VR Gods: A Split VR/Tangible Experience Designed to Encourage Collaborative Spectacle

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Abstract

This paper describes a split physical/virtual video game experience called VR Gods. The experience mediates interactions between the physical and virtual player while each player contributes to the creation of an engaging virtual natural environment. The goal for the virtual player is to explore the virtual environment and interact with a variety of objects to discover their individual behaviors. Physical players will be presented with seven tangibles which can be used to create the objects for the virtual player. The looming presence of the "Gods" is a key component to the collaborative nature of this project as it creates a meaningful artistic experience unique to every player. We will also describe the motivation, intent and design of this system.

Introduction

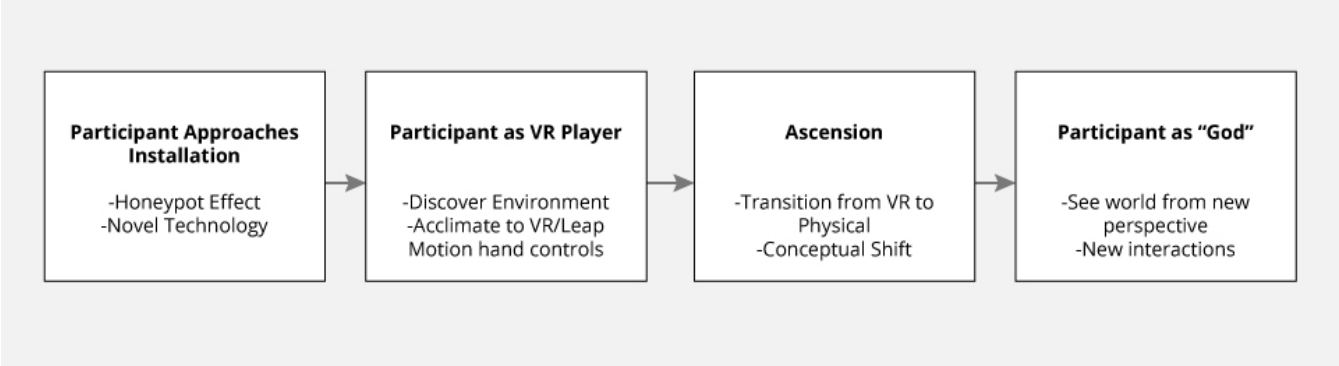
A variety of recent technologies have been designed with the intent of fostering collaboration between people. Social networks commonly seek collaboration on the spread of information, and more focused tools like Slack or Google Documents allow for many different people to collaborate concurrently. However, these designed traits are not universally apparent in other technologies.

Augmented reality (AR) and virtual reality (VR) stand as the two most prominent new technology paradigms that exemplify this. By their newer nature and higher computer performance requirements, they are often pitched and designed as solitary experiences. VR makes this abundantly clear by isolating the user within headsets and earpieces that deprive them of sight and hearing. Likewise, AR tends to only be visible to an individual at a time, either looking through glasses, headsets or some other pass through screen. These issues make synchronous experiences between players a technical challenge. It is therefore worthwhile to explore novel approaches to integrate AR and VR in real-time collaborative experiences in ways that push the boundaries of each individual technical component.

Interactive art as a method of design is one way to approach the issue. Art as a method can help create a bridge between an artist's viewpoint on the conceptual boundaries of a medium or technology and the public's conception of those same boundaries. The often-cited Fountain by Marcel Duchamp exemplifies this notion. By submitting an overturned urinal as art, Duchamp challenged the boundaries of what was considered art in 1917. This notion can extend beyond just artistic boundaries though. Duchamp himself did this later in 1920 by creating Rotary Glass Plates, a machine that displayed optical illusions if perceived from the correct angle.

The interaction design of the the hybrid VR/AR experience described in this paper, called VR Gods, was inspired by Bilda & Edmonds' model of creative engagement. These concepts are utilized in the paper to help describe important design decisions in the project. In particular, we leverage the concepts of attractors and sustainers described by Bilda et al.. Attractors are concerned with gaining attention of the audience, while sustainers work to maintain that attention[1]. Due to the virtual and physical aspects of our experience, attractors and sustainers must exist in both sides of the experience separately and ultimately connect them.

It is also important to be mindful of participants' intentionality when performing actions because the technology is new. Bilda & Edmonds describes participant intentionality starting as more intimate with the focus being around personal fun, curiosity, and pleasure. Once a deeper understanding of the system is gained, then the participant acts in



1. Diagram of the system as a participant approaches the installation all the way to the end where they become a "God"

a manner to elicit a specific outcome from the system.[1] In the context of our project, co-creation begins during the second interaction phase where the expectation is to manipulate the experience of the other player. We will explain in more detail how a participant transitions through these phases of interaction.

The main contribution of this paper is describing a hybrid VR/AR experience that explores the affordances of these new technologies for facilitating creative collaboration and co-creation. This paper also strives to demonstrate the value of interactive art experiences for designing novel collaboration experiences with novel technologies. Finally, we briefly describe how the general approach of combining VR and AR in two distinct yet synchronous experiences can be generalized to other applications domains outside of the interactive art context.

