popular culture, it is reasonable to assume there would be further growth in science-fiction (making it relevant to the future) and there was a good mix of independent and large scale media productions to reference.

Finally, the what; Novum is a two-user AR experience. Built using ARCore, it makes use of augmented reality and the PubNub API to create a science-fiction narrative experience, where both participants have influence over the other's played experience.

Based on the story The Aliens, Novum strives to answer the question "what impact will participatory, group oriented science-fiction experiences have on entertainment media?" by acting as a case study in the broader context of my research on the topic, and setting up a short, interactive experience for two participants to interact with at the same time.

Context Review

The research behind Novum came from a combination of theoretical research, and previously created works from this area of research. One of the initial questions I had in mind to answer was 'what is science fiction'? There was no tackling this topic without answering that question first. Thus, it brought me to one piece of writing that was highly impactful on my research.

Starting in the realm of theory, that impactful work is Darko Suvin's paper "On the Poetics of the Science Fiction Genre". Despite the broadness of the genre, and the variety of sub-genres it encompasses, Suvin makes an attempt to come up with an all-encompassing definition for science fiction works that was inclusive of all materials coming under the umbrella. He coins two terms in relation to science-fiction; cognitive estrangement, and *novum*, the latter being a Latin term meaning 'new thing'. Regarding this newness, he defines science fiction as "the literature of cognitive estrangement"(372). He also takes the time to explore the notion of science-fiction utilizing this as a method to explore phenomenon, rather than just seek to solve them outright.

This is important to Novum firstly in that, to do a study of anything, it's important to be able to define what it is your work encompasses. As research in this format is based heavily off science-papers, having a categorical or quantitative way to define how you're studying is a necessity. While developing Novum, I needed to define how I was using the scope of the science fiction genre, and specify how I was approaching the genre as context for the rest of my research. Thus, my definition of science fiction is based off of Suvin's work. I decided to define science fiction as "any body of work that embodies the idea of 'novum' as a major concept in its identity." This ensures that works are not excluded from my contextual review of the genre, while also leaving leeway for cross-genre ideas, such as science-fantasy. Secondly, since this concept of defining sci-fi had such an impact on how I approached my thesis, this project is names Novum in homage to Suvin's work.

Even after coming up with a personal definition to convey what I was talking about, science-fiction is still a broad genre that is old enough for there to be conflicting schools of thought about where it starts. Because of this, it was necessary to poke around further in the roots of sci-fi, and to study its history.

This lead to my reading of "Science Fiction" by Adam Charles Roberts. This book is a literary criticism of the science fiction genre. Exploring the history of sci-fi, he talks about the 'encounter with difference', much the same as Suvin uses the term novum. He speaks to the history of science fiction, before bringing up a few social and technological points that require discussion (gender, race and technology) and how each is represented.

Science fiction is neither apolitical, or free of bias. Understanding representation in the genre, and advancements through history, can help pave the way for diversity in fiction. It's specifically important to Novum in regards to the handling of issues like xenophobia, and also

with de-gendering the language used so that it is both respectful and accessible in content for participants in the experience.

This was interesting to consider in the context of the paper “Introduction: [S]cience [F]iction and [B]iopolitics” by Sherryl Vint. She studied a more narrowed view in sci-fi, looking at the bio-political implications in a variety of works. Some of it was negative, as is to be expected when dealing with heavy handed topics, but some are more light and hopeful, like the observations she makes on efficiency and multi-culturalism in Star Trek.

Both of these writings came to mind when I was selecting and studying the story that became the basis of my played experience. This story is “The Aliens”, by Murray Leinster; overall, these works hit on the same points of science-fiction always containing bias, and cultural influence. Thus it is the responsibility of science-fiction and creators in science fiction to be mindful of the moral, cultural, and socio-political implications of their works, and to create them in a way that their commentary is respectful of the topic at hand, while also taking into account that their content does not exist in a vacuum and has an effect on the people who experience it.

Progressing to focus on content itself, the logical progression was to look into the transference of content. Since this is rooted in both storytelling and technology, the work recommended to me was The Role of Transportation in the Persuasiveness of Public Narratives by Melanie Green and Timothy Brock. They write about a principal called transportation theory.

Transportation theory covers the concept of how immersed someone is in the story they’re engaging with. This is based off of three main points of immersion:

1. Emotional reactions,
2. Mental imagery, and,

3. A loss of access to real-world information. This happens regardless of work quality, and is based solely on user engagement.

VR, AR, and other alternate reality experiences already tick one of the boxes. The nature of the storytelling medium has a loss of real world access for the user, more so than related mediums (like video games) provide. Like other visual mediums, it also helps augment a person's mental imagery. That leaves the emotional reactions – the maker behind the project can focus on this aspect, since the other two are already covered by the medium choice; this was what my focus had to be on in creating Novum, which benefits from the immersion provided by AR as a medium.

While Melanie and Timothy speak about storytelling immersion, Mel Slater speaks about immersion and player presence specifically in VR in the paper "Immersion and the Illusion of Presence in Virtual Reality". Some of the points she considered to be important for immersion are a higher level immersive system, such as a wide field-of-view, high-resolution, stereo, head-tracked head-mounted displays, real-time motion capture, and auditory and haptic feedback

As AR and VR are closely related fields, and many of these points are applicable to both (and therefore, applicable to Novum). High resolution screens, as well as auditory, haptic, and other tactile feedback are important in a medium that is embedding digital artifacts into a physical space, and out of these, I could control both the physical display of the project, and the tactile interface needed to participate in the virtual environment. This was to be comprised of the image targets each participant could handle to change the state of the virtual environment.

This participant participation in shaping narrative is discussed by Pietro Gagliano in his video "Agence". It is a discussion of changing authorship in stories as technology advances. He

discusses the concept of three way authorship, between the original author, the participant, and an AI.

While there is no A.I. in Novum, it is important to consider the dual authorship that comes in any format of interactive entertainment. Research wise, seeing how entertainment becomes less linear, like movies, and more flexible to suit each user will see impact in the future.

