EMBODIED ENCOUNTERS
A Case for a Virtual Tabletop (VTT) for Role-Playing Games (RPGs) with First-Person Perspective (1PP) in VR

A Thesis Submitted to the Faculty of the Interactive Design and Game Development Department

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This thesis explores the potential for using virtual reality technology to create an online virtual tabletop (VTT) for role-playing games (RPGs) that will induce a sense of avatar embodiment. The aim for this study is to evaluate the subjective experience of playing RPGs from a first-person embodied perspective in an immersive virtual environment. Combining the rules and gameplay mechanics of tabletop RPGs with first-person perspective (1PP) in VR, this project tests the degree of avatar embodiment experienced using an adapted version of the standardized Avatar Embodiment Questionnaire proposed by Gonzalez-Franco and Peck. Playtest participants reported that the ability to play in the first-person embodied perspective induced a sense of avatar embodiment for diegetic gameplay, which is currently not possible with existing VTT options. These findings could be used to inform the development of the next generation of VTTs.

Keywords: Virtual Tabletop, Virtual Reality, Role-playing Games, First-person Perspective, Avatar Embodiment
THESIS STATEMENT

The next generation of virtual tabletops (VTTs) for role-playing games (RPGs) could feasibly include first-person perspective (1PP) in VR, which when combined with the use of a full-body avatar will induce a sense of embodiment for diegetic gameplay.

INTRODUCTION

Defining the Problem

Since the inception of the pen-and-paper tabletop role-playing game (PnP TRPG) genre in the 1970s, the typical place for a group of players to play a PnP TRPG has been around a physical table. However, in recent years, with the advent of virtual tabletop (VTT) software, the playable space has come to include remote, online play environments where players no longer need to be physically collocated to play. A growing number of RPG enthusiasts are engaging in traditional role-playing games while joined together in a virtual game space via computer interface or mobile device (“The Orr Group Industry Report – Q2 2019”).

The predominant trend of VTTs currently on the market is to offer players a single top-down camera perspective onto a playable 2D surface (sometimes referred to as a ‘battlemat’) where players move digital tokens representing their player characters (PCs) and non-player characters (NPCs) along a grid and interact by rolling digital dice to determine outcomes based on the RPG rule-set in use. The VTT has not replaced the physical table by any means, nor is that its intent – many gamers still enjoy playing around a table; however, the VTT was designed to offer an alternative for groups of players who are unable to play together locally. The aim of
the VTT has been to reproduce the tabletop gaming experience in virtual space to allow for simulated face-to-face gameplay via digitally mediated tabletop (Baugh).

The graphics capabilities of VTTs are often listed (by Baugh, Camauer, Taylor, and others) among the most appealing features of VTTs, but for some players, the top-down 2D perspective most commonly used by currently available VTTs is limiting and doesn’t allow for a true embodied perspective into the game space. With the ever-increasing availability of new technologies, the potential of what VTTs could offer online players, through the aid of the computer, is something that has only recently begun to be explored. An investigation into the potential capabilities of these technologies could be of great interest to the virtual tabletop gaming community and could help advance the RPG gaming industry. As virtual reality (VR) technologies become more accessible and less expensive for the home user, current VTTs are missing an opportunity to create a unique embodied experience for virtual tabletop role-playing games.

**Purpose of the Project**

Despite a distinct lack of research into the impact virtual tabletops (VTTs) have had on the way role-playing games are conducted online, the number of VTTs available to gamers and the quality, accessibility, and usability of those VTTs has steadily grown over the last decade. Some examples of VTTs that are actively developed and currently in use include Roll20, Fantasy Grounds, Astral Tabletop, d20Pro, Arkenforge, EpicTable, FoundryVTT, and Mythic Table, to name but a few. A quick Google search for the most popular virtual tabletop software indicates that among these, Roll20 and Fantasy Grounds are the most popular and boast the greatest number of users.

Fig. 2: Fantasy Grounds Interface, borrowed from Fantasy Grounds Demo, store.steampowered.com/app/300790/Fantasy_Grounds_Demo/
As noted, most of the VTTs listed above are of the 2D variety, but recently a few new tools (such as Tale Spire, 3D Virtual Tabletop, Virtual Connect, and YAG) have emerged that feature 3D views, and there are others (such as Tabletop Simulator and AltspaceVR) that offer an “around-the-virtual-table” experience in VR. This project intends to explore and expand upon the potential capabilities of VTT RPG gaming by proposing the use of first-person embodied role-playing in a virtual reality (VR) environment that is unlike any VTT RPG gaming option currently available. This project is intended to investigate the feasibility and propose a prototype for a 3D-VR-VTT-RPG tool that allows players to assume the character’s first-person embodied perspective (1PP) in a virtual Game Master (GM)-mediated game world designed for online multiplayer interaction. The proposed VTT, which combines the rules and gameplay mechanics of tabletop RPGs with a full-body avatar and 1PP in VR, will induce a sense of embodiment for diegetic gameplay.

Visual Prototype Scope, Limitations, and Delimitations

For this project, the basic Dungeons & Dragons (D&D) 5th Edition (5E) ruleset has been adopted as a sample case study for the purposes of research, tool development, and demonstration; however, the intention would be for the proposed VTT to be RPG-agnostic and adaptable to accommodate any number of role-playing game rulesets or genres such as those set forth by Pathfinder, Warhammer, Shadowrun, Star Wars, Call of Cthulhu, StarFinder, or Rollmaster, to name a few. The Oculus Rift in room scale and Unreal Engine 4 were used for the development of the visual prototype.

Though the scope of the visual component for this project is necessarily limited in terms of development and implementation capability, the accompanying VR prototype includes a sample GM-mediated encounter to demonstrate the potential for future advancements in VR-
VTT-RPG gaming experiences. The proposed tool, were it to be developed to full functionality, would bring together the social and interactive elements of traditional tabletop role-playing with visual aspects of computer role-playing games along with the added benefit of physical embodiment within the character (via virtual avatar). Given the limited scope of the development and implementation capabilities for this project, the visual prototype presents a playable demonstration of an embodied encounter in a virtual world for the purposes of playtesting the experience of such an encounter. A fully developed VTT would ideally have a character creator, map building tools, a campaign builder, and the ability to switch between bird’s-eye, top-down strategic perspective and 1PP; however, in the absence of a team of developers and adequate time needed to develop the tool to full functionality, the proposed prototype will not include these features; however, unlike existing VTTs, the proposed VTT would allow players to assume the character’s 1PP for embodied gameplay.

For the prototype encounter, a section of a castle environment has been designed for each player-character (PC) to have the opportunity to come face-to-face with an enemy combatant. Using typical tabletop RPG game turns, each player simulates a full round of combat while being fully embodied in their character avatar. Players select one of two pre-generated character archetypes, each with differing physical attributes in the area of strength (might), dexterity (agility), and speed (movement). For the prototype, playable characters are equipped with a choice of long sword or long bow. The distance a character can move on their turn is determined by the character’s speed attribute. Movement is constrained to a grid, where each square is equal to 5 feet. To simulate “being there” while in the 1PP, combat is conducted by swinging the sword or shooting the bow as one might in any VR fantasy game. With each sword swing or arrow release, a hidden “dice roll” number is generated to determine the action’s outcome by
comparing the character’s attributes to the difficulty number (armor class) of the enemy. Enemy animations (hit/dodge/death) inform the player as to the success or failure of the attack while embodied in the 1PP.

Regarding player actions, one of the considerations impacting interaction in the virtual reality environment is the affect the digital environment can have on player agency. In some ways, it could be argued that player agency will be limited in terms of the grid-based movement and possible action options. However, it could also be argued that because the proposed VTT will be GM-moderated, players will have as much agency as they typically would in a traditional tabletop or VTT game. In the embodied diegetic state of the proposed VTT, players would still have the same level of agency to choose actions, even if those actions don’t occur diegetically, as long as the action is adjudicated by the GM and agreed upon by the party, full player agency remains. For example, if a character wished to perform a feat of dexterity such as jumping from a balcony and swinging from a chandelier, this could be accomplished the same way as in a typical tabletop RPG game played with miniatures. The GM would request a Dexterity roll from the player. If the roll of the dice, plus the character’s Dexterity modifier equaled or exceeded the DC (difficulty challenge rating) then the attempt was a success. The GM describes the outcome and all the players accept the narrative action as having occurred. The player places himself at the location where the action concluded, and all parties accept that “that just happened.” This process stays the same regardless of the playspace—traditional tabletop, VTT, or in VR.

