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Designing for the Hybrid Body

Presence, Representation, and Self in Virtual Reality

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2. Abstract

The notion of embodiment in virtual reality as a culmination between the sense of self-location, sense of agency, and a sense of body ownership is key to understand as an underlying structure framing the user's experience and understanding within a virtual environment. In this research, rapid qualitative research methods are first used to contextualize and create a base of understanding for issues surrounding online disinhibition in online multi-player virtual reality games. This thesis explores inter-player interactions in the two games *QuiVR*, a competitive virtual reality archery game, and *VRChat*, a multiplayer, virtual reality game with a focus on social interactions and user-created content and analyzes the relationship between observed instances of toxic online disinhibition and developer design decisions. Both sets of qualitative findings then form a precedent for design experiments, which look to ways in which abstracted representations and alternative or augmented movement mapping can affect user experience. Together, this research bridges the gap between the potential for embodiment in virtual reality and how it affects the potential for bodily experiences by players of toxic online disinhibition.

3. Introduction

In 1992, above the streets of Adelaide, South Australia, the collective VNS Matrix affixed their “Cyberfeminist Manifesto for the 21st Century” upon a 6’x18’ billboard, a pivotal event that served as both culmination and bold expression of their core philosophy.¹ It proposed in deliberately radical terms that technology can offer alternative modes of identity and sexuality, a creative force for new identities. VNS Matrix saw then-emerging technologies like the web as liberating, something that could be more than an extension of the office or everyday life. As an increasingly pervasive sphere adjacent to broader, physical existence, interactive technologies could be fundamentally transformative spaces for expression and experience. Decades later, we must wonder whether we can find these ideas in our use of current technologies. If the experience with interactive technology does not lead to a transformative social or cultural practice, then how can we envision potential interactions or systems that allow for more expressive and alternative experiences? This thesis looks to answer this broader concern by focusing on two related questions: How have interactive technologies grown as sites for alternative and experimental identities, and what novel modes of being, if any, have emerged? Conversely, to what extent do virtual experiences actually replicate gendered power structures from broader society?

I consider these questions through the lens of user interaction with the design of interactive virtual spaces. I delve into one of the most salient reinforcements of power structures: online harassment. By beginning my research in the extremes of user behavior, I hope to create a basis of understanding for the next interactive opportunity: virtual reality.

I was first drawn to this topic when I encountered the case of Jordan Belamire. On October 20th, 2016, Belamire published an article on Medium.com, describing a disturbing experience she had in the game *QuiVR*, a competitive archery game where player²s use abstracted avatars represented solely by helmets and virtual hands. In her article, “My First Virtual Reality Groping”, Belamire describes how she was playing on her brother-in-law’s HTC Vive, and was enjoying her experience when she was approached by another player, “BigBro442.” She watched as his “floating hand approached [her] body, and he started to virtually rub [her] chest”. She then tried and run away from the other player within the game, but he “chase[d] [her] around, making grabbing and pinching motions near [her] chest”. The assault finished when “BigBro442” shoved “his hand toward [her]

¹ O’Farrell, Mary A., and Lynne Vallone. *Virtual Gender: Fantasies of Subjectivity and Embodiment*. University of Michigan Press, Ann Arbor, 1999.

²**Note:** When using the term player in this research, I am referring to virtual users who are participating in the act of play as defined Caillois and referenced by Celia Pearce in *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. The act of play is characterized as:

1. Free
2. Separate
3. Uncertain
4. Unproductive
5. Governed by rules
6. Fictive

For the purposes of this research, I have omitted the characteristic “free” from my definition of play and so player, as often games are a product that are bought and then enjoyed. While some of these characteristics are problematic (for example, there is a larger conversation surrounding games and play on whether or not they are truly, or must be, unproductive).

virtual crotch and began rubbing”. According to the author, she only played the game for three minutes.³

Online harassment is not a new phenomenon, and is certainly not isolated to games in virtual reality. In 2014, and then again in 2017, the Pew Research Center conducted extensive and informative research projects that catalog the differences in online experiences between American users along gendered and racial lines. They show that users who identify as female are more often stalked, sexually harassed, and virtually assaulted. The surveys demonstrate that online harassment exists along a spectrum. At its best, harassment serves as the background noise of the internet. Mild and malicious internet music that users are expected to ignore. Extreme scenarios are defined by whether or not they affect users beyond the internet, compromising the privacy and physical safety of users.⁴ While the Pew Research Center offers the numbers on sexual harassment, they offer little insight into whether or not harassment has ongoing effect on users.

Researcher Jesse Fox has promoted the notion of “rumination” as a valid and serious consequence of online harassment. Throughout her career, she has focused on the ramifications of harassment off the screen through surveys and user observations. She has built a case that online harassment should be taken seriously as a detrimental component of the online experience, which makes the counter-arguments against the validity of Jordan Belamire’s experience that much more baffling. In one particular Reddit thread about her experience, the discussion revolved around two camps: the first, those who empathized with Jordan Belamire, and the second, those who questioned the very reality of her experience.⁵

There is a disconnect between the understanding of harassment in virtual reality and other online spaces. On the one hand, one’s online presence can be weaponized. In the case of Zoe Quinn, a video game developer and journalist, her online presence became a source of vulnerability as her ex-boyfriend who, after the two broke up, set out to tarnish his ex-girlfriend’s reputation as a non-biased journalist.⁶ It soon became a movement engulfing several gaming publications and other female game developers. Many victims faced such a magnitude of harassment that they were compelled to shut down social media accounts, cancel speaking events due to bomb threats, and even, in some cases, to move from their homes for fear of harm coming to their families.⁷

On the other hand, there are direct instances of online harassment that arise in games. “Teabagging” is a common example of online harassment in video games. A virtual victory lap,

³ Belamire, Jordan. “My First Virtual Reality Groping – Athena Talks – Medium.” Medium, Athena Talks, 20 Oct. 2016, medium.com/sathena-talks/my-first-virtual-reality-sexual-assault-2330410b62ee.

⁴ Pew Research Center, 2017, “Online Harassment”, available at <http://www.pewinternet.org/2017/07/11/online-harassment-2017/>

⁵ “QuiVr - Our response to the issue of harassment in VR • r/Vive.” Reddit.com, 2016, www.reddit.com/r/Vive/comments/59dnaq/quivr_our_response_to_the_issue_of_harassment_in/.

⁶ Hathaway, Jay . "What Is Gamergate, and Why? An Explainer for Non-Geeks." *Gawker.com*. N.p., 10 Oct. 2014. Web. 15 Dec. 2016. <<http://gawker.com/what-is-gamergate-and-why-an-explainer-for-non-geeks-1642909080>>.

⁷ Wingfield, Nick. "Feminist Critics of Video Games Facing Threats in "GamerGate" Campaign." *The New York Times*. The New York Times, 15 Oct. 2014. Web. 15 Dec. 2016. <https://www.nytimes.com/2014/10/16/technology/gamergate-women-video-game-threats-anita-sarkeesian.html?_r=0>

teabagging is the act of one player using their avatar to squat over the face of a felled player. In precedents of teabagging, the player often views the act enacted on them from a third or first person perspective. The virtual reality headset adds a new layer in the emotional response to physical acts enacted one's virtual avatar in that the player can see, in direct relation to their body, the action of another player.

Online harassment is largely a social and cultural issue. However, when in virtual reality, a design perspective becomes important because it can illustrate social, psychological, and spatial issues surrounding online harassment in the same medium they are experienced in: online virtual reality games. In the following chapters, I use a cross-disciplinary approach to understand issues surrounding gender in online spaces and to explore the concept of online harassment as a sub-category of online disinhibition, a theoretical structure for framing and understanding the extremes of online use behavior.

In the Background chapter, I intertwine precedents in the arts, digital ethnography, information science, cognitive science, and design to formulate a multi-faceted understanding of online spaces. In this light, I discuss how power structures are replicated and ultimately reinforced online. I then focus on online gaming communities, and illustrate how a mythology that surrounds female players as a consumer base is created, and maintained, by these power structures. I establish and analyze the artistic precedents surrounding the body and technology. I found it important to incorporate the works of select artists as they push the boundaries of perception, the body and its potential for interaction. Altogether, this chapter is meant to establish a clear understanding of previous studies regarding online behavior and create a basis of understanding so that, moving forward in the thesis, the research can create an understanding for how online harassment and reinforcement of gender-focused power structures are similar, or altered, in virtual reality spaces.

In the first section of my Methods chapter, I derive a methodological framework set by digital ethnographers such as Celia Pearce in her work *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds* as well as the works of Tom Boellstorff and Bonnie Nardi. I have conducted a multi-sited qualitative observation in the online multiplayer virtual reality games *QuiVR* and *VRChat*. In my first qualitative observation, I document my experience in the game *QuiVR*, the site of Jordan Belamire's own assault. Within this section, I sought to explore further how the structure of the gameplay itself might lend itself to the type of event that Jordan Belamire experienced. I then use my own background in architecture and design to formulate my own theory on how the spatial components of *QuiVR* might lend itself to a heightened weaponization of social interactions.

After delving into the community and analyzing the game play of *QuiVR*, my Methods chapter then moves onto the second site of my qualitative observations: *VRChat*, an online social forum set in virtual reality. In my analysis of my observations, I overlay my observations of instances of online disinhibition with how players use their avatars physically or in relation to their surroundings. By focusing on spatial and verbal interactions, I reflect on how players view the boundaries between themselves and their bodies by observing how they use their avatars during moments of high stress such as events of toxic online disinhibition. I then created a rubric based on Scott McCloud's theory on representation and empathy "The Big Triangle"⁸ to evaluate the diversity of user avatars observed during my rapid qualitative research. In his work *Understanding Comics: The Invisible Art*, McCloud draws a correlation between the detail of a character or human representation and a reader's ability to empathize with that representation. This is a useful concept to start to organize the myriad user avatars

⁸ McCloud, Scott. *Understanding Comics: The Invisible Art*. Turtleback Books, New York, NY, 1999.

encountered in my study. The qualitative survey, combined with foundational ideas covered in earlier chapters, leads into a series of original qualitative studies built for this research.

The second section of my Methods chapter includes a series of studies that I developed over the course of a semester that focus on key areas of my observations to better understand how players project themselves into virtual reality environments. I focus on translating my rapid qualitative research into controlled sites for observation. The studies dissect behaviors I have observed and isolated in the first section of qualitative methods to better understand how players understand themselves in the virtual setting. As such, my studies are structured to study the following features of the virtual reality experience: the sense of self-location versus the self-environment, presence in virtual reality, spatial relations between the virtual body and the player, and finally exploring how, when in combination, each individual study contributes to the user experience.

In the game *VRChat*, players are able to incorporate custom worlds and avatars into the game. This activity of customization presents an interesting challenge in that there are few set standards for how players represent themselves. Furthermore, *VRChat* is susceptible to online cultural manifestations such as memes or visual references. This results in an evolving virtual space that reacts and changes with online fads. Drawing from Scott McCloud's "The Big Triangle", I formulate a taxonomy of different types of avatars I observed in the game *VRChat*. I describe the process of creating features and categories for avatars in virtual reality. I also explore the challenges I experienced in trying to create global features for avatars that are customizable by the players and so presented a large range of different instances. Finally, I detail my iteration process and analysis for how social signifiers are adopted in virtual spaces.

Inspired by Oosterhuis' publication and coining of the term, I structure my Discussions chapter under the umbrella term "Hyperbodies in Virtual Reality." In this chapter, I explore how current understandings of user interactions in virtual reality might develop further, with an eye towards ways in which my qualitative and quantitative observations might culminate in future design directions. I propose a series of design interventions for avatars, environments, and controls that might address some of the issues of embodiment and online disinhibition that I encountered. Furthermore, I couch my explorations of immersive technology in some of the questions posed in Donna's Cyborg Manifesto. For example, if the virtual "body" does not need to be gendered, why must it also be humanoid? And, what would it look like to build an intuitive and expressive control scheme for such a body? I would leave off with some directions this research could take in the future, including but not limited to further social study, game design explorations, and new approaches to VR control hardware.

Finally, my thesis moves into the potential applications for my research and how I would like to continue my research. I am interested in how the notion of hybrid bodies can be applied to controls for virtual reality. I would like to explore the intersection between technically challenging control maneuvers and the potential for controlling more complex forms. In my research, I have observed a gap between academic research on embodiment in virtual reality and my observations on the most utilized virtual reality components by players. By expanding the range of possibilities for how players utilize an immersive technology like virtual reality, developers can create a wider range of experiences between the player and their virtual body. Players can, in turn, embody these new forms of being.

4. Precedents

4.1 Introduction

The experience of a player in virtual reality is that of a confluence of spatial domains: that of the player's body and the technological space both of the hardware and the virtual space the player experiences. The body as an active element is a point of departure for virtual reality from traditional digital media, so it is worth unpacking as an element of a player's overall experience. Ken Hillis, in his work *Digital Sensation: Space, Identity, and Embodiment in Virtual Reality*, offers an entry point to consider the body in this technological relationship. Hillis details the body as the flesh shell that tethers the "intersection" of individuality and the cultural sphere.⁹ In the partnership of experience between the user's body and the virtual space, the physical body is not passive. Instead, it is a mediating element that determines how a user encounters virtual reality. The body, and embodiment, is individualized, personal, and a fraught concept. Ken Hillis regards the body not only as a metaphor for intangible elements, but also for its potential as a reflection of the individual that can be externalized. While physical limitations surely play a role in mediating virtual reality experiences, this work suggests that the body is a bridge, a site that can be re-conceptualized based on context.

Embodiment does not presuppose a set, unchanging identity for a player. Hillis, for example, argues that embodiment draws from the metaphorical nature of the body. The body's physical identity, for Hillis, is negligible. While uniting the user and technology, the user herself also becomes fragmented. Ken Hillis ties "the potential to fracture self-identity" to technology's potential for different informational manifestation. In essence, this means that as the virtual headset connects one to multiple virtual environments, the user's potential for fragmentation grows.¹⁰ They are given the opportunity to inhabit multiple bodies, multiple realities, with relatively easy access.

This fragmentation of identity is, however, not unique to virtual reality. Celia Pearce observes a similar fragmentation effect in her study of online communities and user avatars in her work *Communities of Play: emergent cultures in multiplayer games and virtual worlds*. Pearce brings a sociologist's understanding of the performance of identity with social surroundings. She notes that, in virtual environments, individuals by nature replicate a kind of social performance or pretending observed in regular, physical interactions. That is, players create a multiplicity of identities, as each online game (or community) is a new opportunity to create a new identity.¹¹ Reading these works together starts to

⁹Hillis, Ken. "Identity, Embodiment, and Place -- VR as Postmodern Technology." *Digital Sensations: Space, Identity, and Embodiment in Virtual Reality*, 1st ed., University of Minnesota Press, 1999, pp. 164–199, doi:10.5749/j.ctts6mg.11.

¹⁰Hillis, Ken. "Identity, Embodiment, and Place -- VR as Postmodern Technology." *Digital Sensations: Space, Identity, and Embodiment in Virtual Reality*, 1st ed., University of Minnesota Press, 1999, pp. 183, doi:10.5749/j.ctts6mg.11.

¹¹ Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. MIT Press, Cambridge, Mass, 2009.

Key Terms: In her work *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds* by Celia Pearce, the author created a list of terms that she uses to describe her experiences throughout different virtual worlds. For the purpose of this research, I have synthesized her list of terms to the following:

1. **Spatial:** Celia Pearce posits that virtual worlds are inherently spatial. Whether a virtual world be text-based or constructed through 2D or 3D graphics, represent spatial constructs in how the player interacts with the game.

build a framework in which a player's body is an essential locus for their virtual reality experiences, but is itself an empty container for their identity in each space.

Indeed, players do not just wear a digital identity, but instead construct and inhabit them as *intentional bodies*.¹² Also known as the avatar¹³, the intentional body is one that is a conscious body, built and created by the player. Just like the physical body, it changes and is molded over time. In virtual reality, the intentional body is constructed similar to other online video games, but experienced from a different literal and metaphorical perspective.

The intentional body, however, has its limitations. The user is limited to the options afforded by the designer of a given experience, and these designers are themselves caged by their biases. In online gaming communities, avatars are often hyper-gendered in part because of player choice, but also because of the design options available to players. Pearce observes the result of this dual bias in the pervasiveness of young, hyper-gendered avatars in *Second Life*. She explores how virtual communities such as *Second Life* demonstrate a reversal of gendered expectations. Male players often prefer to use female avatars to the point where a "popular folk theory" in *Second Life* is that "female avatars with oversized bosoms" are often "inhabited by male players."¹⁴ This adds another layer to the freedom of virtual environments that Ken Hillis observed. Virtual environments allow for an intermingling between freedom and possession, for male players. Women who are interested in exploring a male avatar, however, encounter the "cultural limits" of imagination when it comes to male physical "comparative lack of fashion options."¹⁵

2. **Contiguous versus Explorable:** If a virtual world is spatial then the world can be considered contiguous and explorable. Contiguous refers to a world's geographical semblance in that there is a spatial continuity between different virtual areas. A contiguous virtual world that is structurally tied to a map. An explorable world is one in which a player can navigate the environment as they wish.
3. **Embodied Persistent Identities:** Virtual worlds are inhabited by players who are represented through their avatars. Embodied persistent identities refer to player representations through their avatars that are consistent across gameplay periods but also onto which players have either mobility or creative control.
4. **Immersive Virtual Reality:** Due to the nature of sensory input in virtual reality, Pearce felt that it was important to differentiate embodiment of virtual reality (classified as immersive) against that of previous virtual worlds. Pearce differentiates the two based on player control over their representation in the virtual world. However with *VRChat*, in which players have creative control over their appearance, the boundary between both might be blurred.
5. **Populous:** A virtual world is one that is populated by players. Part of understanding the populous of virtual worlds in to take into account that the populous of a virtual world is transient.

¹² Taylor, T.L. 2003. "Intentional Bodies: Virtual Environments and the Designers Who Shape Them." *International Journal of Engineering Education* 19 no. 1: 25-34.

¹³ **Avatar:** Celia Pearce defines the avatar in her work *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*, as "the essential unit within the network of the play community" as well as "the means whereby the individual player interacts with both other players and the ecosystem of the play environment".

¹⁴ Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. MIT Press, Cambridge, Mass, 2009.

¹⁵ *Ibid*, 22.

The freedom of expression through digital avatars is primarily a male, and white, experience. In the Pew Research Center's 2014 and 2017 surveys on Online Harassment, a digital divide is rarely a shield for users who identify as female or people of oppressed communities. In my own observations (further described in the next chapter), the moment I was no longer anonymous, outed as a woman by my voice, I became the focus of a hyper-awareness from other players. My freedom of expression and of experience, as a player, was dependent on my anonymity and suppression of self. Moving forward in my research, I regard the relation of the body in communication with the virtual as a metaphor for one's identity, but a powerful metaphor that each player has the power to create for themselves.

Furthermore, while the intentional body can become an outlet or reflection of the player, it can also enact influence on the player.¹⁶ In Jesse Fox's work "The embodiment of sexualized virtual selves: The Proteus effect and experiences of self-objectification via avatars", Fox studied whether the Proteus effect can and does occur when a woman embodies a sexualized avatar and, if so, whether they will self-objectify. Fox found, by asking female participants to embody different avatars that were illustrated to appear sexualized in a western manner, were more likely to agree with rape-myth acceptance statements.¹⁷ I reference this study to support my hypothesis that design decisions for intentional bodies can have an effect on the user. This study, however, does not focus on the effects of an intentional body that is constructed by the player, as the avatars in the study was provided by the researchers. However, I feel that this study is still important to illustrate that the intentional body is not just a means for the player to project their identity into the virtual space, but also can have an impact on the player's perspective of self.

4.2 Expanding on Jordan Belamire's Experience in QuiVR

In my introduction, I cited the experience of Jordan Belamire, a games journalist, who had a visceral experience of sexual harassment in the game *QuiVR*. It drew my attention as a flashpoint, an intersection between issues of online harassment in general, digital identities, and the emerging unknowns of interaction in virtual reality. In light of a more formal concept of embodiment, as explored previously in this thesis, it's worth revisiting QuiVR in more depth.

A sense for how the game feels to play is important to grasp the prospect of sexual assault in virtual reality. To begin, a player is only given one game mechanism, or verb, which is "to shoot" an arrow.¹⁸ The novelty of the game comes from the way this simple verb is implemented. The act of moving one's arms to notch, aim, and then release a virtual arrow adds a simple but effective physicality to the game, which is then augmented by the game's spatial elements. To hit certain enemies, the player might need to lean over to peer beyond a digital ledge. On a given perch, you have

¹⁶ **Note:** The avatar and the intentional body are not interchangeable. In this research, the intentional body is an avatar that has been construed, in some way, by the player. The creation part of the intentional body can be identified as either literal construction (i.e. 3D modeling or 2D illustration), or customization within a game environment (creating a character from a set of assets in a game).

¹⁷ Fox, Jesse, et al. "The Embodiment of Sexualized Virtual Selves: The Proteus Effect and Experiences of Self-Objectification via Avatars." *Computers in Human Behavior*, vol. 29, no. 3, 2013, pp. 930–38, doi:10.1016/j.chb.2012.12.027.

¹⁸ Anthropy, Anna., and Naomi (Game designer) Clark. *A Game Design Vocabulary: Exploring the Foundational Principles behind Good Game Design*. Addison-Wesley, 2014, <http://search.library.cmu.edu/vufind/Record/1565748>.

some freedom to walk around to spot your mark. In essence, this is a conceptually straightforward but intensely physical game.

QuiVR is an example of a game as spatial construct, as delineated by Celia Pearce in her ethnographic works on online multiplayer games.¹⁹ The player moves from perch to perch by the use of portals, accessible only through shooting an arrow. Yet, the player has to carve out their own space within the game. The perches are narrow, and feel claustrophobic when sharing the space with other players. But the player is never forced to share the space for long, as the gameplay rewards a focus on mobility. The need for visibility of monsters makes player proximity a nuisance, and promotes the feeling of finding a space of one's own. And so, while the overt goal of the game might be to accumulate points and move up within the game's hierarchy, the subconscious goal, driven by the collision between spatial and game design, is to stake a place of one's own while moving forward.

The precedents set by the game makes approaching someone out of the ordinary. It weaponizes it. The freedom of movement, taken for granted when facing computer-controlled enemies, is an illusion. One is actually encumbered by their ability to aim at and hit a portal, a small target, often far away. At the best of times, crossing to a new space takes skill. Further, the player experiences restrictions in their physical movement, as they cannot move further than a certain radius before encountering a collider, or the pull of the headset tether. To approach someone in all this is to recreate the sense of anxiety of when a stranger (or someone who has not been given the personal boundary allowance) enters one's personal space. The arrangement of space and movement, in essence, contributes to the potential for unpleasant interpersonal proximity.