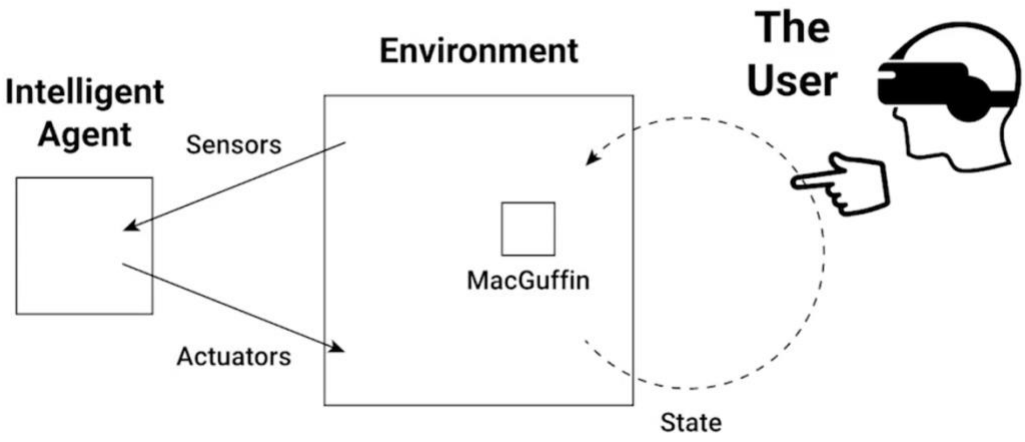


Image 2 Pietro's model of interaction in Agence

With a more solid theoretical basis to work from, studying how established works handled their own narratives was a step of inspiration. The first commercial experience that I wanted to write about it the work from THE VOID. This company creates what they call ‘hyper-reality’ experiences. They make full body, immersive VR experiences, mainly set in established intellectual properties, such as Star Wars. They also have one experience that is based on their own original property, called “Nicodemus: Demon of Evanishment”.

Image 3 An image from The VOID's marketing behind their Star Wars 'hyper-reality' VR experience.

First, this implies there is a sustainable market for this type of experience, and a shift from games as a product to games as a service (and I considered how this would affect user perception of presentation). Secondly, studying how they’ve structured their experiences informed how I could build mine. They keep to short experiences that guide the viewer without making it feel like they’re railroaded in to a single path, and make good use of a tactile environment, even in a VR space.

I conducted a few informal interviews with employees at one of The VOID locations in Florida about the experiences they offered. They will remain nameless for the sake of privacy. Some of the common answers that came up consistently were that they found traversing the world-space was easily taught, even to those with very little literacy in the digital space. It is not

as accessible an experience, and they find that kids at times have more trouble as the equipment is quite heavy.

They do have measures in place for those who do end up having trouble, which they go over. These include raising one's hand to get the attention of an employee, or putting a hand on the wall as a steadying anchor (since all the walls have a real world counterpart).
Out of all the tasks involved, the most time consuming one is the upkeep and maintenance of all the equipment - something that is paralleled historically at DisneyQuest.

The second piece I studied for narrative and construction was “Holojam in Wonderland”, which is an immersive, mixed reality theater performance telling the tale of Alice in Wonderland. They have the audience become participants in the virtual performance space, and have real actors perform inside of the virtual world as well.

Like Novum, Holojam is more a story than a full on game for the audience. And while they are in VR, my work is in AR, which makes the two a good comparative piece. As well, while Novum inhabits the science-fiction space, Holojam in Wonderland inhabits the fantasy genre.

Lastly I did research on a new experience called “Scary Girl”. is a free-roam multi-user experience developed by Dark Slope. They’ve focused on building a site-specific virtual reality experience, and they also plan to make future AR and VR titles.

Image 4 An in game screen-capture from the free roam VR experience Scary Girl, by Dark Slope

As I had a hand in working on this project in collaboration with the Dark Slope

team, it gave me a great deal of insight into participant pathing and how to guide someone through the space. It also was informative, as Dark Slope's work inhabits a similar space to Novum, and being able to study how they integrated the space, and tactility of the game fed into my own research. Being a part of this project gave me a good comparison of how virtual reality and augmented reality are differing in this space, and the span of technical difference and accessibility in creation.

Image 5 One of the experiences that used to be a part of DisneyQuest, as recorded in Rollin's article.

These are all relatively new works, but VR and related mediums are much older, to the point where the practice extends further back than the language used to describe it - the Link Trainer (Jeon 38) (Pope 6), is considered to be the earliest example of virtual reality, and it existed before anyone had described the language that alternate reality experiences use today. Another not-so-old example is the Disney VR space, DisneyQuest, which is no longer operational. "The Dream of DisneyQuest Is Dead", by Rollin Bishop, is an article talking about the now abandoned DisneyQuest experience. Rollin speaks about what DisneyQuest was, and what became of it after its downfall.

The importance comes not from the article, but from the artifact of DisneyQuest. It was pioneering a lot of technology for the time, and the history of virtual reality experiences gives a good timeline for progression. This can provide a basis for examining how alternate reality experiences may look in the future. Secondly, it poses as a warning as well. With how quickly technology becomes obsolete, and the poor practices surrounding preservation in games, it's

clear that creating a repository of work could prove to be problematic. With DisneyQuest itself having sold off or abandoned much of its tech, as well as the lack of preservation of the experiences themselves, there is little record of it to keep it for knowledge for the future. It will be an important consideration to make sure that proper preservation techniques are put into place, and to think about what artifacts are best preserved from Novum. This is considered further in the 'Significance of this Project' section of this paper.

Methodology

I used the IDEO Design Thinking methodology while constructing my case study (See Image 1), as it was the most fitting framework when contemplating this method of entertainment. Already step one could be fulfilled in the brainstorming of the overall question of this paper and step two is well underway. Current inspiration being gathered includes science fiction work that is either a personal inspiration, to dissect what makes each piece so memorable, as well as which science fiction works are financially successful. This is closely linked with step three in the process, which is to generate ideas. Both for the paper and the case study build, this step is still in process, and steps three, four and five will be continuously carried out through the next months. Finally, at the conclusion of this project, step six will be to share it, to both my peers and potentially a larger audience.

Image 6 'Design Thinking: A Method for Creative Problem Solving'. IDEO U, https://www.ideou.com/pages/design-thinking. Accessed 18 Sept. 2018.

IDEO's design is based off of the principles of human-centered design (abbreviated just as HCD) ('Design Thinking'); as written in Eyal Eshet's paper *Human-Centered Design in Mobile Application Development: Emerging Methods*, they summarize the necessity of such design practices in saying that "the HCD approach provides a solid framework of high-level activities for developing interactive systems based on the end-user perspective… Their evolution addresses developments in technology, which becomes more embedded in our lifestyle. Consequently, peoples' relationship with the technology becomes more intimate" (9). Digital development as a whole should follow these principles, not just for application development. Anything that requires a user or participant to interact or react to a digital interface of any sort, it should be tailored in a way that the user does not have to fight with the technology. It should not be taken as a magical fix all when it comes to design, but rather a consideration to creating seamless experiences that are an ease to use, rather than the attempt to complete an activity or task becoming more prevalent than the activity or task itself.