Although the proposed solution does not intend to modify or alter the rules or gameplay mechanics of traditional RPGs, the author acknowledges that this proposal will not appeal to all players or fans of traditional RPGs: the “Power Gamer,” whose primary motivation is to quickly level-up his/her character, or the “Tactician,” concerned with game strategy, for example (Laws
4). However, for those players such as the “Specialist,” who tends to take particular interest in character exploration, the “Method Actor,” who believes role-playing is a form of personal expression, or the “Storyteller,” who is especially drawn to the idea of role-play, or for anyone else who wishes to more actively engage in the act of role-playing through the experience of character embodiment, this solution proposes a new, novel form of VTT gameplay (Laws 4-5).

![Example Player Goal Chart](image/1393/55/1393556080320.pdf)

In conceptualizing the proposed solution, some assumptions (based on general game theory concerning player attitudes and willingness to engage in meaningful play) were applied; for example, the inherent inefficiencies (pauses in game-play or other action delays) created by turn-based gameplay in a virtual environment are presupposed as surmountable through the adoption of a lusory attitude. The proposed solution assumes RPG players, especially those familiar with VTT play, will not only be aware of these unavoidable interruptions to continuous play, they will be willing to overlook them in favor of engaging in the act of play (Salen and Zimmerman 77). Idle players could use the time between turns to strategize their next move and therefore still be engaged in “play,” for example.
CONTEXT

Current Tabletop and Board Game Trends

The concept of augmenting or enhancing traditional tabletop games with computer technology is not new (see, for example, Lindley and Eladhari, Tychsen and Pagden, Temte and Schoenau-Fog, Bergström and Björk), and while traditional tabletop RPG gameplay is arguably preferred by many over gameplay in any other format, gaming groups have been using VTT technology to play RPGs online for more than a decade. In recent years, game designers and developers have been working to create digital adaptations of a growing number of well-established board games to accommodate gameplay in a digital and/or virtual platform; some examples of traditional board games that can now be played with friends online, in digitally-mediated environments include games such as *Axis & Allies*, from Beamdog, *Settlers of Catan*, from developer Exozet, *Scythe*, developed by The Knights of Unity, and *Gloomhaven*, from Flaming Fowl Studios. The *Catan Universe* even features a fully immersive VR version called *Catan VR* (created by Development 7).

Further, White et al. acknowledge “hybrid media that combine elements from tabletop, live action, card, board, educational, ‘serious,’ and/or digital games” are emerging and gaining in popularity (82-83). These trends, when considered along with the current data concerning the use of VTTs for RPGs (see below), clearly establish precedent for the future development of new and innovative ways to utilize computer technology to enhance the gameplay experience of traditional TTRPGs and other types of board games.
Current State of VR Technologies

Consumer VR products have very recently experienced a sort of resurgence – just in the last four years – and great strides have been made during that time to make consumer-grade VR technology both affordable and robust (Larsen). In 2016 three of the leading VR Head Mounted Displays (HMD) were released, beginning with the Oculus Rift in March, followed by the HTC Vive just a month later, and finally, by PlayStation VR in October.

In the years since 2016, a variety of consumer-grade VR gaming systems have been released. As recently as June 2019, Valve introduced the Valve Index VR Kit, a system that is a step above the Oculus and Vive in both price-point and performance level. As the development and release of new VR hardware systems persists, game developers looking to take full advantage of the new technology have found innovative ways to create unique immersive experiences that allow users to feel as though they have been transported to another world (Zantal-Weiner). With fully functional features such as room-scale interactions, touch controls, sensors for hand tracking, and additional features currently under development including foot tracking controls, eye-tracking
technology, and inside-out camera tracking that proposes to eliminate the need for external sensors, virtual reality technology is becoming more mainstream as it gets closer and closer to achieving the “Star Trek Holodeck dream” (Messner).

In terms of its value to academic research, a number of recent studies (Pritchard et al., Steed et al., Danieau et al., and Monteiro et al., for example, where Pritchard et al. and Monteiro et al. utilize the Oculus Rift) have established the viability and validity of utilizing consumer-grade VR systems for the purpose of research projects, claiming these “affordable, high quality” systems have become more readily available and are supported by a large community of artists, enthusiasts, and developers (Pritchard 3). As this technology is continually evolving, its capabilities and potential for enhancing a variety of gameplay experiences is worth investigating.

Current State of VTTs

According to Polygon.com the number of people playing D&D online is greater than ever before, a fact that is due in large part to the decision of the franchise to expand its license to popular online virtual tabletop (VTT) apps including Roll20 and Fantasy Grounds, which allow players to play tabletop games with friends online. Recent statistics from the Orr Group Industry Report of the Roll20 platform indicate that the total number of role-playing games conducted via the Roll20 VTT platform has been steadily rising over the last five years (“The Orr Group Industry Report – Q3 2019”). Fantasy Grounds reports similar increases. As Russ Morrissey of EN World recently reported, Fantasy Grounds was used to facilitate nearly a million virtual role-playing games in the last twelve months alone, and of those, more than two-thirds were sessions of Dungeons and Dragons, 5th Edition (shown in the chart below as “5E”):
Detailed reports from the Orr Group for Roll20 reflect similar trends. From their Q2-2019 and Q3-2019 Group Industry Reports (included below) showing game system frequency and usage of more than four million Roll20 accounts, the charts document the percentage of Dungeons and Dragons, 5th Edition campaigns actively run online using the Roll20 VTT platform (“The Orr Group Industry Report – Q3 2019”). While the percentage of D&D 5E games fell from Q2 to Q3, the overall stats show that it continues to hold a significant lead over other game systems in the percentage of campaigns conducted via the Roll20 online platform. More generally, and of greater significance to this study, the charts demonstrate the continued popularity of using online virtual tabletop software to conduct role-playing games virtually.
With the use of VTTs steadily gaining in frequency and popularity, an exploration into the potential possibilities of expanding the capabilities of such tools to include 3D virtual environments and avatar embodiment could prove both advantageous and beneficial to the
advancement of the industry. What follows is a brief overview of the features of some currently available VTTs.

*Roll20* is a suite of web-based digital tools that expand pen-and-paper gameplay online, offering a system for multiple RPG rule sets. It boasts a simple and clean user interface (UI) which makes learning the basics easy for new players. The tabletop mapping is top-down 2D but offers dynamic lighting (with paid accounts) to restrict players from seeing beyond what is intended for their characters by the GM. Video and voice chat is available directly within the browser without the need of plugins. Digital dice use advanced algorithms that offer truly random results.

*Fantasy Grounds* is a cross platform application for Mac, PC and Linux users that offers a variety of automated and quality-of-life features for GMs. With a visually appealing UI and a wealth of community-created content, *Fantasy Grounds* is a popular and widely used product. However, the learning curve is high, and the costs can be hefty for GMs. While *Fantasy Grounds* offers a variety of automated features, its systems are complex, and do not include dynamic lighting or video/voice chat capabilities.

*Tabletop Simulator* offers a 3D virtual table that can be utilized for online roleplaying. It could be argued that *Tabletop Simulator* is not a VTT at all because it doesn’t boast the same tools and capabilities as a true VTT like *Roll20* or *Fantasy Grounds*, yet *Tabletop Simulator* has perhaps the next best representation of “being around the table” as can be currently achieved and it offers the option for VR gameplay, though not from a first-person avatar embodied perspective.
THEORETICAL MODEL

Sense of Embodiment (SoE)

Utilizing Kilteni et al.’s conception of the Sense of Embodiment (SoE) in virtual reality (VR), this investigation draws on theories of the phenomenological experience of avatar embodiment in VR to explore the potential for increasing players’ experience (PX) of the sense of embodiment through the use of commercially available virtual reality technology. The phenomenological experience of the degree of avatar embodiment was evaluated through user playtesting, observation of playtest participants, and survey responses based on an adapted version of the standardized Avatar Embodiment Questionnaire proposed by Gonzalez-Franco and Peck.

