Escape Heterotopia: A Psychological VR Interactive Game

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Abstract

In this VR game, inspired by Foucault's concept of heterotopia, players explore a world where contrasting spaces coexist, embodied through three distinct avatars. Set in a conventional office, a mysterious 'sexual hotel', and a unifying main room, the game mirrors the complex juxtapositions found in modern life. It invites players to navigate and reconcile these fragmented realities, reflecting the challenges of contemporary existence where diverse, often conflicting, roles and expectations converge. This immersive experience not only challenges perceptions of identity and reality but also echoes the complexities and multifaceted nature of our daily lives.

1. Introduction

1.1. Background

In the fast-paced, hyperconnected world of the 21st century, individuals find themselves constantly navigating between contrasting spaces and identities. Modern life, with its technological advancements and social complexities, presents unique challenges that blur the lines between personal and professional spheres, privacy and exposure, freedom and control. This dichotomy often leads to a fragmented sense of self, where individuals struggle to reconcile their various roles and identities in different social contexts.

1.2. Game Concept

"Escape Heterotopia" is a groundbreaking VR game that delves into these modern challenges through the lens of psychological and social theories. Inspired by Michel Foucault's concept of heterotopia and Marshall McLuhan's media theory, the game offers a unique experiential insight into the juxtaposition of contrasting spaces and the human psyche's response to them.

Foucault's idea of heterotopias [2] - real places that are simultaneously physical and mental, embodying layers of meaning - is central to the game's design. The game features two mirrors leading to a sex hotel and an office, each reflecting different aspects of the player's identity. This setup embodies Foucault's notion of spaces that are both isolated and penetrative of societal norms, challenging players to navigate the complexities of these intertwined realms.

Marshall McLuhan's view of media [3] as extensions of human faculties is deftly echoed in the game's design. The game splits the player's presence between two virtual environments, embodying McLuhan's notion that media shape our experiences and perceptions. This dual presence in distinct spaces resonates with McLuhan's insight that new technologies alter our interaction with the world. He noted, "These extensions not only amplify but also bring about an imbalance and amputations." This concept is mirrored in the game, where dividing controls between contrasting spaces intensifies the sense of fragmentation, a reflection of the disjointed nature of modern life. Through this, players are invited to experience and contemplate the intricate impact of technology on their perceptions and daily lives.

1.3. Related Work

The pervasive use of social media is linked to increased anxiety, loneliness, and diminished well-being, as users often compare themselves to others' curated lives, leading to stress and a sense of isolation. This is extensively documented in research by Primack et al. [4] and Twenge and Campbell [5]. Additionally, social media platforms, particularly Instagram and TikTok, promote unrealistic beauty standards through idealized, digitally-altered images, influencing users' body image and sometimes leading to disordered eating, as explored by Fardouly et al. and Perloff. However, the specific impacts of "amputation" and "overwhelming" in this context are less understood. Virtual Reality (VR), offering immersive experiences, can simulate these subtleties. Projects like "The Machine to Be Another" by BeAnotherLab [1] demonstrate VR's potential in understanding the complex effects of social media on mental health and body image by allowing users to experience others' perspectives.

1.4. Objectives

"Escape Heterotopia" aims to immerse players in an experience that showcases the complexities of sense fragmentation and heterotopia in modern life. The game leverages VR technology to bring to life the theories of McLuhan and Foucault, highlighting the impact of media and contrasting social spaces on perception and behavior.

2. Results and Demonstration

2.1. Game Experience

The overarching interaction flow is shown in the 1

When the player enters the game, the directive "Escape the Heterotopia" appears, followed by a countdown starting from "1:00". She finds herself between two mirrors shrouded in darkness, each reflecting half of her avatar. One mirror reveals her avatar naked in a sensuous hotel setting, while the other shows it clad in a suit and tie, situated in an office. The mirrors track her head movements, and the scenes within mirror her arm movements. To escape within 60 seconds, the player must skillfully navigate and interact with objects in both rooms.

Interaction The player soon discovers doors in each room. Moving backward, as the mirror inversely reflects the avatar's space, she attempts to open the doors. The right-hand door opens, but the left remains locked. Turning around to search for clues, she notices another door on the opposite side of the office, mirrored by a closet in the hotel. Attempts to open the office door are thwarted as the closet in the hotel cannot be bypassed. In her exploration, she finds a vase in the hotel room. Using her left hand, she turns it upside down, releasing a key. Simultaneously, this action causes her avatar's left hand in the office to pull a computer, dragging a charger which topples a bookshelf, obstructing the office exit.

Ending Trapped in this heterotopia, the player faces an impasse. The countdown reaches "0:00" and the surroundings fade to darkness, marking the end of her attempt to escape the intricate duality of these mirrored worlds.

2.1.1 Interaction Design

The overarching interaction design is shown in the 2.

