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A Demonstration of KiaiTime: A Mixed-Initiative PCGML Rhythm Game Editor

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Abstract

Chart creation for rhythm action games is a time consuming task that requires specialized design knowledge. While chart generation systems have been explored in the past, there are currently no co-creative chart authoring systems. In this paper, we present KiaiTime, a mixed-initiative, co-creative PCGML editor for the rhythm game Taiko no Tatsujin. KiaiTime allows the user to interface with an AI partner that acts as a source of guidance and inspiration in the chart creation process.

Introduction

Mixed-initiative procedural content generation (PCG) systems are a type of co-creative system in which both a human creator and AI agent have creative agency (Liapis, Smith, and Shaker 2016). These systems and their effects have been explored in prior work in contexts such as platformers (Smith, Whitehead, and Mateas 2010; Guzdial et al. 2019) and puzzle games (Sturtevant et al. 2020; Charity, Khalifa, and Togelius 2020). We focus on an underexplored genre that has the potential to benefit from a mixed-initiative PCG tool: rhythm games. Rhythm games challenge the player to play along with a song by hitting a series of predetermined inputs, called "charts." From a designer's perspective, rhythm games contain domain specific challenges that make chart creation difficult and time consuming to learn. Becoming an effective chart creator requires learning specific knowledge about a given rhythm game, along with abstract concepts such as rhythmic structure (Johannsen 2016; 5argon 2018).

There has been prior work on automated chart creation (Donahue, Lipton, and McAuley 2017; Lin, Xiao, and Riedl 2019; Liang, Li, and Ikeda 2019), the most recent of which utilize procedural content generation via machine learning approaches (PCGML) (Summerville et al. 2018). However, none of these systems include mixed-initiative co-creative functions beyond the selection of difficulty of a generated chart. Toward the goal of easing the design burden of chart creation for both novice and experienced authors, we present KiaiTime[1], a mixed-initiative PCGML editor for Taiko no Tatsujin (Taiko). The KiaiTime editor interfaces with TaikoNation, a PCGML chart generation system for Taiko (Halina and Guzdial 2021). Utilizing TaikoNation's distinct focus on "the placement of game objects in congruent patterns based on events in a given song," called patterning, KiaiTime aims to provide a source of guidance and inspiration to chart creators.

[1]KiaiTime demonstration video https://youtu.be/sxbi1acV8H0

Related Work

Mixed-initiative PCG tools allow both a human creator and an AI agent to take the initiative in contributing to a shared "artifact" (Liapis, Smith, and Shaker 2016). The artifact in question can be any type of game content, and different mixed-initiative PCG allows for different human and AI actions for impacting this artifact. For example, some mixed-initiative tools utilize their AI component to display a number of variations the user can choose between, often utilizing evolutionary search techniques (Baldwin et al. 2017; Charity, Khalifa, and Togelius 2020; Schrum et al. 2020). Sturtevant's Anhinga uses an exhaustive PCG system to display the "impact" of various changes a player can make to a puzzle game level (Sturtevant et al. 2020). Prior work has used AI for a variety of different tasks, including Charity's Baba is Y'all which assists users with generating, playtesting, and rating game levels using separate AI systems (Charity, Khalifa, and Togelius 2020). KiaiTime uses a "turn-based" interaction framework which treats the AI component of the editor as a "partner" that assists the human user. This type of framework was shown to be capable of fulfilling different roles based on a user's needs and experience level (Guzdial et al. 2019). While mixed-initiative PCG is an active topic of research, to our knowledge there has yet to be a mixed-initiative editor for the creation of rhythm game charts.

There have been a number of PCGML systems created for the task of chart generation for various rhythm games aside from our chosen approach, TaikoNation (Halina and Guzdial 2021). The majority of these prior works focus on subproblems in chart generation which are irrelevant to our editor, like sample classification (Lin, Xiao, and Riedl 2019) and improved onset detection (Liang, Li, and Ikeda 2019). The most general and applicable other choice of chart generation system utilizing PCGML is Donahue's Dance Dance Convolution (Donahue, Lipton, and McAuley 2017). However, TaikoNation outperformed this system on the task of