Player Point-of-View (POV)

Player feedback concerning the use of first-person perspective (1PP) was gathered and weighed against the claims of Rouse, and Denisova and Cairns, and the research findings of Gorisse et al., and Debarba et al., which concur that different viewing perspectives offer both benefits and limitations to gameplay. These benefits and limitations are discussed later within the context of the proposed solution – a tool that allows players to assume a 1PP embodied perspective during gameplay – and in terms of the recorded impact on the playtest subjects’ PX, as revealed through participant questionnaire responses, visual and auditory observation of participants during playtest engagement, and additional follow-up interviews with playtest participants.
User Experience and Engagement

To gauge user experience and engagement with the interactive virtual environment, questions adapted from O’Brien et al.’s User Engagement Scale Short Form (UES-SF) questionnaire were used. Designed to measure user interaction with digital systems, the UES-SF includes specifically formulated questions that are intended to assist researchers in better understanding how individuals perceive the experience of using digital systems to help inform the design and development of digital media (29). The short form questionnaire measures engagement across four general categories: Focused Attention (FA), Perceived Usability (PU), Aesthetic Appeal (AE), and Reward Factor (RW), with the last representing a combined subset of factors included in the original long-form UES measuring Endurability (EN), Novelty (NO), and Felt Involvement (FI) (30, 33). The short form questionnaire used includes three questions for each of the four categories and is scored by both subscale and overall engagement score (39). When examined as a whole, the question responses reveal valuable insights into user experience to expose areas of strength, weakness, and general appeal. For the purpose of this project, and to allow for comparative analysis of the experiential differences between traditional, top-down VTT roleplay and embodied play in the VR-VTT, the questionnaire was administered two different times – first, after participants completed the top-down VTT role-playing scenario and again after completing the VR-VTT playtest scenario.
DEFINITIONS

Virtual Tabletop Role-playing Game

As with any study involving a multitude of disciplinary perspectives, theories, and approaches, it is important to establish relevant and useful definitions for the various and often inconsistently defined terminology presented in order to provide an appropriate basis for the foundation upon which the thesis claims are made. To establish a suitable groundwork, a universally understood and accepted definition of role-playing game (RPG) is needed. For the purpose of this project, the focus will be on the rules and gameplay mechanics of traditional tabletop role-playing games (TTRPGs), but with an emphasis on virtual, online, GM-mediated play via VTT software. What this project is not addressing is the act of engaging in a traditional around-the-table RPG, nor is it addressing live-action role-play (LARP); and despite the use of a computer network for gameplay access, the proposed VR-VTT is not to be confused with a computer role-playing game (CRPG) or massively multiplayer online role-playing game (MMORPG).

According to Craig Stern, in his analysis of the elements required for a game to qualify as a role-playing game, the game must feature “player-driven development of a persistent character or characters via the making of consequential choices” (online). By utilizing the existing rules and gameplay mechanics of a traditional TTRPG, the proposed VTT does not intend to alter the intrinsic nature of RPGs. The character as central to the RPG is an important consideration as it will be argued here that the opportunity to virtually inhabit one’s character from the first-person perspective will create an unprecedented and unrivaled diegetic, avatar-embodied VTT gaming
experience. Understanding the relationship between a player and his/her character is essential to understanding the desire to embody a character during gameplay.

**Player vs. Character**

While a number of different role-playing games studies provide definitions of RPG players and characters, for the purpose of this study, Bowman and Schrier’s definitions of the character as “the portrayal of a consistent persona in a fictional world of a role-playing game,” and the player as “the person who is inhabiting the character or avatar,” are utilized (395). As *D&D* is serving as the test-case for the proposed VTT, the following *D&D* character classes and attributes have been included for reference.

In the process of building a character, players first select the character’s class, which may be dependent upon the needs of the group, if playing within a party system, wherein each character fulfills a different role within the group. Among the most common RPG classes are:

- **Fighter** – versatile masters of weapons and armor, these warriors relies on their strength, and use skills and tactics in the heat of battle and are not afraid to charge headlong into the heart of combat.

- **Cleric** – The Cleric is a holy warrior that relies on wisdom and is capable of both combat and divine magic. Clerics are powerful healers and an enemy to all undead creatures. Their divine magic is often used for defensive purposes, using them to protect their fellow party members.

- **Rogue** – stealthy and nimble, the Rouge relies on dexterity to find and disable traps or pick locks. Rouges make excellent thieves and excel at taking their enemies off-guard with damaging sneak attacks.

- **Wizard** – the undisputed masters of arcane magic, these magic-users rely on intelligence to cast the most powerful and destructive spells available. The wizard may be physically weak, and unarmored, but they compensate for it by their ability to cast offensive long range and area effecting attacks (Wyatt et al. 45, 56, 70, 94, 112).
Each character class demonstrates different attributes that make up the character’s basic physical and mental abilities. These attributes include: Strength, Constitution, Dexterity, Intelligence, Wisdom, and Charisma:

**Strength** – measures physical power and natural athleticism. It affects the character’s ability in combat. In combat, a high strength score means a greater chance of hitting an enemy with a melee weapon like a longsword, as well as increasing the damage output from the attack. High strength scores are important to Fighters because it helps them prevail in combat.

**Constitution** – represents a character’s health and stamina. A high constitution score means that a character has good fortitude and doesn’t easily succumb to exhaustion or disease. A good constitution score is important to all classes.

**Dexterity** – measures agility, hand-eye coordination, reflex, and balance. A high dexterity score means a greater chance of hitting an enemy with a ranged weapon like a longbow, while also making the character more difficult to hit in combat. High dexterity scores are important to the Rogue because it helps them dodge out of way of potential dangers and use their thieving skills to their fullest advantage.

**Intelligence** – measures mental acuity, information recall, and analytical skills. High intelligence is important to Wizards because it affects how many spells they can recall, how potent the spells can be, and how difficult they are to resist.

**Wisdom** – measures intuition, perception, and insight. A high wisdom score means that a character has acute senses and is in tune with what is going on around and are rarely caught off-guard. High wisdom scores are important to Clerics because it affects how insightfully they are and how in-tune they are with the divine, which is the basis for how they cast their divine spells.

**Charisma** – measures strength of personality, persuasiveness, and personal magnetism. A high Charisma score means that a character is confident, eloquent, and is a born leader. A good charisma score is important to any who wish to be leaders or diplomatic characters (Gray et al. 237).

Once the character’s class and attributes have been determined, players typically invest a significant amount of time in creating a background story complete with character motives and personality traits in order to create a fully developed, well-rounded character. Then, players will often engage in the ritual of locating or creating a visual representation for their character; these
character representations can take the form of a token, a miniature, a hand-drawn or digitally created 2D image, or some other unique representative form. For the purposes of this project, and despite the previously stated limitations for the project’s visual prototype to achieve full development and production status, the proposed tool, were it to be developed to full functionality, could feasibly include a full-body, fully-customizable character generator, not unlike those already in use by existing CRPGs for the creation of digital avatars that can then be embodied by game players. In the first-person embodied perspective, the carefully crafted digital avatar essentially becomes a close representation of the player’s ideal character.

### Diegesis

In the study of virtual gaming environments, scholars and game designers have borrowed the term diegesis from literary and film studies to describe “what the player-character can see and interact with” in a virtual game world (Iacovides et al. 13). In terms of the design and development of virtual reality experiences, the discussion of diegesis typically centers on user interface or heads-up display (HUD) design and how these elements can improve or inhibit the level of immersion. Regarding HUD design, Fagerholt and Lorentzon describe the differences between diegetic game elements and non-diegetic elements by explaining that the “diegetic game elements are part of the game’s fiction, while non-diegetic elements exist outside of the fiction” (46). A useful matrix for understanding the requirements for a game element to be considered diegetic was first formulated by Fagerholt and Lorentzon. The matrix was later featured on Gamasutra.com and subsequently adapted by Dave Russell of Dev.Mag to classify user interface elements into those that are diegetic, non-diegetic, spatial, and meta. In this matrix, two primary questions are addressed: (1) “Is the component part of the game story?” and (2) “Is the component part of the game space?” (online). The game elements that exist both as part of the
game story and as part of the game world are considered diegetic and are said to make the overall gaming experience more immersive (Russell).