Jordan Belamire's publicized encounter in *QuiVR*, cited in the introduction to this thesis, is an example of the ways in which *QuiVR*'s spatial and interaction design conspire to exacerbate unpleasant interpersonal interaction. In response to the event, the developers of *QuiVR* responded by adding a "personal bubble" setting in the game. The personal bubble option allows players to make other players' hands disappear as they enter space close to their avatar. Furthermore, the player has the option to make another player disappear entirely from their view, hence restricting the range that players can come towards one another.²⁰

The actions of the developers suggest two things. First, it appears that developers can take a stance against, and accept responsibility for, malicious behavior. Second, there are concrete steps developers and designers can take to keep players safe when they are playing their game. However, their approach ultimately places the burden on the victim, making it the responsibility of those who do not want to be harassed to mitigate the behavior themselves. It is a short term solution, and does not address the core issue actually evidenced by the event: that the distress of one player proved an amusement, and that that behavior is considered acceptable when in an online game setting.

To see how the community responded to the event and these changes, I turned to the game's community discussion boards. In the discussion thread entitled "QuiVr – Our response to the issue

¹⁹Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. MIT Press, 2009, <http://search.library.cmu.edu/vufind/Record/1332031>.

²⁰D'Anastasio, Cecilia. "VR Developers Add 'Superpower' To Their Game To Fight Harassment." *Kotaku*, 2016, <https://kotaku.com/vr-developers-add-personal-bubble-to-their-game-to-fi-1788237241>.

of harassment in VR”, players of *QuiVR* address and discuss Jordan Belamire’s experience.²¹ Within the thread, it’s clear that the public reactions to Belamire’s article ranged from understanding to dismissal of her experience.

Dismissive attitudes seemed rooted in the idea that, as a digital experience, *QuiVR* could have no real bearing on a player’s emotional state. This can be seen in the points laid out by user “kaerfasiyarllih”:

- 1) You can’t feel virtual hands
- 2) The avatars don’t even have torsos. The person “groping” the author of that article was literally making a grabbing motion *at the air* with his floating cartoon hands.
- 3) It’s a freaking cartoon. Oh noes, my invisible torso was groped by someone’s floating cartoon hands. People should stop for a second and listen to how idiotic that sounds.

²²

Another trend within the reddit thread is the notion of ownership. Entire conversations in the thread address the issue of who has ownership of the experience, with interchanges such as:

Novashadow: “Why should adults be subjected to your children in an environment that costed them tons of money to even participate in? It is like taking your kid to a bar and expecting the adults to shapen up and not say anything the slightest bit offensive.”

Quintesse: “Well I haven’t paid 800 dollars to have some a-holes ruin the fun for my (friend’s) kids, adolescent girls, my wife or any other people either.”²³

This conversation keys into the issue of whose experience is valid, and who belongs in a virtual community. It points to a disconnect between one and another player’s understanding of their place within a virtual setting. Unlike when standing in a public setting, players might view their experience as purely their own, no matter the other individuals that occupy the space with them. It seems that the sense of entering a shared, public space, and all that brings with it, is not translated to our experiences online. As users such as Novashadow and Quintess suggest, no matter the community-building potential of games, players do not recognize a shared ownership of the space and experience. In the case of *QuiVR* specifically, the aggressive organization of space does not preclude interpersonal interaction, but neither does it encourage positive exchanges.

²¹ “QuiVr - Our response to the issue of harassment in VR • r/Vive.” Reddit.com, 2016, www.reddit.com/r/Vive/comments/59dnaq/quivr_our_response_to_the_issue_of_harassment_in/.

²² “QuiVr - Our response to the issue of harassment in VR • r/Vive.” Reddit.com, 2016, www.reddit.com/r/Vive/comments/59dnaq/quivr_our_response_to_the_issue_of_harassment_in/.

²³ *Ibid.*

4.3 Coping Mechanisms of Women in Online Games

In her account, Jordan Belamire describes how, no matter how she tried to communicate her discomfort to “BigBro442,” her only means of escaping was when she removed the VR headset.²⁴ Her only recourse was to disengage completely with the experience as a whole. This taps into the points laid out by Jesse Fox and Wai Yen Tang’s work “Women’s experiences with general and sexual harassment in online video games: Rumination, organizational responsiveness, withdrawal, and coping strategies.” In their article, Fox and Tang surveyed women’s experience of both general and sexual harassment in online video games and, in particular, coping strategies developed by those surveyed to mitigate harassment.²⁵ Belamire, in many ways, is not so atypical.²⁶

In their study, Fox et al. were not interested in questioning whether or not women did experience online harassment or if they did try and mitigate their experience. Instead, they tried to pinpoint exactly how women tried to mitigate the effects of upsetting online harassment in their lives. The study used online forums, blogs, and social media sites to recruit participants across different countries and races. Fox et al. found five primary categories of means that women used to cope with online harassment. These categories are:

Gender masking: In which players mask their female gender by either using male or neutral avatars and/or usernames.

Avoidance: In which players avoid social interactions with other players by either choosing single player options or leaving in-game lobbies.

Denial: In which players internalize harassment as a normal, “not bothersome”, to a game.

Seeking help: Asking other players for help or reporting harassment.

Self-blame: Blaming oneself or feeling inadequate and unintelligent for the actions enacted against the player.²⁷

In Fox’s work, Belamire’s self-removal is a common solution for women coping with harassment. Fox and Tang note a cycle in the representation and understanding of female players within networked games, one that is intimately linked with online harassment. They first ascertain that there is a lack of representation of female players, or more a perceived gender inequality in the player demographics of networked games. This perceived lack of women as players is then aggravated by the coping mechanisms female players use to try and minimize their identity and gender, thus reinforcing the perception that women are not interested in networked games.²⁸

²⁴ D’Anastasio, Cecilia. “VR Developers Add ‘Superpower’ To Their Game To Fight Harassment.” *Kotaku*, 2016, <https://kotaku.com/vr-developers-add-personal-bubble-to-their-game-to-fi-1788237241>.

²⁵ Fox, Jesse, and Wai Yen Tang. “Women’s Experiences with General and Sexual Harassment in Online Video Games: Rumination, Organizational Responsiveness, Withdrawal, and Coping Strategies.” *New Media and Society*, vol. 19, no. 8, 2017, pp. 1290–307, doi:10.1177/1461444816635778.

²⁶ *Ibid.*

²⁷ Fox, Jesse, and Wai Yen Tang. “Women’s Experiences with General and Sexual Harassment in Online Video Games: Rumination, Organizational Responsiveness, Withdrawal, and Coping Strategies.” *New Media and Society*, vol. 19, no. 8, 2017, pp. 1290–307, doi:10.1177/1461444816635778.

²⁸ *Ibid.*, 1292.

It is helpful to look at the behaviors that female players so often try to mitigate in the enjoyment of their pastimes. Pina, Gannon, and Saunders trace the term “sexual harassment” to the 1970s American workplace, in which researchers delved into the issue of sexual harassment as a persistent powerplay between genders or, more precisely, unwelcome sexual advances, verbal, or physical conduct.²⁹ This delineation of the interplay between organizational theory and sexual harassment becomes especially relevant when examining the organization of networked games. In this context, organizational theory focuses on the dynamics of power as positional, instead of relational. This means that an abuse of power is more closely linked to the positions of the abuser and victims, over a simple relationship between two individuals of opposite genders.³⁰ This is a useful concept as, considering the coping mechanisms detailed by Fox, gender masking makes it hard to understand sexual harassment in games as purely relational between genders.

Organizational theory and manifestations of sexual harassment in networked games might be more closely linked than anticipated. In their survey of theories on sexual harassment, Pina describes organizational theory as a theory that focuses on reasserting differences in power.³¹ In settings that focus on power hierarchies built on skill, levels, points, etc, harassment in networked games might be most closely related to theories of harassment from an organizational perspective as players have clear metrics for success and advantage, and may engage in abuse in an attempt to reinstate power. Organizational theory on harassment also takes into account the role of permissions allotted to harassers: i.e., the more members of an environment are allowed to harass others, the more they will harass other members of the community. A manifestation of how an adjacent system can permit malicious behavior in a subset community is the case #Gamergate. In an interview, Anita Sarkeesian described the lack of support she had from institutions within the gaming industry.³² Large game studios give permission to extreme online harassment by not voicing support for victims or, in certain cases, actively supporting the harassers. This, in turn, allowed further abuse to propagate without consequence.

This point is reinforced in the community discussions surrounding *QuiVR*, in which players state things such as: “good luck stopping random people from trying to explain to your 12 year daughter a bunch of grotesque sex acts in VR,”³³ or describe Jordan Belamire’s experience as being “no different than being on the Internet.”³⁴ In essence, the sense is defeatist, that internet culture is

²⁹ Pina, Afroditi, et al. “An Overview of the Literature on Sexual Harassment: Perpetrator, Theory, and Treatment Issues.” *Aggression and Violent Behavior*, vol. 14, 2009, pp. 126–38, doi:10.1016/j.avb.2009.01.002.

³⁰ *Ibid*, 132.

³¹ Pina, Afroditi, et al. “An Overview of the Literature on Sexual Harassment: Perpetrator, Theory, and Treatment Issues.” *Aggression and Violent Behavior*, vol. 14, 2009, p132, doi:10.1016/j.avb.2009.01.002.

³² Wingfield, Nick. "Feminist Critics of Video Games Facing Threats in "GamerGate" Campaign." *The New York Times*. The New York Times, 15 Oct. 2014. Web. 15 Dec. 2016. <https://www.nytimes.com/2014/10/16/technology/gamergate-women-video-game-threats-anita-sarkeesian.html?_r=0>

³³“QuiVr - Our response to the issue of harassment in VR • r/Vive.” Reddit.com, 2016, www.reddit.com/r/Vive/comments/59dnaq/quivr_our_response_to_the_issue_of_harassment_in/.

³⁴*Ibid*, 2016

so permissive that users at risk of harassment must simply accept the situation as part of the overall experience. And so the status quo continues.³⁵

4.4 Online Disinhibition

While Fox's findings delineate the results and self-organized means that female players use to mitigate their negative experiences, John Suler examines the forces that push players to harass in the first place. In his work, "The Online Disinhibition Effect", Suler categorizes different forms of disinhibition that manifest themselves in sometimes contradictory ways. The virtual world, according to Suler, is a world of contradiction. While online disinhibition more often manifests itself in a negative manner, also known as "toxic disinhibition," there is also "benign disinhibition," in which users will express extreme generosity to to others. To try and understand this behavior, Suler explores the power of dissociation in virtual spaces. In virtual spaces, anonymity is the standard, which gives power to "technologically savvy" individuals who can detect a user's true identity, and use that knowledge as leverage. Another factor in the disinhibition effect is physical invisibility. When harassing another user, a digital bully doesn't have to worry about the user's physical reactions or retaliations. The harasser has free range to express themselves however they feel. While the experience can be liberating, or therapeutic, for the user enacting the harmful behavior, it is emotionally detrimental to the second.³⁶



Figure 1: The two sides of online disinhibition³⁷

Online Disinhibition is closely related to the terms "dissociative" and "invisibility" within Suler's text. He uses the term "dissociative" to address the notion of "compartmentalized self,"³⁸ a notion that Celia Pearce refers to as well in her own observations of online communities, but refers to as a "multiplicity of identities,"³⁹ in which players adorn themselves with different personas for each community that they inhabit. Pearce explores this as a healthy phenomenon, citing sociologists as support for her theory that with each avatar and game, a player is allowing themselves to express different forms of their personality. Suler, however, regards the categorization as having a dividing effect. Suler regards the player as dissociating themselves with the persona that they create, thus allowing them to compartmentalize their selves, and so "avert responsibility" for their behavior.⁴⁰ This darker view of inhabiting a virtual avatar points towards the basis for harassment in networked games.

³⁵Fox, Jesse, and Wai Yen Tang. "Women's Experiences with General and Sexual Harassment in Online Video Games: Rumination, Organizational Responsiveness, Withdrawal, and Coping Strategies." *New Media and Society*, vol. 19, no. 8, 2017, pp. 1290–307, doi:10.1177/1461444816635778.

³⁶Suler, John. "The Online Disinhibition Effect." *CyberPsychology & Behavior*, vol. 7, no. 3, 2004, pp. 321–26, doi:10.1089/1094931041291295.

³⁷*Ibid*, 321.

³⁸*Ibid*, 322.

³⁹Suler, John. "The Online Disinhibition Effect." *CyberPsychology & Behavior*, vol. 7, no. 3, 2004, pp. 322, doi:10.1089/1094931041291295.

⁴⁰*Ibid*, 322.

Based on the definitions laid out by Suler, online harassment is categorized as a sub-set of toxic online disinhibition. As touched upon by the Pew Research Center, online harassment⁴¹ does not affect online users equally. While 40% of internet users are victims of online harassment, 18% experience more severe forms of malicious online behavior. Hispanic and black internet users, in particular, are more likely to be harassed online *because* of their race.⁴² For young women (between the ages of 18-24), their experience of online harassment is skewed towards more extreme forms of online harassment. In the Center's 2014 survey, the center identified the three categories of online harassment which young women experienced more than their male counterparts: stalking, sexual harassment, and sustained harassment.⁴³

In virtual reality, online harassment builds on the definitions set by the Pew Research Center by introducing physical interaction. While purely verbal harassment is common in online communities such as *VRChat*, a player's physical movements are often tied to the experience as well. A player's understanding of their own use of VR technology intertwines with the experience: as one watches another another player move their avatar's hand forward, one understands that the other player is enacting that action themselves. When the action another player takes is similar to physical actions that are violent or sexual, the virtual world becomes a thin veil between action and intent.

4.5 Sources of Embodiment: Body Image and Body Schema

In discussing digital, online relationships, virtual reality presents a new dimension: the body as an active participant. It's the major differentiating factor for virtual reality experiences, and affects everything from a user's sense of space to their relationship with other users. Embodiment can be thought of, in short, as the way one enters virtual reality spaces, understands themselves, and is understood by others. Naturally, this is a complex discussion that sits at the heart of this research. In this section I will seek to define the concept more fully.

Donning a headset and entering a virtual world, one engages directly with what could be considered a cyborg, hybrid existence. Donna Haraway rings in the era of the cyborg in her seminal piece "A Cyborg Manifesto" (1984). She traces the dissolution of the natural and its amalgamation with the artificial with the rise of the machine in the late twentieth-century. Through her lens, we are all cyborgs. Between machine and organism, our world, partly virtual, is one that is postgender and so the performances of rigid gender and sexuality can be cast aside. As the human merges with the machine, Haraway observes a transfer of energy. The machine becomes an externalization of the mind and the body is left behind, inert, and lifeless. Human consciousness no longer has to be tied to the

⁴¹ The Pew Research Center defined online harassment as the following:

1. Offensive Name-Calling
2. Purposeful embarrassment
3. Stalking
4. Physical Threats
5. Harassment over a sustained period of time
6. Sexual Harassment

⁴² Duggan, Maeve. "1 In 4 Black Americans Have Faced Online Harassment Because of Their Race or Ethnicity." *Pew Research Center*, Washington, D.C. (25 July, 2017). www.pewresearch.org/fact-tank/2017/07/25/1-in-4-black-americans-have-faced-online-harassment-because-of-their-race-or-ethnicity/.

⁴³ Duggan, Maeve. "Online Harassment." *Pew Research Center: Internet, Science & Tech*, Pew Research Center, Washington, D.C (22 October, 2014). www.pewinternet.org/2014/10/22/online-harassment/#

constructions of culture and can focus on creating a pure identity of the self. As humans become more cyborg, Haraway argues, the edges of understanding on identity and subjectivity are tested and can be redefined.⁴⁴

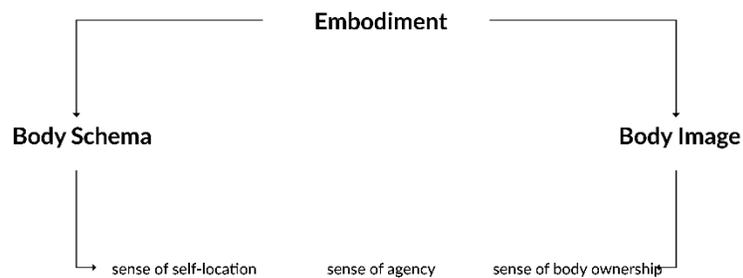


Figure 2: Deconstruction of Embodiment in Virtual Reality⁴⁵

With the rise of the cyborg as defined by Haraway, the body as a definite entity in relation to technology has to be reconsidered. Embodiment, and its relation to identity, can be seen through several lenses. Celia Pearce, for example, views embodiment in virtual realms as the ability to externalize a fragmentation of identity that, until the development of online identities, was internalized.⁴⁶ Alternatively, embodiment can be viewed as a state that is achieved when certain criteria are met. Ultimately, embodiment is an umbrella term for issues surrounding body ownership and agency in virtual spaces for, if it is possible to feel a connection to a virtual self, then one must consider who truly commands or owns the virtual self.⁴⁷

Transitioning to virtual reality, the body comes into play as a mediator of the experience and as an invisible target of harassment. With a sense for the organizational and psychological basis for harassment, it's worth creating a conceptual framework around embodiment itself. Quantifiable precedents in issues surrounding user embodiment in virtual environments draw from a family of experiments and theory called the Rubber Hand Illusion (or RHI) investigate the sense of body ownership, and how that sense of ownership can be manipulated, and so form a useful basis for this exploration. The Illusion subverts assumptions on how individuals understandings the mental boundaries of the body and illustrates that, if the mental map of the body can be manipulated and altered, than it can perhaps be extended into the virtual realm.

In the work of interdisciplinary collectives such as BeAnotherLab, they have developed an embodied virtual reality system that allows others to experience the world from the perspective of another use. In their embodied virtual reality system, *The Machine to Be Another* (2012), participants can share their perspective with another participant and, through an impromptu shared choreography in which one participant directs both participants' movements. A modern form the of the RHI study, BeAnotherLab work to understand the relationship between embodiment and identity and empathy.

⁴⁴ Donna Haraway. "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century." *Sex/Machine: Readings in Culture, Gender, and Technology*, Indiana University Press, 1998, pp. 434–467.

⁴⁵ Kilteni, Konstantina, et al. "The Sense of Embodiment in Virtual Reality." *Presence: Teleoperators and Virtual Environments*, vol. 21, no. 4, 2012, pp. 373–87, doi:10.1162/PRES_a_00124.

⁴⁶ Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. MIT Press, Cambridge, Mass, 2009.

⁴⁷ De Vignemont, Frédérique. "Embodiment, Ownership and Disownership." *Consciousness and Cognition*, vol. 20, no. 1, 2011, pp. 82–93, doi:10.1016/j.concog.2010.09.004.

Their work bridges the quantitative and the qualitative potential of an RHI study as *The Machine to Be Another* (2012) follows a similar structure to an RHI study but focuses on creating an empathetic experience between individuals.⁴⁸



Figure 3: "Gender Swap"⁴⁹ (left) and "LOOFotodok"⁵⁰ (right) by BeAnotherLab

In a typical RHI study, a participant sits and places their hand behind an obstruction. In view, however, is a rubber hand. The participant views the stimulation of the rubber hand while feeling the same stimulation on their own (unseen) hand. Typically, the participant feels that the rubber hand is a part of their own body. However, the phenomenon retains a tenuous grasp on the participant as a major disjunction between the rubber hand's position and that of the participant's hand destroys the illusion. The experiment sets a precedent for a fluid understanding of the notion of self and body.⁵¹

The disjunctive experience seen in the Rubber Hand Illusion presents an entry point to the twin concepts of *body schema* and *body image*. Both are important to the understanding of self and ownership. Body schema can best be expressed as a model, or an unconscious representation of the body that is created and updated through our understanding of the boundaries between our physical selves and the world. Body image, on the other hand, is a purely conscious and mental phenomenon. It is created through a network of beliefs, emotions, and perceptions. Together, the two form our complete understanding of ourselves, body image representing the internal understanding and limitations of our body, while body schema is constructed from the outside.⁵²

Virtual reality presents a new threshold for the ways in which schema and image relate in order to construct one's sense of place and self. In virtual reality, one's external body representation is fluid, as one can alter their morphology and size. The perspective, however, is always first person. Our sense of physical self is reconfigured. We look around and move more or less naturally, and manipulate virtual objects manually. Yet, within the spatial design, physically we cannot experience the expected collision of our body with virtual objects. In essence, there is a more active interplay between a user's

⁴⁸ BeAnotherLab. "The Machine to Be Another." *The Machine to Be Another*, 2012, www.themachinetobeanother.org/.

⁴⁹ BeAnotherLab. "Gender Swap – Experiment with The Machine to be Another" *The Machine to Be Another*, 2014, www.vimeo.com/84150219

⁵⁰ BeAnotherLab. "LOOFotodok" *The Machine to Be Another*, 2018, www.vimeo.com/239374706

⁵¹ Costantini, Marcello, and Patrick Haggard. "The Rubber Hand Illusion: Sensitivity and Reference Frame for Body Ownership." *Consciousness and Cognition*, vol. 16, no. 2, 2007, pp. 229–40, doi:10.1016/j.concog.2007.01.001.

⁵² *Ibid*, 230.

intuitive bodily awareness, their body schema, and how they envision or imagine themselves in relation to the virtual world, their body image.

Embodiment in VR must then place emphasis on the world of the body image, as we ultimately must imagine ourselves within the space and in relation to the avatar. Konstantina Kilteni and Raphaela Groten explore the influence of the body image in their work “The Sense of Embodiment in Virtual Reality.” The authors posit that the sense of body image in a virtual space is structured by three anchors: the sense of self-location, the sense of agency, and the sense of body ownership. The user’s self-location is created through determining their position within the virtual volume of space, while the sense of agency is reinforced by the simulation of motor control within the virtual space. Body ownership is created through morphological similarities between the virtual body and our own. In all, the conceptual groundwork here is for a space where body image, normally an interior process, is externalized in virtual reality.⁵³

In their work, Kilteni and Groten question the notion that each of these anchors needs to contribute equally to the sense of embodiment. Instead, they suggest that these three concepts contribute to a sense of embodiment through a weighted relationship. The work of Char Davies, an early virtual reality artist, questions the equal presence of the tri-categories in her work *Osmose* (1995). The piece was an immersive interactive VR environment in which the immersant’s breadth is used to navigate the environment.⁵⁴ In *Osmose* (1995), the immersant’s sense of location and agency are accentuated. The environment is built along a grid and facilitates the immersant’s ability to identify their position. The immersant’s sense of agency is maintained, as the relationship between bodily action and virtual result are maintained. Body ownership, however, is minimized. The immersant must learn to use their body per the creator’s rules and are limited to one dimension of their bodily potential. While an example perhaps reigned by the available technology of the time, *Osmose* (1995) sets an important precedent for considering the bounds of embodiment in virtual reality, and hints at ways in which they may be undone or expanded.