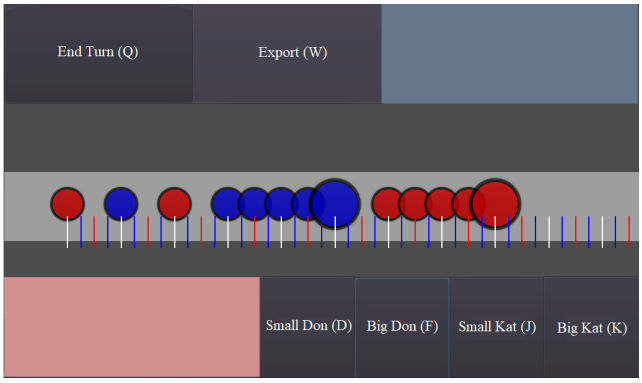

Figure 1: Screenshot of the KiaiTime editor.

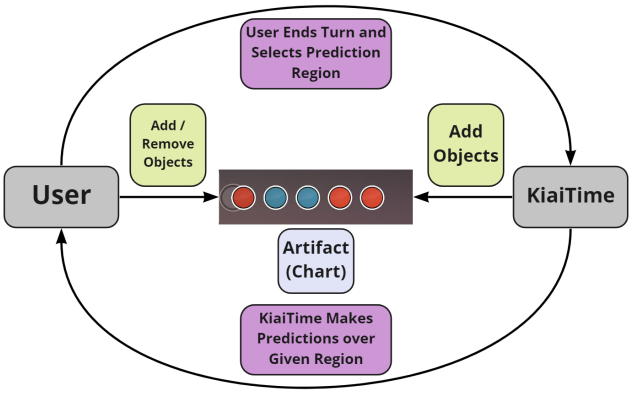

Figure 2: Depicition of the KiaiTime interaction model

"patterning," placing game objects in a congruent manner to one another. Within our editor's framework, the AI partner may be asked to create chunks of coherent content on both a small and large scale. Due to the importance of patterning for generation on both these scales, we deemed TaikoNation the appropriate choice for KiaiTime.

Editor Overview

KiaiTime is an chart editor for Taiko, a long running rhythm game franchise. Taiko's gameplay consists of hitting a series of notes to the rhythm of a song with drum hits or keyboard presses depending on the game version. Our editor allows the user to create and generate playable charts for osu!Taiko, which is a free, fanmade clone of Taiko. KiaiTime's name alludes to "kiai time," a mechanic in osu!Taiko and other rhythm games which provides a visual distinction to the most intense parts of songs. The editor was created in the Godot Engine, and the AI partner's predictions are handled by a backend server containing the TaikoNation model. The technical details of this model are explained at length in the corresponding TaikoNation paper (Halina and Guzdial 2021).

Figure 1 depicts the user interface of the KiaiTime editor. When the editor is opened, the user is presented with an empty Taiko chart in the centre of the screen. Each "tick mark" represents 1/16th of a beat of the selected song. Game objects are snapped to these ticks, ensuring proper timing. Using the large buttons on the bottom row, the user can cycle through the four major object types present in Taiko, placing and deleting them using the left and right mouse button respectively. The timeline can be navigated freely using the arrow keys, and the song can be stopped and started at any time using the Space Bar. "End Turn" allows the user to pass off control to the AI partner, and the "Export" button creates a loadable, playable chart.

A visualization of the interaction model of KiaiTime is shown in Figure 2. We referred to a pre-established turn-based interaction framework for creating co-creative systems, adjusting it based on our goals (Guzdial and Riedl 2019). The user interacts with the AI partner in distinct "turns" which the user defines. By not allowing for the AI partner to make additions concurrently with the player, we allow the user to retain control of the AI partner while also addressing the issue of server latency. When the user is ready for the AI partner to take over, they are prompted to select a region for the AI to fill in. We chose to allow users to select the AI's prediction region to improve controllability, along with addressing issues of frustration found in similar turn-based systems (Jacob et al. 2013; Guzdial et al. 2019). Once selected, the current chart information and selected region are sent to a backend server which returns TaikoNation's predictions over the region. While the human user is free to both add and delete objects, we only allow for the AI partner to add new objects in its allotted region. This aligns with our intent for the AI to act as a collaborative partner providing inspiration to the user, and avoids possible frustration that could arise from the AI partner deleting the human user's work.