In role-playing game studies, the term diegetic has been used to refer to the “fictional game world,” (Björk & Zagal 327) and to the “in-game domain of fiction that game characters inhabit” (Mäyrä 276). For the purpose of this project, diegesis and diegetic are used to refer to the experience of the game world when the player is playing as his or her character in a virtual-avatar-embodied state (for example, actually swinging a sword to attack rather than rolling the dice).
In her latest book, *Avatar Assembled*, Jaime Banks, Assistant Professor of Communication Studies at West Virginia University, has compiled and edited a comprehensive collection of essays that outline what constitutes a virtual world avatar. She introduces the topic by defining avatars as, “digital bodies that extend a user’s presence and agency into digital spaces” (1). The term *avatar* is used throughout this study to refer to the player’s 3D virtual character. The concepts of agency and presence are briefly discussed later, in the review of literature; however, as noted by Farrow and Iacovides, “there is a persistent ambiguity within the literature on virtual realities and games over immersion, engagement and presence” (3). To keep the primary focus of this investigation on the phenomenological experience of embodiment, the use of these terms has been largely and intentionally limited in the review of literature below.

**Sense of Embodiment (SoE) in VR**

As specified by de Vignemont, the term “sense of embodiment” differs significantly in meaning from the term “embodiment” in that the latter refers to a “specific type of information processing, whereas the sense of embodiment corresponds to the associated phenomenology, which includes feelings of body ownership,” (84). Indeed, the notion of embodiment can vary in meaning and use depending on subject matter and context. As such, the definition provided by Kilteni et al. for the “Sense of Embodiment (SoE)” as it pertains to virtual reality applications, as “the ensemble of sensations that arise in conjunction with being inside, having, and controlling a body,” has been applied for the purposes of this study (374-375). In this study, the term “Sense of Embodiment” or “SoE” is used interchangeably with “avatar embodiment” to refer to the phenomenological experience of inhabiting and controlling one’s character avatar inside VR.
REVIEW OF THE LITERATURE

Multidisciplinary Perspectives

Role-playing games, as they are played today, have been in existence for more than 40 years. In that time, they have been studied extensively by scholars from across the academic spectrum. Experts in psychology, sociology, communication, media and game studies, among others, have explored topics ranging from identity and meaning, metacognition and communication, inter-personal interactions, storytelling, and more (see Zagal and Deterding). The addition of computer role-playing games (CRPGs) and massively multiplayer online role-playing games (MMORPGs) has expanded the fields of inquiry beyond the social sciences to include additional disciplines such as those belonging to computer science (human-computer interaction and virtual reality studies, for example). To take into consideration all of the existing scholarship concerning the act of engaging in a role-playing game would be a gargantuan task that would only serve to propel this project beyond the scope of its intended objective. Therefore, for the purpose of the current study, the primary areas of inquiry will focus on recent scholarship into virtual reality and avatar embodiment.

SoE: Self-location, Agency, Body Ownership

A review of recent studies (see Danieau et al., Gorisse et al., DeBarba et al., Bovet et al., and Fribourg et al.) concerning the phenomenological experience of embodiment (SoE) in a virtual avatar reveals an overwhelming and consistent reliance on the claims of Kilteni et al. which describe the SoE as comprised of three central subcomponents: “the sense of self-location, the sense of agency, and the sense of body ownership,” (373). Although discussions of embodiment in virtual environments appear much earlier in the literature (Biocca for example),
the more recent findings of Kilteni et al. have since been widely adopted as the foundational basis for defining and investigating SoE illusions in VR. For the purpose of this study, any mention of the concepts of self-location, agency, and body ownership will coincide with the descriptions provided by Kilteni et al.:

*Sense of self-location*: refers to one’s spatial experience of being inside a body; it does not refer to the spatial experience of being inside a world (375)

*Sense of agency*: refers to the sense of having “global motor control, including the subjective experience of action, control, intention and motor selection and conscious experience of will” (Blanke and Metzinger, as qtd. in Kilteni et al. 376).

*Sense of body ownership*: refers to one’s self-attribution of a body; it has a possessive character and it implies that the body is the source of the experienced sensations (377).

These subcomponents are briefly discussed in terms of recent research regarding their respective roles in facilitating the experience of embodiment in VR and as they pertain to this project.

**Sense of Self-location**

As noted in the previous description of the *sense of self-location*, Kilteni et al. make a distinction between self-location and presence in claiming that self-location concerns the relationship between the *self* and the *body* and presence concerns the relationship between the *self* and the *environment* [emphasis added] (375). Further, they claim that the feeling of presence can be achieved even in the absence of body representation while the sense of self-location can only be achieved when the self feels physically “located inside the biological body or an avatar’s body,” (375). Gonzalez-Franco and Peck agree with these findings, adding that in order to induce an embodiment illusion, “users must perceive the avatar as collocated with their own body, and that they own the body” (2).
It’s important to note that although studies concerning the sense of self-location often include some form of synchronous visuo-tactile stimulation (such as those based on the “rubber hand illusion,” for example), Maselli and Slater determined that congruent visuomotor and multisensory stimulation are adequate to achieve the illusion even in the absence of synchronous visuo-tactile stimulation (2). This is significant as the commercially available Oculus Rift VR system, which was used for this project, includes positional motion-tracking, spatialized audio capabilities, and hand-controller haptic feedback which was utilized to provide the necessary visuomotor and multisensory inputs required to achieve the sense of self-location illusion.

**Sense of Agency**

In their discussion of agency and motor control for establishing embodiment illusions, Gonzalez-Franco and Peck rely on the research of Kokkinara and Slater, which determined synchronous motor control over the avatar, or what they call “visuomotor (VM) synchrony,” to be a critical factor in the experience of agency (Kokkinara and Slater 44). Similar results were reported by Zopf et al. who found that “a key index of agency – intentional binding” was increased when “visual and non-visual movement information was congruent” (6). These claims support the earlier discoveries of Kilteni et al. linking the development of agency over a virtual body to the “synchronicity of visuomotor correlations” (377). In 2013, an examination by Steptoe et al. into whether or not humans could develop agency over an avatar with a tail determined the synchronization of visuomotor cues to be an important factor in forming “convincing perceptions of body ownership and agency” as test subjects exhibited full agency and motor control over the entire avatar body, despite the presence of an extra-human appendage (590).
In agreement with the conclusions of Danieau et al., which state that control over one’s avatar improves the quality of the embodiment experience, Gonzalez-Franco and Peck determined that appearance and control of the avatar, rather than being required for the experience of the embodiment illusion, serve to enhance the illusion (Gonzalez-Franco and Peck 2). To create and sustain the sense of agency and motor control over the virtual avatar, the playable prototype for this project, in addition to utilizing the motion-tracking capabilities of the Oculus Rift System, will employ the use of inverse kinematics (IK) in the elbow and shoulder joints to produce the illusion of visuomotor (VM) synchrony through the replication of congruent player-avatar movements. According to the research findings of Parger et al., this addition of IK for upper body motion tracking in consumer-grade VR systems results in “generating realistic and responsive arms in VR,” which their study determined leads to an increased sense of embodiment (9).

Sense of Body Ownership and Player Point-of-View

Also significant to the factors influencing the SoE is the general understanding of the way user point-of-view (POV) is correlated to the illusion of virtual body ownership (IVBO) (see, for example, Slater et al., Petkova et al., Maselli and Slater, Kokkinara and Slater, and Gorisse et al.). In their 2010 study of the experience of body transfer in VR, Slater et al., concluded that first-person perspective (1PP) of a life-sized virtual body in VR was sufficient to induce the illusion of body ownership over a virtual body (1). Maselli and Slater confirmed these findings in their 2013 study of the perceptual building blocks of the virtual body ownership illusion where they concluded that “first person perspective over a fake humanoid body is essential for eliciting a body ownership illusion” (1). In their 2014 study, Kokkinara and Slater concluded that the “key to full-body ownership illusions appears to be the experience of the substitute virtual body
seen through a first-person perspective (1PP)” (44). In a later study, Kokkinara et al. augmented these earlier findings in their analysis of seated participants who exhibited a strong sense of illusory agency and ownership over a walking body when that body was viewed in 1PP in VR (1). A preponderance of recent investigations into the influence of user POV on body ownership in VR have found that 1PP strengthens the IVBO (Gorisse et al.).

