

# ARTIFICIAL PLAYFULNESS

Investigating the use of AI in game user experience evaluation

How can **artificial intelligence** empower the next generation of **game UX research**?

## Motivation

Our main objective is to streamline early playtesting through the use of autonomous agents. We believe this will make rapid iterative development more robust and accessible, especially for independent developers. We also aim to explore the simulation of human-like decision making in games to inform other game UX solutions and future in-game AI agents.

## Our Project

We are creating a framework for semi-automated game testing in the Unity engine, informing our system design and development through comprehensive background and technical review. After completing the framework, we plan to assess its utility through comparative studies with real players and expert evaluation with developers. Eventually, we hope to openly deploy the tool for commercial use.



### What is Playtesting?

Playtesting is the process of having prospective users play through a game in development, helping developers gain a better understanding of the experience they are creating. This is also vital in identifying design issues and areas for improvement. However, full-scale playtesting isn't always feasible, with major challenges and expenses in recruiting players and orchestrating tests.

## AI in Game UX Research

Researchers have been integrating AI techniques within game UX research for years, with many successes. Clustering and pattern-mining algorithms are now common ways to analyze large player datasets that render manual analysis infeasible. Player models built with the help of AI can help researchers better understand player interactions. AI may also be used to identify player emotions, create behaviour prediction models to tailor more adaptive gameplay experiences, evaluate the playability of games, and even playtest.

Some researchers have also been trying to create AI-driven game design and research tools specifically for non-programmers, so that a wider variety of developers will be able to benefit from the technology. Still, most AI tools have rather narrow applications. General AI, or AI that can react intelligently to a wide range of different scenarios, has proven to be an elusive prize for computational research, with the potential to revolutionize the ways we use machine intelligence.

### AI and Games

Originally, "game AI" referred to simple pre-programmed character behaviour. Today, a multitude of AI programs have been created that are so proficient that they can beat human players (OpenAI's Dota2 AI robots) and even world champions (AlphaGO, Deep Blue). Modern AI also contributes to game development through design tools (e.g., procedural generation), and research techniques such as game data mining and player modelling.

## System Design

Our proposed framework is focused on the emulation of human navigation for agent-based playtesting. The first version of the tool will use simple models of perception and memory coupled with a heuristic action planner to drive in-game behaviours (see Fig. 2 below). Informed by existing theories of player behaviour, designers will be able to customize agents to reflect different player characteristics. Rather than serving as a replacement for human testing, this utility aims to introduce validation earlier in the design process by approximating player behaviour (see Fig. 3).

