Computer Game Piece: Exploring Video Games as Means for Controlled Improvisation

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ABSTRACT

Video games provide an interesting framework of rules, actions, events, and user interaction for the exploration of music expression. In this paper we describe a set of computer games designed for group improvisation and controlled by playing musical instruments. The main contribution of our work is the two-way interaction between music and video games, as opposed to the more commonly explored one-way interaction. We investigate the different challenges involved, such as finding adequate game controlling events, provide enough expressive freedom to musicians, correct playing speed and game complexity, and different artistic expression forms. We also present the problems encountered, design considerations, and different proposed and tested solutions. The games developed in this project were used in a concert and a set of workshops.

1. INTRODUCTION

The artistic exploration of novel means of musical expression is the first motivational element of our work. Games provide an interesting medium for music creation giving a set of controllable and uncontrollable events, rules, interaction, and visual support to engage the audience. This work explores the use of computer games as a framework for musical improvisation, a natural evolution of game pieces [1] where musicians control and play video games as they improvise music pieces. The main contribution of our work is the two-way interaction between music and video games, as opposed to the more commonly explored one-way interaction.

In this paper we investigate different challenges involved in creating such framework, such as finding adequate game controlling events, provide enough expressive freedom to musicians, correct playing speed and complexity of the game, and different artistic expression forms. Section 3 present the problems encountered, design considerations, and the proposed and tested solutions.

Our system was completely implemented and used in a performance as part of the cycle of improvisation concerts ”Trans-Fuzja”. It consists of four video-games where players are controlled by the musicians through their music performances. These games covered several types of interaction among players: collaborative (Mustetrix), competitive-collaborative (Pong), competitive without interaction between players (TreeStory), and competitive with interaction between players (Rip Switch). These games also cover a range of timing requirements. As described in detail in section 4, we found that both timing and the nature of the game have an important influence on the music produced, and need to be taken into consideration when designing this type of interaction.

A second aspect of our work is educational. Presenting the creation of music through video games provide an attractive medium which audience, specially young audiences, can recognise and relate to. We believe that this field of work has the potential to ease the introduction of musical concepts to audiences that might not have apriori music interests. This aspect of the work will be further evaluated in future planned workshops as described in section 5. We are further developing the system to introduce more complex artistic interaction and to better use the system for educational purposes.

2. BACKGROUND AND PREVIOUS WORKS

Computer games, as an audiovisual medium have been connected to music almost from the beginning. At first, this connection was limited to playing pre-composed music which was unaffected by the game state, except for different tunes connected to different game levels and tempo-synchronization, and sound effects as reaction to game events. Later, this relationship became more complex with two notable developments. The first one was the incorporation of generative music into the computer games. Some notable examples are iMuse, used in LucasArts games [2], ”riffology” system used in Ballbrazer (more on that technique in [3]) and more recently in Rez. Also the sound effects started to have more musical meaning (for example, in aforementioned Rez). The second development is emergence of rhythm games and especially its music-based subgenre. Rhythm games are a subgenre of action games which requires players to take actions (most often to press the correct keys) at precise times, often according to the beat of underlying music. One of main types of those games are music video games such as Guitar Hero. These games started utiliz-

ing keyboards as the input device, however, nowadays the facto standard is the use of peripheral devices either similar in shape to the musical instruments (Guitar Hero, Rock Band etc.) or real musical instruments (e.g. Rocksmith). There are also some educational games in this genre which are intended to teach beginners how to play musical instruments (e.g. Joytunes, [1]).

Although at first glance similar, those games and our approach differs in several fundamental ways. In our work games are created in a way that encourages creativity and improvisation, while in rhythm games, players are supposed to mimic predefined actions as close as possible. Another difference is that music rhythm games have themes related to music playing, whereas our games are just general-themed video games.