Using a design thinking methodology seemed much more apt than adopting an AGILE Scrum methodology instead, which relies on using short sprint sessions to accomplish a larger task. This method is often used to avoid bottlenecking a project by never letting too long go without check–ins or updates, and often heard of in business workplaces. Higuchi and Nakano point out in their paper "Agile Design: A Combined Model Based on Design Thinking and Agile Methodologies

for Digital Games Projects" that SCRUM and Design Thinking do have some similarities between them. However, while Higuchi and Nakano state that "as expected, game developers already use Agile Methodologies in their game development process. It was also observed that the most popular AM among developers is the SCRUM,"(Higuchi et al. 123) since this has such a heavy reliance on meetings to consolidate work and advance progress, it did not seem like the right methodology to employ for a single person team. This also has some timeline limitations, as due to the scope of the project, iterations can only be made in smaller segments, rather than major overhauls to keep to a coherent piece with a coherent schedule.

Taking this in a broader scope, while IDEO is ideal for their push to tell a story at the end of their process, design thinking as a school of thought is applicable for various applications in a context lateral to 'game making'. As stated in "Making Computer Games and Design Thinking: A Review of Current Software and Strategies", "[d]esign thinking, as the ability to think about—and influence—social systems, can thus be a precursor to learning how to negotiate the complexities of modern life" (Hayes and Games 328). It is namely the influence and thought on social systems that is most applicable in the context of multi-user experiences. Like multi-player, there is an innate social aspect to be explored through the interactions between participants, and between participants and the environment they are interacting with or observing. The five step process is similar to IDEO's, with the steps being *empathize* → *define* → *ideate* → *prototype* → *test* ('Design Thinking Bootleg'). Empathize process to be the most different, aside from the lack of a 'sharing' stage at the end; empathy in design thinking is about leaning about the humans that human centered design products are being geared towards ('Design Thinking Bootleg - Deck'). Using both these processes together will benefit the user, as the product – in this case, the experience – will be catered towards them, and their values.

Challenges and Limitations

Technologically, some of the biggest setbacks are the bugs in the tools being used, which hamper the polish of the final build; some of these bugs are APK bugs, such as a major bug in ARCore that caused errors based on the folder structure of the project. Another large challenge is in finding the proper hardware to actually run the project. Likewise, since the repositories being referenced are in progress, and development makes it difficult to upgrade a project without needing to re-write a large section of the code.

There is currently scope limitations being addressed, in the form of reducing the scope at the moment to accommodate a finished project. The original build size was too ambitious to tackle all at once, and is thus being limited to a smaller build size to try and accomplish more in the time provided.

As a field of study in itself, the technology also poses a challenge. Specifically, as mentioned by Bujari et al in "Optimal configuration of active and backup servers for augmented reality cooperative games", is that "[a]n increasing interest is coming also from researchers due to the technical challenges of AR applications" (2). Specifically they single out cooperative AR gaming as having a large number of technical challenges to overcome, especially in terms of where, what they call 'computational load' is being placed. With augmented reality allowing you to roam, it becomes a challenge of how to host local servers for players who are together, without putting the burden on one of the player's devices. This is less of an issue for site-specific experiences, since the site itself will undoubtedly have a server present, regardless of the medium, however anything disseminated to the public will have a difference issue.

This also leads into challenge two, also regarding technology, and this is in dealing with cost and obsolescence (planned or otherwise). The largest example is apparent in Bishop's article

entitled “The Dream of DisneyQuest Is Dead”. Bishop writes that “ ‘We knew the equipment was too expensive to be practical,’ says one former employee who asked not to be named because their current employer hasn’t permitted them to do interviews, though they are no longer at Disney. ‘But the goal was to buy our way into the future, to learn about VR [ten]-plus years before everyone else.’” This technology, however, did not remain as the technology of the future forever; upkeep is expensive, and at a certain point, is no longer worth it to try and maintain. With technology snowballing in capabilities and upgrades, and changes coming out at least yearly, there will remain the question of how meaningful experiences be created where they will not be obsolete within a year or so of creation.

Significance of the Project

This project will hold significance in an emerging body of work with studies like *Holojam in Wonderland* (Gochfeld et al.). Not only will it seek to categorize current technologies, and provide speculation on the future of an industry, but will also begin to formulate academic work so that we have a body to reference in the future as an academic community. This also hopes to promote the proper preservation of emerging works and experiences before it becomes a problem such as with video games specifically, where many games have not been properly preserved and are no longer around for study, or where it has fallen to the player community to preserve games in a legally-gray area; this is mentioned by Bachell and Barr in “Video Game Preservation in the UK: Independent Games Developers’ Records Management Practices”, that “[f]an-based initiatives now represent some of the most active groups in preserving gaming heritage, which have attracted the interest of more established institutions, who must consider how the growing wealth of fan expertise and resources can be utilised in future projects, or if they should be used at all” (143). With no

established industry standards, and fan preservation being more comprehensive collections of digital games, there is already a dangerous precedent being set for other forms of entertainment media; this danger only grows regarding both the history of alternate reality experiences, specifically in virtual reality, only compounded by many of alternate reality experiences fitting into the 'digital games' umbrella as well.

Looking at the history of VR specifically, the original virtual experiences were not classified as such because he terminology did not exist to describe them yet. The Link Trainer simulation is considered one of the earliest 'VR' experiences (Jeon 38) (Pope 6), and it was a flying simulator that was used by pilots to train and experience what actually flying was supposed to be like, minus the actual aircraft. Pope writes in a paper titled "Introduction to Virtual and Augmented Reality" that "while other fictional genres have kept the idea alive, The Matrix (1999) is considered to be the driving factor for public interest in VR" (Pope, 6). The history is harder to trace since the terms were not coined until long after conception, such as Tom Caddell in 1990 coining the term augmented reality (Pope 7); creating a body of academic study now that these terms and the language to describe them exists are needed to help promote the study of augmented, virtual, extended, and mixed reality as used in entertainment as a valid area of study, which in turn will promote talk around proper preservation of works.

Likewise, while digital games are often persevered through ROM dumping and emulation, and movies through ripping and streaming, these multi-'player' or multi-participant experiences would not be able to be preserved by the community in the same manner. Since many of these would require specialized setups and are displayed on site locations, there are no files accessible to the public to preserve in lieu of companies and developers taking the initiative

to preserve the work. Short of insiders leaking the files, they would be lost forever without proper preservation methods in place for both the hardware and software aspects.

Development Process

My process work is broken out into four main sections for this project:

The storytelling, which is comprised of:

1. The book I based this off of,
2. My analysis, and,
3. How I adapted it for a different medium.

The experience flow, which encompasses:

1. The technical workflow,
2. Player interaction, and,
3. A brief coding overview.

The digital artifacts, which is:

1. 3d modelling components
2. 2d overview, and,
3. Auditory work.

And the prop and setup fabrication, which encompasses:

1. Physical prototyping,
2. Material usage, and,
3. Participant interaction.

Storytelling

"The Aliens" is a novel by Murray Leinster – this was the pseudonym that author William Fitzgerald Jenkins wrote most of his science-fiction work under. "The Aliens" is about

a crew of humans, specifically the protagonist Jon Baird, and an encounter with aliens. It can be considered a hard science fiction read – it does consider science as a factor in play, and still tends to lean to explaining plausible, if impossible at the time of writing, information about the rules of the world. This includes information like what the human crew's ship's physical capabilities are, and a slightly more vague description of the alien one encountered, as well as biological differences.