According to Gonzalez-Franco and Peck, the embodiment illusion is “not only elicited in look-alike or gender/race consistent avatars” as studies have shown the illusion is achievable even when using avatars of different races, genders, ages, sizes, and even shapes (2). Although a majority of published studies have utilized anthropomorphic avatars to gather data concerning the sense of embodiment, some have experimented on the effects of inhabiting a non-humanoid avatar (see Steptoe et al., for example). Additionally, in an experiment designed to test player response to avatar differences, Christou and Michael-Grigoriou found that playtest subjects experienced an equal sense of ownership over both the human avatar and the alien avatar used in their study (6). In a 2015 study of avatar anthropomorphism and IVBO, Lugrin et al. discovered that users immersed in VR via HMD with visuomotor synchrony correlated to humanoid, block-based, and robotic avatars exhibited a high degree of IVBO over all avatars, but with a noted “decrease of acceptance towards an avatar with a higher human resemblance, possibly indicating an uncanny valley effect” (230). This is significant as the range of characters possible with the proposed VTT could potentially include some extra-human or other-worldly character representations. For the purpose of this project, players were immersed in VR via HMD with visuomotor synchrony in 1PP of one of two full-body humanoid avatars. The predicted outcome is that the IVBO will be successfully induced.
Additional Studies

In their comprehensive, yet now outdated examination of the effects of enhancing pen-and-paper (PnP) RPGs with computer technology, Tychsen and Pagden analyzed the various gaming tools and technologies that were either in use or in development at the time to provide an overview of their inherent strengths and weaknesses in the enhancement of PnP RPGs (1). In their review, the authors note the potential for full-immersion VR to transform the way RPGs are played but acknowledge that the technology was not sufficiently developed at the time (3). Additionally, at the time of writing, the VTT platform known as Fantasy Grounds, which they classify as a “scenario management program,” had only been in existence for two years (11). The authors argue that while Fantasy Grounds introduced some helpful innovations, its features and functionality created an inferior RPG gameplay experience. However, as the Fantasy Grounds statistics shown above suggest, online VTT gamers are not deterred.

Despite Tychsen and Pagden’s claim that RPG software can actually slow down gameplay, Temte and Schoenau-Fog found the opposite to be true when they compared player experience of a traditional table-top RPG scenario playthrough to the experience of diegetic play through the same scenario reproduced in a GM-moderated 3D virtual environment (VE). In their experiment, the role-playing scenario conducted in the VE reduced the total playthrough time by nearly half (108). In applying their diegetic framework, which they called Player Action and Utterance Typology to the players’ actions and speech during the two different playthrough scenarios, Temte and Schoenau-Fog found that not only did players spend more time acting and speaking in-character when engaged in the VE version of the scenario, but out-of-character and off-game utterances were reduced significantly as well (108). Their study confirms that players experience an increase in diegetic play when immersed in a GM-moderated virtual environment.
PROPOSED SOLUTION

Visual Component: Design Narrative

The inspiration for the setting of the project comes from an *Advanced Dungeons & Dragons* adventure module called “Ravenloft,” by Tracy and Laura Hickman from 1983. *Ravenloft* is a Gothic horror story set in the bleak lands of Barovia. Far above the gloomy village of Barovia sits a cold, dark, and brooding castle named Ravenloft, the home of Count Strahd von Zarovich, a powerful wizard and vampire lord.

The castle and its surrounding lands share similarities to those of Dracula’s castle and the lands of Transylvania. Castle Ravenloft is architecturally based on a mix of old Gothic and Romanesque styles. Three locations of interest within the castle are iconic to key points in the story: the dining room, the chapel, and the courtyard where a garden connects to an overlook. It is in this garden and overlook where the most pivotal point in the story takes place. These three areas are represented in the final playable visual component prototype.

During the early development and testing stages, a single room “playground” was constructed for testing features and components of the game.
This room would later become more elaborate and formed the basis for what would eventually become the dining room. The dining room was expanded to include a connected garden area, and later, a door from the garden leading into a desecrated chapel was added. The scale of the room was derived from the notion that players would move along a grid, and that each grid space would be 5-feet. This 5-foot space corresponds well with both a typical VR room-scale environment and the standard space that a character occupies in an RPG. Throughout the design and development process, a sketchbook was maintained to jot down notes and sketch out ideas. Along with reference images, these sketches proved to be useful tools for projecting and planning.
Reference photos and illustrations of castles, arches, columns, and decorations were collected from a variety of online sources and proved invaluable for visualizing the design and details of virtual objects to be included in the game world.
When planning the environment layout, it was important to create a space which would be perceived as larger than it actually was. This was accomplished by adding additional doors to rooms that were barred, locked, or were otherwise inaccessible from within the room. Balconies with stairways leading upwards could be seen by the players, but not explored. Outdoor environments allowed players to look up at tall castle spires overhead with only a guess as to what they might contain. All these visual cues were purposefully added as part of a design philosophy to give the players the sense that they were in a much larger structure than the three-room game space. Additionally, auditory cues were added to further break up the space, add variety between the rooms, and enhance the feeling of “traveling” through the game world.

Autodesk Maya was used for modeling and UV mapping. Photoshop, xNormal and Marmoset Toolbag were utilized for texturing and normal mapping. Materials and textures

*Fig. 13: Modeling in Maya (Visual Component) created by Kelly Romeo*
for the game world were subject to several significant technical considerations. Normal mapping is a technique used to fake lighting on the surface of an object, however, due to the stereoscopic nature of virtual reality, the illusion can be ineffective or broken inside VR. Normal maps work on smaller objects with small details, but large objects with large details, like the stonework on a wall, tend to look flat when viewed in an HMD. Parallax offset mapping is a technique for real-time approximation of displacement mapping that works better in VR. Assets from the Unreal Marketplace that included parallax offset mapping were incorporated into the design of the level to give surfaces a more realistic look and feel.

Gameplay begins in a small larder room and continues down a hallway into a large dining room. Beyond a locked door from the dining room is a covered walkway around a garden and an overlook. Play ends inside a high walled chapel. Players encounter two vampire spawn enemies in each room and must defeat them in combat to continue.

Fig. 14: Level Design (Visual Component by Kelly Romeo)
Fig. 15: Starting / Larder Room Layout (Visual Component by Kelly Romeo)

Fig. 16: Hallway layout (Visual Component by Kelly Romeo)

Fig. 17: Dining Room layout (Visual Component by Kelly Romeo)
Fig. 18: Chapel Garden layout (Visual Component by Kelly Romeo)

Fig. 19: Chapel Garden layout (Visual Component by Kelly Romeo)

Fig. 20: Chapel layout (Visual Component by Kelly Romeo)
Several game mechanic systems were designed to give the players options for interacting with the virtual environment, other players, and enemies in the level. These systems were created using Unreal Blueprints; Unreal Engine’s node-based visual scripting language. Line Tracing formed the basis for most interactions and was used for selecting objects from menus, for character movement along a grid, possessing and unpossessing creatures, and rolling dice.

Players begin gameplay standing in front of a character selection menu with options for two different characters and two different weapon types. Selecting a character from the menu triggers the ‘embodiment’ of that character. The players then find themselves inhabiting the character model and holding whichever weapon was selected from the menu. In the playable prototype, up to two players can join a game hosted by a DM. Blueprints were created to enable the multiplayer replication needed to play remotely via Steam’s online services.
Movement is conducted along a grid in 5-foot increments. Line Tracing from the controller to the floor shows allowable spaces where players can teleport. Teleportation snaps to the center of the 5-foot square space. This not only adheres to the rules of typical tabletop RPGs, but also makes for a very comfortable VR experience for individuals who might be prone to VR sickness.
Players were given access to three 20-sided dice, each representing a different RPG stat. The red die was used for strength, the green die for dexterity, and the blue for intelligence. These dice can be found along the right side of the mini-character sheet when the player looks down.

When triggered from a line trace, the die ‘pop’ off the menu and roll along the ground. When the die settles, the result is displayed above the player’s head for everyone in the room to see.

The DM’s role is to run the game and provide challenges for the players. To accomplish this, a system for “possessing” the enemy creatures was created. At any time, the DM can target a creature with a line trace and press the ‘A’ button to inhabit the creature. While possessed, the
DM can move and attack as the creature. Pressing the ‘B’ button “unpossesses” the creature allowing the DM to separate from the creature controls.

Attacks are conducted diegetically by swinging a sword, firing an arrow from a bow, or attacking with claws. At the point of overlap with a combatant, a random number is generated by the system. This number is added to any applicable modifiers and is then compared to the defensive value of the target. The results are displayed over the target’s head for everyone in the room to see. As combat continues and damage is dealt, material values on the creature textures change to red to signify to the players that the creature has taken damage and is now closer to defeat.
Playtest Procedure

To gather participant feedback, a series of playtests were scheduled. Volunteers were selected from a pool of people ranging from those with a high level of experience in tabletop roleplaying games, video games and VR to those who had never played a tabletop RPG, had little interest in video games, and had never used a VR HMD. Playtesting was conducted over the course of two full days with 10 participants.