As a counterpoint to *Osmose* (1995), some explorations in virtual reality appear to integrate and shuffle *body image and schema* through the unique possibilities afforded by the technology. “The Machine to be Another” project by BeAnotherLab is an exploration where artists and scientists came together to explore the possibility of using Virtual Reality as a means to experience the body and experiences of others. The piece involves two participants: a performer and a user. Each of these roles delineate the responsibilities for the participants in this performance piece, which is a study on the boundaries and fluidity of a user’s sense of self in virtual reality.

⁵³ Kilteni, Konstantina, et al. “The Sense of Embodiment in Virtual Reality.” *Presence: Teleoperators and Virtual Environments*, vol. 21, no. 4, 2012, pp. 373–87, doi:10.1162/PRES_a_00124.

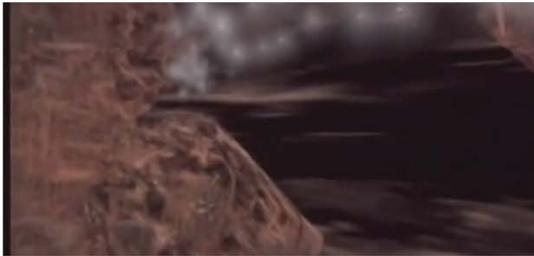
⁵⁴ Davies, Char. “Osmose.” Immersence, 1995, digital, www.immersence.com/.



Osmose (1995) by Char Davies flythrough 00-01-25



Osmose (1995) by Char Davies flythrough 00-02-47



Osmose (1995) by Char Davies flythrough 00-08-19



Osmose (1995) by Char Davies flythrough 00-10-37

Figure : "*Osmose*"(1995) by Char Davies flythrough stills⁵⁵

The performer's responsibility is as someone interested in sharing their perspective with the user. The performer is in control of the scene, controls the actions of the piece. The user sees, through a virtual reality headset, the performer. While both the performer and the user interact with one another through a virtual reality set, they are then given different sets of equipment. The user is given a set of wireless headphones, in order to be more immersed in the experience, while the performer is given a wide angle webcam. This slight differentiation between both participants helps solidify the roles that the two individuals are to fill in the experience. While the user is given a tool to further remove them from reality, the performer is given a tool in order to aid the piece's goal of creating a more complete sense of the space around the two individuals.⁵⁶

The goal of this performance is to experiment with the use of empathy within an environment where the medium for communication is through a technological lens. The schema of the performer is translated, through the machine, into the body image of the user. The agreement between the two, where the performer mimics the users action, confers a sense of agency and body ownership. Meanwhile, the apparatus of cameras helps build an idea of self-location. An interesting note is the behavior of the participants within this embodied experience. The experiments ranged from young participants experiencing the world of an elderly person with limited mobility, to individuals experiencing the body of another person of opposite gender. In such a case, as demonstrated below, it is interesting to note the difference between male participants who were given responsibility as the "performer" versus women. In most cases, male performers directed the female participant to touch their breasts while the male participant looked on. In the reversed situation, women rarely directed the males to touch their genitalia. BeAnotherLab's aim for this specific experiment was to explore the

⁵⁵ Davies, Char. "Osmose (1995) - Char Davies - 16 Min." YouTube, YouTube, 3 June 2014, www.youtube.com/watch?v=54O4VP3tCoY.

⁵⁶Bertran, Philippe, Christian Cherene, Norma Deseke, JJ Devereaux, Daniel Gonzalez Franco, Daanish Masood, Marte Roel, and Arthur Tres. "The Machine to be Another." *The Machine to be Another*. BeAnotherLab, 2014. Web. 05 Apr. 2017.

limits, or lack thereof, participants felt when immersed in a completely foreign body.⁵⁷ For me, it suggests that virtual reality starts to blur the line between puppeteering and inhabiting an external body.

My research explores the relationship between the *body image* and *body schema* in virtual reality by focusing on the play between the user's sense of location, agency, and body ownership. By delving into how game developers and players manipulate these three anchors of embodiment, I believe that researchers can begin to better understand how embodiment is different in virtual reality from other immersive media. As an extension, such an understanding of how embodiment is structured in virtual reality might help designers, developers, and players mitigate negative virtual events from affecting users in the physical world.

5. Methods

5.1 Introduction

While the background for this research looks at past and isolated explorations of embodiment and its impact on users, gaining a true understanding of its implications requires an understanding of modern virtual reality experiences and the way players encounter themselves, and one another, within. Virtual, multi-user worlds allow for both focused play and experimentation in cultural play, performance, and creativity. This latter mode can be thought of as the bedrock for the growth of virtual communities, a concept at the heart of my research.

Communities of experimentation arise out of the meeting between two sets of priorities and visions: those of the developers, and those of the players. The framework for an experience, including its controls and constraints, are largely the doing of the developer. On the player's part, a virtual world becomes the opportunity for a multiplicity in identity and social roles. In other words, players form communities and societies within games around the activities and interaction methods available to them. This kind of interaction occurs adjacent to the deliberately designed content of a game, but within its broader structures. To study this form of interaction, I employ the tools of digital ethnography as it allows me to focus on understanding the present state of communities through a cultural lens. This lens enables me to study everyday life but incorporate considerations on player embodiment and representation.⁵⁸

A virtual ethnographic method is important for my study, for the virtual reality medium stages a close connection between a player's physical and digital states. When a player lifts their hand towards another in either a lewd or angry gesture, so do I observe the player lifting the controller. In virtual worlds, technology is just as much a tool as it is a component in embodiment, and so I consider technology as well as cultural manifestations in my notes and analysis. Furthermore, the cultural context that I am observing is highly selective in that, while it is not restricted to a single global region, it does only affect those who have access to a virtual reality headset. My study follows a historical precedent of virtual ethnographies. Furthermore, it is important to expand the qualitative approach to include how players use the technology they are given.

⁵⁷ *Gender Swap Experiment*. Dir. BeAnotherLab. *The Machine to be Another*. BeAnotherLab, 2014. Web. 5 Apr. 2017. <http://www.themachinetobeanother.org/?page_id=12>.

⁵⁸*Ethnography and Virtual Worlds : a Handbook of Method*. Princeton: Princeton University Press, 2012. Print.

Virtual communities such as those of *QuiVR* and *VRChat* are the result of over forty years of evolution in virtual communities. An early precedent are MUDs⁵⁹, online text-based worlds, which in turn evolved with advent of graphical environments and commercial implementations of virtual worlds. These games have open space for social interaction, but usually bring more formal systems and are the ancestor of games like *QuiVR*. Meanwhile, the open structure and social focus of *VRChat* finds its origins in LambdaMOO⁶⁰, a text-based virtual world. Much like *VRChat*, LambdaMOO allowed players to create and add their own “rooms” to the text-based virtual world, much like *Second Life* later did with player-authored realms. In these cases, the heart of the experience is not just the social interactions between users, but the user-authored spaces in which they occur.

LambdaMOO is important because it is also the site of Julian Dibbell’s “A Rape in Cyberspace”, an article first published in *The Village Voice* in 1993 and a precursor case study for the concerns I’m now exploring. In his work, Dibbell describes the events surrounding the disruption within LambdaMOO’s community when a subprogram allowed a player to attribute their own actions to other players. The player then used this ability to enact textual sexual actions between characters. Involuntary for both the receiver and apparent instigator of these acts, Dibbell saw this as a “cyberrape”.⁶¹

“A Rape in Cyberspace” questions bodily autonomy in virtual spaces and the relationship between avatars and the players who manipulate them. It indicates that the link between player and their digital presence is imagined but strong. Likewise, it exposes how digital communities abide by bonds of social trust that are vulnerable to bad actors in the group. Yet, this question has not been fully resolved. Jordan Belamire’s experience in *QuiVR* can be seen as a modern counterpart to “A Rape in Cyberspace”.⁶² While reactions to Dibbell’s article aren’t readily documented, we can see via community forums that the response to Belamire’s article was polarized, with many suggesting that her abuse should not be taken seriously because she was not physically harmed.⁶³

“A Rape in Cyberspace” the result of a user manipulating the program’s code to puppeteer other users. However, it exposed the threat of violation and sexual assault latent in any anonymized, open-ended and connected space. It underscored that, given even the basic tools for social interaction and no restraints, users could easily enact abuse on the unsuspecting.

The questions raised by “A Rape in Cyberspace” applies strongly to a program like *VRChat*, in which the relationship between player and virtual presence is both more complex and more intimate than before. Whereas violations in “A Rape in Cyberspace” happened only through text, similar behavior in *VRChat* has much greater potential to be visible, audible, and embodied. In *VRChat*, technically-adept users create their own avatars with custom animations that less-technically proficient

⁵⁹ **Note:** An MUD, short for “Multi-User Dungeon” or Multi-User Dimension and Multi-User Domain, is a multi-user virtual world game that is usually text-based. A text based game involves typing commands to navigate a virtual world that is mentally constructed from either maps or text descriptions.

⁶⁰ **Note:** “LambdaMoo” is a MOO game, a text-based online virtual reality system that supports multiple players. The primary feature that differentiates a MOO from other text-based online games are that users can perform object-oriented programming within the game’s servers.

⁶¹ “A Rape in Cyberspace.” *The Village Voice* 21 Dec. 1993 : 36.

⁶² Belamire, Jordan. “My First Virtual Reality Groping – Athena Talks – Medium.” *Medium*, Athena Talks, 20 Oct. 2016, medium.com/athena-talks/my-first-virtual-reality-sexual-assault-2330410b62ee.

⁶³ “*QuiVr* - Our response to the issue of harassment in VR • r/Vive.” *Reddit.com*, 2016, www.reddit.com/r/Vive/comments/59dnaq/quivr_our_response_to_the_issue_of_harassment_in/.

players can use, often acquired via external communities or stores. The intentional body, in *VRChat*, has the potential for self-determination but can also be determined by others in unique manners. Players can not only control their appearance but also their movement, which means that others can also control their movements. This opens up the player to the potential of a scenario similar to that of “A Rape in Cyberspace” in that the movements and actions of a player are not wholly in the control of the player. In my own experience, I did not realize that a standard avatar made facial expressions while I spoke. It was only apparent when a companion pointed it out. *VRChat* opens up the player’s experience to unwanted actions as designers can create custom animations of which a player might not initially be aware.



Figure 4: Custom Avatar Animation in "VRChat"⁶⁴

To study both *QuiVR* and *VRChat*, I draw from the precedents set by Celia Pearce and, in particular, her work *Communities of Play: Emergent Cultures In Multiplayer Games and Virtual Worlds*. I focus on her concept of spatial literacy as a component to understand and inhabit virtual worlds.⁶⁵ Pearce defines spatial literacy as the ability to “read” and “write,” i.e. to understand and create within the spatial design of a virtual world.⁶⁶ In a competitive setting, spatial literacy confers an advantage: a player more familiar with the shape of an arena will find their way more quickly and be harder to surprise. In a more open, less formal game like *VRChat*, online disinhibition is tied to “reading” and “writing” virtual space for one player’s benefit over the other.

Play ecosystems are the environments in which behaviors develop, or emerge, between inter-player events tied with the possibilities of the playable space they occupy. In my research, I look to ways in which various gameplay structures and environments shape inter-player interactions. I use the following rubric to try and determine which behaviors can be considered an emergent behavior: In my research, I explore emergent phenomenon in *VRChat* that I observe from instances of online disinhibition. In my rapid qualitative research, I observe player awareness of their selves in relation to their avatars that are contradictory to the constraints of virtual reality. I anchor my analysis in the definition of emergence, as defined by Yaneer Bar-Yam and explored by Pearce in her work, can identified if it the behavior is unique and inherent to the virtual environment. Furthermore, if the

⁶⁴ Brysen. “BEST DANCER IN VRCHAT! (VRChat Funny Moments) - YouTube.” Youtube, 2018, <https://www.youtube.com/watch?v=S0iXJPBYvqQ>.

⁶⁵ Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. Cambridge, Mass.: MIT Press, 2009. Print.

⁶⁶ Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. Cambridge, Mass.: MIT Press, 2009. Print.

behavior cannot be isolated from the game world without it changing, fundamentally, in its characteristics.⁶⁷

Because of the scope of this research, I focus on identifying an emergent behavior network that focus on issues of embodiment and presence. In the ensuing sections of my analysis, I isolate and argue that the spatial discrepancies between how players use their bodies is an emergent behavior in *VRChat* and it is tied to virtual reality as a technology, but also the game as a setting for player interaction.

This holistic, systemic approach stems in part from feminist ethnography. I define my qualitative methods as feminist not only because of the subjects that I focus on during my research, but also how I position myself as an observer. First, within both *QuiVR* and *VRChat*, I take part in the community as a vulnerable observer as I accept that part of the behaviors I am interested in observing towards others might be directed towards myself. Furthermore, my approach differs from the precedents set by Celia Pearce, or the studies of Tom Boellstorff and his work in *Second Life* in other ways beyond the focus on gender. In their own work, Pearce and Boellstorff spend minimum period of twelve to eighteen months within a digital environment. Due to the constraints of scope for this thesis, I have focused my research in *QuiVR* over two weeks, and in *VRChat* over forty days, for fifteen to thirty minutes in game each day, and otherwise researching the community through video and online thread. I do, however, draw heavily from the methods set by Pearce, Boellstorff, and others in their own work to establish this work as a valid basis for discussion and further investigation.

A qualitative approach was important for my research to create my own frame of reference for online harassment in virtual reality spaces. While the internet allows for visibility for issues of gender, race, and power, it also sometimes amplifies issues and can create a false portrayal of events. As such, I felt that it was important for me to experience firsthand each of these communities. Furthermore, my goal for the qualitative approach was to observe two categories of player-technology interaction: first, how players use technology and relate to their surrounding environment in moments of high stress, and second, how players use technology in ordinary, casual moments within both games.

In this chapter of my research, I follow the steps outlined in the work by *Ethnography and Virtual World: A Handbook of Methods*. I first introduce a brief history for each world, drawn from online threads and videos. From this research, I set the stage for my own observations. I also try and represent the world from multiple perspectives, and so, while I include examples of online disinhibition in my thesis, I also include examples from those who do not view online harassment to be an issue in virtual worlds. In my research on the history of each community that has developed around *QuiVR* and *VRChat*, I also describe my own preparation of sites for observation. After introducing each game, I then move onto my preparation of self⁶⁸ for each site that I observe, in which I describe my process for determining how I present myself in each game.

⁶⁷ Pearce, Celia. *Communities of Play : Emergent Cultures in Multiplayer Games and Virtual Worlds*. Cambridge, Mass.: MIT Press, 2009. Print.

⁶⁸ **Preparation of Self:** Introduced and defined in the work *Ethnography and Virtual Worlds: A Handbook of Method* by Tom Boellstorff, Bonnie Nardi, Celia Pearce, and T.L. Taylor. This is a two part process as it involves the preparation of the research self and the preparation of the in-game self. In this thesis, I focus on the preparation of self for in-game representation. Considerations during this phase are how I present myself through my avatar, but also in my experience level. Due to the scope of this project I was not able to gain a level of expertise in gameplay for *QuiVR*. As such, both set of observations are from the perspective of a novice.

Finally, in my research, I am interested in learning more about the nature of online disinhibition in virtual reality. In this section of my research, I aim to understand further how trends in online harassment from online communities such as MUDs and their descendants have transferred to virtual reality communities. I posit that the way developers address toxic online disinhibition draws from their understanding of precedents from MUDs and their descendants. However, I believe that this instinct by developers focuses too much mitigating online disinhibition that manifests itself as verbal online harassment. Instead, I seek to observe the organizational and spatial issues surrounding toxic online disinhibition as it arises in verbal, visual, and bodily behavior as conveyed by the use of virtual reality technology.⁶⁹

5.2 Preparation of Site, Self, and Observations

Firmly grounded in the precedents set by Celia Pearce in her seminal work *Communities of Play* and her handbook for digital researchers *Ethnography and Virtual Worlds: A Handbook of Method*, I chose to follow her example and base my qualitative methods through a multi-sited lens. My decision arose first from the instinct that to fully understand the issue of user behavior in relation to gender and virtual spaces, a single community would not be sufficient. Second, I had noticed a major shift in my initial site for observations. *QuiVR*, the site of Jordan Belamire's assault, had over the past six months dwindled in player numbers, the game waning in popularity from its height in 2016. Furthermore, I had found a new site that piqued my interest: *VRChat*, a game that focused more on social interactions over formal, competitive gameplay structures.

⁶⁹**Key Terms:** In her work *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds* by Celia Pearce, the author created a list of terms that she uses to describe her experiences throughout different virtual worlds. For the purpose of this research, I have synthesized her list of terms to the following:

1. ***Spatial:*** Celia Pearce posits that virtual worlds are inherently spatial. Whether a virtual world be text-based or constructed through 2D or 3D graphics, represent spatial constructs in how the player interacts with the game.
2. ***Contiguous versus Explorable:*** If a virtual world is spatial then the world can be considered contiguous and explorable. Contiguous refers to a world's geographical semblance in that there is a spatial continuity between different virtual areas. A contiguous virtual world that is structurally tied to a map. An explorable world is one in which a player can navigate the environment as they wish.
3. ***Embodied Persistent Identities:*** Virtual worlds are inhabited by players who are represented through their avatars. Embodied persistent identities referred to player representations through their avatars that are consistent across gameplay periods but also onto which players have either mobility or creative control.
4. ***Immersive Virtual Reality:*** Due to the nature of sensory input in virtual reality, Pearce felt that it was important to differentiate embodiment of virtual reality (classified as immersive) against that of previous virtual worlds. Pearce differentiates the two based on player control over their representation in the virtual world. However with *VRChat*, in which players have creative control over their appearance, the boundary between both b might be blurred.
5. ***Populous:*** A virtual world is one that is populated by players. Part of understanding the populous of virtual worlds in to take into account that the populous of a virtual world is transient.

Having chosen my site, my next consideration in this research was to decide on self representation within the game environments. While in *QuiVR*, for example, decisions about self-representation (i.e. *body image*) were made for me, in *VRChat* the decisions were much more complex. For the initial phase in my research, I decided to explore the game through informed avatar decisions based on Fox's work on women's coping mechanisms in games. In particular, I wanted to explore how masking my gender through avatar decision would influence my experience.

I prepared to catalog my observations through video recording, finding that Pearce's "two-boxing"⁷⁰ method was difficult to do because of the necessity of a second computer and the complexity of screen-sharing when using a VR headset. In preparation for my research, I worked closely with Carnegie Mellon University IRB department to ensure that my study protected the identity and rights of players I recorded during my rapid qualitative research. To respect participant privacy, I have removed all usernames from any images I have included in this thesis from my video recordings. I also found that taking field notes during my game play was disruptive, as the pace of *VRChat* often meant engaging with users for prolonged periods of time in sequence. Furthermore, the very nature of a virtual reality headset negates the ability to write when in the game. Video recording helped me maintain a game flow and record examples of online disinhibition that I witnessed. All my gameplay interactions were recorded either using "VR Capture," a free recording software for virtual reality games, or "OBS Studio," a free screen-capture and game streaming tool. After my gameplay recordings, I would note poignant moments and review my footage to note the exact time of these encounters.

My in-game observations did not take place synchronously. My observations in *QuiVR* were obtained in October 2017 while my observations in *VRChat* were obtained between February 16th and April 30th 2018. My goal for my rapid qualitative research was to gain a more clear perspective of inter-player behavior in online multi-player game environments. While community threads and articles offer a more direct conduit to behavior reactions to a game or event, they also offer biased perspectives. I sought to explore two virtual reality games with different in-game structures (competitive versus social) and observe, from a neutral perspective how players interact with each other. I also used videos by Youtubers⁷¹ to supplement by understanding of *VRChat* because, often, Youtubers have access to in-game communities that, given the scope of my research, I was not able to contact.

5.3 QuiVR

QuiVR, developed by Bluteak, is an online multiplayer competitive archery game in virtual reality. Players are introduced within a tutorial worlds to the actions they can use to navigate the world. Their primary tool is their bow and arrow, used to vanquish AI-controlled enemies and to move through the game world by shooting special portals (Figure 3).

⁷⁰ Two-boxing, as defined *Ethnography and Virtual Worlds: A Handbook of Method* by Tom Boellstorff et al, is a method of collecting observations by controlling two avatars on two different computers, but inhabiting the same virtual environment. This allows a research to take fieldnotes on one computer while focusing on the game in another. However, because both games were virtual reality games, it was not possible to use this data accumulation method.

⁷¹ **Note:** A Youtuber is a class of Internet celebrity who have gained popularity from their videos on the video hosting service site Youtube.com.



Figure 5: *Shooting Monsters (left) and Constructing the Intentional Body in QuiVR (right)*

Despite that bodies are abstracted in *QuiVR*, there is still the opportunity for players to create intentional bodies in the game. Virtual masks, darts, bows, and jerkins can be upgraded as the player gains points and so, as an extension, skill. I consider the above figure to be an instance of an intentional body because the game mechanic offers players a means to manipulate and customize their appearance. In terms of the game play, the intentional body or customization of the avatar does not come into play very often, although as one progresses in level, the player does gain special items that allow for killing more monsters. Gains in items only seem to revolve around killing more monsters and do not affect speed.



Figure 6: *Tutorial World in QuiVR*

The landscape depicted above is from the lobby and tutorial space of *QuiVR*. This is a solitary, private zone with no goals or timers. The image shows the range of stations that a player can navigate towards using the blue portals hovering above the floor. As shown, the world is kept to human scale and each station is geared towards helping the player map their natural, human movements to the controls in VR. As depicted in Figure 2, the trigger of the Vive controller is mapped to a grabbing motion. The connection is reinforced by visual feedback depicting an object moving in relation to the player's hand by substituting the actual motion of the player (pressing a trigger with their finger) with the visual display of fingers curling around the area of a game asset which then responds to the controller's positional tracking.



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Time: 00: 03: 03

Figure 7: Picking up an object in *QuiVR*

In Virtual Reality, the quintessential tutorial level common in so many games has been given the additional task of teaching the player how to adjust and relate their understanding of their physical selves to the VR controls. In *QuiVR*, the tutorial served to try and negate a jarred *body schema*. The player, blinded by the headset, tethered to a computer, and clutching two plastic controllers, is physically reminded of the division between the virtual and the body. The tutorial world seeks to ease the player away from the trauma of a screen pressed against their face with a masked avatar, and the curling of the player's fingers are mimicked by the visuals of a hand curling around an object. The *body image*, however, is immediately sought to be replaced as floating hands move.