Some of the themes and tropes from "The Aliens" that I wanted to explore further when creating Novum were:

1. Personal bias: "Baird shook his head, to himself. The Niccola's orders were to make contact without discovery, if such a thing were possible. The ideal would be a Plumie ship or the Plumie civilization itself, located and subject to complete and overwhelming envelopment by human ships—before the Plumies knew they'd been discovered. And this would be the human ideal because humans have always had to consider that a stranger might be hostile, until he'd proven otherwise." (13)
2. Xenophobia: "His choice had been deliberate, because he was a xenophobe. ... Because if the Plumies were hostile, a well-adjusted, normal man would never think as much like them as a Taine. He was capable of the kind of thinking Plumies might practice, if they were xenophobes themselves." (13)
3. Non-conformity: "'I'm trying,' said Baird bitterly, 'according to orders!' But he disagreed with those orders. It was official theory that arithmetic values, repeated in proper order, would be the way to open conversation. The assumption was that any rational creature would grasp the idea that orderly signals were rational attempts to open communication. But it had occurred to Baird that a Plumie might not see this point." (16)

4. Communication: "The Plumie gazed about with an air of lively curiosity. Then he drew out a flat pad with a white surface and sketched swiftly. He offered it to the Niccola's skipper." (26)

Despite not being a well-known work, The Aliens seemed like the perfect work for adaptation for a few reasons:

1. Many of these topics are still currently relevant today.
2. It had enough world-building to provide a good frame of reference, without a rigid timeline.
3. The classic science-fiction tropes of aliens and space would fit the criteria of my definition, and view that way to a viewer as well, in familiarity.

Keeping these topics, and the main themes of the story in mind, I adapted Murray's work for my own story. The first part comes through in the explained story: both participants are applicants to join the Niccola's mission in space (the Niccola being the ship from the novel). This serves as a prequel to the original story. The interactive experience is a very brief test for both participants, and they are both allowed the option to interact with additional objects to gain additional story cues from them.

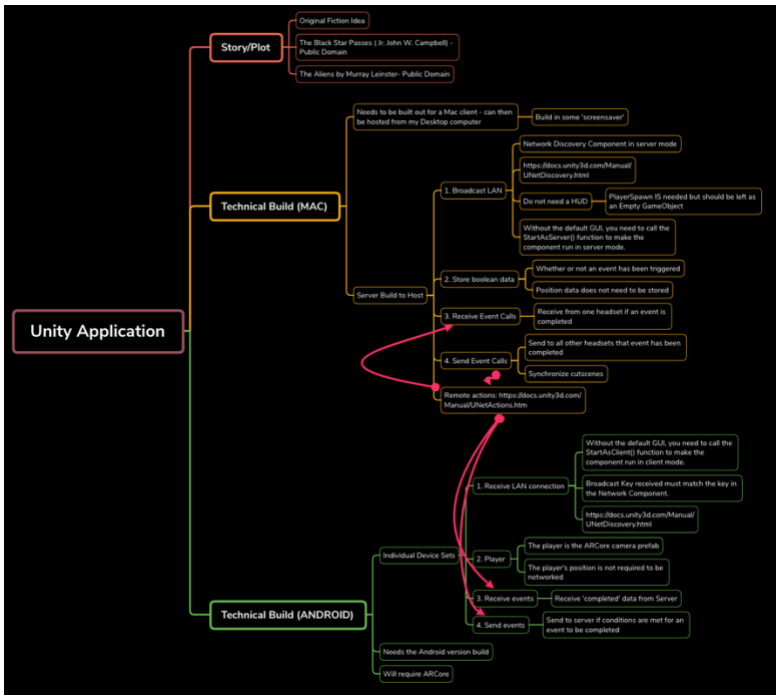
The rest would be explored in the method of storytelling itself. Part of this falls back on the trope of an unreliable narrator. In the context of the participant's test, the answers that may seem more intuitive or correct are generally not, and are there to make the participant uncomfortable and doubt both themselves and their test partner.

Experience Flow

Version one of my experience flow was created to try and envision the interaction between participants. This was changed drastically between this version and the final, as the

participants were much more involved with one another than with the experience itself at this point in time.

Version two of Novum's experience flow focused more on the technical side of Novum. This include how the devices would interact with one another, and what setup was required for this to work. At this point in time, I was still utilizing Unity's built in server functionality and relying on a third server host (a Mac computer that would host the LAN) to manage the experience.



While this setup would work in theory, poor documentation on the Unity server manager made it difficult to implement in a way that was both functional and efficient.

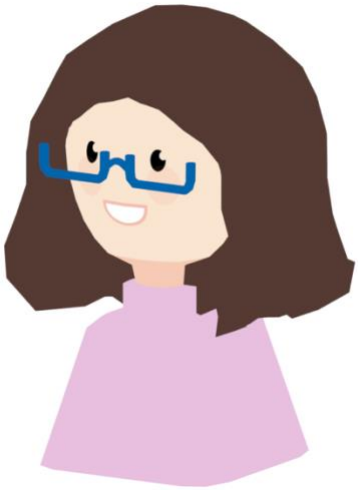
Version three of Novum's experience flow focused on a scoped down two-participant version of Novum, and was the version the final experience was built from. This version made use of a recommended tool called PubNub for development, to handle the server side of Novum. This easily hooked into Unity through a few different library calls, and allowed for more time to be spent in developing the narrative interaction, and the physical props that were used for the final setup.

Digital Artifacts

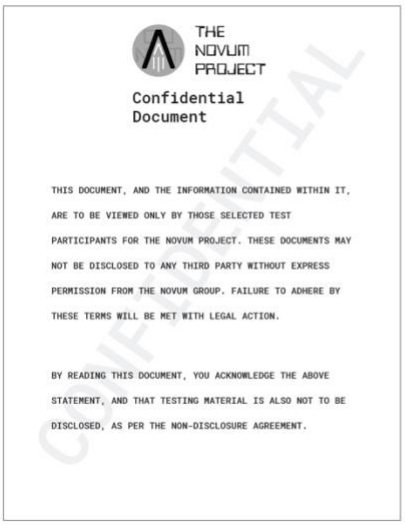
Creation of digital artifacts drew from 2D, 3D, programmatic, and audio creations that all facilitated the digital half of the experience. Unity was used as the main framework for creating the application itself, while Blender was used to create the 3D models. All models had to follow the rules that any low-poly art generally takes into consideration. Minimizing the number of polygons was crucial in ensuring the application would still run smoothly on a mobile device, and this not disrupt the participant's experience with lag or latency. The second reason for creating simplistic models, such as the ones shown on the right, was due to the smaller screen real-estate visible on a mobile phone. Since the screen space is much smaller than a computer or tablet, and there would already be visual clutter from the camera itself (since the augmented reality portion would give view of

the physical props as well), the models themselves needed to be simplistic and easy to recognize at a glance.

