Player Driven Video Games

Marcello Bonello

Abstract

This research investigates the use of AI-driven systems to enable real-time dynamic environments and quest generation that respond directly to player decisions. The primary objective is to enhance interactivity and immersion in game design through the integration of procedural content generation (PCG), decision-based logic. A Unity-based prototype was developed in which player actions visibly influenced both the game environment and quest outcomes during live gameplay.

Post-session feedback was collected from all participants through structured questionnaires, and the data was analysed to assess system responsiveness, engagement levels, and perceived immersion. The results indicate that dynamic reactivity significantly improves player involvement, making the experience feel more personal and impactful. Although the prototype featured a simplified narrative structure, it effectively demonstrated the potential of reactive design to shape both moment-to-moment gameplay and broader player experience.

This study contributes to the growing field of procedural and adaptive game systems and outlines future research directions, including the expansion of branching quest structures and the implementation of environment-based quest triggers that evolve in response to accumulated player choices over time.

Keywords

- Procedural Terrain Generation.
- Player Driven Narrative.
- Dynamic Objectives.
- Unity Game Engine Development.

Introduction

Modern games increasingly emphasize player agency, yet many rely on static environments and pre-written bjectives. This project addresses a gap in dynamic, decision-driven game systems by implementing real-time environment and quest changes based on player choices. The aim is to create a more immersive and personalized game experience.

Research Questions:

1. What algorithms are most effective for generating objectives that respond in real time to player actions?
2. How can player decisions dynamically influence game environments and objectives?
3. What impact does real-time adaptability have on engagement and immersion?

Hypothesis:
Integrating real-time decision-tracking systems into games can increase interactivity and narrative depth by dynamically generating and adapting objectives and environments based on player choices.

Literature Review

Lopes and Bidarra [2] highlight the importance of **context-aware PCG**, where the environment changes based not just on randomness but also in response to gameplay context. For example, terrain, lighting, and accessible areas may shift based on player morality or mission choices. Such responsiveness enhances the illusion of agency, reinforcing the connection between player decisions and world state.

Togelius et al. [1] emphasize the role of Search-Based Procedural Content Generation (SBPCG) in adapting content to player behaviour. GOAP (Goal-Oriented Action Planning) has been effective in creating believable quest chains that react to world states [2]. Behaviour trees and rule-based systems have also been used in adaptive narrative design [3].

Recent studies highlight the use of player modelling and environment feedback loops to dynamically adjust quest objectives, improving engagement and variety. However, most commercial games still rely on predefined storylines, revealing a gap this study aims to address.

Methodology

A Unity 3D prototype was developed to demonstrate real-time responsiveness to player decisions. The prototype included:

• A decision-tracking system implemented using Boolean flags and enumerations

• An endless procedurally generated environment created in real time, supported by optimization logic

• A reactive environment that responded to player choices, such as enviorment texture (color) swaps and changes in objectives.

• A basic quest generator that assigned objectives based on conditional logic and player state

Participants were given approximately 5 to 10 minutes to explore multiple gameplay paths. Following the session, they completed a short questionnaire designed to assess immersion, perceived responsiveness, and overall experience. The data collected was analyzed qualitatively, focusing on player feedback related to environmental interactivity and narrative perception.

Findings

The prototype was clear and straightforward, allowing participants to easily understand and interact with its systems. All participants observed visible environmental changes in response to their actions, and 75% recognized that their choices influenced quest generation. Participants consistently rated the experience as more engaging when consequences were clearly reflected in both the environment and overall game feel. However, most rated the game's replay-ability as 3 or lower out of 5, suggesting limited incentive to explore alternative outcomes. While the prototype remained simple and did not delve deeply into narrative complexity, it effectively conveyed the intended experience and supported the hypothesis that reactive design enhances player engagement.

Conclusion

This research successfully demonstrated a functional prototype in which player decisions dynamically influenced both game objectives and environmental elements in real time, particularly the terrain. The results support the hypothesis that reactive systems enhance player engagement and interactivity, especially in narrative-driven and exploratory game genres.

Limitations:

• The prototype was limited in scope and complexity

• AI behavior and quest generation logic remained basic

• The testing group was relatively small and informal

Future Work:

Further development should include the implementation of a player logging system to collect detailed datasets across multiple playthroughs. Additionally, expanding the narrative framework and introducing more advanced, branching quest generation systems would provide a deeper and more immersive experience, allowing for a broader evaluation of reactivity and decision impact over time.

References

[1] J. Togelius, G. N. Yannakakis, K. O. Stanley, and C. Browne, “Search-Based Procedural Content Generation: A Taxonomy and Survey,” *IEEE Transactions on Computational Intelligence and AI in Games*, vol. 3, no. 3, pp. 172–186, Sept. 2011.

[2] R. Lopes and R. Bidarra, “Adaptivity Challenges in Games and Simulations: A Survey,” *IEEE Transactions on Computational Intelligence and AI in Games*, vol. 3, no. 2, pp. 85–99, June 2011.

[3] R. Evans and D. Short, “Versu: A Simulationist Storytelling System,” in *Proc. of the 2014 Foundations of Digital Games Conference (FDG)*, 2014.