The game is structurally designed to confine the player. As shown, players are asked to move from portal to portal, perching themselves atop landscape featured. The radius of the perch is to dissuade players from moving beyond tether of the hardware. Space, ultimately, becomes a competitive advantage in this game. As shown below, certain perches allow the player to gain a competitive advantage against the monsters, or enemies, making it easier to kill monsters and so, accumulate more points, pushing the player up the player hierarchy.



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Time: 00: 06: 53

Figure 8: Rare Instance Player Responding to My Wave in "*QuiVR*"

When the player can no longer move freely, it exacerbates the feeling of facing an obstacle from within the game. Furthermore, because the player cannot easily escape, it emphasizes the feeling of threat or hostility. I experienced a similar situation to Jordan Belamire's within *QuiVR*, in which I was briefly pursued by another player who did not respond to my own words to tell them to stop. (shown, with username omitted, in figure 4). In *QuiVR*, space is weaponized as movement is closely tied to the spatial configuration of the world. The game mechanics make it so that you have to be adept at the game's mechanics in order to navigate the game world.

The series of images (Figure 7) depict the following interactions between myself and the other player. In the first image, I try and initiate contact with the other player through the voice chat method and vocally greeting them, and with my hand (shown in the lower right corner) by waving at them.

The other player begins to move their hand in a gesture that I originally perceived to be a signal of a friendly nature. Then, as shown in the third image, I realize that the player was reaching for an arrow, which they then aim directly at my avatar. While I manage to leave this player immediately (through a lucky shot to a nearby portal) the other player pursues me. It is crucial to note that player-versus-player conflict is not part of the game. While arrows shot at other players do stick in their targets, they deal no damage and such actions confer no formal benefit to the aggressor.



Figure 9: Pursued by Player in QuiVR

As I stand on the perch, I try several times to remove myself from the situation but, as a newcomer to the environment, it was hard to aim to the next portal and so I was trapped while the player drew their bow back repeatedly to shoot at me. While the experience was not troubling in the immediate, I was able to place myself in the perspective of Jordan Belamire. Had the player removed

their bow and approached me, with their arms outstretched, the situation would have been very similar.

We might say that *QuiVR* is a game is tailored for embodiment, referring back to the three anchors of embodiment formulated by Kilteni.⁷² A sense of body agency is maintained through the physicality of the game's interaction, counteracting the abstracted nature of the player avatar. Ownership is actually encouraged through avatar customization, but is deliberately limited: only a few elements (head and hands) are open to the player, and acquiring new items takes many hours of play. The sense of location, while confusing at first, increases as a player gains familiarity with the space. The actual inhabited space is limited to small areas arranged in a circuitous route, forming more of a relay or obstacle course than a broad, contiguous world.

Most of my communications with other players were actually through pseudo-sign language, limited to hand waving and gestures to demonstrate that I was amiable to communicating with them. I found that, despite the bold nature of Jordan Belamire's harasser, players were hesitant to initiate conversations with me and for the most part were focused on maintaining the game flow: to move constantly forward and accumulate as many points as possible. It took several sessions over a period of several weeks, all of which were around the same time of the day, for my presence to begin to be accepted by other players, and for me to form connections with others. Socializing is not the focus in *QuiVR* and is superfluous. The developers' goals seemed to be to recreate the feeling of games that involve group campaigns in which vocal communication is mainly for coordinating efforts.

5.4 VRChat

At the polar opposite of the VR game spectrum lies *VRChat*, a free-to-play online multiplayer virtual reality game developed by Graham Gaylor and Jesse Joudrey. The focus of the game is to promote social connections, as players spend time in different worlds that act more as lounges, as there are no formal actions or highly structured games dictating the overall experience. The focus, compared to *QuiVR*, is to enable as many social interactions as possible. This is achieved, in large part, through an important feature: player-authored worlds, avatars, and activities.

The progression of discovery in *VRChat* directs the player first through a series of tutorial environments meant to instruct the player to map their natural physical movements to the actions available in the game environment. In the tutorial world, players are taught to "move," "grab," and "shoot," all of which are mapped to the same trigger control, the difference lying primarily in the object at hand and its associated scripts. In *VRChat*, the emphasis of game control design is not focused on offering a wide variety of actions, instead focusing on a plethora of objects that respond differently to the same control. In my observations of *VRChat* player creativity does not manifest itself in a multiplicity of possible interactions. Instead, creative player content is found primarily in terms of custom visuals, as players create a variety of avatars and environments.

5.5 Worlds

VRChat extends the notion of the intentional body to the intentional *world* as players can create their own worlds or avatars are possible through a custom SDK for Unity. Player built worlds become extensions of the player themselves, as is most apparent in worlds used to promote music or visual artists. In other instances, players use the worlds as a means to commune with visitors, offering the

⁷² Kilteni, Konstantina, et al. "The Sense of Embodiment in Virtual Reality." *Presence: Teleoperators and Virtual Environments*, vol. 21, no. 4, 2012, pp. 373–87, doi:10.1162/PRES_a_00124.

world as a tranquil experience in and of itself. As an illustration of this point, I would like to describe a few worlds that I have explored within *VRChat* that demonstrate the spectrum of experiences that content creators offer other players. Through my observations, worlds tend to fall into a few major categories: “markets”, in which players showcase custom content that other players can either buy or use freely, “lounges,” social spaces with different aesthetic tones but whose main purpose is to provide a common area for players to stand and talk, “physically experiential” and “visually experiential”, “game specific worlds”, and “clan worlds”. My process for defining the different types of world is drawn from the primary player use of the world that is exhibited. While some worlds are a combination of these categories, each world has a primary purpose. For example, an adventure or game specific world may be attached to market, offering other players content from the adventure.



Figure 10: Avatar Market in *VRChat*

“Market” worlds demonstrate a burgeoning economy of goods developing in *VRChat*. While for the most part these markets offer free assets for players to enjoy, often they still benefit the world creator as either makeshift portfolio displays, or as venues for profit. Often, players become informal advertisers for content creators as they navigate other worlds using avatars made by others. Such market worlds are possible in *VRChat* because players can model, rig, and upload custom avatars. This has also created an unspoken hierarchy between players that use standard avatars and players who build their own avatars. My interpretation that there is a hierarchy is supported by my observations that, while players in standard are not vilified, players sporting custom avatars often draw crowds or positive remarks, and so such customization carries social weight and becomes incentivized.

As an aside, it’s worth calling out how market worlds intersect with player embodiment. These places allow players to change into specialized, if not fully customized avatars. While not always paid, the commercial framing of this activity suggests that avatars in *VRChat* serve more as clothing or uniforms than as consequential bodies. This is a notion that I explore more in-depth below.

“Lounges”, then, are where such socialization is most likely to take place. These spaces can be themed, and they are either one room or a series of rooms with game assets on which player avatars can “sit,” such as benches or beds. In lounges, players occupy the spaces either in adherence to the environmental cues or congregate in new, and sometimes odd, ways. Players will congregate in bathrooms, hallways, corners, on tables, and on roofs. There is little importance in the physical signifiers of the assets themselves.

Based on my observations, such worlds tend to have the most aggressive and abusive user interactions. Contrary to my original assumptions about the world, aggressive behavior is not rooted in any structural or formal competition. Instead, less direction and open-floor spatial plans seem to create more aggressive behavior, tying spatial relations to the design of games and the resulting

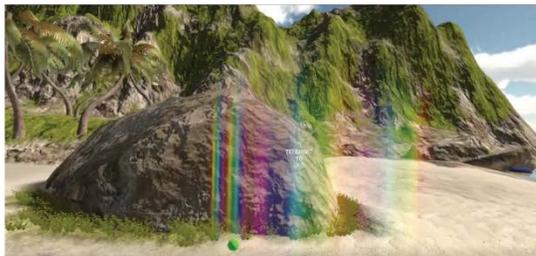
interactions. In lounge worlds, the main user interaction is vocal, and very rarely do players use their arms. For the most part, I have observed that players tend to hop onto objects, crouch, or propel their avatars into others.



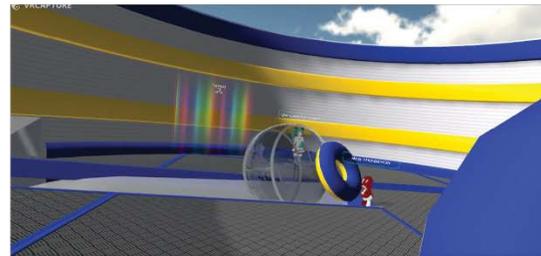
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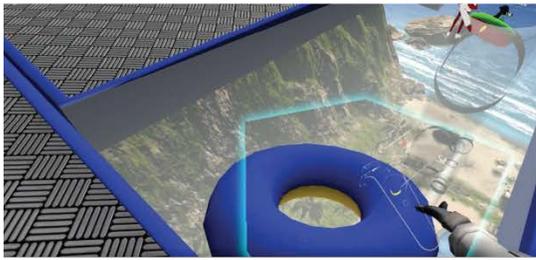


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Figure 11: Exploring a Beach World

“Physically experiential” worlds are designed to purposefully make the player feel a specific, physical sensation. Such examples can include forcing the player to jump from elevated positions or experience twisting and turning paths. For example, in a world themed for a beach vacation, the content creator had built a water slide. Once the player jumps into the slide, it immediately twists the player, pushing them forward before finally shooting them out into the sea. The experience was nauseating while eliciting a certain thrill based purely on the visual sense of rushing through space. Other worlds, the “visually experiential”, are designed for more considered navigation. Such worlds will often be accompanied by original music by the world developer, and the visual surroundings are

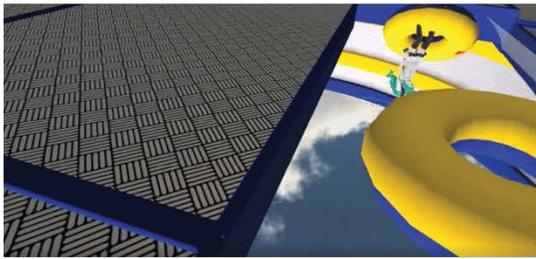
more an aesthetic accompaniment to their music. These worlds are rarely inhabited for extended periods of time unless the developer hosts events, or also include social “lounge” spaces in the world.



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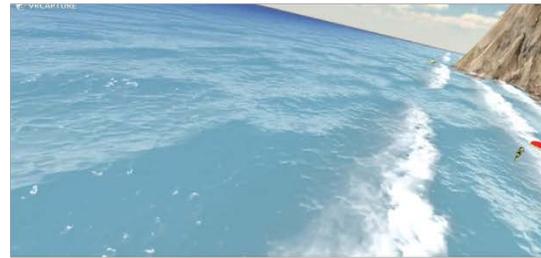
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02/20/18: 00:16:12

Figure 12: Tumbling Through A Rollercoast in a Physically Experiential World

Game-specific worlds are worlds that are constructed around a defined gameplay. Usually, these worlds are only “active” for a specific period. In other cases, the world remains available but players must coordinate amongst themselves when they would like to use it. In one world I have observed, entire pseudo-rituals have been developed around specific game worlds. For example, in the world “Ultimate Werewolf/Mafia”, a world based on the real game “Werewolf,” in which players will sit quietly to indicate to the player who is “running” the game that they are willing to begin the game. They shush or shepherd other players who do not follow the rules, even though it is unclear to an uninformed observer why this silent circle has become the signal to begin the game. This creates an air of exclusivity, and places more weight on establishing proper social relationships in order to learn proper rituals or be able to access the game worlds at all.



Figure 13: Hide and Seek Game World in VRChat

As I have spent more time within *VRChat*, I have observed that specific communities of players have formed around these different worlds. The most extreme example of this are “clan” worlds. These worlds are perhaps the least in number, but are the most visible example of communities forming, and then separating themselves from the rest of the worlds. An example of a “clan” world is the “Uganda Knuckles” world.

“Uganda Knuckles” is a character often found in *VRChat*, usually manifesting in a hoard of players all using the same avatar. The original character was the character Knuckles from Sega’s long-running franchise *Sonic*. Today, the original character depiction has been repurposed into a racist character – Uganda Knuckles.⁷³ Uganda Knuckles can be recognized as a deformed likeness of the original character, but voiced with a poor Ugandan accent, usually stating racist, tribal statements. Now, *VRChat* is the home to an informal “Uganda Knuckles” clan, in which players, all using the avatar, will swarm a world, choose another player, and then chase that player around the world making “clicking” and “spitting” noises at them (Figure 14). In response, other clans formed to reclaim the game as one focused on fun and jovial socializing.

The “Cat Parade,” for example, is a group of players with cartoon cat avatars who, as a marching band, migrate from world to world spreading cheer. They have created an entire world that makes it easy for any player to choose a cat avatar and instrument, and join the parade. In both cases,

⁷³ “Ugandan Knuckles.” Know Your Meme, Feb. 2018, knowyourmeme.com/memes/ugandan-knuckles.

clan worlds showcase how player creativity and experimentation affects individual representation, community formation, and the construction of entire worlds.



Date: 03/29/2018
Video Time: 00: 12: 44



Date: 03/29/2018
Video Time: 00: 12: 46



Date: 03/29/2018
Video Time: 00: 12: 48



Date: 03/29/2018
Video Time: 00: 12: 50

Figure 14: Players as Ugandan Knuckles Overrun the Open Mic World

My purpose in describing these different worlds is first to illustrate the breadth of ways players create within *VRChat* but also how the worlds act on and are acted upon by the players. The worlds within *VRChat* are a network of spaces that amalgamate into a whole system of play and sub-communities. Furthermore, the description of these worlds is used to show that different worlds have different allowances of behavior. This section sets a precedent for the notion of permissive behavior within games and how, in a game like *VRChat*, a single game can serve as an umbrella for several different behavior, each defined and distinct from one another.

5.6 Weaknesses in Worlds as Spatial Construct

Players can move from world to world in either personally or communally. If a player wants to move between worlds individually, they simply have to open their menu and scroll through the over one thousand worlds that *VRChat* boasts. It is a useful method that works fine, as it allows the player to explore the different worlds before actually visiting one.

The more difficult method is when a player wants to move as a group to a different world. Because of the number of worlds within *VRChat*, it is difficult to coordinate a group move from one world to another as it requires vocal communication of the different world. The only way for a player to be able to follow another player without having to coordinate vocally, is if they are friends with the player, and then they can jump to the location, and world, of their friend. If you are trying to move

through *VRChat* you can also “drop” a portal which serves as a public passageway between your current world and another.

Open portals become problematic when you are afraid of people potentially following you. In one instance, I was traveling between worlds with another player, leaving open portals when we landed in a “lounge” world. We began conversing with others when it became clear that first, everyone in the world seemed to know each other from before and turned their attention to us, second, once it was clear that we were two women, the interest peaked and we were surrounded. Uncomfortable, I tried to drop a portal so that my companion and I could move together away from the situation. The portals, however, can only be dropped in a in-game space that does not have any other players within a certain



vicinity.

Figure 15: Multiple Players Follow Me Throughout the Space

The figure above illustrates a group of players who have become aware of the presence of myself and the other player with whom I was traveling from world to world (player with platinum hair away from me). The players alternate between moving towards me and moving towards my friend and, as I try and move away, they follow me (as shows in the last image of Figure 11 in which I move past them but am followed by the player in the grey dress). While the players were not overtly angry or hostile, this moment does represent a shift in attention once I began talking. Furthermore, there was an odd equivalence to my person as a player and my avatar. My avatar was an anime girl similar to the others in the scene, and other players began to comment on the appearance of the avatar with such adjectives such as “pretty”.

Furthermore, there was no means for me to secretly divulge my plans to my companion without the other players knowing the plan: drop a portal, get out of here. I did not want the other players knowing where I was. Ultimately, I had to leave the companion behind and then, through the Steam messaging system, direct my companion to follow me by using the menu option to follow me as a friend. Space, in this instance, became a priority and my lack of space felt hostile. Despite that the main means of communication within *VRChat* is voice chat, despite that their avatars did not present

an actual, virtual block to my movements, the other players grouped together around myself and my companion, as if to force us into a single location.

5.7 Player Behavior: General Observations

Throughout my observations, I have noticed two predominant player behaviors towards myself, apart from the casual hello or initiating conference. The first is the “hello-proposition.” The “hello-proposition” is a form of greeting I have noticed where one player will approach another with a sexual proposal. The second player will either play along, or will remain quiet and try to get away. In some instances, particularly if the second player is female or a child, the second player will ask the first player to stop. Often, in particular if the second player is a woman, the request will not be respected, and sometimes if they are a child as well. However, when a player is clearly a child who is being approached in this way, other players will often try and intervene. In one instance, I witnessed a group of players try and move their avatars between the a solicitor and their target, shielding the child from the proposition. Avatars are not solid assets in the game, and one can just walk through them, so their defense was not fully effective.

In my own experience, I have been accosted by others with the “hello-proposition,” no matter the avatar that I was using (robot or woman, though I have not experienced the proposal when in a male avatar). The most common form of the “hello-proposition” I have witnessed is of a player with a male-presenting avatar approach a player with a female-presenting avatar. Often, the female avatar is used by another male player who will make this known by speaking. The understanding that the second player is a male, however, does not deter the first player, nor, often, the second. The two will then continue to pretend a sexual situation, vocally, for a time, before one player leaves. I have not witnessed the event happen for longer than a few seconds.

Objectification and puppeteering of the female body is an important element to the fantasy because of the second behavior I commonly observe: the “girl-shock”. Often, in particular “lounge” world setting, players will be shocked that I am an actual woman even if I use an avatar that presents female. I believe that this is because most female avatars are used by male players, and while the physical actions do not escalate once it is known that I am a woman, I do receive more attention and from more individuals in the vicinity.

In the next section, I use my preliminary observations of both *QuiVR* and *VRChat* to structure my interactions more formally. I explore how a few key observations led me to reframe my approach to further understand the relationship between *body schema* and *body image* in *VRChat*. More precisely, I use a series of avatars that perform male, female, or are more abstracted (i.e. robots) and move through various worlds within *VRChat*, cataloging and then comparing my interactions. I map, spatially, how players approach or interact with me, and compare between each world and interaction. I also investigate how other players present themselves, and how avatar choice changes their experience. These observations are constructed to better understand how players view the limits of their bodies in virtual settings.

5.8 Different Avatars with Different Avatars

I tested my initial experience within *VRChat* using different avatars at the onset of different gameplays. In this part of my observations, I made sure that I did not change my avatar except for at

the beginning of my entrance into either the home world or another world of the game. I did this because I was interested in observing how other players first assumed my identity based on my avatar and whether there were any assumptions on the part of others based on my appearance. Below I have noted a few of my most notable experiences.



Figure 16: Selection of Different Avatars Used⁷⁴

In my experience with different avatars, I found that I was less harassed when in a female avatar *while* my gender was not apparent through the voice chat option in the game. One consideration in why I might not have received as much as attention in the female avatar shown above (Figure 16: Frame 3) is because I observed that the avatar was very popular among newcomers to *VRChat*. On the other hand, when I used the blue robotic avatar (Figure 15: Frame 1), I was first approached by multiple male players and propositioned even though I had never indicated my gender. Within the first to few minutes of my use of the first avatar, two male players approached me and began to ask what I was and what I was doing. When I did not respond, both players, who had very short avatars, began to jump towards my face, which, because they were asking me to perform oral sex, I assumed was because they wanted to get their virtual crotches towards my face. In this instance, there was a clear understanding on the part of the other players that the spatial relationship between their avatar and mine could be used to mimic bodily relationships in the physical world.

5.9 Key Observations

During my initial phase of study, one key event in *VRChat* allowed me to frame and re-approach what I was seeing in relation to virtual reality avatars and their relationship to players. To give some simple background, the event occurred in a relatively active world dedicated to playing a digital version of the party game *Mafia*. Because each session was run manually by a self-appointed moderator, players waiting for their session are kept in a separate lobby area. Players can choose to spectate instead, and this is the role I planned to fill.

During this observation session, I came into the world in the middle of a brewing feud between different players waiting to play the game. To illustrate the events that I observed and protect user privacy, I ascribe pseudonyms to the important characters in this event. The scene began with an avatar of Eddy (a character from the cartoon *Ed, Edd, and Eddy*), and an armored *Halo* Spartan avatar. Eddy and the *Halo* Spartan were engaged in a rap battle (transcript attached), and transitioned to insulting one another. There were a few other players who were involved within the interaction, but were not participating in the rap battle. These players were “Pink Haired Woman”, “Woody” (from *Toy Story*), and “Young Woman,” who cycled through a series of avatars and so cannot be identified

⁷⁴ **Note:** Other avatars I used were a male avatar (I was not able to record this interaction), and a selection of female anime avatars. Part of these experiences are explored throughout this research.

through a single avatar. Each of these other players were in the background, watching and occasionally giving comments and laughing.



Figure 17: VRChat Cast of Players

Though I had planned to not participate in the interactions between players in this world, I was approached by Young Woman, who asked why I was removed from the group. Positioning myself as an observer, I did not notice that I must have seemed odd in the background of the room. Suddenly, the attention of the room turned towards us, and we were swarmed by the other players. While the attention was not overtly hostile, tension was building. Young Woman garnered a special amount of extra attention because she often engaged with Halo Spartan or Eddy. For example, she often swore back when other players cussed at her, and would taunt others in a kind of verbal sparring match. It is important to note that, from her voice, she was also clearly young.



Figure 18: Pink Haired Woman tries to get between Eddy and Young Woman

The truly crucial moment came shortly after. Things escalated when Eddy began to direct his attention entirely towards Young Woman. He began to threaten her with rape, swearing at her insistently. As Eddy crossed this line, other players began to intervene. At first, they started to vocalize their discontent with Eddy's actions. The most interesting moment came when other players tried to intervene directly. The Pink Woman stepped between Eddy and Young Woman with her avatar, making herself into a visual obstruction (Figure 13: Frame 3 and 7). This became a kind of dance, as Pink Woman continually repositioned herself to try and thwart Eddy's advances towards Young Woman.

As upsetting as the interaction was, it was a crucial moment that, as a high-stakes social interaction, exposed how players think of themselves in relation to other players and their own avatars. Player avatars lack actual collision in *VRChat*, so any player could simply pass through another. Yet,

the players were using their bodies as physical blocks instead of the permeable virtual representations they actually were. This suggested that, as a baseline, players understood themselves as standing in physical relation to others, and, on some level, that their avatar bodies had weight.

Though the way players were using their bodies indicates a physical understanding of the relationship between themselves and their avatars, they were not in this instance fully enacting physical behavior. That is, they mainly maneuvered their body as a unit, and opted not to raise or spread their arms to help block one another. Because *VRChat* maps avatar hand and arm motions to a player's controllers, this instance also shows that the players themselves were not entirely physically involved in the exchange.

