

Sakura: A VR musical exploration game with MIDI keyboard in Japanese Zen environment

Chen Ji

Center for Computer Research in Music and Acoustics(CCRMA)

Stanford University

Palo Alto, CA, USA

jjjjc@stanford.edu

Abstract—Sakura is a VR musical exploration game with MIDI keyboard in Japanese Zen environment, which provides music-creating experience in immersive environment and uses MIDI keyboard as the in-game interface instead of traditional VR controllers. In this work, the author explores a novel way to create an immersive and entertaining music playing experience by using virtual reality technology, physical instrument interface and exploration game concept. All the events and actions in the game are generated and controlled by user’s MIDI input so that playing the game is playing music itself. According to players’ feedback, they enjoy this immersive magical music journey with their own input and feel relaxed and calm after playing. A four-minute gameplay demo can be found here:<https://youtu.be/58HPwiiap7I>.

Index Terms—game design, MIDI interface, virtual reality, musical experience, gamification

I. PROJECT BACKGROUND

Music is no stranger to games. Both of playing music and playing games can provide the “flow” state, where people feel engaged and concentrated [1]. People try to explore how music interaction and game elements can be well incorporated to unlock optimal experience [2]. Therefore, Music games started showing up in the market, such as classic Super Mario Bros, Proteus, GuitarHero, and BeatSaber, etc. All of these musical games can be divided into two categories: 1) the music (e.g. ambient music, in-game sonic feedback) is controlled or generated by the gameplay (such as Super Mario Bros and Proteus); 2) rhythm-based instructions are given to lead players to finish a song (such as GuitarHero and BeatSaber). Lack of degree of freedom is a defect, because players have no much choice but to follow the routine leading to a preset ending.

Different from the music games mentioned above, this paper proposes a novel approach to design the game mechanics that the gameplay is generated by the player’s music-making. By using the physical MIDI keyboard as the game interface, the player will have more real music-making experience than using the controllers, joysticks as well as computer mice and keyboards. In this way, the game provides more freedom and creativity since players will take “playing music” as the main activity in the game.

Also, with VR headset, the game is able to provide the player with immersive experience visually accompanied by

listening enjoyment. Playing instruments in fascinating surroundings such as seaside or cherry forest is probably one of the fantasies for all music lovers. It is difficult, however, to move huge instruments like piano to those places, which is another reason why this game was born.

II. CONCEPT AND DESIGN

A. Game Design

The game environment is set in Japanese Zen style, in order to create a peaceful vibe. At the beginning of the game, the atmosphere is set as dark and the player’s task is to wake up this dark and silent world by using their own music. With the player inputting musical notes from the MIDI keyboard, the pre-designed animation will be triggered and previously hidden spots will appear. Although this is a music-making game, it doesn’t mean that we need to set the whole game as a silent audio track waiting for player’s musical input, the game still has a background music looping throughout the whole game to build up the atmosphere. According to study of by Cassidy et al. [3], the players have optimal gameplay experience when they are able to choose the background music they prefer. Therefore, this game is designed to provide background music choices for the player.

Before starting the game, the player should sit on the chair, put on the VR headset and put their hands on the MIDI keyboard, then the player is ready for playing the game. Considering the inconvenience of walking around and playing MIDI keyboard simultaneously, the author decides to make a pre-designed route for the player, so that the player can move automatically when the game is going on. However, the moving speed along the route is influenced by the input speed of musical notes. If the player stops playing notes and the route will stop moving, because we assume the player will want to pause and look around the scenery around; If the number of pressing numbers in a certain timeframe reaches a threshold, the route speed will be steady and constant. Otherwise, the route speed is in proportion to the speed of user input.

In the beginning, as Figure 1a shown, environment around the player is dark, and suddenly, there is a glowing orb coming close to the player, which will be the leading cube along the route. The glowing orb will emit the colorful particles, which interacts with the input notes. There are 12 notes in major scale: C, C#, D, D#, E, F, G, G#, A, A# and B in an octave,



Fig. 1. Screenshots of cut-scenes in the game: Figure 1a(top) is beginning scene with leading cube; Figure 1b(middle-top) is street market; Figure 1c(middle- bottom) is Torri by the water; Figure 1d(bottom) is piano under sakura trees.

so the author assigns seven different colors of C, D, E, F, G, A and B to the particles emitted from orb. Also, the note the player pressed will trigger the star trace with different colors in the night sky. The second scene along the route is the market place shown in Figure 1b, where there are several lanterns along the street. while the player generates the music, the lanterns will be turned on.