On the other hand video games have also influenced music. The most notable example is the creation of new music genres, two of which are: game soundtracks, and those based on musical application of game consoles - chiptunes [4] . There were also more subtle influences. First of all, the aforementioned use of generative music in games made the idea of algorithmic composition known and accessible for the general public. Second worth mentioning influence is the usage of sound effects, characteristic synthesis techniques, and motifs from the game music to evoke certain moods associated with the video games. Two interesting systems such as scrabble2midi [5] and "Music for 32 Chess Pieces" [6] use sonification of game states as the main musical element. In these systems the game controls the generation of music, our work also includes the opposite direction, where music controls the game.

More closely related to our work is the application of game elements in musical composition and improvisation. One of the earliest examples is the eighteenth century Musikalisches Würfelspiele [7] , in which dice were used for choosing music segments form a given set of possibilities. Another example are the game-theory-based Xenakis' compositions, i.e. *Stratégie* and *Duel* [8]. The work most relevant to our system is the so called "game pieces" - which consists of sets of rules used in group improvisations. The compositions by John Zorn (e.g. *Cobra*, *Hockey*, *Lacrosse*, *Xu Feng*)[9] are the best known game pieces. Two other examples of game pieces by Shiba Tetsu can be found in `http://www20.brinkster.com/improarchive/sht_gp.htm`.

3. CONTROL AND ANALYSIS STAGE

We chose to divide each game into two modules which communicates via the MIDI protocol. Those modules are control/analysis and game. In this section we will discuss the control modules which were created in the Max/MSP environment. We have also used Sonuus i2M audio to MIDI converters for simplifying the controls modules in case of pitch related analysis.

[1] http://www.joytunes.com/

3.1 Goals and Problems

There were few goals and problems which we needed to answer during the design and implementation of the control modules. The first of them, and one of the two most important, was choosing a control scheme which allows players to take intended action in games. The most important factor in this scheme, which affects the level of control that players have, is calibration of the analysis parameters. Without correct calibration, there were situations where players were not able to take action or many false readings occurred. Finetuning the parameters after any change in the audio systems, change of microphones, levels, instruments, etc, was crucial to achieve correct performance. The second most important problem was allowing musical freedom for players. Since one of the main elements of this project was improvisation, we wanted to avoid situations similar to the ones in rhythm games, where a player can only repeat a predefined sequence of actions.

In the games where players were rewarded for performing certain actions, we identified the risk of encouraging only high intensity playing rather than the desired artistic expression. Two solutions to this problem were investigated. First we consciously designed the games so they did not encourage high intensity playing all the time. Second, we introduced artificial limits to the number of events in given periods of time above which, new events were ignored.

3.2 Control Schemes

There are many possibilities for which musical elements should be involved in the control of the games. This section presents and comments on a few of them.

- **dynamics-** The use of dynamics for playing gave players a natural control of the effect of their actions in the game by playing louder or softer. A good example of this was the Pong game, where the speed and direction of the paddle movement was controlled by the intensity difference between two musicians playing. In games where the possible actions were just one-off discrete events (such as in Mustetris) we implemented two possibilities: The first one was to set a threshold above which every loudness measurement produced an action. We found this impractical and limiting from musical point of view. The second option was to define a "counter trick". The counter trick took each value of dynamics measurement added it to the counter. When the counter reached a limit, the action was triggered and the counter is zeroed. This resulted in a simple yet effective way for controlling the games without limiting musical freedom excessively.

- **density -** A similar idea is to use density of playing as a controlling element. We measured it either by counting *NOTE_ON* messages (for MIDI instruments) or analyzing transients (for acoustic instruments). We have found that using density gives similar results to dynamics, but limits the types of music textures possible to use.

- **registers -** We tested two different register-based control approaches. In the first one, actions were triggered by change of register. In the second, actions were associated with playing in the corresponding registers. We found that the second approach was better for games such as R.I.P.Switch, where not all of the actions are available all the time. This allowed for great musical freedom.

- **intervals -** Actions can be also triggered by playing a specific interval. If the game is prepared to encourage taking the same action repeatedly, leading to nice intervallic improvisations. This control scheme was planned and rehearsed for the TreeStory game, with appealing results. However, during the concert, due to involvement of the drum player we resign from using it.