The incident ended with the Young Woman asking the other players in the room to help her block Eddy. In *VRChat*, players have the opportunity to block other players through a "vote-to-kick" mechanic.⁷⁵ After I voted to block Eddy from the interaction, I realized that the blocking mechanic did not completely remove Eddy from the world and he was just relegated to a corner of the space (Figure 13: Frame 8) unable to interact with other players, but his presence is still in the world. After a period of time, the block was disabled and Eddy was able to interact with the group again. While Eddy did not continue to harass The Young Woman after the incident, his presence has still been present throughout the interaction.

How the developers designed the in-game moderating mechanism demonstrates a disconnect between how the developers understand presence and in-game interactions within virtual reality. To mute the player but maintain their visual presence in the world, it does not address the link between the players understanding how the avatars are an indication of other player presence, and the actual actions that the other players enact. The player's understanding of the technology acknowledges that the player does not just disappear when the avatar stops moving, they are still behind the visual component of the avatar and are watching the victim they just stopped harassing.

This incident suggests that a player's understanding of their body within the virtual space is complex, standing somewhere between a direct, physical impression of occupying space and the understanding, at the same time, of properties that have been abstracted. For example, a avatar is mapped initially to a player's head and hands, with inverse kinematics used to position the avatar's torso, legs, and feet. A few questions arise out of this, which helped guide the next phase of my research. How do we understand the space our body encompasses in a virtual world? How do we understand the effect of our actions, our movements? In this instance, I witnessed a disconnect between how players understood the limitations of their presence in virtual reality, and their actual sense of presence and space in a virtual world. After this instance, I revisited my findings in *VRChat* to try and further understand how players understand the relationship between their body, the virtual reality technology, and virtual reality itself.

⁷⁵ **Note:** In *VRChat*, the vote-to-kick method is a communal method for moderating interactions within the game. The way that players use the "vote-to-kick" feature is by using the player's menu in which they choose which player they would like to vote to kick. Then all the other players receive a notification, after which they can either accept to block the player or not. The pro of this mechanic is that it stops abuse in that it add an extra step before a player is kicked out of the group. The failing of the system, however, is that in situations that are very tense or stressful, it does not offer a quick means of dealing with the situation. In this instance, for example, The Young Woman had to negotiate and ask those around her to block Eddy. Just as in the case of *QuiVR*, the responsibility is placed on the victim to deal with the harasser.

5.10 Evolution in Methods

Moving forward, I organized two studies to consider these questions through the lenses, respectively, of *body schema* and *body image*. In this first section, I look towards body schema. Body schema represents the self-understanding of an individual that is created and reinforced by bodily feedback. For example, an individual's feeling of moving forward, the sensation of their legs swinging back and forth and their feet hitting the floor, are all inputs that contribute towards the body schema. When participating in virtual reality, the body schema of a player is constructed by head and hand movements, as well as the sensation of having the screen and hardware pressed against the player's head. As a researcher, I can trace the body schema of other players in virtual reality by observing how their avatars move. The hands and direction of the head's gaze reflect how the player moves their body. I look towards a simple mapping device for observing and analyzing how players interact with one another, bodily, in instances of toxic disinhibition in virtual reality.

Returning to my previous observations, I sought to map the different interactions that I witnessed in virtual reality. I focused on interactions involving disinhibition. I found several different instances from my documented observations and parsed them out, frame by frame. I then mapped the head and hand points of each player in each frame and isolated the points in a separate diagram. Furthermore, I did not map the limbs or joints of the avatars, as those positions are calculated by inverse kinematics. I wanted to focus on the points that directly reflect the physical motions of each player.

I set a few constraints concerning my mapping in order to maintain consistency. First, I only recorded and analyzed instances of online harassment where the victim stated that they did not want to engage with their harasser (either by trying to move away or stating verbally that they wanted the other to stop). I focused only on taking a screenshot (and so mapping the points) every two seconds. I also limited the mapping of each instance to no more than twenty seconds. Often, the beginning and end of instances of online harassment are hard to pinpoint. Sometimes, toxic interactions arise out of a gradual escalation of emotion between several players. In other instances,, the onset of an instance is abrupt. Similarly, an exact end of an instance of toxic online disinhibition is hard to pinpoint unless the instance drives the victim from the world entirely. In the case of *The Young Woman*, for example, the instance of toxic online disinhibition seemed to end when Eddy was blocked from the game, but this only relegated him to a corner of the game space, lurking in everyone's peripheral.

From my mapping, I found variations in how players used their controllers. In cases of overt, "physical" threat, the victim would use the VR motion controls directly. In other instances, like that of *Young Woman*, the players used their avatars more as unitary blocks than as gestural bodies.



Figure 19: Two Male Players Harass Female Player

Even with constraints in place, I found enough variability in the interactions that I could not make a steadfast, singular rule for how players used their VR equipment during events of toxic disinhibition. While in some instances players seemed to use their headsets more to interact with other

players, in others the players seemed to be conscious spatially in other ways. Sometimes actions were more closely linked to the world setting or to their avatar's accessories. For example, one player who had a weapon accessory with her avatar used it to fend off two players (Figure 14: Frames 4 and 7) who used their avatar to play with the victim's crotch (Figure 14: Frame 8).

In virtual reality, *body schema* is exercised through external engagement. When placed in a high tension situation, the player sense of self-presence becomes consequential. In the case of when the Young Woman was harassed, the other players' sense of body schema was only initiated or brought into play when the interactions escalated. The form of the avatar had little impact on the players' body schema and one's form in *VRChat* is more of a means of self-expression.

5.11 The table of avatars, are avatar representation mostly signifiers in their representation

My next exploration in *VRChat* focused on the *body image* as it is reflected by the players of *VRChat*. The body image, as mentioned previously in this research, is an internal mental understanding of a person's physical representation, that is constructed from social expectation and pressure. Here I hoped to understand more about the how players represent themselves in *VRChat*, and how, if at all, that might affect the player's experience.

Choosing or creating an avatar is an important part of *VRChat* culture. I sought to create taxonomy of virtual representation based on Scott McCloud's "The Big Triangle." In his work, *Understanding Comics*, Scott McCloud developed a categorization methods for visual vocabulary found in graphic novels. He developed the Triangle by first looking towards the extremes of visual representation. Each vertex of the triangle represents one of the categories of representation, meaning, and the picture plane. First, resemblance is active in images that are closest to photorealism, directly invoking the way an object registers on the retina. Meaning, on the other hand, is active in all images where, the subject is still immediately recognizable, but is depicted through increasingly symbolic means. As images move between representation and meaning, each image undergoes a level of iconic abstraction. On the third vertex of the triangle is "the picture plane, which represents images that depart from resemblance or meaning, and instead are composed of pure shape, color, and line. These images move towards pure abstraction.⁷⁶ As a spectrum, the triangle provides a framework to chart the relationship of these three concepts as they manifest in a broad range of representational art. This is a useful tool for *VRChat*, in which avatars come in nearly unlimited forms.

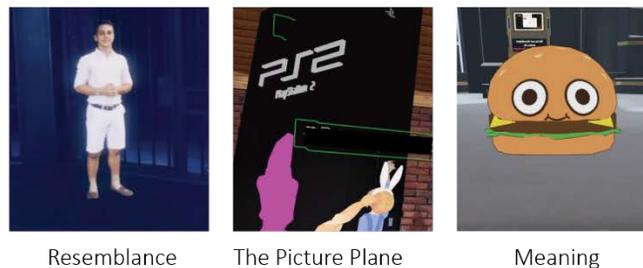


Figure 20: Examples of Avatars Along Vertices

⁷⁶ McCloud, Scott. *Understanding Comics : the Invisible Art*. New York, NY: Turtleback Books. Print.

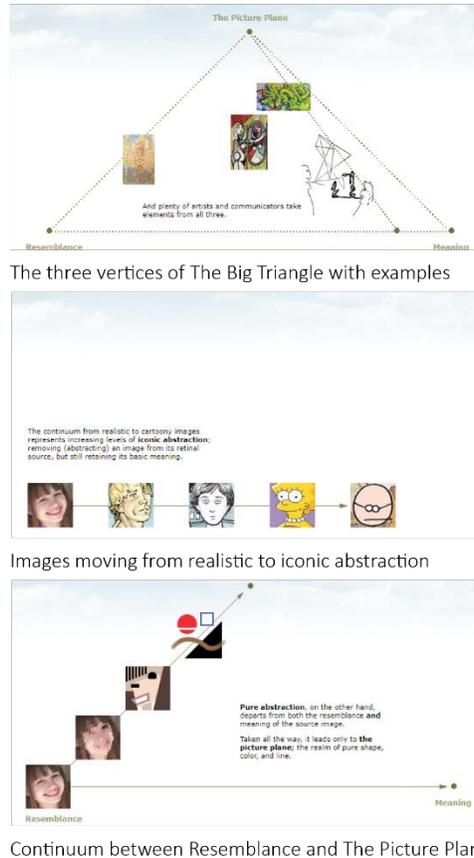


Figure 21: Scott McCloud's "The Big Triangle"⁷⁷

I sought to transfer Scott McCloud's categorization methods to player representation in *VRChat*. To prepare for my own classification of representation in *VRChat*, I collected ninety-seven images of avatars from my own gameplay. My criteria for including a player's avatar in my database was that I could sample the avatar in its entirety. If during my video recording I was not able to record the majority of the player's avatar (either because of other players playing beside them or my camera angle), I did not include the avatar in the sample. For each vertex of the triangle, I identified 10 possible features and assigned them a binary value depending on whether they were present (0 or 1). For each avatar, I averaged the values from each category. I then plotted each avatar in 3 dimensions (one for each category) on a single graph to get an overall sense for the distribution of properties across the spectrum.

⁷⁷ McCloud, Scott. "The Big Triangle." *Scott McCloud Journal RSS*, scottmccloud.com/4-inventions/triangle/index.html.

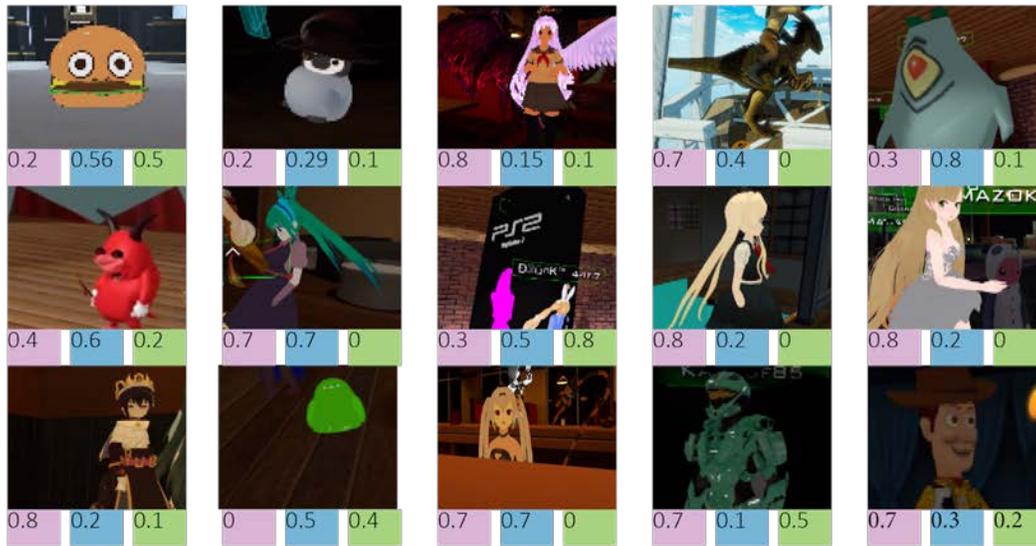


Figure 22: Sample Avatar values based on Representation (pink), Meaning (blue), and The Picture Plane (Green)

Looking at the relationships between approaches to representation, I noticed and became interested in the lack of diversity between humanoid and non-humanoid representation. Despite having the ability to, in theory, perform as any being, *VRChat* players overwhelmingly inhabit stylized, but ultimately human forms. I posit that part of this lack of non-human likeness in virtual reality is due to the strong precedent set by the technology guiding the experience: the default bipedal avatar, hardware that focuses on the head and hands, and the default/universal actions open to *VRChat* players.

According to Scott McCloud's theory at the base of 'The Big Triangle', images that fall closer to representation elicit a greater empathetic response in viewers. In the case of Scott McCloud, empathy is defined as the viewer being able to see themselves as or in the character. In virtual reality, however, the player is inhabiting the image and so empathizes with their body image through body ownership. On the one hand, however, the images that I have cataloged are often images from media, pushing the avatars into the realm of player signifiers. On the other hand, avatars in *VRChat* are intentional bodies in that they are constructed (custom avatars using the SDK). While my observations draw certain correlations between the behavior I witnessed and how players project their identity into virtual reality, it is not clear if it is *the* cause in players blurring the line between how they would act in the physical space and in the virtual.

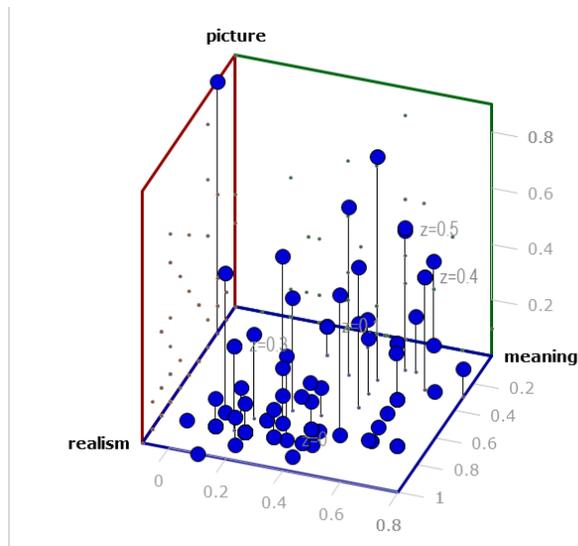


Figure 23: VRChat Avatars in 3D Point Cloud

By taking away signifiers in the avatar's representation and regarding behavior and player movement in the least-represented interactions in virtual reality, I hope that I will better understand how players embody themselves and understand the space between themselves and the avatar. If a player can feel fear, joy, excitement in an abstract avatar that is so distant from the player's own body, what does that mean in terms of how players envision themselves in a virtual space? Can an avatar body be isolated to the idea of a physical presence, or does it have to resemble a human form?

In the following chapter of my research, I set up a series of experiences that focus on abstract representation in virtual reality and user interaction. By observing how players move an abstract form and in a series of different environments, I hope to better understand the player-avatar relationship from a physical perspective. While there are precedents on the psychological relationship to an avatar, I feel that the following studies address a key difference in virtual reality from other mediums: the sensory nullification between the player and the physical world (attained through the VR headset and earphones), and the physical integration between body and technology as players puppet their virtual selves.

6. Explorations

6.1 Introduction

Online disinhibition reinforces and reflect social power structures. In the Pew Research Center's 2017 survey of Americans who experience the toxic form of online disinhibition, the Pew Research Center details that while online users generally experience negative forms of online disinhibition such as name calling or purposeful embarrassment, they are also expected to these negative interactions simply as a consequence of being present in online spaces.⁷⁸ On the other end of the spectrum lies more insidious activities such as online stalking, physical threats, sexual and

⁷⁸ Duggan, Maeve. "Online Harassment 2017." *Pew Research Center*, 2017, pp. 1–85, <http://www.pewinternet.org/2017/07/11/online-harassment-in-focus-most-recent-experience/>.

sustained harassment. At this end of the spectrum, the gender disparities also become more extreme. Per the results of a similar survey conducted by the Pew Research Center but in 2014, while only 8% of internet users are stalked, 6% are sexually harassed, and 7% experience sustained harassment, women between the ages of 18 and 24 experience these categories of harassment at 26%, 25% and 18% respectively. As detailed in previous chapters of this thesis, women have formulated coping mechanisms to mask their gender, demonstrating that the events are tied to their gender.⁷⁹

The toxic manifestations of online disinhibition is a feminist issue and should be explored and addressed through a feminist perspective. In my observations, toxic online disinhibition along gendered lines is an issue attributed to the virtual body. Issues surrounding the virtual body have been addressed by writers such as Haraway in her work “A Cyborg Manifesto”, and then in the VNS Matrix transformation of her ideas to suit the current and future technological landscapes “The Cyberfeminist Manifesto for the 21st Century”.

In the collective’s interactive computer artwork and multimedia installation piece, “All New Gen”, players join three characters: Patina de Panties, Dentata, and the Princess of Slime, to fight again Big Daddy Mainframe and his sidekicks. VNS Matrix aims to include a more feminist language in technology by creating a world of hybrid bodies. All New Gen herself, the protagonist of the game, is a fluid creature who is at once the techno-world of the game itself, a leader of the DNA Sluts, and an omni, yet conscious, presence.⁸⁰



Figure 24: “All New Gen”(1992) by VNS Matrix

Bodies, in “All New Gen”, are hybrid forms. Unfixed in their gender and boundaries, VNS Matrix challenges how bodies are incorporated into technology. When the topic of hybrid bodies is directed towards virtual reality spaces, we see that social spaces such as *VRChat* remain anchored to the world of signifiers, metaphorical representations, and gender polarization. Artists such as VNS Matrix set the precedent that it is possible to create and interact with hybrid bodies beyond the polarized perspective of gender between man and woman.

Another such artist that has explored other ways of being, or hybrid bodies in virtual spaces is Micha Cárdenas. In her piece “Becoming Dragon”, she lived for 365 hours as a dragon in Second Life, an online virtual world in which players can create custom avatars.⁸¹ Cárdenas had sought gender

⁷⁹ Duggan, Maeve. “Online Harassment. Pew Research Center: Internet.” *Science & Technology*. Retrieved from [Http://www.pewinternet.org/2014/10/22/online-Harassment](http://www.pewinternet.org/2014/10/22/online-Harassment), 2014, <http://www.pewinternet.org/2014/10/22/online-harassment/>.

⁸⁰ VNS Matrix. “Vns Matrix – Merchants of Slime.” *WordPress*, <https://vnsmatrix.net/>. Accessed 23 Apr. 2018.

⁸¹ secondloop. “PRESS RELEASE: Becoming Dragon, a Mixed Reality, Durational Performance in Second Life, Opens December 1st | Becoming Dragon.” *WordPress*, 2008, <https://secondloop.wordpress.com/2008/11/18/press-release-becoming-dragon-a-mixed-reality-durational-performance-in-second-life-opens-december-1st/>.

reassignment surgery, but was denied until she could demonstrate an ability to live as a woman for 365 days. “Become Dragon” questions this construction of gender by redirecting the question towards a completely hybrid, mythical form. Cárdenas examines the subjectivity of defined identity, and how digital media can, just as the dragon does in mythology, shapeshift and, as a result, create a wider gendered range of possibilities.⁸²



Figure : "Becoming Dragon"(2009) by Micha Cárdenas⁸³

Returning to the above discussion regarding the abstraction of digital representation, I wanted to lean into a gap of representation that I observed through my interactions in *VRChat* and delve into the potential of the abstracted body in virtual reality. For this, I turned to the abstract art movement from the 1960s. In his work *Abstract Bodies: Sixties Sculpture in the Expanded Field of Gender*, David J. Getsy focuses on how abstract Expressionism investigates how form decoupled from gender, and negotiates the coupling of objecthood and personhood in an inadvertent transgender capacity.⁸⁴

The avatar in virtual reality lives between the realms of the sculpture and two dimensional media. On the one hand, the avatar presents three-dimensionality in its interaction. Just like the sculpture, the avatar is a physical and spatial object. To borrow the term from Getsy, the avatar has an “activated relationship”⁸⁵ to the body. This is to say that, in sculpture, a piece has a presence, sensed to be a foil for the viewer’s body in form and scale. The avatar is, however, also pictorial in that it is a two dimensional mode of representation. While the production of an avatar is in three dimensions, its delivery is in two.

The avatar differentiates from both in the space that it shares with the user. The avatar is a sculpture that the viewer puppets from the inside. The relationship between objecthood and personhood for the player in virtual reality is different than that for the viewer of statuary. In virtual reality, the personhood of the piece is at once externalized and internalized: the viewer of the statuary (the avatar) in virtual reality puppets their own statue (the avatar).

Just as in David Smith’s work, the avatar of *QuiVR*, for example, omits limbs as players float above the virtual ground without legs and arms. Their hands are disconnected from their body. When looking towards other players, the user is confronted with masked figures. Gender is meaningless in this world as players are neither male nor female, the only signifiers relegated to usernames and voices.

⁸² secondloop. “PRESS RELEASE: Becoming Dragon, a Mixed Reality, Durational Performance in Second Life, Opens December 1st | Becoming Dragon.” *WordPress*, 2008, <https://secondloop.wordpress.com/2008/11/18/press-release-becoming-dragon-a-mixed-reality-durational-performance-in-second-life-opens-december-1st/>.

⁸³ *Ibid.*

⁸⁴ Getsy, David. *Abstract Bodies: Sixties Sculpture in the Expanded Field of Gender*. Yale University Press, New Haven, 2015.

⁸⁵ *Ibid*, 5.

While gender might be hidden in *QuiVR*, the experience of Jordan Belamire demonstrates that targeted behavior along gendered lines is not.

From my observations, I found several disjunctions between *QuiVR*, *VRChat*, as well as my initial expectations for both worlds. The goal for a virtual reality developer is to map the human body into virtual reality yet, in my observations in *VRChat*, players do not use their bodies as they might in the real world. In moments of high stress, such as instances of online harassment, players will use their bodies as blocks of space that can be used to come between them and their harassers.

In this chapter, I first explore how the avatar and the user interact with one another within the constraints of standard tools available to developers. I analyze a popular developer tool, “VRTK”, and its limitations towards rigging of non-humanoid form. I then return to my exploration of how abstract form can inhabit a virtual reality space. Within a single environment, I am interested in testing the following components:

1. The user’s ability to perceive the movement and presence of others in the form of moving non-player characters.
2. Whether or not users feel a distorted sense of embodiment when traversing a space that does not map directly to their physical sensations.
3. The user’s ability to puppet a body that falls along a range of spectrum between humanoid representation and abstract expressionism.

All three of these elements are combined into a single world, “Hyperbodies”. Inspired by the precedents set by VNS Matrix and Micha Cárdenas, I then analyze my observations through the lens of cyberfeminism.