2D design skills were utilized in two separate places. One, in the creation of paper printouts to be handled by the player (see the Physical Setup and Fabrications section). The second was for some minimal UI elements to teach the participant how to use the physical objects within the augmented reality setting, giving guidelines on where image targets needed to be aligned to be visible in the digital space.



The last set of digital artifacts that were needed were the audio cues for the participants. While the script of dialogue was written, IBM's text to speech was used to create the actual voiceover. This allowed for the inflection to still be modified for voice lines, while also maintaining a distance, cold, and slightly robotic sounding narrator to overlay the participant's actions.


THE NOVUM PROJECT

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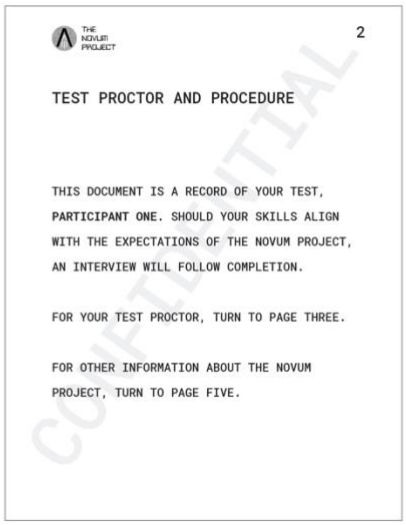

2

TEST PROCTOR AND PROCEDURE

THIS DOCUMENT IS A RECORD OF YOUR TEST, PARTICIPANT ONE. SHOULD YOUR SKILLS ALIGN WITH THE EXPECTATIONS OF THE NOVUM PROJECT, AN INTERVIEW WILL FOLLOW COMPLETION.

FOR YOUR TEST PROCTOR, TURN TO PAGE THREE.

FOR OTHER INFORMATION ABOUT THE NOVUM PROJECT, TURN TO PAGE FIVE.


3

PLACE ME IN FRONT OF YOUR TESTING APPARATUS

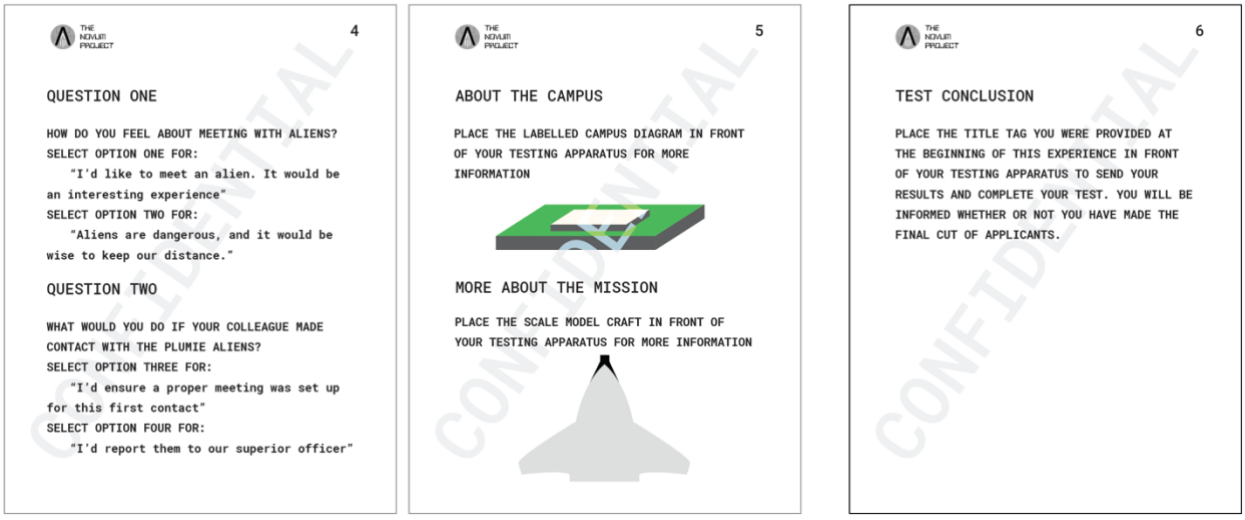


Image 7 These documents were designed to have a very simple, sterile look and feel. Only the image target, or indicators of the image target, are used in colour as a focal point. The text used is a clean sans-serif to make it easily legible for any participant.

Physical Setup and Fabrications

Physical fabrication was an important factor in building Novum, as augmented reality provides the ability to interact with real world objects while in a virtual space. Not utilizing this would have been a mistake, as it would have not used the full potential of the medium for the purposes of this study. Mould-making, sculpture, and rapid prototyping was all required in the creation of the individual props that would be both interesting to view and had a pleasant textural feel for participants to handle. They also still had to match the overarching theme of science fiction so as not to feel out of place in the experience.

Version one of physical fabrications was kept exceptionally simple for testing purposes. Paper only targets were used by themselves as easy to replace image targets. This was done while starting out with the ARCore kit for Unity3D, since ARCore has an image scoring system built in. Each image is given a score from zero to one hundred, with zero being unrecognizable and having no distinguishable feature points, to one hundred being the maximum recognizability of the image, and lots of unique feature points it could be detected by.

Version two experimented with the form of objects. Using balsa wood as an inexpensive prototyping material, different mock-ups were assembles to test what felt best for the participant to hold. Cubes were one of the least pleasing, since they had no 'correct' direction to be oriented. Pyramids, however, worked well due to the fact they could be marked to have a right side up, which helped gui machine helped to speed up this process considerably.

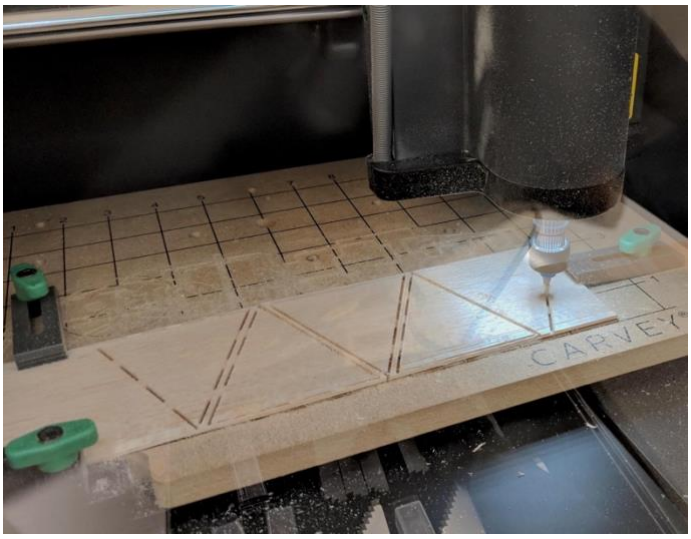


Image 8 CNC cutting of the initial prototyping mockups.