Related Work

There is recent and previous research that investigated the use of VR and AR technologies to support collaboration in some manner. For example, Billinghurst and Kato constructed a collaborative mixed reality application that demonstrated the potential for concurrent use of AR and VR, but these collaborative experiences are often goal-driven work contexts (e.g. computer supported cooperative work), rather than open-ended, creative, and expressive contexts, such as interactive art applications [2,3,4]. Sandbox-style interactive experiences like Audi's Sandbox Driving Experience and Beckhaus, Schröder-Kroll and Berghoff's Granules Landscapes sandbox experience both track physical elements, and in the case of Audi's those elements are later digitized. However, these projects do not intertwine concurrent physical and virtual interactions.

Given this gap, we sought to identify other work that might serve as a model for the interactions we intended. We would suggest that Dungeons and Dragons, a role-playing game designed for tabletop where one user acts as the dungeon master (DM) and facilitates primarily verbal gameplay between players, represents the closest analogue to our design. It exemplifies a similar design patterns because different players, DMs and players, have radically different sets of information about the state of system.

By design, DMs facilitate gameplay for players. They often write stories and draw maps before sessions with a plan for how they hope players will progress. DMs must also actively change their intentions as players inevitably deviate from the DM's expectations.

System Design

Our system, VR Gods, seeks to incorporate practices from prior co-creation systems and specifically is designed to facilitate collaborative spectacle, which we define as the creation of novel and compelling visual/aural feedback with the system. To that end, VR Gods is an installation art piece designed for public spaces, to be played over a short period of time, and with simple interactions guided by facilitators.

First, we knew that a public art installation would include a diverse group of players, and given the relative novelty of VR we would need to accommodate players without prior VR experience. That notion led us to maintain a short and simple experience that can be facilitated easily. It's here that we chose to emphasize spectacle over interaction complexity. Additionally, we maintain a timely pace for the experience to mitigate boredom that players may feel when they have exhausted the novelty of the system.

On both sides of the system, the goal for the players is to explore the system, interact with a variety of objects and discover their individual behaviors. For the virtual player, their motivation lies in the fact that the objects are spawned by the physical players (or "Gods"). The looming presence of the physical player is a key component to the collaborative nature of this project. For the physical player they similarly learn the individual outcomes of each tangible. The location

of tangibles are represented as visible particle systems in the sky and also indicate where objects will spawn. The virtual player will see the particles move and be drawn to these locations to await an unknown object spawn.

The distinction between the capabilities of the physical and virtual player paired with their differing sets of information are the primary underpinning principles driving the system design of VR Gods. This separation also drives collaboration between players, but primarily focuses that collaboration around the virtual player's experience. Although both players see the same environment, because the physical player creates the environment and that outcome is most salient in VR, the physical experience centers around eliciting emotional reactions from the virtual player. We however believe that by the system is collaborative, not through systemic goals but through facilitating the creation of emotional outcomes. Physical players can share the emotional outcomes of the virtual player simply by observing the play. In this sense, the art of the experience is not an explicit physical or virtual object, but is instead the shared emotional experience between the players.

Summary of Phases

1. **Participant approaches installation.** VR technology acts as honeypot to draw attention. Interaction possibilities are unknown at this point.
2. **Participant enters VR environment.** Users are given a chance to acclimate to VR and then to the experience as a whole. They perceive new objects being spawned but are not overtly told that the objects are derived from other people. Actions transition from unexpected to deliberate.
3. **Participant "ascends" and are given a concrete end to that experience.** They learn other people were controlling the object placement the method by which the objects were placed. The experience is reinterpreted as they are then offered a chance to participate as a god.
4. **Participant is led into a curtained off section of the gallery where they see the table,** which on it's screen displays the world they were just inhabiting. they also see a being in the world that they were a moment ago. They now have an entirely new set of interactions which facilitate them indirectly interacting with the current virtual player.

Phase 1: Approaching the Installation

We are relying on the HTC Vive technology to be the attractor before the player beings to participate. VR technology is new and therefore intriguing for people who have not used it. Potential participants are also able to watch the current VR player move and even see what they see through a projection on a nearby wall. This phase serves to prime the user's expectations of the system.

VR play-space and table with nature themed props

Phase 2: VR Exploration

When the participant enters the VR environment, they are given a chance to acclimate themselves and learn about how the environment reacts to their actions. The facilitators guide the virtual players through putting on the headset and headphones, and ensure that the virtual player realizes that their hands are virtually represented and that they can touch objects in the scene. Aside from this guidance though, the facilitator attempts to allow the virtual player to discover the system on their own. The experience does include a short tutorial area that requires the virtual player to touch a bush, which helps ensure that virtual players realize how their core interaction works.

The VR experience is centered around spectacle and interesting feedback when the user interacts with virtual objects. The player is given agency through the Leap Motion controller which uses embedded infrared sensors to track the position of a user's hands. That position data is interpreted by the computer and mapped to generic 3D models of each hand, which we use to check for collisions with nearby objects. This enables players to "reach out and touch" objects.