- **pitch -** Arguably the simplest method for MIDI instruments is associating actions with exact pitches or pitch classes. This is much more difficult for acoustic instruments, especially in the case of the percussion instrument, extended techniques or when using electronic equipment for generation of sounds which do not have a determined pitch. During the testing, we found out that this presented several limitations on music creation, so it was discarded for the concert.

- **rhythms or phrases -** A promising idea that we could not explore for time constraints, was to associate actions with precomposed phrases or rhythms. Given enough compositional work this could lead to very good musical effects.

- **additional sensors -** The use of additional sensors and prepared instruments also promises to provide new creative possibilities. For now we only used footswitches for cutting down trees in TreeStory, but for the event in 2016 we would like to utilize instruments with built-in additional sensors.

4. GAMES

4.1 Games Elements

In this section we would like to discuss few game elements which we found as the most influencing on the musical outcome. The first important element is cooperativity, scoping three possibilities:individual players competing with each other, teams, and cooperation of all players.

Teams needed to synchronize their actions, and this often led to situations where players took turns for playing (or playing louder).

In the case of competing duets this produced nice fluctuations of texture. Fully cooperative games, in which players have different roles, we found it beneficial to exchange roles between players, as different roles encourage different activity levels.

In the case of individual players competing with each other, we did not create any specific artificial musical situation, providing a better environment for individual improvisation

During the development of this project, we also realised the importance of timing. There were many differences in the musical outcome for real time games with exact timing requirements, real time games without tight timing requirements, and turn games.

Real-time games requirements made a great difference in the produced music. In games where exact timing was expected from players (e. g. Pong or R.I.P. Switch) the music tended to be more pointillistic, especially at the beginning of improvisation. Players in this situations tend to play in short bursts of activity in similar timing to the game. This could give the impression of underlying groove or complex rhythm scheme. If the timing required by the game is more relaxed, this effect disappears. Turn-based games tend to create unnatural temporal structure in the players actions and thus in music. We chose to omit them in the first concert, although we believe that with appropriate preparation and practice these games would be viable option.

The second important element influencing the music output is what we called game-master elements. By this we mean the ability for one or more of the performers to control game conditions in a way that exceeds the normal player ability. We explored several of such actions: introducing and removing players, changing game speed, moving to the next stage, and adding visual effects. This allows a performer to take a role similar to the conductor leading the improvisation.

In order to make room for more free improvisation we introduced in every game an intro and outro sequences which visualize music but do not put any constraints on the performers actions.

Last but arguably one of the most important elements, is the sound generated by the game. Here we have found the following approaches:

- **Event-based sound effects:** Introducing sound effects to the game gives two musical results. First players have additional sound source as their actions could result in some effect being played. Secondly many events in games happen at more or less regular intervals, which gives some rhythmic framework for players.

- **Precomposed soundtrack:** This could somewhat limit improvisation possibilities, but on the other hand it gives player a reference to perform.

- **Direct sonification of the game state:** We used this approach in Mustetris - every field on the board have sound assigned to it which was played if the field was filled. This allows players to create some background accompaniment without constantly playing it by themselves.

- **Sonification of game statistics:** The games produced sounds depending on points accumulated by player, number of times the player dies, etc. This gives similar results to the previous approach, but with smaller amount of control for players.

- **Usage of game state elements as parameters in generative music:** This could be used to add another layer of complexity to the music created. In our case the music produced was already complex enough and busy at times, thus we chose to remove generative music from games.

4.2 Games Used

The games were implemented in Python using the pygame library. They have dual control system - standard keyboard control implemented with events and MIDI- event based for cooperation with our analysis system. For the first two events we chose the following 4 games:

- **Pong -** this is our version of a classic Pong game [2] . Players are divided into two duets. In each duet one person is responsible for moving the paddle up, the other - down. Speed of each move is dependant on the dynamics of the sound produced by corresponding performer. We chose event-based sound effects for this game.

- **Mustetris -** Clone of the Tetris [3] game. Each player is responsible for one of the four actions - move left, right or down (last one could also happens automatically with time) and rotation. Players' roles were randomized for every piece. After players lose, they are supposed to clean all the board by randomly clearing fields (the speed of the process was controlled by intensity of playing). As mentioned earlier, for the concert situation we associate every field to one sound, which results in the later stage of the game in complex drone in the background. For the workshops we chose standard sound effects instead.