Motor System The game employs a unique mirror system where players can only see and interact with the scenes behind their avatar. To engage with objects or navigate the space, players must move backward, aligning their actions inversely with the reflections. **6 Degrees of Freedom (6DOF)** allows full spatial movement. Players can move by physical movement, or using the stick. They have the freedom to move up, down, left, right, forward, and backward, as well as to rotate and tilt, providing a comprehensive range of motion for intricate interaction within the game environment.

Pinch Interaction The player can use "pinch" to interact with door, vase, cabinet, and computer. Players can grasp the vase with a pinch gesture, mimicking the action of holding and pouring in real life. By pinching and pulling the door handle, players can open and close doors within the game.

Collision When the player's avatar bumps into a wall or encounters a locked door, the system immediately detects this collision. Upon collision, the game triggers a boundary prompt.

3. Implementation

In this section, I will outline the tools utilized and the primary challenges encountered in the project. The overarching architecture of the system is depicted in the accompanying figure 3.

3.1. Tools and Technology

For this project, I employed **Unity** and **Blender**. Our focus here will be primarily on the game design aspect, specifically the Unity component. The Unity portion was developed in C# along with Unity's native shader language. Testing was conducted on a Windows 10 PC equipped with an Intel Core i7-8700K CPU, 32GB RAM, and an NVIDIA GeForce GTX 1080 Ti GPU, using the Meta Quest 2 VR headset. Key packages integrated into the project include **XR Interaction Toolkit**, **XR Plugin Management**, and **Animation Rigging**. The XR Interaction Toolkit is instrumental in facilitating XR interactions within Unity projects. XR Plugin Management acts as an interface for XR plugins, providing essential APIs for XR plugin framework integration. The Animation Rigging package offers a suite of tools for procedurally authoring animations in real-time.

3.2. Challenges and Solutions

I will delve into specific challenges faced in this project, such as the multi-controller system, camera, and mirror system, and describe the solutions implemented.

Multi-controller System To capture a sense of fragmentation, I created three full-body avatars, each located in distinct spaces. The primary avatar represents the main player's perspective, while the other two avatars, situated in an office and a 'sexual hotel', serve as player substitutes. Each avatar is equipped with a **Rig** component for realistic

(a) Opening (b) Door Interaction (c) Cabinet Interaction

(d) Cup Interaction (e) Vase and Computer Interaction (f) Ending

Figure 1. Game Experience

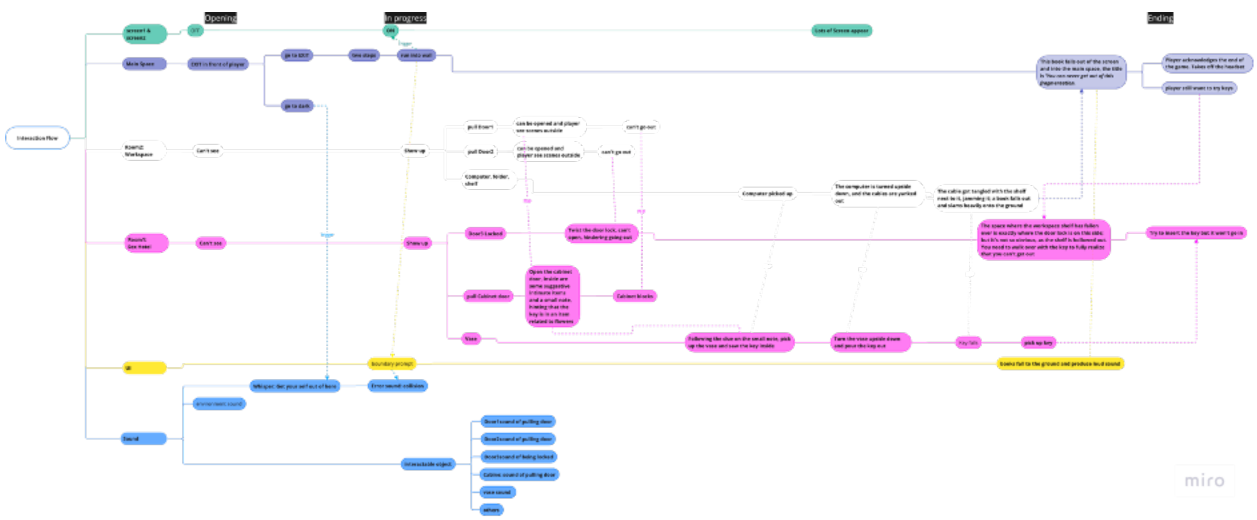

Figure 2. Interaction Flow

action simulation, and an **IK Target Follow VR Rig** component, ensuring that the avatar's hands and head follow the controller movements. Control over the three avatars is facilitated through a triad of controller systems (**XR Controller**), each incorporating a **locomotor system** for 6DOF movement. The left and right-hand controllers feature a **XR Direct Interactor** for managing pinch interactions. In the VR environment, the player can simultaneously control all three avatars, mirroring the player's actions.

