Navigating Precision: A Comparative Analysis of Guided Walking Techniques in Virtual Reality

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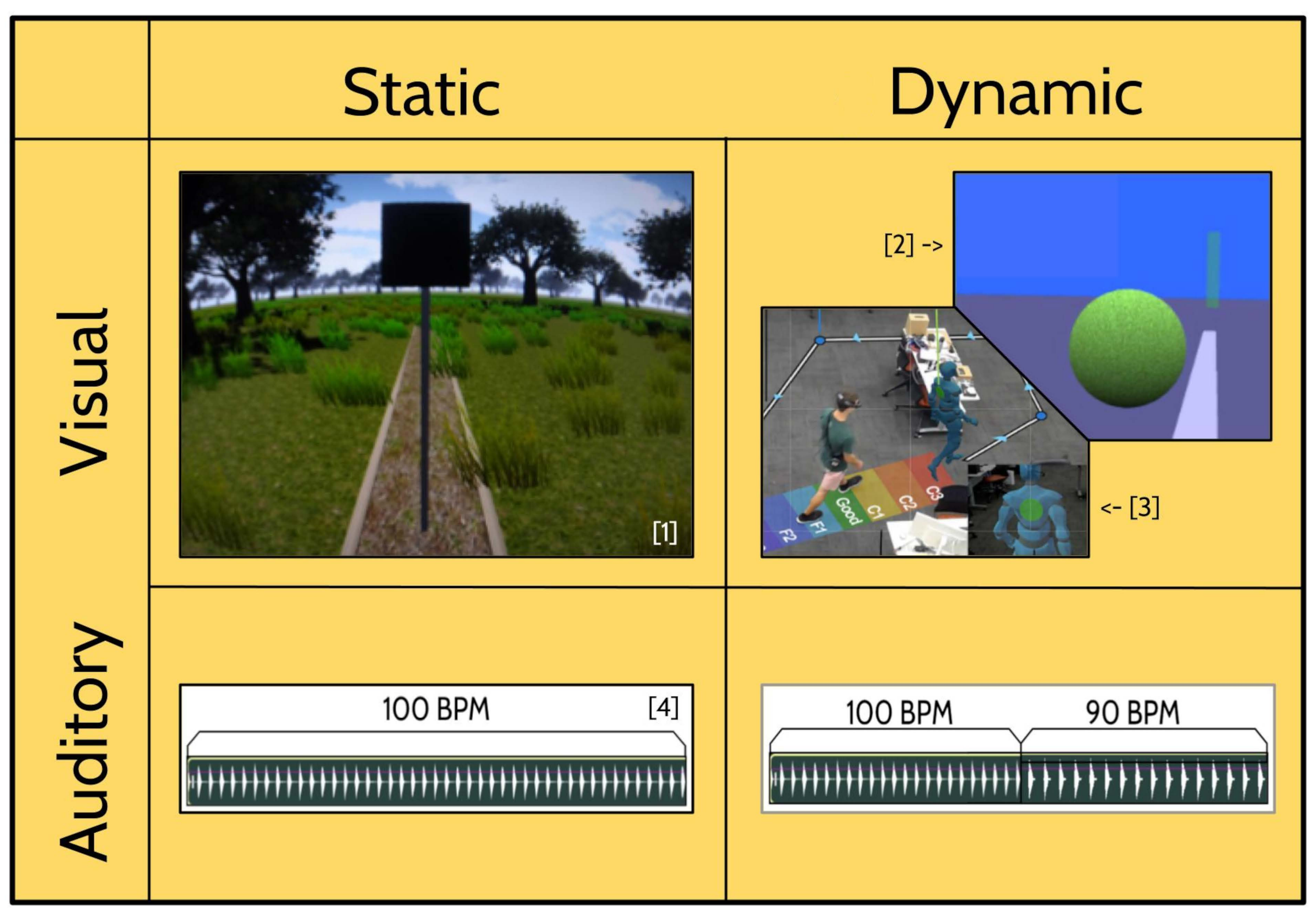
Problem/Background

- The consistency of walking speed among participants in Virtual Reality (VR) studies is often challenging to maintain, introducing **unwanted variables** that can impact a study's results.
- Many studies use **"Guided Walking" technique**s to control users' walking speeds, which use visual or auditory stimuli to prompt the user to walk at the desired speed, or in a desired direction.
- Studies use different techniques to do this, but **none of these techniques have been verified to work effectively**, nor has one been proven to work better than another.