Version three was done using durable materials, and took on a form factor that was used in the final build. This included creating objects like space-ships, where an image target could be attached to one side, but the object was still visibly appealing from all sides. Other objects that were used were a combination of bought objects and created designs, such as the clipboards used for the participant's 'testing materials'. These were disguised as small info packets of top-secret information, while image targets for the participant to interact with were scattered throughout the

Image 9 A model of a space ship, before the sanding process. Bondo has been used for durability on this model.

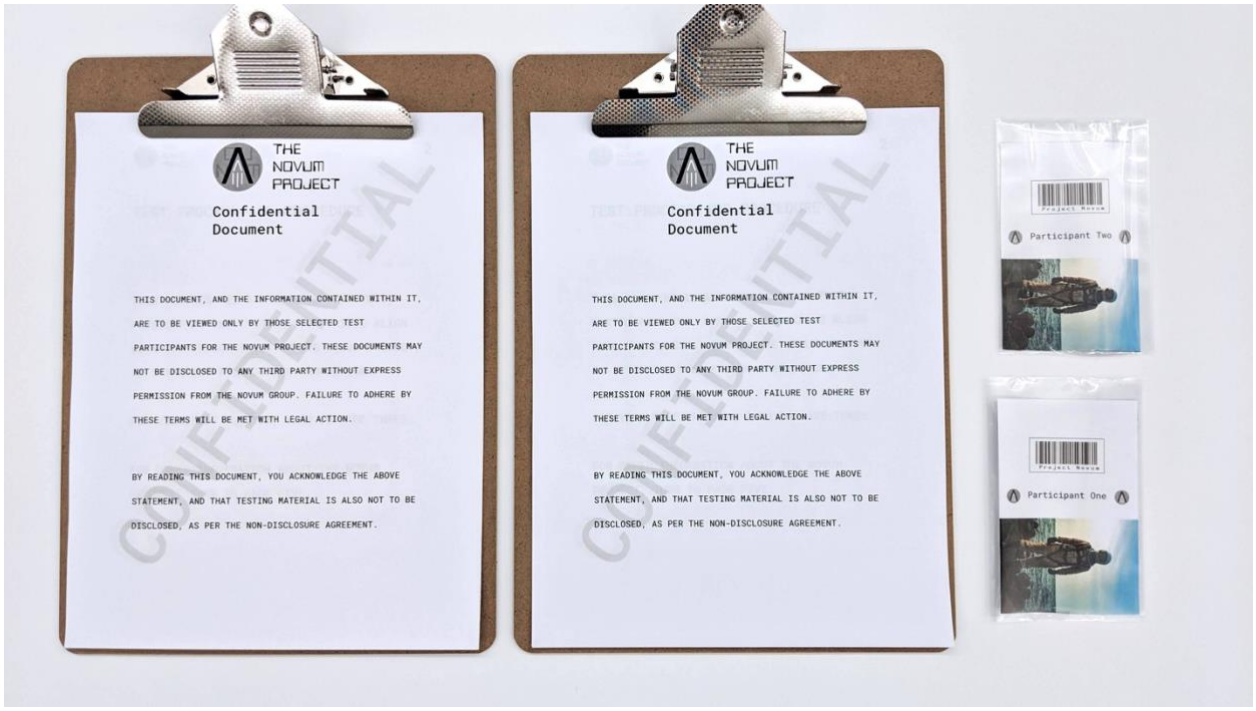


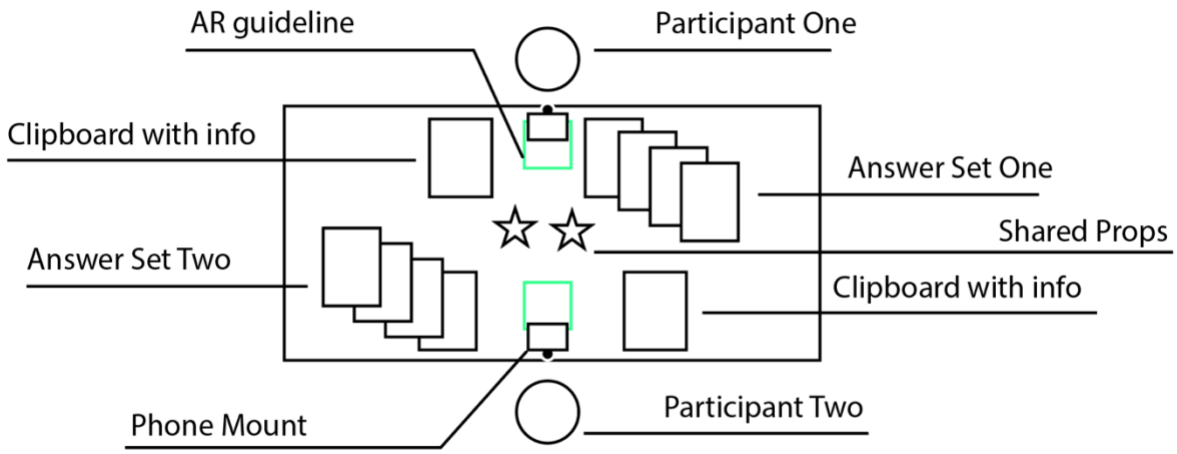
Image 10 The participant's clipboards. The text content is partly for immersion and storytelling, to give the props a certain amount of authenticity. The rest provides some brief participant instruction and the AR targets. The participant's name badges also provide an AR target, giving a sense of professionalism and belonging to another prop.

document itself to blend that feeling of a test situation with the necessary requirements of the image markers to still be recognized by the application

Due to needing the durability for constant handling, these objects were created out of materials such as Bondo (a brand of car filler used in automotive repairs). This knowledge was brought from the cosplay and crafting communities, which often make use of such products to enhance the durability of props and costumes created so they can be worn and handled without a large risk of breakage.

Part of what was necessary for this setup was some way to mount both phones that were being used. Since it is a dual player experience, each needed their own phone running the program, and it needed to be setup in a way that ensured neither participant needed to touch the screen for the duration of the experience. This was so that the participants can focus on handling the physical objects, and not handling the screen itself.

The solution to this was using gooseneck phone mounts - this gave enough flexibility to position them comfortably at each participant's work station, while also enough stability to keep them in place for the duration of the experience. As had come up in some testing, the initial setup favoured right handed individuals, due to the way the coil was setup.



