

Principles for AI Co-Creative Game Design Assistants

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Abstract

While human-AI co-creative game design assistants are a relatively new technology, clear paradigms for their design are emerging. Our research aims to investigate the AI techniques, heuristics, and design conventions that are key to effective co-creative game design assistants. We propose that now, during their infancy, a series of principles for the formulation of these systems is a timely contribution to the literature.

Introduction

The continual release of fun, original, and balanced content for competitive multiplayer games presents a difficult task for game designers. With the scale, complexity, and rapid release cycle of modern game content, designing for these simultaneous, interacting factors is particularly challenging for human designers. This argument for the necessity of computer-assisted game authoring tools is well established (Jaffe 2013). Our research will investigate best practices for the design and development of co-creative (i.e. human-AI collaboratively creative) game design assistants (CCGDAs). We will then develop a set of guidelines for the design of these systems, providing a robust framework for the development of future CCGDAs.

The use of CCGDAs is a relatively new concept, with preliminary experiments in real-time strategy level design (Liapis, Yannakakis, and Togelius 2013) (Figure 1), Super Mario worlds (Guzdial et al. 2017), and crowd-sourced puzzles (Charity, Khalifa, and Togelius 2020). While these early prototype systems demonstrate the viability of AI game design tools, there has been little research into principles and conventions for the design of such systems.

Our research will investigate the different AI techniques, gameplay heuristics, and interaction strategies that should be considered for the design of effective CCGDAs. Our research will use digital card games, such as Hearthstone, as a research platform due to some of the factors which make them popular in AI research (Hoover et al. 2020), including:

- Strategy-rich, turbulent metagames

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Figure 1: Sentient Sketchbook, a prototype CCGDA featuring a prominent level editor and AI-powered suggestions (Liapis, Yannakakis, and Togelius 2013)

- The regular release of original game content
- The wide variety of feature-rich simulation software

Our research argues that effective CCGDAs would reduce labour costs and improve the quality of released content by improving fun, balance, and originality. Yet as there are no established standards for the creation of CCGDAs: we propose principles for the design of effective CCGDAs is a vital addition to the literature. To that end, our research has three primary objectives:

1. Evaluate heuristics for fun, balance, and originality
2. Explore different interaction strategies for CCGDAs
3. Develop a set of design principles for CCGDAs

Our research will follow an iterative research-through-design method (Zimmerman, Forlizzi, and Evenson 2007), whereby we will develop a series of prototypes aimed at exploring the specific heuristics and strategies that form effective CCGDAs. Informed by insights from these prototypes and associated user studies, we will establish provisional principles for the design of effective CCGDAs.

Existing Paradigms

Despite their infancy, common paradigms for the design of CCGDAs have emerged. Based on our review of the design

of existing CCGDAs, we have established initial principles we aim to investigate. Some of the main paradigms we have identified, and will study are:

- Mixed-initiative creative interfaces (Deterding et al. 2017)
- Quality-diversity optimisation genetic algorithms, such as MAP-Elites (Gravina et al. 2019)
- Communicative and explainable AI (Gunning 2017)
- Simulation and recommender systems (Liapis, Yannakakis, and Togelius 2013)
- Prominent graphical content editors (Figure 2)

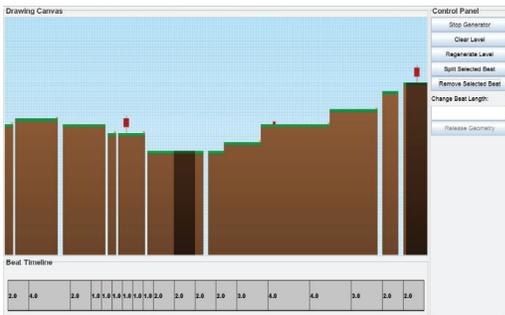


Figure 2: Tanagra, a prototype CCGDA featuring a prominent level editor and an AI-powered “Beat Timeline” assisting with pacing (Smith, Whitehead, and Mateas 2010)

Research Methodology

Following an iterative research-through-design (Zimmerman, Forlizzi, and Evenson 2007) methodology, we will develop a series of prototype CCGDAs. Through associated studies, we will evaluate these prototypes to gain valuable insights into what makes them effective. These insights will inform our principles for effective CCGDAs: the primary contribution of our research. Using our prototypes in three primary studies, we will investigate each of our primary research objectives independently.

The first of these studies will involve the development and testing of heuristics for fun, originality, and balance. By conducting user studies with game designers, we will evaluate the importance of these factors along with effective algorithms for their implementation. We will also investigate common algorithmic techniques such as quality-diversity optimisation genetic algorithms and recommender systems. The second study will focus on the interaction strategies that communicate these heuristics such as the mixed-initiative protocol.

Our final study will be aimed at refining our provisional principles into a set of robust guidelines for the design of CCGDAs. This will be a collation of insights gained throughout our primary studies. Our final prototypes will also act as communicative design artefacts (Zimmerman,

Forlizzi, and Evenson 2007) capable of demonstrating practical implementations of our guidelines.

Conclusion

The challenging task of designing for the often interacting game design factors of fun, originality, and balance is best solved by CCGDAs. During their infancy, these systems need robust guidelines to act as a framework for future development. Through a series of prototypes and studies, our research will investigate common paradigms in the design of effective CCGDAs thereby establishing these guidelines; a timely and valuable addition to the literature.

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