Purpose

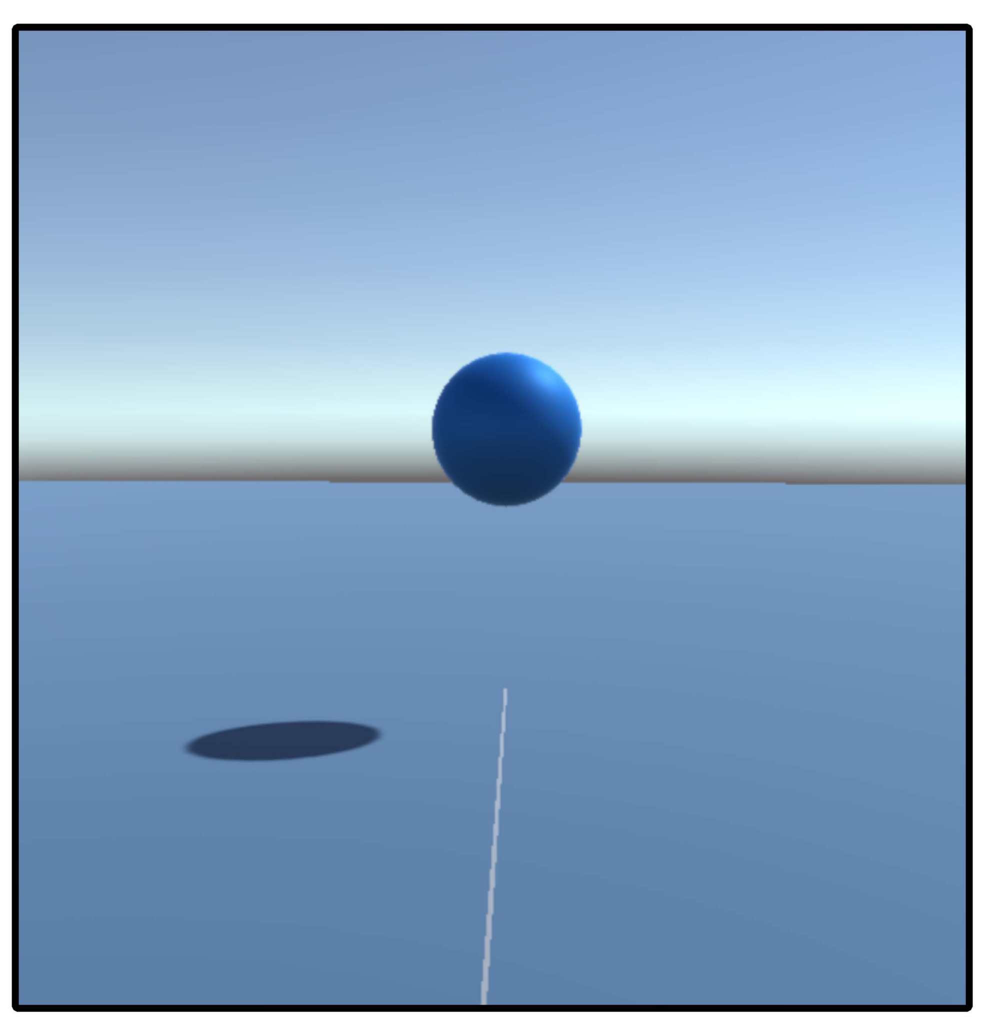
- This study aims to **evaluate the effectiveness** of various guided walking techniques, and compare their results.
- By testing different guided walking techniques, this study seeks to identify the strategy that can either **eliminate** or predictably control these **extraneous variables**, thereby enhancing the reliability of further VR research findings.