When the player reaches out and touches an object, it reacts with a series of "touch-effects". These touch-effects are fired when any of the player's fingers intersect the objects spawned by the physical God players. These touch effects can tween the color of the given object, tween the size or rotation of the object, play a short sound effect or release a particle effect. Different elements of the touch effect are intended to last for different amounts of time, but all effects are contingent on the virtual player touching an object in order to maintain consistent feedback.

Every effect is also intentionally created around the specific affordances of the target object. For example, when a tree is touched, leaves fall from the canopy; when a flower is touched, the pedals spin. The wide range of objects and touch-effects allows the player to maintain a high level of interest over the duration of the VR experience, which is fixed at just over 3 minutes.

Due to the limitations of the VR play space, we implemented a teleportation system to allow the virtual player to access areas of the environment outside the bounds of the initial play space. Unlike other experiences where the virtual player has control over teleportation location, this project allows the physical players to control the teleportation location via tangible. This tangible is linked to a virtual "North Star". When the virtual player looks at this star for a short amount of time, they are teleported to the area directly underneath. Cooperation between the virtual and physical players are needed for the teleportation system to be fully functional.

2. Screen capture of VR environment at dusk

Phase 3: Ascension

The VR experience occurs over the course of a virtual "day" in the environment. At night, the participant ascends and the VR experience ends. They take the goggles off and are escorted to a previously curtained-off area with the table and other players who were controlling the tangibles. At this point, the participant realized that it was other people who were in fact watching over them, spawning objects, and controlling the location of their teleportation. They reinterpret the meaning of their experience due to this gained knowledge which will manifest in how they act as a new "God".

Phase 4: VR God

3. Tangibles (from left to right) include teleportation, lively, tall, and stoney. Each spawns a different object based on the name.

The last phase allows the user to view the VR environment from the top-down as an interactive table. They will be presented with seven tangibles which can be used to create a variety of objects. Having been a VR participant, they are knowledgeable of the types of objects than can be spawned but do not know the tangible combinations. The exploration in this phase is combining different tangibles to understand what objects are spawned. The tangible design will match the behavior in some respect also playing into participant expectations. For example, if they use a tangible that looks like a rock, and some form of rocky object is spawned, the participant feels rewarded for their action; this is a form of a sustainer. Once they understand the system, then they can intentionally create objects for the virtual player. The objects they choose to spawn and the object location will be determined not only by their own preference, but also how they think the virtual player will respond. For example, the tall stone head surprises most virtual players on touch by abruptly turning towards them while the tree is more pleasant with falling leaves. The physical player determines which emotional response they want to elicit and is satisfied when they observe the virtual player reacting to the object. How physical players act is determined by their personal interpretation of the previous phases combined with the emotion reactions of the virtual player therefore no two experiences will be the same across participants.

Future Work

We see VR Gods as a model for future work on collaboration between players using different technologies and with different sets of information. The interactions possible in VR Gods were necessarily shallow for the purpose of a gallery show, but the notion that interactive elements in an environment can be created while a separate player concurrently interacts with those same elements is abstract enough to allow for wider generalizations to projects in other application domains.

Virtual environments in VR are already a common experience, but given the ability of one player to control an environment uses cases such as architecture visualization could become much more usable. A virtual player could view and traverse a visualization while a facilitator switches in and out at the virtual player's' request. This would allow the interface used by the facilitator to resemble existing, well understood mouse and keyboard interfaces, reducing the burden on the virtual player of both investigating their environment and learning a new interface at the same time.

Additionally, game design already utilizes systems where different players have access to different information or capabilities. These are commonly described as "asymmetric" experiences. By its nature VR Gods is an asymmetric experience and could serve as a model for future games not unlike tabletop Dungeons and Dragons.

Admittedly, our system offers little in the way of emergence, but from our standpoint the system would be well suited to allow for this. Simply a system where the objects generated by the physical players, or the interactions of the virtual players, had lasting outcomes on the state of those objects would open the door for emergent properties. True games could be designed where virtual players are tasked with eliminating all generated objects, or virtual players hide in the environment created by the physical players. Regardless of the approach, we see the topic of emergence as a fruitful direction to further research.

Conclusion

The capabilities described above we believe articulates what makes VR Gods unique among the slate of experiences offered by VR and AR technologies. Although the technology is relatively new, we can use concepts of creative engagement to model our participant experience to ensure unique and pleasurable outcomes. The novelty of the technology serves to attract participants while the world building/co-creation dynamic sustains their interest in the interaction. The asymmetrical distribution of information also serves to create a rewarding experience. Specifically, the VR player is not aware of the God players' influence on the environment while the God players are unsure of how the VR player will interact with the environment they are creating. We can potentially generalize this concept of information asymmetry in an interactive art installation to other contexts outside of the one presented in this project; where the key component is the concurrency of participant actions and how they each interpret the meaning of those actions. One such possibly would be an extension into the field of game design. Much of the engagement in video games comes from the limitations imposed by a system. Our system by design enforces information limitations on both users. That sort of dichotomy could, among other potential uses, be the basis for a strategic game played between players with asymmetric capabilities.

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