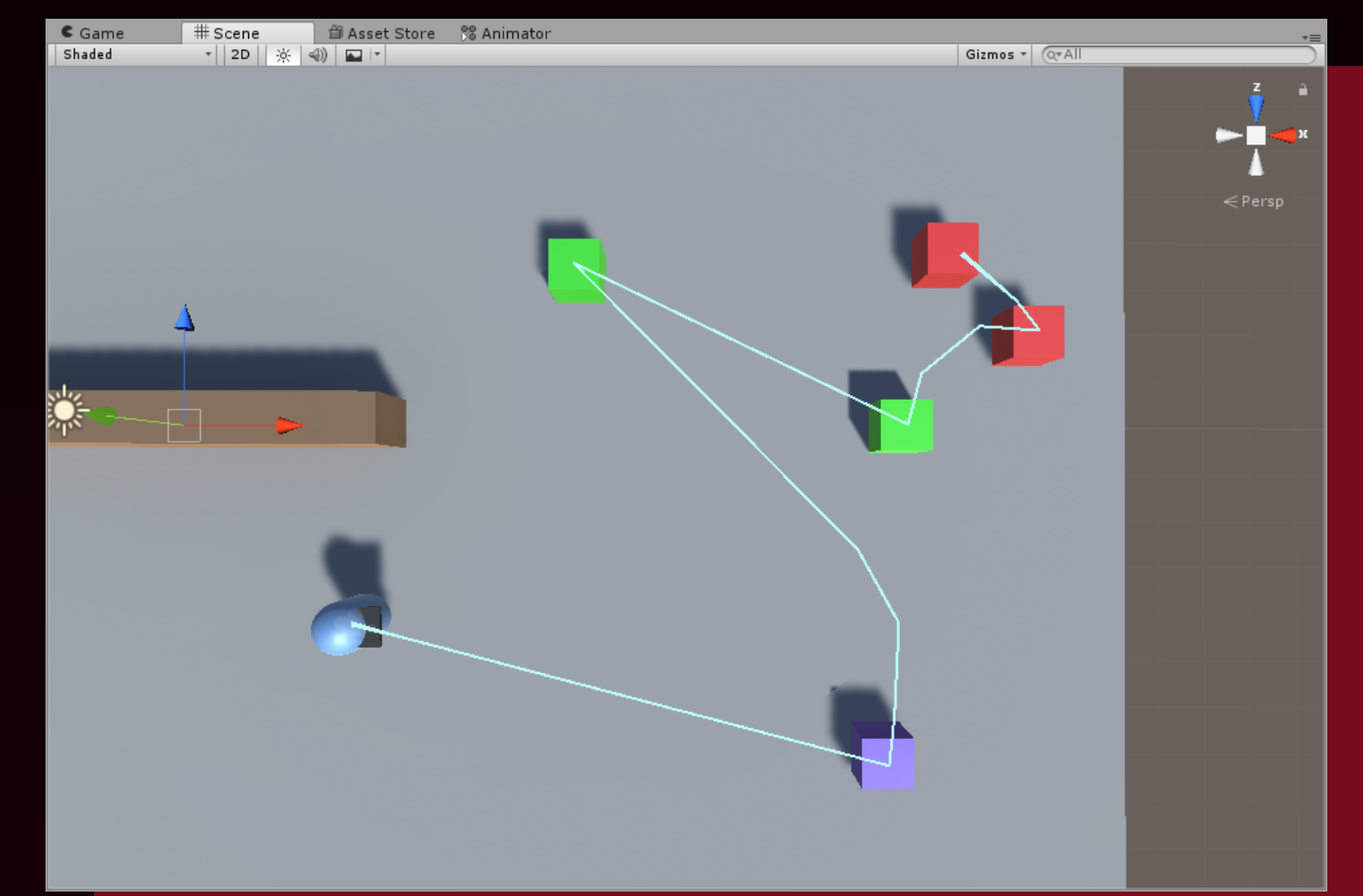
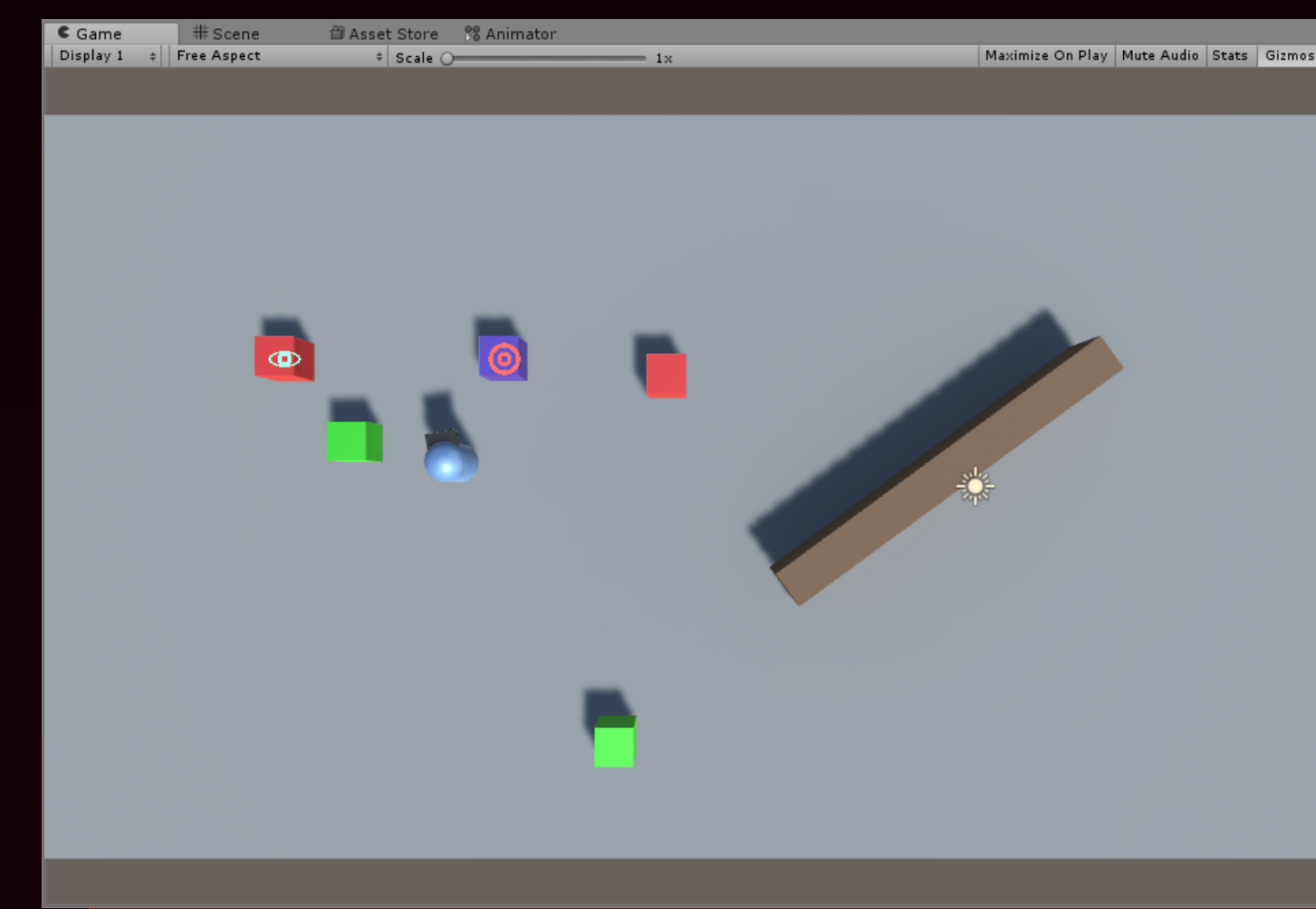


