

# Adaptive Mirror-World Simulation Roadmap

## Overview

This roadmap outlines the planned structure and implementation phases for creating an adaptive virtual environment that reflects and responds to user cognitive patterns, movement dynamics, and behavioral signatures. The system operates using stock Unity components, C# scripting, and dynamic audio modulation to shape the experiential atmosphere.

## Core Concept

The simulation serves as a reflective environment. The world observes how the user behaves, moves, hesitates, explores, avoids, or remains still. These patterns form a cognitive signature that guides how the environment adjusts ambient audio, spatial resonance, and atmospheric tone.

The simulation is not persuasive or manipulative. It is a non-intrusive mirror.

---

## Phase 1: Foundation and Baseline State

### Environment Setup

- Create a single room environment (e.g., pool corridor, empty bookstore).
- Use minimal environmental detail to emphasize atmosphere.

### Player Controller

- Standard Unity first-person controller with smooth movement.
- Track the following metrics:
  - Movement velocity over time
  - Direction changes
  - Idle duration
  - Gaze fixation points

### Audio Baseline

- Implement low-frequency ambient loops.
  - Introduce subtle binaural or phase-coherent tones.
  - No dynamic modulation yet.
-

## **Phase 2: Behavior Signature Tracking**

### **Data Capture**

Track and store player behavioral metrics: - Time spent in open vs enclosed spaces - Approaching vs avoiding focal points - Speed of navigation

### **Profile Inference**

Behavior patterns map to baseline cognitive tendencies, such as: - Exploratory vs cautious - Direct vs meandering pacing - Internal focus vs external scanning

This profiling is interpretive but descriptive, not evaluative.

---

## **Phase 3: Adaptive Audio System**

### **Dynamic Audio Modulation**

Create a C# audio controller that adjusts: - Frequency balance - Reverb decay and wet/dry mix - Ambient density and resonance

### **Response Rules**

Environmental audio changes smoothly based on: - Slowing movement triggers more spacious reverberation - Rapid pacing increases tonal density or pressure - Stillness softens high-end presence

The system responds gently, without sudden shifts.

---

## **Phase 4: Multi-Environment Expansion**

### **Add New Spaces**

- Additional liminal environments: mall hallways, office atriums, underground service corridors.

### **Continuity of Signature**

- Behavioral profile follows the player across spaces.
  - The world feels continuous even when settings change.
-

## Phase 5: Refinement and Polishing

### Sensory Cohesion

- Ensure lighting, acoustics, pacing, and spatial layout reinforce mood.

### Optional Enhancements

- Subtle environmental animation (air movement, reflections, flickering light).
- Very light procedural geometry variation influenced by user pacing.

### Documentation

- Prepare explanation text for design intent and psychological framework.
- 

## Final Goal

A perceptually responsive simulation that operates as: - A cognitive mirror - A self-recognition space - A world that reflects how the player exists inside it, not how it wants the player to behave.

The system learns *you* by watching *how you move through it*.