The above diagram was created after this realization, to ensure that a full setup between two participants would be used by both left and right handed individuals equally, with an upwards coil in the center to support the mobile device.

Shared props are placed between the two participants, ensuring there is both digital and physical interactions between the two of them. Considering the tense narrative implemented and the exclusionary theme, it is intended to be an uncomfortable setup, as the players must acknowledge and suspect one another through the duration of the experience.

Final Thoughts and Further Development

Between my primary case study, and my research, I have concluded that there are a few major impacts participatory science-fiction will have on entertainment media:

1. Entertainment, and games specifically, will be viewed more as a service, not a product,
2. Shorter experiences will become more prevalent for the everyday consumer, and,

3. Self-representation will become easier, however creatives will need to take a stance in science fiction to ensure toxicity stays to a minimum, and that representation overall is healthy in their experiences.
4. The preservation of entertainment will become more difficult and less observed. However, independent creators will better maintain this content than large companies.

Entertainment as a service takes into account both the decline of movies as a service, and the decline of the box office, with the need for space for participatory entertainment. VR and AR often have much larger space requirements than traditional games and entertainment do, both to setup equipment, store equipment, and to actually run the experience at hand. The individual consumer is unlikely to be able to afford the equipment or the space, and it is much more feasible to go somewhere to participate with friends. Since theater companies, like Cineplex, are already placing VR in alternate entertainment spaces, such as The Rec Room (‘The Rec Room’, n.d.), I forecast that movie theater spaces will become less oriented to just showing movies, and that more and more alternative group entertainment with a new, exciting gimmick will take its place.

From here, these experience will adopt a shorter time length than what is previously seen in site specific entertainment. Unlike movies, or the theater, or even AAA games, participatory, alternate reality experiences will benefit more so from the shortened experience time. Firstly, they can get more people through the door to the experience. Secondly, there is a greater chance of enjoyment without fatigue for the participants themselves. While testing Novum, experiences from The VOID, and Scary Girl, fatigue makes its presence known mainly in physical form. For augmented reality, like Novum, this is a physical fatigue that comes from handling unique, but non-ergonomic objects for long periods of time. They are engineered to fit the world-space, and for participant interest, but are too heavy and unwieldy to be used for long stretches of time at

once. For virtual reality experiences, fatigue comes from having to carry the equipment itself around, whether this be from the headsets, controllers, or haptic devices. There is also a degree of eye fatigue, due to having the screen from the headset so close to the participant's eyes, that is a contributing factor to shorter term use.

This will lead to shorter stories for narrative pieces. For established titles, these stories will either focus entirely on established characters, or small player spin-off missions that build small bits of lore around the world space. For independent titles, this is more conducive to either short, episodic structure stories, focused on one-shot storytelling, or series based stories where participants come back over multiple sessions for each 'episode' of the story (where then there is the opportunity to build off of character and world lore). In science-fiction, this could lead to more 'soft' science fiction stories, with looser rules, instead of hard science fiction which would need more time to explain the inner workings of the science behind it.

Ultimately, a play experience will be between fifteen and thirty minutes in length as a maximum, not making participants make a large time commitment, and ensuring that a proper orientation, and switchover time can be accomplished. This also provides less of a strain on the technology, as headsets and other electronic devices are being swapped out between play groups for cleaning, maintenance and charging.

Lastly, story wise, self-representation and the notion of representation as a whole will become a topic of importance. As mentioned earlier in this paper, science-fiction has a responsibility to be mindful of their context and the implications (whether subtext or otherwise) are not harmful to the community at large.

With VR and AR providing a medium for first person experiences, one point that is worth bringing up is the language of gender. To be sensitive to participants, it would be

beneficial to use more gender neutral language within first-person entertainment (where the participant may or may not have the option to customize a character in this setting) to be inclusive of all participants.

Secondly is the actual story-content. While utilizing a medium that is inherently better at transporting a participant to a new space, content needs to be curated in a way that maintains the participant's boundaries. Experiences with mature content need to be rated in a way that informs those considering engaging with it of the content within, and content warnings need to be more specific. An example of a source that currently does this fairly well is IMDb, which has a breakdown of content warnings per show, and the instances of it. If this were applied to all media, with such a detailed breakdown, it would be safer for participants to pick and choose experiences that are not going to make them uncomfortable, or cross any boundaries that make them feel unsafe, or relive past unpleasant experiences.

Lastly is the actual content itself that is produced. Looking specifically to games, there is a large enough amount of gratuitous content that is demeaning or degrading on purposes, or that creates a toxic community around. With alternate reality experiences being a new branch that is lateral to the games industry, it will be up to current creators to create a safe space for creators and participants alike. With a larger barrier to content showcasing, due to setup, maintenance, and space, it is easier for hosting facilities to curate what content is and is not shown. They will have a responsibility to pick science-fiction that is tasteful, and to support a more positive, in person community for everyone to enjoy.

In regards to preservation, games themselves have already proven to be difficult to keep historical copies preserved, due to licencing, copyright, and the lack of initiative from larger companies. This is going to be a larger problem still with the rapidly changing technologies of

alternate reality. This will include both peripherals, hardware, and the emulation software needed. It is independent creators that will preserve the most amount of this content. One, this will exist in creators putting up their development process across social media sites, and services such as Patreon. Second, independent developers will have slower turnover times to make new work, which means their existing work has to last to be played much longer. Thirdly, with more control over their creation's IP, and more flexibility on contract than with established IPs, discontinued works have the potential to be stored online for others to access in the future.

This is precisely the route I am taking with Novum for future consideration. The codebase is kept publicly on my GitHub account, for others to use in a non-commercial way. This will include all the digital assets used to run the experience. As well, all physical props and setup documentation will be on my website to be archived, so in the future it could be recreated by others. This ensures that even when it stops seeing development, it is never truly going to vanish and be lost to time.

Works Cited

alessia-ip. *Novum*. Thesis. 2018. 2018. GitHub, https://github.com/alessia-ip/Novum.

Bachell, Alasdair, and Matthew Barr. View of Video Game Preservation in the UK: A Survey of Records Management Practices. Oct. 2014, doi:10.2218/ijdc.v9i2.294.

Bishop, Rollin. 'The Dream of DisneyQuest Is Dead'. Polygon, 18 Oct. 2018, https://www.polygon.com/features/2018/10/18/17888722/disneyquest-disney-vr-closed

Box Office Mojo. "Box Office Revenue of The Highest Grossing Movies in North America in 2017 (in Million U.S. Dollars)." *Statista - The Statistics Portal,* Statista, www.statista.com/statistics/794432/box-office-revenue-of-the-top-grossing-movies/, Accessed 18 Sep 2018

Bujari, Armir, et al. 'Optimal Configuration of Active and Backup Servers for Augmented Reality Cooperative Games'. Concurrency and Computation: Practice and Experience, vol. 30, no. 20, Oct. 2018, p. e4454. Wiley Online Library, doi:10.1002/cpe.4454.