Participants were asked to group themselves into pairs representing a small adventuring party. Players selected the character they would be playing – either a sword and shield wielding Human Fighter or dexterous Elf Ranger with a bow. Each pair, in turn, were asked to sit at a table in front of a laptop where a 2D top-down version of the adventure was played out using Roll20 as the VTT.

Fig. 28: Character Icons from playable VR-VTT (Visual Component by Kelly Romeo)

Fig. 29: Top-down 2D VTT Session 1 Playtest
Participants were asked to imagine themselves sitting behind the screen in their own homes while the DM led them through the scenario. Participants were shown a digital map of the setting while a brief adventure synopsis was read to give the players some context.

**Adventure Synopsis:**

You are an adventurer from a foreign land who has found yourself mysteriously transported to the dark and gloomy land of Barovia. Surrounded by a deadly fog and ruled by Strahd von Zarovich, a vampire lord and powerful wizard, you have been set on a deadly course of action that has brough you to the very heart of Strahd’s domain – his home and fortress of Castle Ravenloft. The castle stands atop a great spire of rock, invincible and ever watchful over the valley and the oppressed village of Barovia below. Every night, thousands of bats fly out of the castle to feed. It is said that Strahd sometimes flies with them. Barovia will never be safe until the evil in his castle is destroyed.

Digital character sheets were provided within the Roll20 interface for players to reference. The players’ screens then displayed the room where their characters were located as the DM read the room’s description, much like a typical tabletop roleplaying game. Actions were
suggested and adjudicated by the DM based on dice rolls and the character stats that modified them. Gameplay continued out of the starting room and into a small corner section of the castle, Ravenloft. Three separate combat encounters were played involving the two players and two vampire spawn whose actions were controlled by the DM. Play continued until the last vampire spawn was defeated in the third and final room of the adventure. The mini adventure concluded with the DM describing the appearance of count Strahd Von Zarovich, the vampire lord of this castle. Below is the map of the castle, and the room descriptions read to the players as they made their way through the encounters.

*Fig. 31: 2D Castle Map used in Roll20 playtest scenario (created by Kelly Romeo)*
Room Descriptions:

K1. Larder
You have managed to sneak your way onto the main floor of the castle by way of a network of narrow servants' corridors. You emerge into what appears to be a larder. Rotted bags of grain and other food stuffs litter the corners of the room. A layer of dust and cobwebs cover nearly every surface. A simple wooden door leads out to the north.

K2. Hall
A short hallway heading north connects to a main corridor leading west. Small recesses in the walls feature statues covered in cobwebs and dust. Torches set in sconces provide adequate light to see by. A pile of rubble blocks a pair of large wooden doors to the east. Beyond is a small semicircular alcove with a single arched window to the outside world. Moonlight and night sky can be seen beyond.

K3. Dining Room
This spacious dining hall must have been grand at one time. Now, moonlight shines dimly through broken stained-glass windows into this brooding shadow of its former glory. Moth eaten tapestries hang heavy on the walls. Broken glass and shards of pottery litter the floor. Old wine casts, long dried up, line the walls, and statues stand guard over the room. A balcony overlooking the room runs high along the south wall and terminates at either end in stairs. In the center of the room is the dining table with odds and ends. Around the edge of the table move two figures in the dim gloom.

K4. Covered Walkway
Torches and moonlight provide light around an arched covered walkway that runs the perimeter of a small cloister ending in a door on the south wall. The sounds of wind and nocturnal creatures can be heard in the distance. Small stairs descend into an overgrown garden to the south. Similar stairs step down to a balcony to the north.

K5. Chapel Garden
Tall castle walls loom high over this neglected and overgrown garden. Small flowers press sadly skyward against the gloom. A small fountain sits empty at the center while a statue of a woman looks mournfully on. The name, “Tatyana” etched in its base.

K6. Overlook
Chill mountain winds blow across a balcony hanging precariously over the edge of a cliff. Through the fog, the country of Barovia spreads out in the valley over 1000 feet below.

K7. Chapel
A short hallway connects the cloister to the main chapel. Whatever warmth this chapel once held has long since departed. The weight of Strahd’s presence is palpable in this place. Crumbling columns have blocked the main door to this room. Whatever furniture have once been here has mostly been removed, but signs remain of the of the destruction that took place in this chapel. In the alcoves coffins and ancient sarcophagi lay silent. An eerie light emanates from the front of the chapel where an alter sits on top a dais.
Following the *Roll20* session, players were asked to complete a questionnaire based on their experience with the 2D top-down VTT. After a few qualifying questions (age, gender, experience level with RPGs, virtual tabletop, and VR use), 12 experience questions from O’Brien et al.’s *User Engagement Scale Short Form* (UES-SF) questionnaire were asked to get a sense of the players’ character engagement and how satisfying it was to play their chosen character from the top-down perspective. [See Top-down VTT Questionnaire, Appendix A.]

After completing the short questionnaire, the playtesters were taken to a room where they would play the same DM-moderated mini adventure again, but this time in the playable prototype (visual component) VR-VTT created for this study. Three Oculus Rift VR stations were set up and used to simulate “remote” play for the participants.

![Fig. 32: Playtest Session 1 Setup](image)

All communication between DM and players was conducted within the Rift HMD. The players once again chose their characters in VR, this time as fully embodied avatars. Both players’ HUDs featured a small ‘character sheet’ for their character showing important stats and modifiers. In the virtual environment, the player controlling the human fighter holds a sword in
the right hand and a shield in the left. The player controlling the elf ranger holds a bow in the left hand. Arrows automatically notch themselves to the strings when the player pulls back the bow string with the right hand. Just as in the 2D top-down version, players found themselves in a small starting room where they could see themselves, but not the DM. Players opened the door by interacting with the door handle, which swung the door open. Players moved their character on their turn by selecting a grid square on the floor within the limit of their movement speed (30 for the human fighter, 35 for the elf ranger.)

Combat was conducted using the same rules as in the 2D VTT. When players came within sight of vampire spawn enemies, the DM called for initiative rolls to determine who would attack first. Players rolled for initiative by triggering a 3D dice roll on their HUD; once triggered, the die, mimicking a physical dice roll, was sent spinning and rolling across the virtual floor. Once the die stopped, a number appeared over the head of the player so everyone could see the value. Play would continue one after the other in a turn-based fashion with each player and the DM taking turns moving and attacking. Players attacked by moving within one square of an enemy and either swung their sword or stood at a distance and shot the enemy from range with an arrow. On the enemy’s turn, the DM would take “possession” of the enemy by pressing the appropriate button on the controller. This would jump the DM into the avatar and allow the DM to act as the fully embodied representation of the enemy. The DM would then attack as the vampire spawn by swinging his arms in a claw attack at the players’ virtual faces. Another button would “unpossess” the enemy, jumping the DM back out of the body.

Players were free to explore the environment and ask the DM for more context into the adventure. In one instance, the players found that the door to the next area was locked, giving them a reason to search the room and dead bodies for clues. The players would move close to an
area of interest and declare their intentions to search. The DM would ask for a search check, and
the players would roll the 3D virtual die associated with the Intelligence stat. The resulting
number would indicate to the DM if they found anything or not. In this case, a Metal Key could
be found somewhere in the room that would unlock the door to the next area. If the search
checks were not high enough, the players could opt to pick the lock, or smash in the door instead.
Picking the lock required a Dexterity check, and the Ranger with the bonus to Dexterity was the
most likely candidate for success. If the players chose to go for brute force and smash the door
down, the Fighter’s high Strength score made the most sense. Rolling the appropriate dice
determined the outcome and the DM described the results. The DM would then trigger an
“unlock” feature on the door, and the door would open.

The VR-VTT playtest continued along the same course as the 2D VTT adventure
concluding in a large desecrated chapel where the vampire lord Strahd appears in front of the
player characters. At the conclusion of the playtest, players were asked to fill out a second,
longer questionnaire with questions about both their experience of avatar embodiment within the
VR-VTT as well as questions from O’Brien et al.’s UES-SF questionnaire to measure the
players’ engagement and level of satisfaction in playing their chosen character in the first-person
perspective [See VR-VTT Questionnaire, Appendix B.]