6.2 Study Method

In this section, I draw primarily from games user research (GUR) methods to explore and create the following explorations. Games user research uses an interdisciplinary approach to tie player actions to interactive design decisions. GUR methods also maintains a global perspective of how the infrastructure of an interactive experience can affect player behavior such as controls, menus, artwork, etc. GUR methods use methods from many different research fields such as human-computer interaction, psychology, design, media studies, and computer science. These methods were also important for these studies for two reasons: one, GUR methods acknowledge that several different methods can be used for a single research question, and that each method offers insight from a different perspective, and two, it focuses on evaluating *players* instead of *users*.⁸⁶

The difference between players and users is an important distinction for my study. Users do not denote a specific form of environment and can be attributed in studies regarding robotics, mobile interactions, social networking sites, etc. Players, on the other hand, denote a more specific form of interaction as well as a frame of mind participants have when interacting with a study. If participants are players, they might have certain expectations of the experience that should be taken into consideration. Players are also harder to divorce from the historical precedents associated with the study. There are few online or social designs today that are truly unique in that a participant would not associate with other experiences. When analyzing each of these explorations, I made an effort to draw

⁸⁶ Lewis-Evans, Ben. “A Short Guide to User Testing for Simulation Sickness in Virtual Reality.” *Games User Research*, 1st ed., Oxford, 2018, pp. 501-506.

correlations between my design and interactive precedents and acknowledge how potential associations might affect the study results.

When designing each of these explorations, not only did I take into considerations the GUR methods, but also the challenge virtual reality poses regarding sickness when engaging in a virtual reality setting. Simulation sickness presents a series of considerations that are not necessary in traditional games. To mitigate the feeling of simulation sickness, I did not tamper with the following components, which have been found to emphasize nausea from virtual reality: frame rate, motion blur, flickering, rolling motions, camera movement not in the control of the player, uncomfortably positioned UI.⁸⁷

There were three potential sources for simulation that I was not able to exclude from my research and so, when finding participants for my study, communicated the risks for simulation sickness with the participants. The components in question were camera height and motions that involve being suspended above a virtual void. To try and avoid the more extreme results of simulation sickness (such as vomiting vertigo, or disorientation)⁸⁸, I followed the practical considerations outlined in Ben Lewis-Evans' work "A Short Guide to User Testing for Simulation Sickness in Virtual Reality":

1. I prepared a safe place for testing in the CodeLab (the Computational Design program at Carnegie Mellon University on campus lab).
2. I asked players to inform me immediately if they felt uncomfortable and was ready to assist them.
3. Clarified that all participation is voluntary and that they could stop at any point.⁸⁹

I created my own rubric for analysis and to inform my design decisions between each iteration. Previously in this thesis, I explore the work of Konstantina Kiltene and her work on the sense of pillars of embodiment. In her work, Kiltene links three concepts with a sense of embodiment: the sense of self-location, the sense of agency, and the sense of body ownership. She focuses on the importance on human representation and likeness in a user's ability to feel a sense of presence or embodiment within a virtual environment.⁹⁰

⁸⁷ *Ibid*, 503.

⁸⁸ Lewis-Evans, Ben. "A Short Guide to User Testing for Simulation Sickness in Virtual Reality." Games User Research, 1st ed., Oxford, 2018, pp. 502.

⁸⁹ *Ibid*, 504.

⁹⁰ Kiltene, Konstantina, et al. "The Sense of Embodiment in Virtual Reality." Presence: Teleoperators and Virtual Environments, vol. 21, no. 4, 2012, pp. 373–87, doi:10.1162/PRES_a_00124.

The Three concepts linked to Embodiment:

1. **Sense of self-location vs sense of self-environment:** The sense of self-location references to one's spatial awareness in relation to the body. Self-environment, on the other hand, refers to the feeling of one's self in a spatial environment (physical or virtual). In my research, I posit that the boundary between self-location and self-environment is more permeable than Kiltene defines. In her work, Kiltene ties significant importance to the body having a human likeness, and that the experience of space and body are separate.
2. **Sense of agency:** This is the sense of a correlation between control and resulting active movement. The sense of agency is tested by manipulating the proposed results in relation to the predicted sensory result. "Simulator" games present an extreme version of a

I appropriate Kilteni's three concepts and utilize them towards abstract and hybrid representations in virtual reality. In my classification efforts in which I create a taxonomy of virtual representation based on Scott McCloud's "The Big Triangle", I noticed and became interested in the lack of diversity between humanoid and non-humanoid representation. I posit that part of this lack of non-human likeness in virtual reality is in part because of the precedent in research that embodiment within virtual spaces is intimately tied to human-likeness in representation. On the other hand, cyberfeminism has challenged a strict adherence to the human form or experience in virtual settings because of the implicit bias or lack of diversity in design perspectives. I argue that virtual reality has the potential for a more experimental range of experiences but the current standard tools limit developed experience set by classical gaming tropes.

While tropes can be subverted, transformed, or evolved to fit changing cultural interests or needs, they cannot offer fundamentally new experiences. By breaking apart theories of embodiment into concise, virtual explorations, I use my findings to propose an alternative standard in developer assets. Having outlined my methods in the current section of this chapter, I then move to a brief analysis of the software and developer tools that I used to create each exploration. Finally, I analyze the explorations and move onto how I would like to use my findings to create my own standard toolkit that aligns with the goals of cyberfeminism.

6.3 Technology: Hardware, Software, and Developer Toolkits

All of these explorations were made using Unity, a game development platform by Unity Technologies. Unity is a popular platform for 3D game, mobile, desktop, VR/AR, console, and Web developers. The platform, however, offers only a bare bones base for game development. For more elegant experiences, it requires customization in both scripting and modeling. The true lure of the platform lies in its ability to import or support different platforms within a single environment. Developers often also create "toolkits", complete with scripts, models, and custom assets, that they either sell or share for free online.

For the purpose of this study, I have focused solely on the HTC Vive headset and controls system. The HTC Vive controller has certain constraints in terms of technology, but also in the ability to fully map the human body in virtual reality. While the HTC Vive does have 360 degree play area tracking coverage and wireless syncing, the headset is tethered in an almost brutalist method at the back of the headset⁹¹. When playing, one is periodically reminded of the tether when stopped short while moving or when one's legs are intertwined by the cord. Furthermore, the spatial capacities of

virtual environment in which the sense of agency is minimized. For example, in the game *Hand Simulator*, developed and published by HFM Games in 2017, players attempt to manipulate articulated hands in virtual reality that fail to respond to the controls in an adequate manner. In this game, the draw is the comedy that arises from the lack of agency.

3. **Sense of body ownership:** Is the implication that there is a correlation between the body as the source of an experienced sensation. Kilteni traces the sense of body ownership from neuroscience perspective as the sensory information that the brain receives from visual and tactile input. However, she also posits that an artificial body can promote the sense of body ownership if the visual input from the artificial body resembles a human likeness.

⁹¹ **VR Headset:** A virtual reality headset is the primary means for a player to immerse themselves within a virtual environment. The headset is composed a front-facing camera, an inner screen that is molded to the face by the headset padding, and adjustable straps to anchor the headset to the face.

my studies were restricted by the spatial capacity of the HTC Vive base stations⁹². The controllers⁹³ themselves follow the precedent of abstracting human movement to virtual feedback with a multifunction trackpad, grip buttons, dual-stage trigger, and system and menu buttons. With this technology, there are some initial limitations, or obstacles, to achieving embodiment on the part of the player. The controllers assume a familiarity with the abstraction of controls in games. When observing participants who are not familiar with the HTC Vive, I have observed have trouble familiarizing themselves with the controller.



Figure : HTC Vive (left) and controller (right)⁹⁴

“VRTK”, or Virtual Reality Toolkit, is one such assets package. It is a collection of useful scripts and assets to aid developers to rapidly build VR solutions. In particular, *QuiVR*, the game where Jordan Belamire was assaulted, was built using VRTK. The toolkit also solves a range of issues in developing for virtual reality and offers solutions for locomotion, interactions, body physics and controls. It also bridges a development gap, in that it allows the developer to simulate VR controls in a standard computing environment, allowing for easier iteration on designs.

Within each of the previously stated categories, however, there are few means for expansion of user interaction beyond the humanoid experience. The options range from nullifying the bodily experience of moving (i.e. moving via teleportation), to the abstract (moving forward by combing the headsets rotation with a button activation), and more physically involved (“playerclimb”: a locomotion solution in which the player must use their arms and controls to mime climbing a surface). It is this latter locomotion option, climbing, that I choose to focus on in my later explorations.

The second toolkit that I used is “Final IK”, developed by Rootmotion. This toolkit helps developers incorporate inverse kinematics in the manipulation and movement of their avatars. While “Final IK” does have a customizable option in which non-biped characters can be rigged using the toolkit, the standard package is tailored to easily rig a biped, either for traditional display or as the avatar for a virtual reality control scheme. To understand the limitations of this toolkit in terms of its potential for avatar creation, one must first understand how avatars are moved using articulated bodies and inverse kinematics.

An articulated body represents the skeleton of most animated bodies and is a series of linked joints that can be manipulated. Animations are created using forward kinematics or inverse kinematics, which differ in how they compute the target position of the articulated body. Inverse Kinematics (IK) is the inverse function of Forward Kinematics, which takes a target position and then calculates the pose required to reach the target position. With inverse kinematics, the whole pose of an articulated

⁹² **Controllers:** VR Controllers draw from a long history of video game controllers. Just as its precedents, the HTC Vive offers an abstract interface for human micro-movements to be translated into virtual responses.

⁹³ **Base Station:** The base stations are necessary for 360-degree tracking and wireless syncing.

⁹⁴ “VIVE Virtual Reality System.” VIVE, www.vive.com/us/product/vive-virtual-reality-system/.

body does not need to be defined. Rather, only the target position is defined, and the intervening joints (elbows and knees, most commonly) are posed to solve for that position. These positions are then combined to create an animation of walking or general locomotion.⁹⁵

Apart from these standard toolkits, which are available on the Unity asset store, I also created a small series of custom scripts for my explorations. In these scripts, I explored different scaling methods for players to create different spatial relationships between players and the objects surrounding them. This was inspired by the notion of “presence” as explored by Frank Biocca in his work “The Cyborg’s Dilemma: Embodiment in Virtual Environment,” and I wrote an additional script to allow any object to turn towards and track the player.

In the following section of this chapter, I trace the development of different explorations I have developed throughout the semester to better understand how players embody avatars, and to more closely examine the relationship between the body and space in virtual reality. These explorations are each divided into three main parts: the conceptual phase in which I describe my research and sources in creating the exploration, the execution of the concepts found in my research, and then the evaluation and discussion.

6.4 Scaling Exploration

6.4.1 Concept

Virtual reality is, in part, a spatial experience. Celia Pearce references games, in particular as a spatial construct.⁹⁶ Building on her premise, I have combined her perspective of interactive spaces as a spatial construct with Biocca’s perspective that spatial awareness of virtual spaces plays a part in the user’s awareness of self-presence. In his work “The Cyborg’s Dilemma: Embodiment in virtual environments”, Biocca describes how users construct mental maps of their spatial surroundings. Mental maps of virtual environments differentiate from the physical in the type of cues that the user registers. In his work, Biocca maintains the position that spatial cognition in virtual reality is hardly to maintain because the user’s senses are not constantly engaged, but admits that in more recognizable settings (such as architectural walkthroughs) a user presence might be maintained.

Camera perspective and materiality are intimately linked to the mental comprehension of a space. Concerned with the transformation of civil society as reflected in electronic media, Harun Farocki was an author and filmmaker that focused on chronicling the history and media transformations as a reflection of changes in cultural understanding of space and visual representation. I am particularly interested in his concept and analysis of the “afterimage” in media. The afterimage is the unseen, either the subliminal or the invisible in cinema. One example author Thomas Elsaesser offers in his analysis of Farocki as an artist and theorist is an instance where Farocki one noticed and commented on an editing instance of the evening television news. The topic: an air show disaster at the Raminstein airbase in January 1989. The afterimage: a brief cutaway, just before the planes collided.⁹⁷

⁹⁵ Bermudez, Luis. “Overview of Inverse Kinematics – Unity3DAnimation – Medium.” *Medium*, 2017, <https://medium.com/unity3danimation/overview-of-inverse-kinematics-9769a43ba956>.

⁹⁶ Pearce, Celia. *Communities of Play: Emergent Cultures in Multiplayer Games and Virtual Worlds*. MIT Press, Cambridge, Mass, 2009.

⁹⁷ Elsaesser, Thomas. “Harun Farocki: Filmmaker, Artist, Media Theorist.” *Harun Farocki: Working on the Sight-Lines*, edited by Thomas Elsaesser, Amsterdam University Press, 2004, pp. 11–38.

The afterimage is fluid in that it is not tied to any one medium but instead to the audience's attention. He zeroes in on the image that we, as a viewer, are not meant to see or notice, bringing them to the forefront and so destroys the image's identity as an afterimage. In his final work "Parallel I-IV" (2012), Farocki explores virtual worlds and the development of details and signifiers in computer games over three details. As technology progresses, the need for abstraction in virtual representation is minimized. As explored in "Parallel I", the virtual tree, once signified through lines, now rustles in an imagined wind.



Figure 25: Progression in Tree Designs, Stills from "Parallel I" by Harun Farocki⁹⁸

In the subsequent films of his series, Harun Farocki takes on a more involved role, no longer serving as a curator but instead as a researcher, testing the limits of design within virtual worlds. In his work "Parallel III", Farocki experiments with the boundaries of the camera. His work draws from an Eames precedent and mimics the style and tone of "Powers of Ten" (1977) by Charles and Ray Eames. Farocki at once builds on and leaves behind the Eames rubric. He begins his piece in a Eames fashion, moving upwards until the video game is no longer recognizable and the view becomes a god-like figure as pre-programmed characters rage war in an infinite cycle. Dissatisfied with an infinite bird's eye view, Farocki returns to the ground plane, fascinated by the permeability of material in virtual worlds. Virtual materials are illusionary in that they seem tangible but offer little obstacle to player movement.

⁹⁸ spiritstereo. "Harun Farocki - Parallel I." YouTube, YouTube, 31 Mar. 2017, www.youtube.com/watch?v=Yzc3OPc8gUM.



Figure 26: "Powers of Ten" by Charles and Ray Eames (above)⁹⁹, "Parallel III" by Harun Farocki (below)¹⁰⁰

In "Powers of Ten", there is a limit to the viewer's connection to God's perspective as the film enters the realm of imagination and the images are replaced by illustrations of the universe. Farocki never escapes a deity's vision and encounters the edge of the virtual universe. In virtual reality, and with VRTK, the player is limited to the ground plane. Kiltner's concept on embodiment is reinforced as the player is tethered to the human scale in relation to their surroundings. The sense of self-location, the player relation to the avatar's space, is always the reinforced perspective. In this exploration, I sought to blur the lines between the sense of self-location and the sense of self-environment by drawing inspiration from Harun Farocki and finding a means for the player to move beyond the ground plane of an environment.

6.4.2 Execution

In this exploration and the next, I wanted to delve into the issue of "presence" that Frank Biocca initiates in his own work. I focused on the ability of the user to "map" their surroundings. I wrote a script that interpolates the player's scale in relation to their surroundings. The result is that the player feels as if they are alternating between the first person perspective and the quintessential "third" person perspective. Part of my inspiration was the virtual reality game *Rez Infinite*(2002), in which the player controls a human figure and operates from the third person perspective.

In *Rez Infinite*(2002), the third person perspective allows the player to at once construct a mental map of the space around them as well as position themselves within the virtual world through the human figure they control. I wanted to explore how a similar shift in the perception of scale could be achieved but through interaction with the setting itself. In my script, I programmed a short interaction that allowed the player to scale themselves to the height of the object =with which they

⁹⁹ "Thinking in Powers of Ten." Eames Office, 18 Dec. 2016, www.eamesoffice.com/education/powers-of-ten-2/.

¹⁰⁰ spiritstereo. "Harun Farocki - Parallel III." YouTube, YouTube, 31 Mar. 2017, www.youtube.com/watch?v=voq7QB-5xoA&t=16s.

interact.

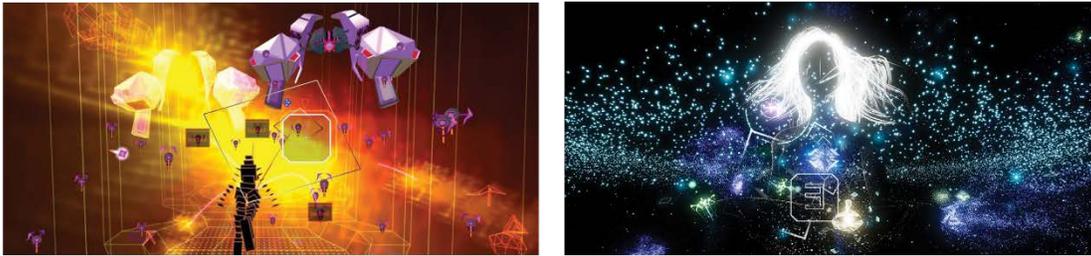


Figure 27: "Rez Infinite"(2002) by Tetsuya Mizuguchi

The objects within the environment served as anchors for the experience not only because they gave the player a sense of reference when they scaled upwards, but also because I wanted to add a form of interaction with the environment to form a bridge between the sense of self-location and self-environment. The scripts was paired to the pointer class of VRTK¹⁰¹ and altered the interaction with an objects. I experimented with difference forms of scaling upwards or downwards of the player's scale in the environment. To be more precise, I explored with different factors that altered the scale of the player after they activated the pointer. I first tested how the player controls felt if the player's scale took on the same XYZ scale of the object. While, as expected, the transformation made it difficult to manipulate the object after scaling. I then limited the scaling function to the Y-axis of the player and kept the XZ axis the same no matter the scale. I found that I did not feel a distortion of scale concerning the manual interactions. Finally, I placed a series of objects at different scales, created a pseudo-obstacle course for scaling.

¹⁰¹ **Pointer:** A "pointer" is a common term to reference in-game mechanics in which a player triggers a visualization that indicates when an object is an interacting object. In VRTK, the Pointer class emits a pointer from the controller and is activated or deactivated by utilizing different button combinations. The Pointer Class also requires a "Pointer Renderer" that extends to objects and indicates whether or not they are interacting objects.



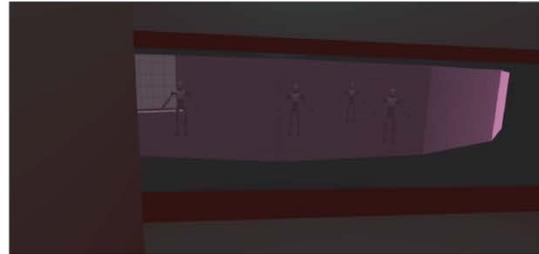
Scaling Exploration 00: 00: 28



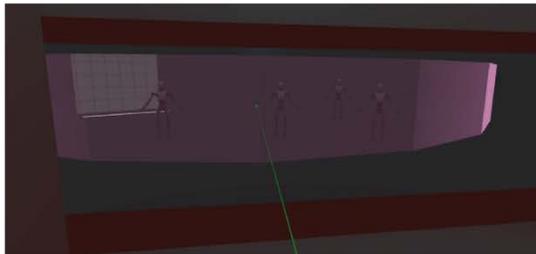
Scaling Exploration 00: 00: 29



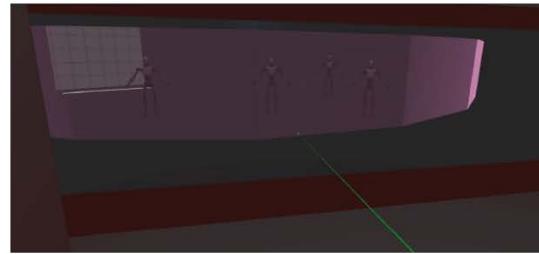
Scaling Exploration 00: 00: 30



Scaling Exploration 00: 00: 31



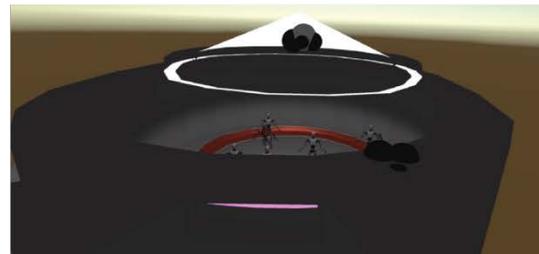
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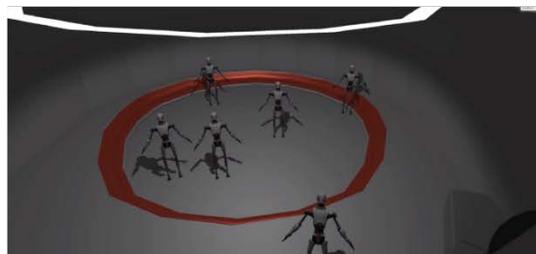
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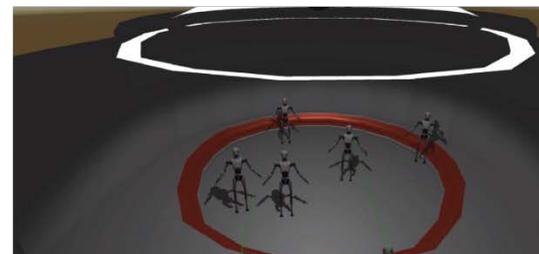
Scaling Exploration 00: 00: 36



Scaling Exploration 00: 00: 46



Scaling Exploration 00: 01: 36



Scaling Exploration 00: 01: 43

Figure 28: Moving at Different Scales in Virtual Environment

6.4.3 Evaluation

From my personal observations, I found that the most disconcerting experience was when I was at a smaller scale than my initial scale. I found that I had to reorient myself for a longer period of time as my position within the environment was not immediately apparent. I believe part of this is that, when at a smaller scale, the 2D characteristics of the world are more pronounced. The world becomes less volumetric and my vision is reduced to planar surfaces. When the virtual reality environment is removed further from the appearance of a 3D volumetric space, a player's ability to map their position and relate themselves to their surroundings is compromised.

For future explorations, I would test how different object configurations might tilt the sense of self-location or self-environment might change if there are clear patterns in object configurations. Furthermore, I would try and customize the interaction so that it can extend downwards or upwards in a more naturalistic manner. I would also like to test the difference in self perception of players between worlds where the player can move or manipulate the objects, and if they cannot be manipulated after the player scales upwards or downwards.

Drawing from the three concepts on embodiment developed by Kilteni, I would describe this experience as one where the sense of self-location and self-environment are maximized while the sense of body ownership and sense of agency is minimized. A more balanced distribution between the three might be accomplished if the player had more control over the bodily transformation. Right now, the feeling is that of a jolt in scale and resembles for a fluke than a controlled game mechanic. This refers to the issue around balancing¹⁰² a game mechanic, which was outside the scope of this experience.