After player passing the market street area, the player will see a Torri by the water as Figure 1c shown, the player needs to play music and wait until the hidden island appears. The end scene of the game is the piano around sakura trees in the island as Figure 1d shown. The player can end up enjoying play piano while watching flowers falling.

B. User Analysis

Whether players are keyboard players or not should be considered when thinking about user experience. Keyboard players will have better control of the MIDI keyboard due to previous experience and they will easily create beautiful melodies both with their improvisation ability and finger muscle memory. But we do need to consider who have no previous experience in keyboard instruments. By asking many non-keyboard players, they said they still can perceive what notes sound harmonious. Therefore, for the triggering condition, the author decided to use the method that detecting whether the player's input notes are in harmonious interval when being close to the to-be-triggered objects.

III. IMPLEMENTATION

The interaction of game is implemented in Unity using C#. The game assets are from CGTrader but the level design was done by the author. The soundtracks used in the game were designed in Logic Pro X(DAW). MIDI Jack from Keijiro's GitHub repository was used to captures the MIDI input to Unity engine. The internal audio unity engine was used to play the musical audio samples according to the MIDI input.

IV. ASSESSMENT

Six keyboard players and six non-keyboard players tested this game prototype, where the criterion classifying participants as keyboard players and six non-keyboard players is

whether they can perform music with keyboard independently. They were interviewed about how they felt after playing the game. Most participants give positive feedback that they felt engaged with game environment and they described the game with "relaxing" and "healing".

Comments from keyboard players confirm previous hypothesis that keyboard players may have better experience in this VR music playing game. They said they felt amazed by the final scene where they can play the piano under the sakura tree and see what they are playing affects the environment around them. The question "Does game environment and other visual effects help music playing?" was asked to keyboard players. Most of them said they were trying to play the melodies fitting the current scene they saw and they enjoyed the visual feedback based on what they were playing. For the non-keyboard players, they also felt they were in a magical music journey, where they can make sounds and trigger the pre-designed animations. They said they wished they would have known how to play the piano and really want to learn after playing this game. By comparing the animations generated by keyboard players and non-keyboard players, it is noticeable that keyboard players produced more smooth and rich animations. For example, three star traces will show up in the sky with unit color palette when a Tri-chord is played, and lanterns in the market street will all turned on if the player composes harmonious melody constantly, etc.

Some limitations still exist in the game. Firstly, since the keyboard is invisible in the virtual environment, non-keyboard players' experience was affected because they felt confused about what notes they pressed. Secondly, since the sample size of game-testing is insufficient, we still cannot draw the conclusion that all keyboard players will enjoy more in this game, so further statistical measurement should be conducted.

V. REFLECTION

This work explores the new music game mechanic by setting the music-making as the main activity and the game play is generated by the musical input from the player. Giving players freedom to play music in the gameplay gives players the sense of control and purer happiness gained from music. In the future, the limitations mentioned in the assessment section will be improved and the relationships between image and "imagination of music" can be further studied by analyzing and modeling with some machine learning methods. Playing music should be magical and go beyond our imagination.

REFERENCES

- [1] Csikszentmihalyi, Mihaly, and Mihaly Csikszentmihaly. *Flow: The psychology of optimal experience*. Vol. 1990. New York: Harper & Row, 1990.
- [2] Wang, Ge. "Game design for expressive mobile music." *Proceedings of the international conference on new interfaces for musical expression*. Vol. 16. 2016.
- [3] Cassidy, G., Mac MacDonald, R., and Sykes, J. *The Effects of Aggressive Relaxing Popular Music on Driving Game Performance and Evaluation*. Abstract in <http://www.gamesconference.org/digra2005/viewabstract.php?id=94>, 2.4.2006.