Once all the playtest groups had completed both the 2D and VR versions of the adventure
and filled out both questionnaires, they were all brought together to discuss the pros and cons of
each VTT through open-ended questions intended to prompt further discussion. [See Player
Discussion Questions, Appendix C.]
RESULTS ANALYSIS

Playtest Participants

In all, ten subjects participated in the playtest and served as respondents to the playtest questionnaires and follow-up interviews. Playtest subjects represented the following demographic groups: Male = 8, Female = 2, Age under 18 = 1, Age 18-24 = 1, Age 25-34 = 1, Age 35-44 = 3, Age 45-54 = 4, and possessed the following levels of familiarity with RPGs and VR-HMD use: Experienced RPG players = 7, Non-experienced RPG players = 3, and Previous VR-HMD use = 9, No previous VR-HMD use = 1. The small number of playtest participants is less than ideal; however, equipment availability and the complexity of arranging multiple VR stations in a home setting for the sake of testing necessarily limited the number of playtest participants that could be accommodated. While a larger sample size would have undoubtedly produced more varied results, given the investigative nature of this experiment, even the small sample size produced some valuable data that would be useful in the future development of new and innovative kinds of immersive RPG gaming experiences.

Playtest Questionnaires

The purpose of using two separate playtest questionnaires for this study was to obtain a baseline comparison of user experiences between engagement in a more typical manner of VTT RPG gameplay and engagement in the proposed manner of embodied VR-VTT RPG play. Although questions regarding avatar embodiment (not experienced in the 2D, top-down scenario) were excluded from the first questionnaire which was administered following the 2D, top-down adventure, the objective for that questionnaire was simply to measure the level of player engagement and not the sense of avatar embodiment experienced during that particular scenario.
However, in the questionnaire administered following the embodied VR-VTT scenario, a set of standardized sense of embodiment (SoE) questions proposed by Gonzalez-Franco and Peck were included, as players were given the opportunity to physically embody their player character during the VR-VTT playtest. As the objective for the second questionnaire was to measure both the sense of embodiment and player engagement experienced during the VR scenario, questions from both standardized questionnaires (Gonzalez-Franco and Peck, and O’Brien et al.) were included. In order to compare the levels of participant engagement between the two different scenarios, the twelve user engagement questions, adapted from O’Brien et al.’s *User Engagement Scale Short Form* (UES-SF), along with one wildcard question remained the same between the two questionnaires.

**Embodiment Questionnaire**

Designed to measure the three key aspects of embodiment: Ownership, Agency, and Self-location, as well as perceptions about avatar Appearance, the twelve embodiment questions adapted from Gonzalez-Franco and Peck’s *Standardized Embodiment Questionnaire* that were included in the VR-VTT Questionnaire use a 7-point Likert-scale, from strongly disagree to strongly agree, to gauge participants’ experience of avatar embodiment while engaged in the use of the proposed VR-VTT (visual component created for this study). The questionnaire results (included below) show that the VR-VTT playtest subjects experienced a relatively high degree of body ownership over the digital avatar, considerable control over the virtual body (agency), and a strong sense of shared location with the digital body. These findings support the claim that a full body avatar, playable in the first-person perspective, with motion and action controls such as those available in VR can induce a sense of avatar embodiment for diegetic gameplay.
VR-VTT Embodiment Questionnaire Responses

Categories in the left-hand column were NOT shown on the questionnaire completed by participants.

<table>
<thead>
<tr>
<th>Body Ownership</th>
<th>Q1. “I felt as if the virtual (avatar) body I saw when I looked down was my body”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
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<td>0.00%</td>
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<table>
<thead>
<tr>
<th>Body Ownership</th>
<th>Q2. “It felt as if the virtual (avatar) body I saw was someone else”</th>
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<tr>
<td>Strongly Disagree</td>
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<tr>
<th>Body Ownership</th>
<th>Q3. “It seemed as if I might have more than one body”</th>
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<tr>
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<table>
<thead>
<tr>
<th>Agency</th>
<th>Q4. “It felt like I could control the virtual body as if it was my own body”</th>
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<tr>
<th>Agency</th>
<th>Q5. “The movements of the virtual body were caused by my movements”</th>
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<tbody>
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</table>

<table>
<thead>
<tr>
<th>Agency</th>
<th>Q6. “I felt as if the movements of the virtual body were influencing my own movements”</th>
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<table>
<thead>
<tr>
<th>Agency</th>
<th>Q7. “I felt as if the virtual body was moving by itself”</th>
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<tr>
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<td>50.00%</td>
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<tr>
<td>Location</td>
<td>Q8. “I felt as if my body was located where I saw the virtual body”</td>
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<tr>
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<tr>
<td>Location*</td>
<td>Q9. “I felt out of my body”</td>
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<tr>
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<td>STRONGLY DISAGREE</td>
</tr>
<tr>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Appearance</td>
<td>Q10. “At some point it felt that the virtual body resembled my own (real) body, in terms of shape or size”</td>
</tr>
<tr>
<td></td>
<td>STRONGLY DISAGREE</td>
</tr>
<tr>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Appearance</td>
<td>Q11. “I felt like I was wearing my character’s clothing/costume”</td>
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<td>STRONGLY DISAGREE</td>
</tr>
<tr>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Location</td>
<td>Q12. “I felt as though I was looking through the eyes of my character”</td>
</tr>
<tr>
<td></td>
<td>STRONGLY DISAGREE</td>
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</tbody>
</table>

*Many respondents indicated they were unsure of the exact meaning of this question (Q9). Its results should therefore be disregarded.*
Some disparities were noted in responses to questions about body ownership and location. Specifically, a significant number of respondents reported misunderstanding or misinterpreting the meaning of Q9 (noted above), which asked participants to respond to the statement, “During the playtest there were moments in which I felt out of my body.” Question 9 of the Embodiment Questionnaire should therefore be excluded from consideration in the overall results. Aside from this, the disparities in responses to the body ownership questions could be due to several factors including technical inconsistencies in the virtual display. These inconsistencies (glitches) happened intermittently throughout the playtest sessions and impacted several players. For example, some players reported experiencing difficulty in drawing the bow and arrow and in the perception of the body size of the Elf Ranger character. The digital avatar used for the Elf Ranger was a female character, smaller in stature than the Human Fighter character and this was noted by some of the larger male playtest participants. Additionally, some players reported they experienced an intermittent lag in the graphics processing that affected their sense of being immersed in the game space. Despite these interruptions, which could feasibly be corrected with graphic manipulation, code adjustments, and/or the use of a more robust processor or graphics card, all playtest subjects expressed an overall sense of satisfaction with the VR-VTT experience.

**Player Point-of-View (POV) Interviews**

Significant to these results is the subjective experience of playing in 1PP as described by participants in the Discussion Group Question sessions following the playtest scenarios. When asked, “What would you say are the benefits or drawbacks of playing a role-playing game via VTT in the first-person embodied perspective?” participant responses included the following statements:
Without any prior knowledge of the claims made by Denisova and Cairns, Petkova et al., or Gorisse et al. regarding the benefits and drawbacks of the various camera positioning options often utilized in virtual environments, playtest participants reported pros and cons similar to those presented in these published and peer-reviewed studies. Conclusions drawn from the playtest participants’ experiences echo these earlier findings: 1PP brought players closer to the game world and to the character they were playing (Denisova and Cairns 147), 1PP is not ideal for determining one’s location in virtual space or for spatial navigation (Petkova 1), and 1PP “favors the sensation of being located in the virtual body as well as the sense of ownership,” (Gorisse et al. 10). Additionally, playtest participants noted a distinct difference between playing the part of a character and actually playing as a character. One respondent said, “When I’m playing D&D, I feel like I’m making decisions for my character. When I’m playing in VR, I think I am my character.” Another participant agreed saying, “In D&D, it’s five people trying to make a story and in VR, it’s five people in a story.” These responses strongly suggest the experience of engaging in a role-playing game while embodied in the 1PP is decidedly different from engaging in RPG gameplay from a more traditional top-down perspective. Ultimately, these findings support the claim that playing an RPG via VTT in 1PP creates a new and novel form of gameplay not currently possible with commercially available VTTs.
User Experience and Engagement Questionnaire Responses

The bar graphs that follow reveal participant responses to the twelve user engagement questions adapted from O’Brien et al.’s *User Engagement Scale Short Form* (UES-SF). The first graph shows user engagement with the traditional, 2D top-down VTT playtest scenario. Using a 7-point Likert scale with weighted values from strongly disagree (-3) to strongly agree (3), the first set of UES-SF responses show that participants were engaged, but not overwhelmingly impressed with the 2D top-down VTT experience. It’s important to note that questions pertaining to Perceived Usability (PU) were reverse coded—strongly disagree (3) to strongly agree (-3)—in keeping with O’Brien et al.’s scoring guidelines, as these questions measure a negative experience factor. When calculated by subscale, user data indicates the following levels of engagement for the Top-Down 2D VTT scenario: Focused Attention (FA): 4, Perceived Usability (PU): 11.33, Aesthetic Appeal (AE): 3.67, and Reward Factor (RW): 13.67, with an Overall Engagement score of 8.17 (calculated as the average of all responses across factors).