- **R.I.P. Switch -** Clone of the flash game G-Switch [4] . Players are controlling direction of the gravity of running men. For the concert we choose register-based control i. e. the player needs to play in the higher register for upward gravity and in lower for downward gravity. The percussionist was responsible for triggering some visual effects (rotating screen, shaking screen, noise and broken screen effect). For the workshops each man is controlled by two teams, one responsible for upward, the other for the downward gravity. For this game we choose standard sound effects, with steps sounds played at different interval for every player.

- **TreeStory -** Simple economy game in which players were responsible for growing, cutting down and selling trees. Each player at one time controls one tree and works on growing new branches or widening existing ones. There are also some mutations involved and randomly appearing fruits.

[2] http://en.wikipedia.org/wiki/Pong
[3] http://en.wikipedia.org/wiki/Tetris
[4] http://vascof.com/GSwitch.html

5. EVENTS

5.1 The Concert

On 23th of the February the concert was performed and recorded for the Polish Radio Program 2 as part of the cycle of improvised concerts "Trans-Fuzja". In addition to the improvisation based section described in the paper, there was also a live improvised soundtrack for the normal video game. The videos from the concert are available at http://tinyurl.com/transfuzja9 . The performers were Macio Moretti (percussion, electronics), Andrzej Bauer (cello, electronics), Cezary Duchnowski (piano, keyboard, computer), Paweł Hendrich (guitar, computer) and Dariusz Jackowski (computer). The organisation of concert was as follows:

1. Pong, three games with increasing speed and background groove added in the third one
2. Mustetris, 2 games
3. TreeStory, one 9-minute game with intro
4. Short interlude played on the computer keyboard
5. R.I.P. Switch
6. Live soundtrack to the Slender: The Eight Pages [5]

5.2 Workshops

During April 7-10 a set of workshops were carried out as part of Musica Polonica Nova, one of the oldest contemporary music festivals in Poland. During the workshops, participants improvised music compositions using our system and instruments from the collection of the group "Małe Instrumenty" [6] . The event was intended for the high school students (16-18 years old). Half of the participants involved were from the musical school, the second half were studying in a non-specialised high school. During the workshops, students were divided into 4 teams, each team taking up the role of one player in the games. Also due to the number of people and character of the instruments involved, the only possibility for controlling the games was using *dynamics*. We observed similar patterns to those in the rehearsal before the first concert. At first there was a learning phase, where the participants played the games without any musical thought. Once participants had learnt the rules and controls of the games, they started to introduce more and more musical elements and non-game related interaction. Games with more freedom (such as TreeStory) gave a smaller musical effect, although in case of professional musician, the effect was opposite. In the post-workshops surveys participants reviews were mostly positive and most of them declared that they enjoy the experience and desire to take part in similar events in the future.

[5] http://www.parsecproductions.net/slender/
[6] http://maleinstrumenty.pl/instrumenty.php?lang=EN

5.3 Future Events

In May the current version of the system will be used for aleatoric and improvised music workshops for the musical highschool students. Also within the near future, we plan to use our system for some informal workshops about improvisation for the Musical Academy students and for some additional concerts. In 2016, the extended version of the project will be presented in an event exploring the connections between videogames and music prepared by the National Forum of Music as part of celebration of European Capital of Culture.

6. CONCLUSIONS

In this paper we presented a project that explores a two way interaction of computer games and music as opposed to typical one way approach (music and sound generated by a game). We found that our ideas could be quite useful for rule-based improvisation in a way which is not only novel, but also could be presented to the general public with additional appeal of incorporating well known and liked element of video games. We have described a fully tested system which, in its first incarnation, was used in a concert situation, and in educational context. In both cases the results were satisfactory and provide a good starting point for our future developments. We also presented our solutions to the problems encountered regarding interaction and control, and we hope our findings can be used to build upon by people interested in creating similar projects.

7. REFERENCES

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