Methodology

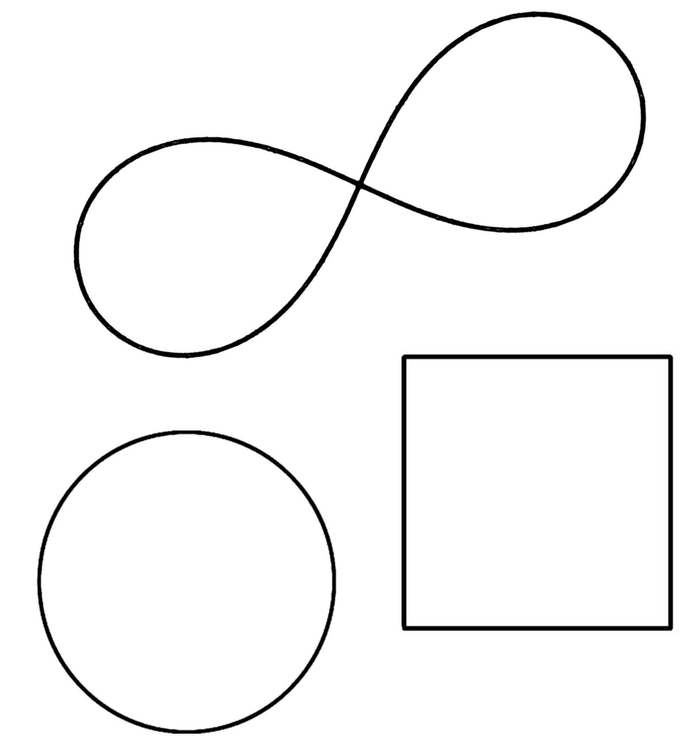
Utilizing a Finite State Machine developed in C#, this study employs a controlled experimental design within a **Unity** environment to systematically assess four guided walking techniques:

- **Static Sphere**
  A yellow sphere which floats in front of the user at a constant speed, which the user is instructed to follow at a consistent distance.
- **Dynamic Sphere**
  Much like the Static Sphere, except it changes color on a continuous spectrum from red (too close) -> green -> blue (too far). The participants will be asked to keep the sphere green.
- **Static Metronome**
  A metronome will sound at a variable interval, which is calculated using the user's stride length before the experiment.
- **Dynamic Metronome**
  Much like the Static Metronome, but the interval between beats changes depending on the user's current velocity, to get them to either accelerate or decelerate.

User POV



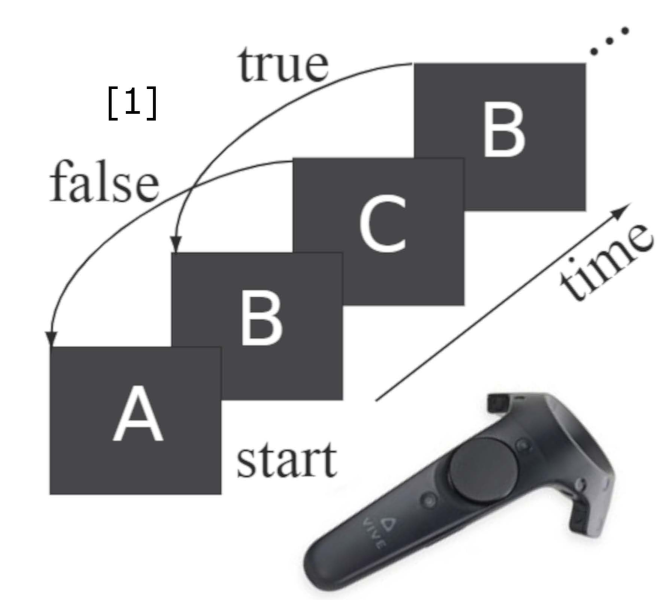
The trials will be uniformly distributed amongst three different path shapes: a **circle, a square, and a figure-eight.** These path types were selected because they offer a variety of curves, straights, and vertices.



Data Collection

To collect data, we will be tracking a few different things from the users:

- Position and Velocity data
- Eye gaze data
- Reaction time to Two-Back Haptic stimuli



Expected Outcomes

We expect that:

- the **Dynamic methods** of Guided Walking will yeild a better control for walking speed.
- the Dynamic methods will induce **significantly** increased cognitive load compared to Static..
- the **Visual methods** of Guided walking will yeild a better control for walking speed.
- the Visual methods will induce **slightly** increased cognitive load compared to Static.

References

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[3] Lu, Feiyu, et al. "Glanceable AR: Evaluating Information Access Methods for Head-Worn Augmented Reality." 2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR), 2020, pp. 930–39, https://doi.org/10.1109/VR46266.2020.00113.

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