The second graph shows user engagement with the VR-VTT playtest scenario. The scores from this questionnaire are markedly different, with subscale calculations as follows: Focused Attention (FA): 23.33, Perceived Usability (PU): 12, Aesthetic Appeal (AE): 23.33, and Reward Factor (RW): 25, with an Overall Engagement score of 20.92. Most notably, the factors measuring FA, AE, and RW were significantly higher in the VR-VTT playtest scenario. While the perceived usability score was slightly higher for the VR-VTT, this is not entirely unexpected and is likely a result of the technical glitches described above. The comparison of these questionnaire responses demonstrates a significantly higher level of user engagement with the VR-VTT over the 2D top-down VTT and supports the value of exploring the potential for VR technology to enhance the VTT RPG gameplay experience.
Fig. 33: Top-down VTT User Engagement Questionnaire Responses, questions 1-12 from O’Brien et al.’s User Engagement Scale Short Form, 2018.
**VR-VTT User Engagement Questionnaire Responses**

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
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<tbody>
<tr>
<td>&quot;I felt interested in this experience&quot;</td>
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<td>&quot;My experience was rewarding&quot;</td>
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<td>&quot;Using this VTT was worthwhile&quot;</td>
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<td>&quot;This VTT appealed to my senses&quot;</td>
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<td>&quot;This VTT was aesthetically appealing&quot;</td>
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<td>&quot;I was absorbed in this experience&quot;</td>
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<td>&quot;The time I spent using this VTT just slipped away&quot;</td>
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<tr>
<td>&quot;I lost myself in this experience&quot;</td>
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<tr>
<td>&quot;I had the feeling that I was playing as my character&quot;</td>
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</table>

Fig. 34: VR-VTT User Engagement Questionnaire Responses, questions 1-12 from O’Brien et al.’s *User Engagement Scale Short Form*, 2018.
CONCLUSION

This thesis project provides an analysis of the feasibility of incorporating VR technology into role-playing games conducted online via VTT. The visual prototype presents an immersive encounter in VR for the purposes of testing a VTT function that provides players the ability to play in the first-person avatar-embodied perspective (1PP) to induce a sense of embodiment for diegetic gameplay. The visual component demonstrates how character-embodied play can be achieved inside VR for VTT players using a ruleset like *Dungeons & Dragons*. The data gathered confirms the findings of earlier studies measuring the user experience of embodiment and reveals that avatar embodiment for diegetic RPG gameplay could feasibly work under the right conditions, which would be without technical glitches and ideally, with the option to switch between a top-down, bird’s eye view and a 1PP embodied view. This option to switch would combine the benefits of both perspectives and allow idle players to exit the 1PP to review their character sheet, read through PDF rulebooks, or strategize their next move. With additional coding expertise, a more robust processor and high-end graphics card, many of the technical challenges experienced in the VR-VTT playtest scenario could be overcome, allowing for a more seamless user experience.

Despite the small sample size, participant responses corroborate previous embodied gameplay research claims regarding the experience of being collocated with a virtual avatar and controlling the avatar from 1PP while immersed in a virtual environment. The implications of this study demonstrate a need for future research into the possibility of using VR and other emerging technologies to enhance the experience of diegetic, embodied role-playing via VTT. Topics for further study might include the exploration of other hybrid forms of VTT RPG play that combine 2D top-down VTT play with opportunities for embodied VR play at specific points.
in the game, for example, during combat or other encounters. This combining of more traditional forms of RPG play with the use of new and emerging technologies to create innovative and novel gameplay experiences helps advance the gaming industry by offering gameplay experiences unlike any currently available.


APPENDIX A – TOP-DOWN VTT QUESTIONNAIRE*

Participant ID ______________

Please select your level of agreement with the following statements:

“During the playtest there were moments in which...

Q1. “I had the feeling that I was playing as my character”

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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<td>(3)</td>
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Q2. “I lost myself in this experience”

<table>
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<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
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<th>Agree</th>
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Q3. “The time I spent using this VTT just slipped away”

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
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Q4. “I was absorbed in this experience”

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Q5. “I felt frustrated while using this VTT”

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<tr>
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<th>Somewhat disagree</th>
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Q6. “I found this VTT confusing to use”

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<th>Somewhat disagree</th>
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<th>Agree</th>
<th>Strongly agree</th>
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<td>neither agree nor disagree</td>
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<td>neither agree nor disagree</td>
<td>somewhat agree</td>
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<td>neither agree nor disagree</td>
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<td>Q10.</td>
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<td>somewhat disagree</td>
<td>neither agree nor disagree</td>
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<td>Q11.</td>
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<td>disagree</td>
<td>somewhat disagree</td>
<td>neither agree nor disagree</td>
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<td>Q12.</td>
<td>“My experience was rewarding”</td>
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<td>neither agree nor disagree</td>
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<td>Q13.</td>
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<td>somewhat disagree</td>
<td>neither agree nor disagree</td>
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</table>

*All questions measuring User Engagement
Participan ID ______________

Please select your level of agreement with the following statements:

“During the playtest there were moments in which...

Q1. “I felt as if the virtual (avatar) body I saw when I looked down was my body”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q2. “It felt as if the virtual (avatar) body I saw was someone else”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q3. “It seemed as if I might have more than one body”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q4. “It felt like I could control the virtual body as if it was my own body”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q5. “The movements of the virtual body were caused by my movements”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q6. “I felt as if the movements of the virtual body were influencing my own movements”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q7. “I felt as if the virtual body was moving by itself”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)

Q8. “I felt as if my body was located where I saw the virtual body”
   strongly disagree disagree somewhat disagree neither agree nor disagree somewhat agree agree strongly agree
   (-3) (-2) (-1) (0) (1) (2) (3)
Q9. “I felt out of my body”

<table>
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<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Neither Agree</th>
<th>Somewhat Agree</th>
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Q10. “At some point it felt that the virtual body resembled my own (real) body, in terms of shape or size”

<table>
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<th>Strongly Disagree</th>
<th>Disagree</th>
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Q11. “I felt like I was wearing my character’s clothing/costume”

<table>
<thead>
<tr>
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Q12. “I felt as though I was looking through the eyes of my character”

<table>
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<tr>
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Q13. “I had the feeling that I was playing as my character”

<table>
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Q14. “I lost myself in this experience”

<table>
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Q15. “The time I spent using this VTT just slipped away”

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Q16. “I was absorbed in this experience”

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Q17. “I felt frustrated while using this VTT”

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Q18. “I found this VTT confusing to use”  
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Q19. “Using this VTT was taxing”  
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Q20. “This VTT was attractive”  
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Q21. “This VTT was aesthetically appealing”  
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Q22. “This VTT appealed to my senses”  
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Q23. “Using this VTT was worthwhile”  
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Q24. “My experience was rewarding”  
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Q25. “I felt interested in this experience”  
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*Questions 1-12 measuring Embodiment; questions 13-25 measuring User Engagement*
APPENDIX C – PLAYTEST DISCUSSION QUESTIONS

1. What would you say are the benefits or drawbacks of playing a role-playing game via VTT in the first-person embodied perspective?

2. What would you say are the benefits or drawbacks of playing a role-playing game via VTT from a top-down/bird’s-eye view only?

3. Did one format or the other make you feel part of the action? How or why?

4. In the VR-VTT, you virtually swung a sword or shot an arrow at the enemy instead of rolling the dice to attack. Did this experience affect your gameplay in some way? If so, how?

5. What was your experience when the enemy attacked you back?

6. What are your thoughts about the possibility of having the option to switch between bird’s eye view and 1PP in a VTT?