6.5 Artificial Presence in Virtual Reality

6.5.1 Concept

The concept for this exploration also builds on the concept of presence by Biocca and, more specifically, social presence. The author defines social presence as the perception of intelligence in the appearance of another being. I sought to explore the limitations of the social presence in virtual reality by creating a custom script in Unity that allowed abstract geometric shapes to follow with their "gaze". In my experiment, I purposefully omitted facial features from the virtual setting, wanting to reduce the appearance of another intelligence beyond the programmed cognizance.

For this exploration, the potential for virtual hostile body language and the minimalist expression of intent. Ken Hillis draws compares theories on the computer body and intelligence as programmed, or engineered, while corporeal intelligence is a gathering of human sensation, bodily experience, memory, and, most importantly, agency. Computer intelligence, to Hillis, is a projection of human experience and so cultural signifiers of human behavior are mimicked or transferred to the machine.¹⁰³

I drew from the precedents set by Fritz Heider and Marianne Simmel in their work "An Experimental Study of Apparent Behavior" and their study on the ability of participants to construct

¹⁰² **Balance:** In his work *The Art of Game Design*, Jesse Schell describes game balancing involves insuring that certain game mechanics do not disproportionately affect a game's gameplay.

¹⁰³ Hillis, Ken. "Identity, Embodiment, and Place -- VR as Postmodern Technology." *Digital Sensations: Space, Identity, and Embodiment in Virtual Reality*, 1st ed., University of Minnesota Press, 1999, pp. 164–199, doi:10.5749/j.cttts6mg.11.

narratives surrounding abstract shapes. In their study, Heider and Simmel showed a short moving image film that entailed the movement of three geometrical figures and then asked participants to answer questions that anthropomorphized the figures. I pivoted away from the overt anthropomorphism in the study and focused instead on finding the minimal characteristics necessary to create a sense of presence in virtual reality.

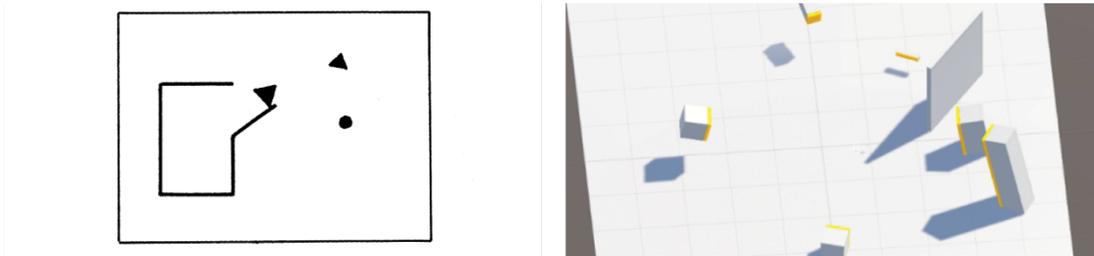


Figure 29: Exposure-Objects Displayed in Various Positions and Configurations from the Moving Film by Heider and Simmel (left)¹⁰⁴ and Still from *Artificial Presence in Virtual Reality Study* (right)

Virtual Reality artist and computer animator Nicole Stenger toys with cultural history and understanding in relation to disembodiment in her work “The Wish”(2013-2015), a virtual reality movie in which the view is freed from physical constraints. Viewers float from scene to scene, the ground plane inexistent or camouflaged, each character floating along the eyesight of the viewer. In her work, characters are programmed to act independently, hybrid bodies that enact the wishes of Stenger. Despite that facial features are not animated and the bodies are hybrid, and so not purely human, characters reflect distinct personalities.

Expression, in Stenger’s work, is communicated by physical movement. The narrative of the piece is expressed from the narrator’s expression and the metaphorical associations between virtual objects. In my own exploration, I sought to build on Stenger’s and Hillis’ work on the ability for cultural signifiers to be projected into virtual spaces by challenging the necessity of signifiers in communication and perceived artificial intent. After my observations in *VRChat*, I wanted to create and observe the minimal amount of motion or artificial expression necessary to express hostility or threatening behavior in virtual reality. In the following sub-sections for my exploration on presence in virtual reality, I detail how I built the scene by creating a custom script in VRTK, and then analyze the different test sessions I conducted during the development of this exploration. In my analysis, I also detail the elements I continued to use in my ensuing explorations.

6.5.2 Execution

I began developing this exploration by first using a standard example seen available in the VRTK toolset. I programmed a series of cubes to follow with their “gaze” the player as they moved throughout a plain space. I experimented with different heights of the cubes along with different cube sizes. An unintentional result of the cubes was a forward pitching of the cubes when they initiated their tracing behavior. I also experimented with how the cubes “froze” once the player was too far from the cubes to initialize the cubes’ programmed behavior.

¹⁰⁴ Heider, Fritz, and Marianne Simmel. “An Experimental Study of Apparent Behavior.” *The American Journal of Psychology*, vol. 57, no. 2, 1944, pp. 243–259. JSTOR, JSTOR, www.jstor.org/stable/1416950.

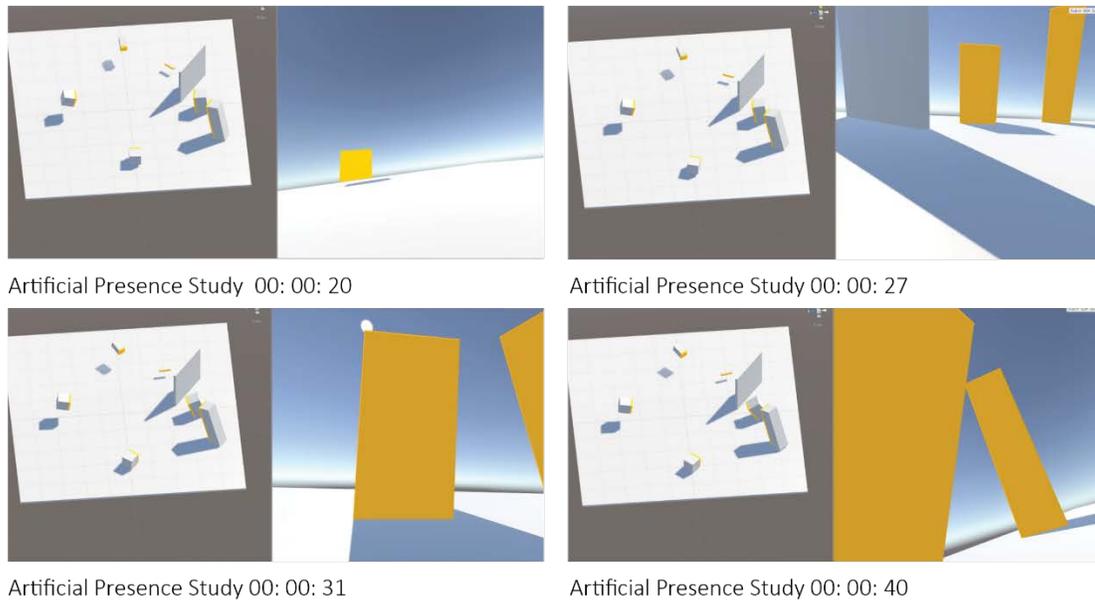


Figure 30: Study Development-moving through the space

In the above figure, I moved throughout the environment and recorded the scene view of Unity side by side of the game screen. I purposefully omitted a rendering of my location. Part of my methods for this study was to see if, through the custom movement of the cubes alone, I could identify my location in scene view. This design decision was to observe two characteristics of the cubes. The first, whether or not their movements could be seen from within the virtual world, and if, when observing from a third person perspective, the programmed behavior was noticeable. This method is an altered a standard Critical Facet Playtest in that I am reviewing a single game facet from two different perspectives (instead of just one that is analyzed through survey). In my observations of both in virtual reality and while observing the screen, I found that while that the movements of the cubes were not apparent enough and were not noticeable within the virtual environment.

I was aware that my knowledge of the exploration and the cubes would make me biased and hyper-aware of movement in the environment. As such, I built a series of following iterations that differed from the original environment in the following ways:

1. First, I created two copies of the original environment, one with a single cube that would detect the presence of the player, the other with a six cubes scattered throughout the environment. For this version of the environment, I was curious to observe if multiple characters exhibiting artificial behavior was necessary for participants to detect that they were being watched. Participants were only allowed to explore each environment for one minute, after which they were interviewed on their experience. I included the time constraint to ensure that the participants would not, eventually, notice a single moving cube. Part of the experiment was to observe how long it took participants to realize that they were being observed.
2. Second, I partially shielded the moving cubes behind larger cubes that did not respond to participant behavior. The cubes were of the same color to mitigate the participant's ability to quickly identify the different between different cubes. I built on the previous exploration in which I had a copy of the shielded cubes in which one had a singular moving

cube and the other had several moving cubes. I retained the same time constraint for participants and interviewed them at the end of the study.

3. Third, I sought to study the effect of participant self-environment awareness if the game mechanic of “being observed” was introduced at the onset of the game. This stems from the game design concept of introducing the verbs of game mechanics at the beginning of a virtual interaction, as to immerse the player in the rules of the game. I then placed cubes that detect participant action above the eyeline of the player and observed if the player detected their presence within a minute of participation.

In each of these exploration I sought to observe whether or not a hostile artificial behavior could be created, and, if perceived, if human features are necessary. The three sub-explorations described above were developed to create constraints and variables within this exploration. The constraints I set up were the amount time that participants were allowed within each environment, and the variables the number of artificial behavior agents and obstacles.

6.5.3 Evaluation

Some components of my study were successful in that the cubes seemed hostile or domineering. However, while the main function was apparent in the third person perspective, it was not apparent in the first. From the perspective of a Critical Facet Playtest, the first component of the playtest was successful. The second, however, was not. This could be because of the following different factors of the design:

1. The cubes were too abstract to enable a noticeable shift in position and movement from a first person perspective. This might suggest that more humanoid or diverse construction of objects are necessary in the perception of artificial presence.
2. It could also suggest that the parameters of movement that I had set in my custom script (i.e. speed, tilt, etc), were not dramatic enough.
3. In my observations, the instinct when in virtual reality is to maintain an eye-level gaze when moving throughout the space. The cubes mostly tilted downwards from above, but their movements were not perceived at a human scale. While I designed the different scale cubes with the consideration that the shadows would communicate the movements, this was not the case.

To further pinpoint the how to create an artificial virtual presence in VR, I developed a series of survey questions that are designed to access and evaluate the participant’s ability to perceive the change in movement of abstract forms. The survey questions are specifically designed to not insinuate any inherent behaviors within the scene, and to not direct the participant to a particular answer.

I observed that, while I was cognizant of the movement of the cubes, the instance I felt the greatest sense of uneasiness was when the cubes were of similar scale to my own and were pitched forward, casting a shadow behind the cube along the ground plane of the setting’s ground. When observing the cube swivel to follow my position, the pitched y-axis make it seem almost threatening, as if it were scowling at me from a distance. From my brief exploration in this setting, I believe that the minimum necessary behavior in virtual reality is for a “being” to be reactive to the actions of the player.

Based on the precedents by Heider and Simmel, I can suggest a more articulate or dramatic animation that would draw the participant’s attention to the cubes. On the other hand, I. can also alter where the objects in a scene lay along the spectrum of abstract expressionism. In the following study,

I observe how movement and Kilteni's concept of self-location is altered when a player manipulated a abstract avatar.

6.6 Space and Body

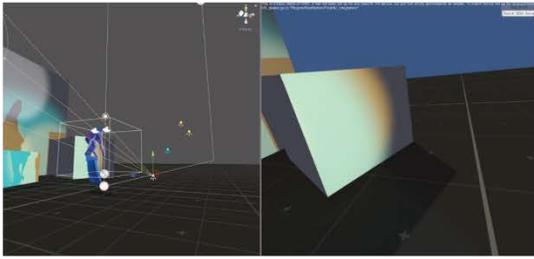
6.6.1 Concept

In his work *Abstract Bodies: Sixties Sculpture in the Expanded Field of Gender*, David J. Getsy revisits Abstract Expressionism as an era not only where the human form as representation was questioned, but as a space to defy the concept of a universal language for gendered representation. Getsy focuses on the statuary form and on the work of David Smith. Getsy reinterprets the work of Smith as an amalgamation of form, material, and of human representation free of the constraints of gender. In this study, I sought to study how a similar amalgamation between form and representation could be recreated in virtual reality, and how would that affect the movement and exploration of a player in a virtual environment.

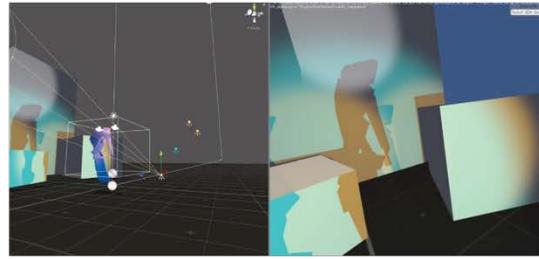
In this exploration I sought to explore the spatial relationship between the player and the avatar. Building on the theories of Abstract Expressionism and cyberfeminism detailed earlier in this chapter, I collaborated with game designer, 2D and 3D artist Eric Grossman to create and rig an avatar that draws from abstract expressionist artist David Smith. I was interested in experimenting with the limits of embodiment in relation to abstract figures. In particular, does an abstract, non-humanoid figure.

6.6.2 Execution

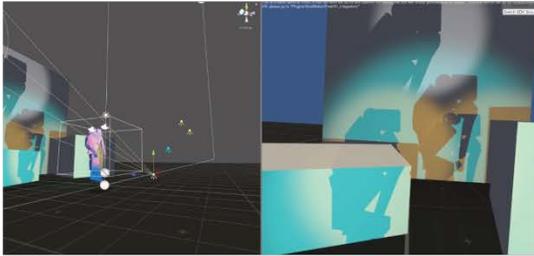
In this study, I had sought to build an avatar prototype that would bridge the gap between statuary forms and the viewer by placing the player within an abstract form. Originally, I sought to observe how a player would manipulate an abstract form that had no limbs, but Final IK as a rigging system did not allow for it. As such, the avatar had to be altered to fit a bipedal model. I found that there was little flexibility in the standard developer toolkits that I was using. Though the initial avatar design was not closely linked to a bipedal, two armed humanoid figure, my collaborator and I were forced to create a contrived humanoid articulated body for our avatar. This reduced the abstraction of the first model that we created as well as the interactions that I was able to design. I also found that, because of the camera perspective, the level of abstraction of the avatar was not clear when the player uses the avatar. As such, we incorporated a light and walls for the player to see their shadow and observe their form in its complete form.



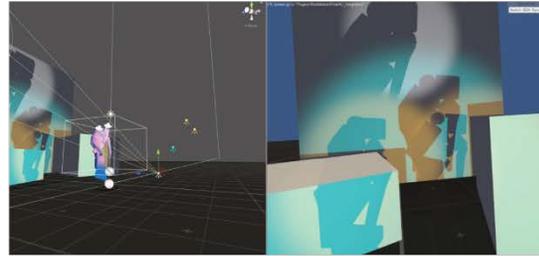
Space and Body 00: 00: 12



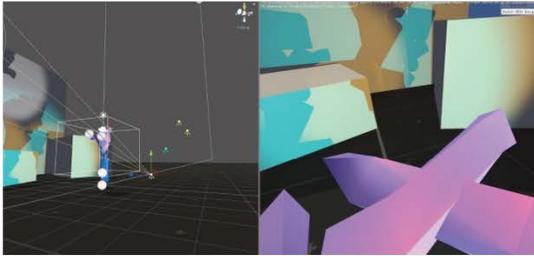
Space and Body 00: 00: 14



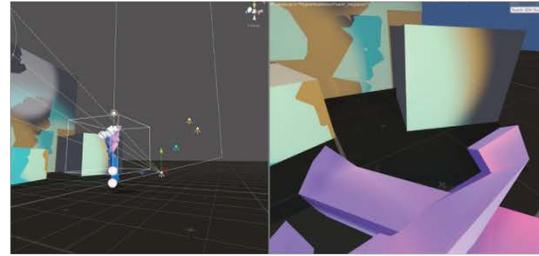
Space and Body 00: 00: 16



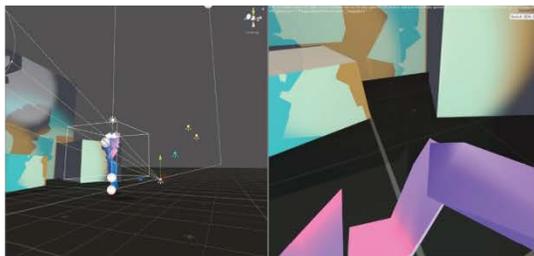
Space and Body 00: 00: 18



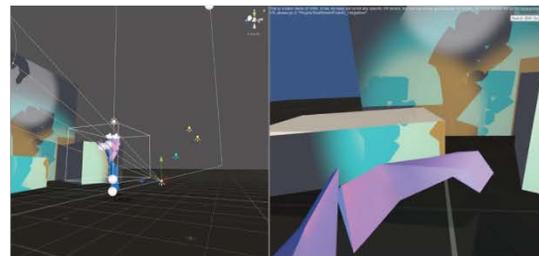
Space and Body 00: 00: 30



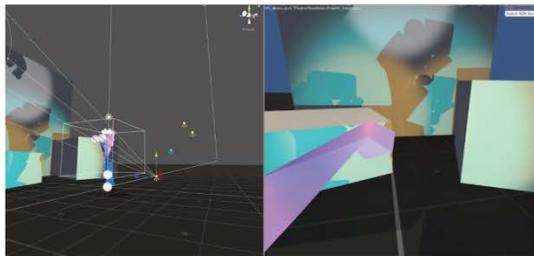
Space and Body 00: 00: 32



Space and Body 00: 00: 34



Space and Body 00: 00: 36



Space and Body 00: 00: 38



Space and Body 00: 00: 38

As I developed this study, I found that the first person perspective in VR did not allow for a full cognizance of the avatar's form. As such, my collaborator and I added lighting to the scene behind the avatar to observe how self-perception was different between how the player understood their body from the first person camera perspective, and their shadow projected on a wall.

As an extension of this concept, I also sought to observe how a player would interact with another form of a hybrid body. In the above exploration, I sought to view how the player would interact with a body that experimented with the bipedal form. My technical consultant and I rigged external limbs to an avatar and sought to observe how manipulating an form that did not map human movement to the virtual setting.

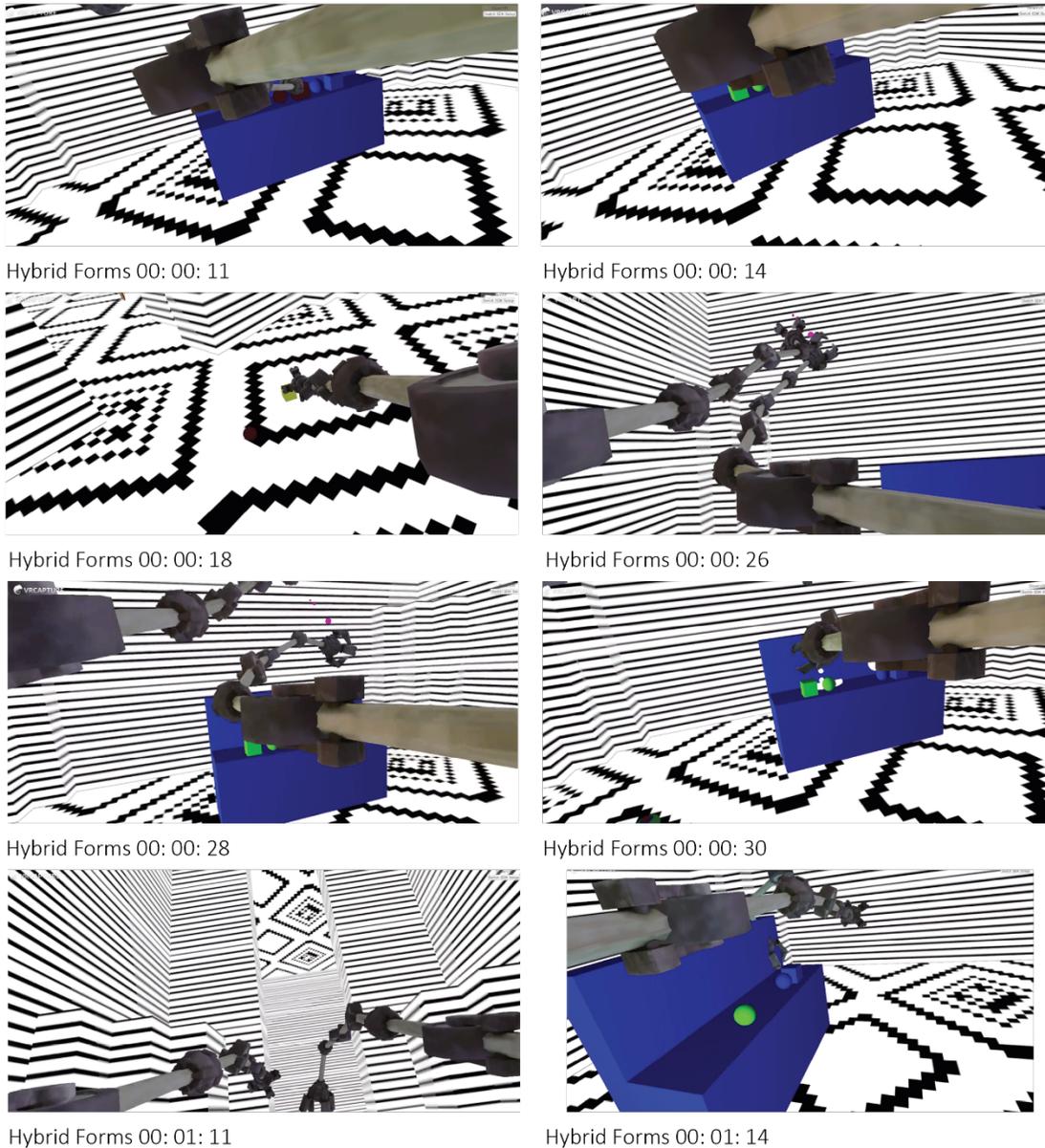


Figure 31: Manipulating a Hybrid Form

6.6.3 Evaluation

I was frustrated by the limitations of the standard toolsets as well that, because of the camera angle and the forced human scale on the avatar, there is little opportunity for the creation of more hybrid being. The most interesting moments in this exploration was when I was able to see the shadow

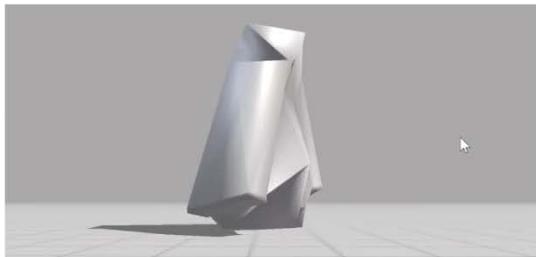
of my own avatar and observe the effects of my manipulations of the avatar. The second most interesting portion of this exploration was when I returned the view to scene view and observed how a user moved the avatar from a third person perspective. This, however, has clear weaknesses in that it is part from the in-world exploration.