Campbell, John W., et al. *The Black Star Passes.* Ace Books, Inc., 1953. Project Gutenburg , www.gutenberg.org/ebooks/20707.

Cummings, James J., and Jeremy N. Bailenson. 'How Immersive Is Enough? A Meta-Analysis of the Effect of Immersive Technology on User Presence'. Media Psychology, vol. 19, no. 2, Apr. 2016, pp. 272–309, doi:10.1080/15213269.2015.1015740.

'Design Thinking: A Method for Creative Problem Solving'. IDEO U, https://www.ideou.com/pages/design-thinking. Accessed 18 Sept. 2018.

'Design Thinking Bootleg'. Stanford d.School, https://dschool.stanford.edu/resources/design-thinking-bootleg. Accessed 5 Oct. 2018

‘Design Thinking Bootleg - Deck’. Stanford d.School, https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/5b19b2f2aa4a99e99b26b6bb/1528410876119/dschool_bootleg_deck_2018_final_sm+%282%29.pdf. Accessed 5 Oct. 2018

Digital Entertainment Group. "Consumer Spending on Digital Home Entertainment in The United States from 1999 to 2017 (in Billion U.S. Dollars)." *Statista - The Statistics Portal*, Statista, www.statista.com/statistics/188941/us-consumer-spendings-on-digital-distribution-since-1999/, Accessed 18 Sep 2018

Digital Entertainment Group. "Consumer Spending on Digital Home Entertainment in The United States from 2012 to 2017, by Type (in Billion U.S. Dollars)." *Statista - The Statistics Portal*, Statista, www.statista.com/statistics/296345/us-consumer-spendings-on-digital-entertainment-by-type/, Accessed 18 Sep 2018

Durkin, Erin. ‘Space Force: All You Need to Know about Trump’s Bold New Interstellar Plan’. The Guardian, 10 Aug. 2018. www.theguardian.com, https://www.theguardian.com/us-news/2018/aug/10/space-force-everything-you-need-to-know.

Eshet, Eyal. "Human-Centered Design in Mobile Application Development: Emerging Methods." *International Journal of Mobile Human Computer Interaction*, vol. 4, no. 4, 2012. Academic OneFile, http://link.galegroup.com.ocadu.idm.oclc.org/apps/doc/A425363133/AONE?u=toro37158&sid=AONE&xid=fc669fa0. Accessed 19 Sept. 2018.

Gochfeld, David, et al. ‘Holojam in Wonderland: Immersive Mixed Reality Theater’. *Leonardo*, vol. 51, no. 4, Aug. 2018, pp. 362–67.

Green, Melanie C., and Timothy C. Brock. ‘The Role of Transportation in the Persuasiveness of Public Narratives.’ *Journal of Personality and Social Psychology*, vol. 79, no. 5, 2000, pp. 701–21. *Crossref*, doi:10.1037//0022-3514.79.5.701.

Higgins, Vincent. ‘Augmented & Virtual Reality: The Future of Work, Not Just Play’. *Professional Safety*, vol. 62, no. 6, June 2017, pp. 86–87.

Jeon, Chihyung. ‘The Virtual Flier: The Link Trainer, Flight Simulation, and Pilot Identity’. *Technology and Culture*, vol. 56, no. 1, Feb. 2015, pp. 28–53. *Project MUSE*, doi:10.1353/tech.2015.0017.

Leinster, Murray. *The Aliens.* 1959. Project Gutenburg , www.gutenberg.org/ebooks/24104.

Makoto Higuchi, Marcelo, and Davi Noboru Nakano. " Projeto Agil: Um Modelo Combinado Com Base Em Pensamentos De Desenho E Metodologias Agilais Para Projetos De Jogos Digital." *Revista de Gestao e Projetos*, vol. 8, no. 2, 2017, p. 109+. Academic OneFile, http://link.galegroup.com.ocadu.idm.oclc.org/apps/doc/A513194896/AONE?u=toro37158&sid=AONE&xid=5800ad28. Accessed 19 Sept. 2018.

M. Curlango Rosas, Cecilia & Ibarra Esquer, Jorge & Etelbina Chávez Valenzuela, Gloria & Gonzalez, Maria & Eugenia Arredondo Acosta, Linda & Rodriguez, Marcela. (2014). Understanding Game Playing Preferences. CLEI Electronic Journal. 17. 10-10.

Pope, Hannah. ‘Introduction to Virtual and Augmented Reality’. *Library Technology Reports*, Aug. 2018, http://link.galegroup.com.ocadu.idm.oclc.org/apps/doc/A553126268/AONE?sid=googlescholar.

Roberts, A. C. (2006). Science Fiction. Routledge. Retrieved from https://books.google.ca/books?id=RAvM9els2acC

Robertson, Adi. ‘Former VR Film Company Jaunt Is Giving up on VR to Focus on Augmented Reality’. *The Verge*, 15 Oct. 2018, https://www.theverge.com/2018/10/15/17980420/jaunt-vr-layoffs-ar-focus-switch-restructuring-xr-platform.

Slater, Mel. ‘Immersion and the Illusion of Presence in Virtual Reality’. *British Journal of Psychology*, vol. 109, no. 3, Aug. 2018, pp. 431–33. *Wiley Online Library*, doi:10.1111/bjop.12305.

Suvin, Darko. ‘On the Poetics of the Science Fiction Genre’. *College English*, vol. 34, no. 3, 1972, pp. 372–82. JSTOR, doi:10.2307/375141.

The Rec Room. (n.d.). Retrieved 22 March 2019, from http://www.therecroom.com

THE VOID - Step Beyond Reality. https://www.thevoid.com/. Accessed 31 Mar. 2018.

‘Top Trends in the Gartner Hype Cycle for Emerging Technologies, 2017’. *Gartner*, 15 Aug. 2017, https://www.gartner.com/smarterwithgartner/top-trends-in-the-gartner-hype-cycle-for-emerging-technologies-2017/.

US Census Bureau. "Estimated Revenue of U.S. Movie Theaters from 2005 to 2016 (in Billion U.S. Dollars*)." Statista - The Statistics Portal*, Statista, www.statista.com/statistics/184147/estimated-revenue-of-us-movie-theaters-since-2005/, Accessed 18 Sep 2018

Vint, Sherryl. ‘Introduction: Science Fiction and Biopolitics’. Science Fiction Film and Television, vol. 4, no. 2, Oct. 2011, pp. 161-. Academic OneFile.

Wikipedia. "Highest Grossing Film Franchises and Series Worldwide as of July 2018 (in Billion U.S. Dollars)." *Statista - The Statistics Portal*, Statista, www.statista.com/statistics/317408/highest-grossing-film-franchises-series/, Accessed 18 Sep 2018