

Ariadne:

A Parameterizable VR Maze Framework for Experimental Psychology

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CONTEXT

Virtual Reality has become a valuable tool for experimental psychology, enabling researchers to study human behavior, memory, and cognition under conditions that combine high ecological validity with rigorous experimental control. Immersive environments allow precise manipulation of variables such as spatial layouts, object placement, agent behavior, and environmental cues, supporting reproducible protocols that would be difficult or impossible to implement in physical settings. Maze-like environments have a long tradition in psychological research, offering controlled spaces to investigate spatial memory and navigation, where the ability to recall where objects or events were located is central to understanding episodic memory and how people build mental representations of the world around them.

However, developing custom VR experiments typically requires substantial programming expertise, placing a barrier between psychologists and the tools they need. Each new study often demands bespoke development, slowing down research cycles and limiting the range of conditions that can be explored. A flexible framework that allows researchers to parameterize the experimental environment (e.g., maze size and topology, number and placement of objects, presence and behavior of virtual agents, ambient conditions) would substantially streamline experimental design. Additionally, capturing participant behavior in a way that supports the study of spatial memory and related phenomena, including trajectories, revisits, interaction events, gaze, and task performance, is essential for enabling rigorous analysis across diverse experimental protocols.

OBJECTIVES

This work aims to design and develop a parameterizable VR maze framework that enables psychologists to configure experimental environments and to collect relevant data regarding participant behavior and performance.

TENTATIVE WORK PLAN

- Review the research context regarding the use of VR for experimental psychology, with emphasis on maze-based paradigms, spatial memory, and behavioral data collection
- Problem characterization, requirement definition (in collaboration with psychology researchers), and proposal of a system architecture for the parameterizable VR maze framework
- Iterative development and testing of framework components covering, for instance: 1) configuration of maze topology and environmental parameters; 2) placement of objects; 3) collection and logging of participant performance data (e.g., trajectories, interaction events, completion times)
- Validation of the developed framework through a representative experimental scenario defined together with psychology partners
- Write documentation of the work carried out

RESEARCH CONTEXT

The work to be developed is relevant for ongoing research @ IEETA on human-machine interaction and immersive environments, and supports collaboration with the Department of Education and Psychology of the University of Aveiro on projects such as Map2Protect, which investigates spatial memory and the behavioral immune system using virtual environments.