6.7 Exploring the Disjunction between Movement and Physical Sensation

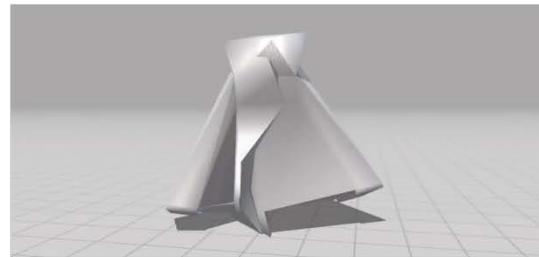
6.7.1 Concept

Building on my observations on how minimalist representation in virtual reality can create a hostile presence, I created an environment in which players would be surrounded by abstract, but hostile non-player characters, eliciting an emotional response for the player. I aimed to shape my research, and observations from QuiVr and VRChat into a format that isolates the player's bodily experience through a sense of urgency and obstacles. And so, Hyperbody tasks a player with manually ascending a virtual cliff-scaffold with a challenge to acquire a unique bodily form, then escape. If the player falls, the playthrough ends.

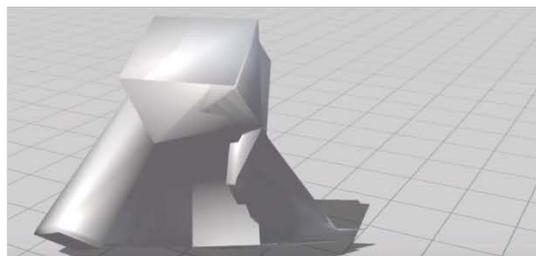
I then sought to contend with player self-representation in *VRChat* by exploring why players do not present themselves in an abstract manner. By placing the player in an abstract form, I tested whether or not a player *could* feel embodied in a non-representational avatar. And, if so, explored how that commented on the seeming necessity (on the part of developers, designers, and software engineers) of mapping the human experience in virtual reality.



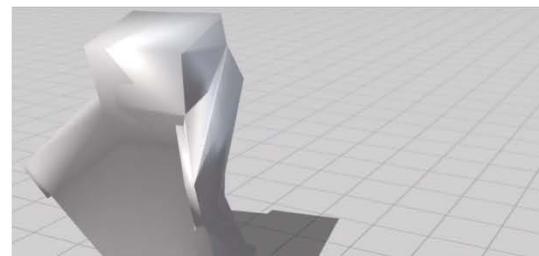
Abstracted Avatar 00: 00: 06



Abstracted Avatar 00: 00: 08

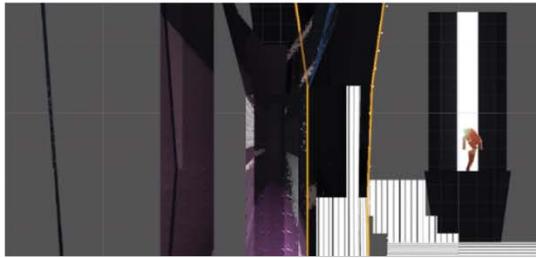


Abstracted Avatar 00: 00: 20



Abstracted Avatar 00: 00: 22

Figure 32: Process Image of Abstract Body Exploration



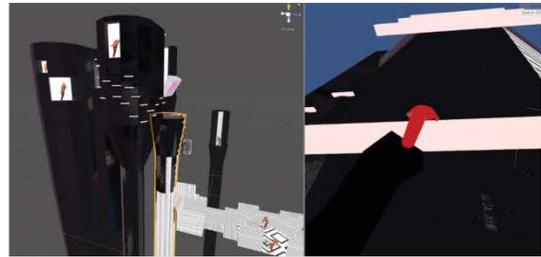
Hyperbody Process



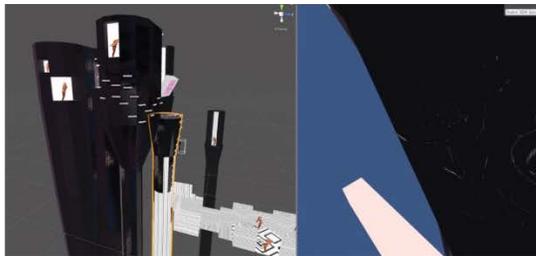
Hyperbody Process



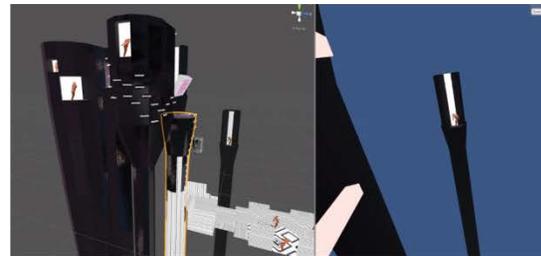
Hyperbody Process 00: 00: 45



Hyperbody Process 00: 00: 50



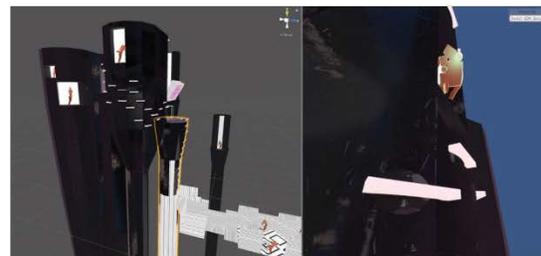
Hyperbody Process 00: 00: 55



Hyperbody Process 00: 00: 58



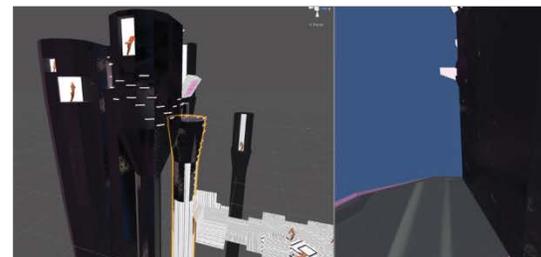
Hyperbody Process 00: 01: 36



Hyperbody Process 00: 01: 48



Hyperbody Process 00: 01: 51



Hyperbody Process 00: 01: 59

Figure 33: Process Image from Hyperbody, testing NPC responding to player location

6.7.2 Execution

As a researcher, I built Hyperbodies with discrete decision-points in mind to observe player decision making in non-threatened, low-stakes terrain, threatened areas, and threatened areas with high-stakes terrain. Each player was then interviewed briefly to understand their impression of the bodily experience, and their sense of connection to their virtual body.

From this process, I sought to explore and better understand how the body is “transferred” into the virtual world. By better understanding how the body is mapped into virtual reality, I could understand the limitations of the body in virtual reality. I tested the spatial relations that the user formulates between themselves and their surroundings by creating two different means of moving through the environment: moving forward, and climbing upwards. Once at the top of the ladder, the player can then propel themselves from platform to platform. These three actions allowed me to observe how comfortable users are enacting more physically involved actions when their avatars are more abstract in their design. I observed that users, in fact, were more quickly able to decipher the actions expected from them, while they were more unsure how to move forward in a linear space that was less volumetric.

In keeping with RITE methods, Hyperbody is designed so that each player could be given a survey following their playthrough. Hypothetically, I would collate responses and distill common adjectives or terms used in player responses to understand their range of experiences. In this interactive exploration, I used survey questions to understand how players interacted not only with their spatial surroundings, but also their avatars. With this, I hope to truly understand if the concepts of embodiment are relegated to humanoid forms, or it is possible to become embodied in an abstract shape.

In structuring the survey, I focused on the same three categories Kiltner outlined in her three concepts of embodiment by asking participants how easy it was to move the avatar (sense of agency), if it hindered their ability to view their surroundings (sense of self-environment/location), and whether they became attuned to their new bodies (ownership). Some additional survey questions include:

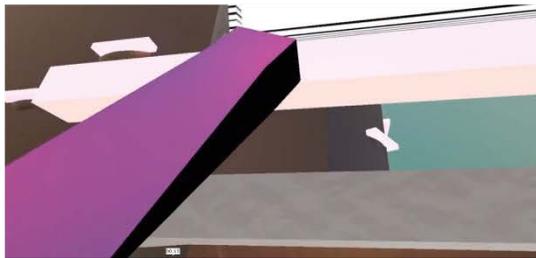
1. How did you interact with the avatars at the beginning of the game?
2. What did you notice as you moved upwards?
3. Did you find it difficult to gauge where your controllers are in relation to your hand?
4. Did your virtual body obstruct your movement? Did it facilitate your movement?

6.7.3 Evaluation

My first focus for the piece was to incorporate feminist language into technological rhetoric of virtual reality. The lexicon serving the virtual reality surrounds the body as terms such as “body schema”, “body image”, “embodiment”, and “presence.” With such a focus on the body, it is important that a feminist perspective be included in the formulation of that rhetoric. For my own text, I sought to invent a narrative that is cognizant of the role of the body as a connection to the virtual, and specifically in virtual reality, but is also conscious of a plurality in gender and identity.

The body, is a fraught issue in relation virtual reality, it is at once a vessel for interaction, but is also not self-defined or malleable in virtual reality. In virtual reality, your body is designed by the developer and only in certain cases (those with the funds or the knowledge to do so) can be self-defined. While the tools are readily available for a more customized self-expression, they are not automatic. As such “Hyperbody” seeks to create a more fluid rhetoric surrounding virtual reality.

In the cyborg's dilemma, part of enforcing a sense of embodiment is how the user places themselves in space. Being able to spatially find yourself/understand your environment is part of being embodied. In *A New Gen*, however, part of the goal is to create a purposefully disorienting environment. Or more, the point is to be a transgressive environment. They do not focus on making the environment close to what you would experience in the physical world. By not creating a pure, linear space, they support their ability to not make a linear narrative.¹⁰⁵



Hyperbody Playthrough 00: 00: 12



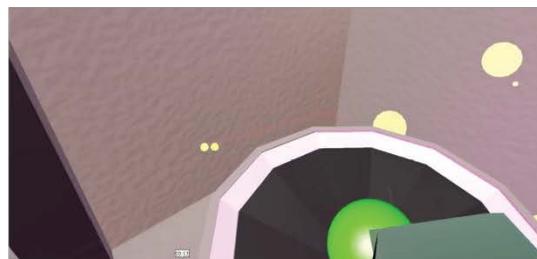
Hyperbody Playthrough 00: 00: 16

Figure 34: Hyperbody Playthrough Maneuvering Virtual Environment

Within *Hyperbody*, characters are inspired by my own interactions and the game *VRChat* in which there were periods of awe and beauty and then intense sensory overload as my space was overwhelmed by others. Masks are provided to hide behind to find a moment of solace from the barrage of hate-speech and criticisms. However, the respite stops the player from being able to move forward or even interact with the environment. The thought process behind these design decisions is to one confront my experiences in *QuiVr* and *VRChat*, but also to create a sense of urgency and obstacle. Ultimately, the player must move forward to complete the experience. There are tools for the player to address and mitigate the experiences, but they can never fully stop them.



Hyperbody Playthrough 00: 00: 33



Hyperbody Playthrough 00: 00: 34

Figure 35: Player Changing Bodies

¹⁰⁵ Biocca, F. "The Cyborg's Dilemma: Embodiment in Virtual Environments." *Proceedings Second International Conference on Cognitive Technology Humanizing the Information Age*, 1997, pp. 12–26, doi:10.1109/CT.1997.617676.

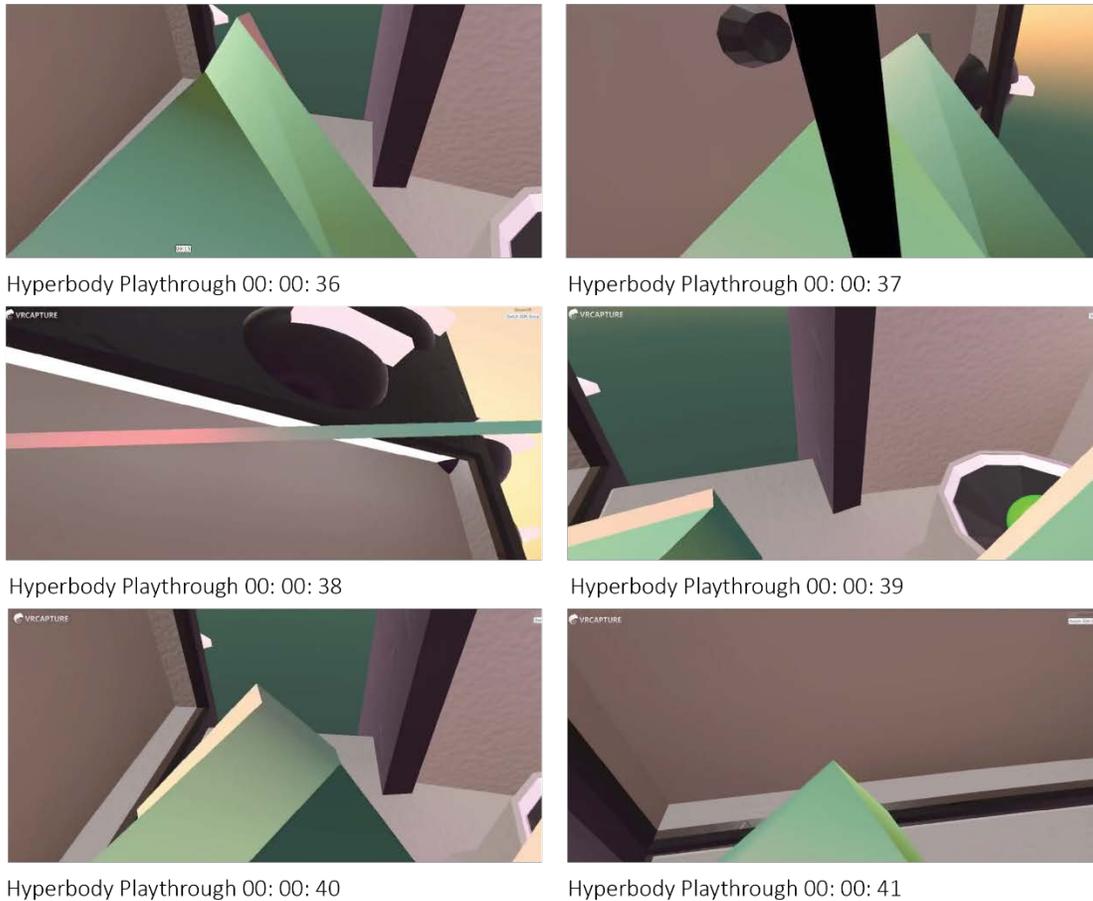


Figure 36: Player changing body from humanoid to abstract

The study demonstrates that while the abstract body affects the body image, the body schema is more affected by the virtual environment. When participants used the abstract avatar, the location of the controls are obfuscated but the player's instincts remain the player continues to reach forward, move forward, and interact with the environment in a similar way as with the humanoid body. The understanding of the boundaries of the avatar by the player are, however, confused. The player falls almost immediately into the void beyond the platform because they can no longer discern the limits of their avatar's body. These findings demonstrate that representations along the Picture Plane vertex affect the player's ability to perceive and sense their self-location and so affects the body schema through the body image. The body schema, in terms of the player's understanding of the physical limitations, are affected.

7. Contributions and Discussion

First, I feel that I should address some limitations and shortcomings of my research and suggest paths in future work that might address them. First and foremost, I focused on the effect and relationships between the player and toxic online disinhibition in virtual worlds from a gendered perspective. This perspective does not address nor acknowledge the great disparity between the experience of white players and persons of oppressed communities. My observations and experiences

in *QuiVR* and *VRChat* comes from a white, female perspective and should be regarded as just one piece to the larger puzzle of malicious behavior in online communities. In future work, I would like to use my research as a starting point for a larger conversation, and incorporate issues surrounding racism and homophobia that I was not able to address in this thesis.

Furthermore, I was not able to offer a definitive solution to online harassment. When I began my research, I had hoped that perhaps a software or design decision could help mitigate this behavior that has become almost analogous with the online experience. However, as I engaged with the reality of online harassment and how players experienced or enacting malicious behavior, the more I found the issue to be complex and pervasive across digital spaces. As such, I focused on the concept of bodily presence and autonomy: do victims have a claim in their own experience? And can a player claim ownership over their virtual body?

In my research, I stake the claim through field observations, academic precedents, and design explorations, that the virtual body is one's own and should be dictated by similar understandings of ownership and agency found in the physical world. I argue in support of this claim by observing that the virtual body is an intentional body, formed, designed, and manipulated by the player. Research by Celia Pearce and other digital ethnographers have set the precedent that the virtual self is an extension of the player's identity, and can grow and mature along with the player. My observations in virtual reality support her theory, as players take ownership of their form with custom avatars or avatars that represent their interests and passions.

Finally, my observations along with my explorations demonstrate that we, as players and users of virtual reality, maintain a complex bodily relationship with our avatars. Because of the nature of virtual reality as a mapping device of our bodies into the virtual world. The player's experience in virtual reality fulfills the three concepts of embodiment and so when one enacts an action on the self in virtual reality, one should consider that they are enacting the act on an embodied being. However, the necessities for being embodied in virtual reality are not anchored by the fulfillment of all three concepts of embodiment delineated by Kiltner. I found that an emphasis on the sense of self-location is not the primary method in achieving embodiment. Instead, elements of a design that focus on instilling body ownership and sense of agency are more important.

By breaking apart theories of embodiment into concise, virtual explorations, I found that embodiment is not tied to bipedal mapping of a player's experience but instead is a complex amalgamation between the self and forms of agency, ownership, and surroundings. My research has illustrated that spatial relationships between the self and the avatar as well as the virtual surroundings are key in embodiment. The methods designed by the developers of *QuiVR* and *VRChat* for reducing online disinhibition are counter-productive to the goal of embodiment because the efforts either restrict spatial interactions or isolate players, allocating them to the corner (i.e., spatial isolationism). If the goals of designers for virtual reality are to map the human body into the virtual world, then embodiment of the player should be a priority. As of now, the designers do not fulfill that goal.

My hope for this research is to be the first step in my own practice that follows a similar development narrative as delineated in this thesis, and that builds on some of the ideas it explores. The process I've built in this research begins with in-depth game analysis from a feminist perspective and leads to formulating a body of research, before moving on to focused gameplay interaction experiments. These culminate in a game design that, in and of itself, can offer insight into the questions at hand, which in his case is the relationship between the player and the virtual world they inhabit.

In future studies, I would like to delve into gaming communities in which spatial isolationism actively detracts from the game's goal, forcing players to either accept toxic online disinhibition or

remove themselves from the community. Moving away from social gameplay and into competitive game communities would allow me to better understand organizational psychology in relation to competitive gameplay. Finally, I hope that my work will inspire others to use the structures delineated by artists such as VNS Matrix in regards to technology and design, and leaves others with the following question:

If the experience with interactive technology does not lead to a transformative social or cultural practice, then how can we envision potential interactions or systems that allow for more expressive and alternative experiences?

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9. Appendix

9.1 Appendix A

Custom Script for Scaling in Unity

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class AutoScaler : MonoBehaviour {

    //static
    static public AutoScaler Scaler;

    public bool isScaled = false;

    [SerializeField]
    private float defaultHeight = 1.8f;
    [SerializeField]
    private Camera camera;

    //never change this
    private float initialHeadHeight = 0.0f;
```

```
private float initialScale = 0.0f;

private float headHeight = 0.0f;
private float scale = 0.0f;

// Use this for initialization
void Start(){

    Scaler = this;

    //never though these
    initialHeadHeight = camera.transform.localPosition.y;
    initialScale = defaultHeight / headHeight;

    headHeight = camera.transform.localPosition.y;
    scale = defaultHeight / headHeight;

}

// Update is called once per frame
void Update(){
    if (Input.GetKeyDown ("f")) {
        transform.localScale = Vector3.one * scale;
    } else if (Input.GetKeyDown ("g")) {
        isScaled = false;
        transform.localScale = Vector3.one;
    } else if (Input.GetKeyUp ("q")) {
        transform.localScale = Vector3.one * scale;
    }
}

public void ChangeState(float newScale){
    scale = newScale;
    Debug.Log ("here");
```

```
        isScaled = true;
        transform.localScale = Vector3.one * newScale;
    }
}
```

Custom script which returns bounds of environmental objects:

```
public class ReturnBounds : MonoBehaviour {

    Collider m_Collider;
    Vector3 m_Center;
    Vector3 m_Size, m_Min, m_Max;

    // Use this for initialization
    void Start () {

        //fetch the collider
        m_Collider = GetComponent<Collider> ();
        //fetch the center of the collider volume
        m_Center = m_Collider.bounds.center;
        //fetch the size of the collider volume
        m_Size = m_Collider.bounds.size;
        //fetch the min and max bounds of collider
        m_Min = m_Collider.bounds.min;
        m_Max = m_Collider.bounds.max;
        //output of this data
        OutputData();

    }

    // Update is called once per frame
    void Update () {
```

```
}

void OutputData(){

    //output to the console the center and size
    /*
    Debug.Log("Collider Center:" + m_Center);
    Debug.Log("Collider Size:" + m_Size);
    Debug.Log("Collider bound Minimum:" + m_Min);
    Debug.Log("Collider bound Maximum:" + m_Max);*/
}

void OnTriggerEnter(Collider other){
    float scale = m_Size.y;
    Debug.Log ("true");
    AutoScaler.Scaler.ChangeState (scale);
}
}
```

9.2 Appendix B

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class LookAtPlayer : MonoBehaviour {

    public Transform Player;

    private bool FollowPlayer = false;

    //other script
```

```
public GameObject FoundPlayer;
private AutoScaler AccessScaler;
private bool ScalerBool;

//valuables to check if at original scale
private Transform player_Transform;
private float player_Size = 0.0f;
private float OriginScale = 1.0f;

void Start() {

    AccessScaler = FoundPlayer.GetComponent<AutoScaler> ();

    ScalerBool = AccessScaler.isScaled;

    Debug.Log (ScalerBool);

    //player size
    player_Transform = FoundPlayer.GetComponent<Transform>();
    player_Size = player_Transform.localScale.y;

}

void Update() {

    if ((player_Transform.localScale.y) == 1.0f) {
        transform.LookAt (Player);
    }

}

public void FindPlayer() {
    if (Input.GetKeyDown ("k")) {
```

```
        FollowPlayer = true;
    }
}
}
```

9.3. Appendix C

Survey Questions:

1. What did you notice in the scene?
2. How would you describe the elements in the scene?
3. How would you describe how you felt?
4. What did the elements in the scene do?