Camera Each room is equipped with a camera, serving as a mirror's texture material in the main room. These cameras capture the avatars' upper halves. The **Smooth Camera Follow** component governs two critical functions of these cameras:

1. *Following shoulder movement:* The camera tracks the avatar's movements, maintaining a constant relative rotation and y-axis transition, while keeping x and z-axis rotations fixed.

2. *Collision avoidance:* Cameras are equipped with colliders and use **linecast** for collision detection. Upon collision detection, the camera reverts to its last non-collision position, adjusted by an offset.

The camera's behavior is summarized in the attached pseudocode.

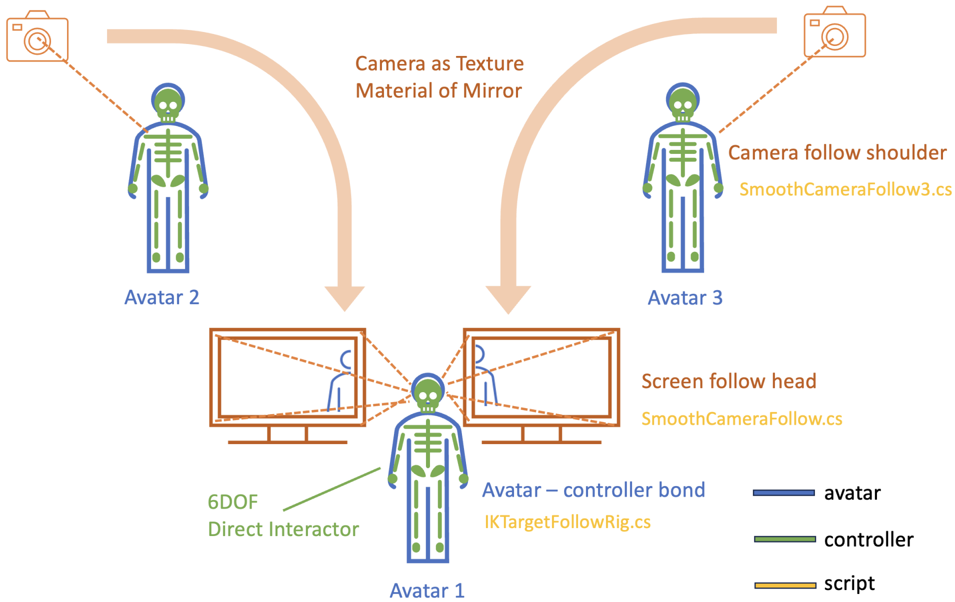

Figure 3. Implementation

Algorithm 1 Smooth Camera Follow

Input: target3, smoothTime3, rotationLerpFactor, collisionLayerMask, collisionOffset
Output: Updated camera position and rotation
Initialize:
$wantedRotationAngle \leftarrow$ Y-axis rotation of target3
$currentRotationAngle \leftarrow$ Y-axis rotation of camera (transform)
Main Loop (LateUpdate):
    1. Interpolate rotation angle:
        $currentRotationAngle \leftarrow$ Interpolate(currentRotationAngle, wantedRotationAngle, rotationLerpFactor, deltaTime)
    2. Convert angle to rotation:
        $currentRotation \leftarrow$ Quaternion.Euler(0, currentRotationAngle, 0)
    3. Calculate target position:
        $targetPosition \leftarrow$ target3.position $-$ (currentRotation $\times$ offset)
    4. Smoothly interpolate position:
        $newPosition \leftarrow$ SmoothDamp(camera.position, targetPosition, smoothTime3, velocity)
    5. Collision detection and response:
if Linecast(target3.position, newPosition, collisionLayerMask) **then**
    camera.position $\leftarrow$ hit.point + hit.normal $\times$ collisionOffset
else
    camera.position $\leftarrow$ newPosition
end if
    6. Apply smooth rotation:
        $targetYRotation \leftarrow$ target3.eulerAngles.y + rotationOffset
        $smoothedYRotation \leftarrow$ SmoothDampAngle(camera.eulerAngles.y, targetYRotation, smoothTime3)
        $limitedYRotation \leftarrow$ LerpAngle(camera.eulerAngles.y, smoothedYRotation, rotationLerpFactor)
        camera.rotation $\leftarrow$ Quaternion.Euler(camera.eulerAngles.x, limitedYRotation, camera.eulerAngles.z)
    (Optional: Camera looks at target3)

mirror The main room features two mirrors reflecting avatars in the office and 'sexual hotel'. These mirrors consist of two planes, with room cameras serving as the mirror textures. The movement of the mirrors, controlled by the **Smooth Camera Follow** component, follows the main avatar's head movements. The underlying code is akin to that used for the camera system.

4. Discussion

Insights obtained, future work (if any), and limitations of the current system. In the future,

References

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