Fig 1. Screenshots from a proof-of-concept playtesting agent prototype showing live navigation view (left) and post-simulation trajectory review (right).

## Prototype

Our current prototype uses a simple configurable heuristic planner based on the gameplay objectives of exploration, achievement, and aggression, coupled with a tagging system to identify in-game entities. After configuration, agents can be placed in a virtual world containing game entities and simulate the navigation of a player with similar priorities. Agent trajectory can be reviewed through a simple visualization system.

## Future Work

Our next step after completion of the current prototype will be to evaluate its effectiveness as a testing utility. To do this, we plan to assess the similarity of human and AI playtraces, compare design issues found when using human vs. agent-based testing, and perform expert evaluation of the tool with game developers. Following this iteration of the framework, we plan to investigate the use of imitation learning to produce more complex and robust game behaviours. Eventually, we hope to release the tool as an accessible, affordable testing solution for independent developers.

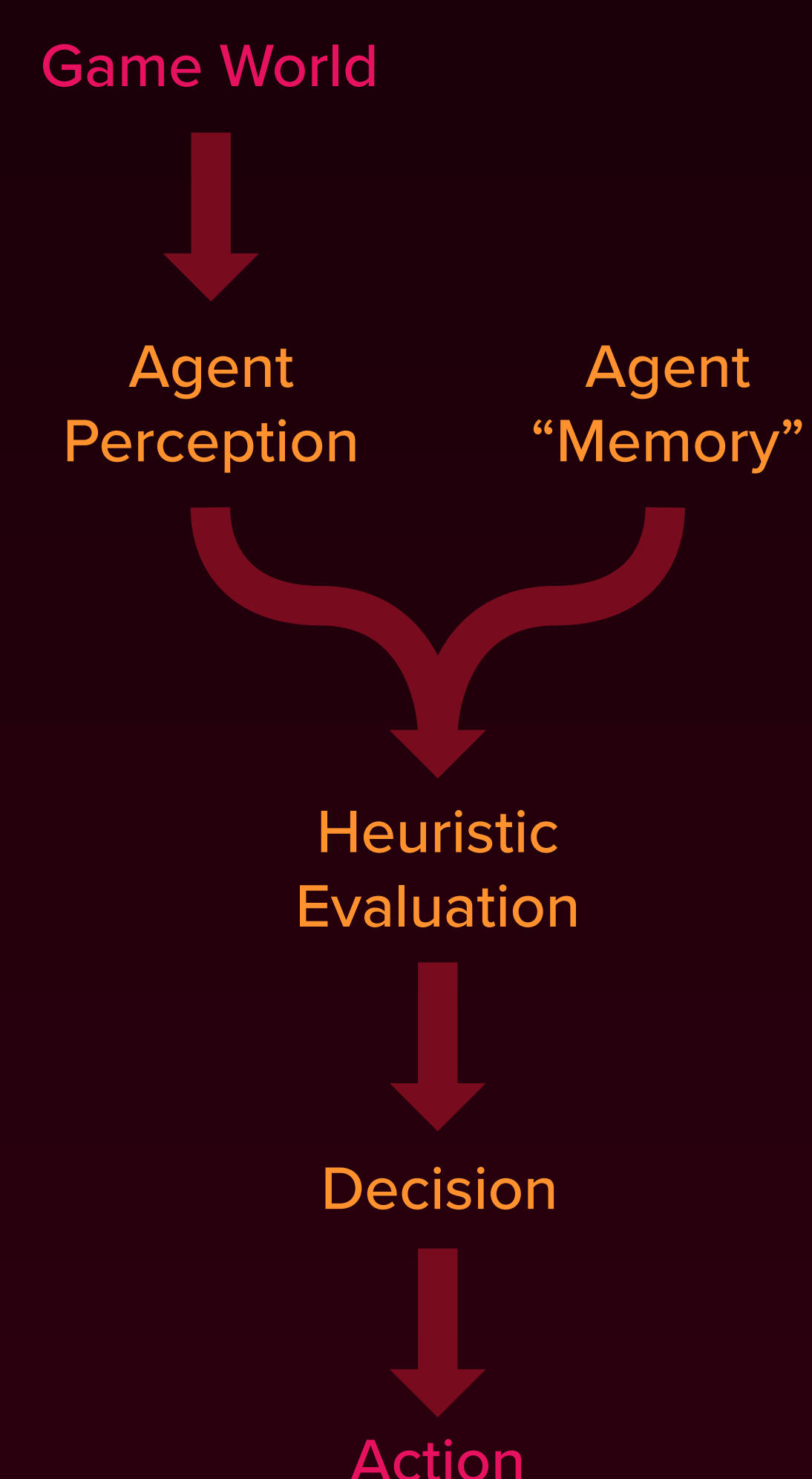


Fig 2. High-level overview of heuristic-based agent planning.

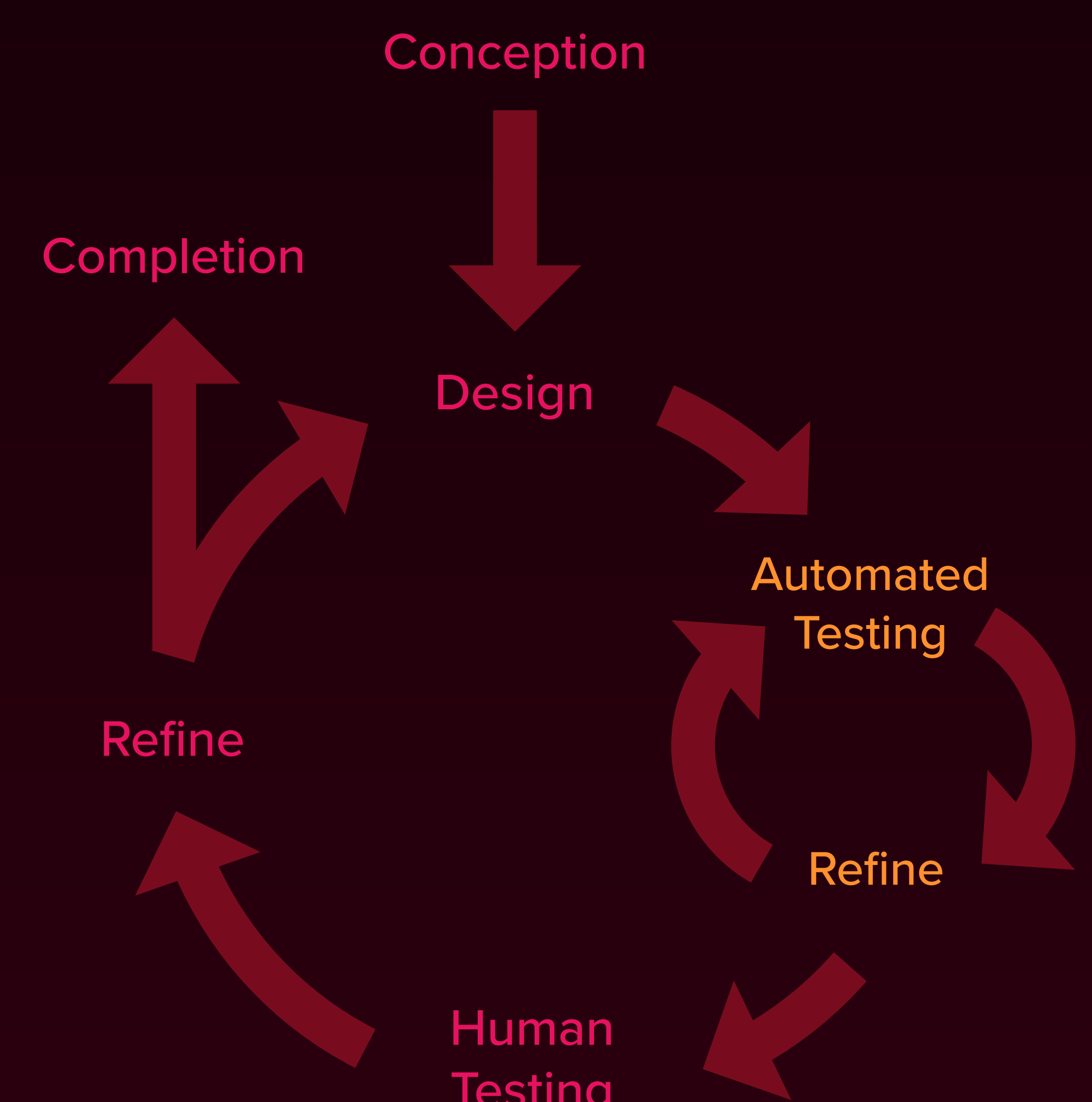


Fig 3. Positioning of agent-driven testing in the game development cycle, enabling rapid, informed iteration earlier in the design process.