Discussion

Our immediate future goal is to conduct a human subject study to assess the usability and utility of the KiaiTime editor. We are interested in how the tool can be used by both novice and experienced chart creators in order to improve and enhance their chart creation process. With this submission, we hope to gather additional feedback on the editor's UI and usability from users with different experience levels with rhythm games.

Conclusions

We have presented a mixed-initiative PCGML editor for the rhythm game Taiko no Tatsujin which strives to provide inspiration and guidance to its users. This demonstration showcases KiaiTime's UI and interaction model, giving insight to the decisions made in the editor's development. We hope KiaiTime will prove to be a useful tool for both novice and experienced chart creators after further development.

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References

5argon. 2018. Game design and notecharting. https://exceed7.com/native-audio/rhythm-game-crash-course/game-design-and-notecharting.html. Accessed: 2021-08-16.

Baldwin, A.; Dahlskog, S.; Font, J. M.; and Holmberg, J. 2017. Mixed-initiative procedural generation of dungeons using game design patterns. In *2017 IEEE conference on computational intelligence and games (CIG)*, 25–32. IEEE.

Charity, M.; Khalifa, A.; and Togelius, J. 2020. Baba is y'all: Collaborative mixed-initiative level design. In *2020 IEEE Conference on Games (CoG)*, 542–549. IEEE.

Donahue, C.; Lipton, Z. C.; and McAuley, J. 2017. Dance dance convolution. In *International conference on machine learning*, 1039–1048. PMLR.

Guzdial, M.; Liao, N.; Chen, J.; Chen, S.-Y.; Shah, S.; Shah, V.; Reno, J.; Smith, G.; and Riedl, M. O. 2019. Friend, collaborator, student, manager: How design of an ai-driven game level editor affects creators. In *Proceedings of the 2019 CHI conference on human factors in computing systems*, 1–13.

Guzdial, M.; and Riedl, M. 2019. An interaction framework for studying co-creative ai. *arXiv preprint arXiv:1903.09709* .

Halina, E.; and Guzdial, M. 2021. TaikoNation: Patterning-focused Chart Generation for Rhythm Action Games. In *International Conference on the Foundations of Digital Games*.

Jacob, M.; Coisne, G.; Gupta, A.; Sysoev, I.; Verma, G.; and Magerko, B. 2013. Viewpoints ai. In *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, volume 9.

Johannsen, B. 2016. osu!mapping tutorials. https://docs.google.com/spreadsheets/d/10Z5kWe084MQVHUcuZ5VATwz-ciIpt89XLmrCjibwyLw/edit#gid=0. Accessed: 2021-08-16.

Liang, Y.; Li, W.; and Ikeda, K. 2019. Procedural content generation of rhythm games using deep learning methods. In *Joint International Conference on Entertainment Computing and Serious Games*, 134–145. Springer.

Liapis, A.; Smith, G.; and Shaker, N. 2016. Mixed-initiative content creation. In *Procedural content generation in games*, 195–214. Springer.

Lin, Z.; Xiao, K.; and Riedl, M. 2019. Generationmania: Learning to semantically choreograph. In *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, volume 15, 52–58.

Schrum, J.; Gutierrez, J.; Volz, V.; Liu, J.; Lucas, S.; and Risi, S. 2020. Interactive evolution and exploration within latent level-design space of generative adversarial networks. In *Proceedings of the 2020 Genetic and Evolutionary Computation Conference*, 148–156.

Smith, G.; Whitehead, J.; and Mateas, M. 2010. Tanagra: A mixed-initiative level design tool. In *Proceedings of the Fifth International Conference on the Foundations of Digital Games*, 209–216.

Sturtevant, N.; Decroocq, N.; Tripodi, A.; Yang, C.; and Guzdial, M. 2020. A Demonstration of Anhinga: A Mixed-Initiative EPCG Tool for Snakebird. In *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, volume 16, 328–330.

Summerville, A.; Snodgrass, S.; Guzdial, M.; Holmgård, C.; Hoover, A. K.; Isaksen, A.; Nealen, A.; and Togelius, J. 2018. Procedural Content Generation via Machine Learning (PCGML). *IEEE Transactions on Games* 10: 257–270.