A System for Improvisational Musical Expression Based on Player's Sense of Tempo

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ABSTRACT

This paper introduces a system for improvisational musical expression that enables all users, novice and experienced, to perform intuitively and expressively. Users can generate musically consistent results through intuitive action, inputting rhythm in a decent tempo. We demonstrate novel mapping ways that re ect user's input information more interactively and e ectively in generating the music. We also present various input devices that allow users more creative liberty.

Keywords

Improvisation, interactive music, a sense of tempo

1. INTRODUCTION

Recently the lines between a composer, a performer, and an audience member have become blurred [1]. Improvisation may seem di cult to and frustrating for musical novices and performers who cannot compose. However, recent technological advances related to interactive music have the potential to release us from such frustration[2]. Although a lot of interactive music systems vary in their time control and sound mapping methods, there are not many systems that aim to be used by both novice and musically trained users[3]. Some earlier systems address this issue by producing good musical results using strict time control methods. With these methods, most of the timing of the users input is adjusted to systems timing or is completely ignored. Even though these systems produce outstanding musical results regardless of who is using them, they fail to provide ow musical expressivity and impair user s musical intuition.

Compared to strict time control, methods like eliminating, adding and keeping a users input time unchanged seem to be more bene cial. It may hint to the user to input with a good sense of tempo as well as decorate musical results.

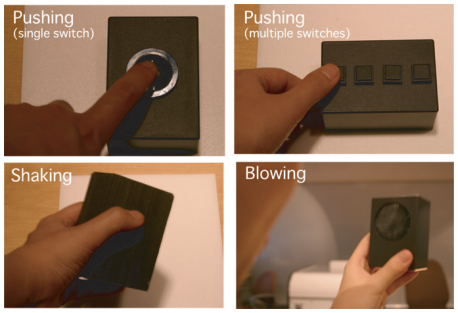

Figure 1: Input devices

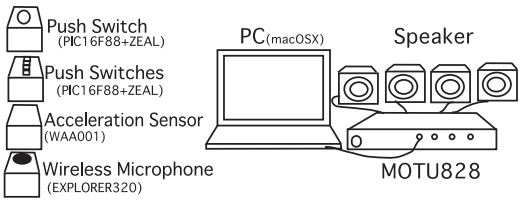

Figure 2: Overview of the prototype system

Therefore our system, through simple rhythmic inputs and adding to and keeping musical timing consistent, enables any user to improvise intuitively and generate coherent musical results. In our system, if a user inputs rhythm freely, the same rhythm plus an added rhythm is generated, hinting to the user how to continue playing. If a user continues to input their rhythms in a decent tempo, additional melody sequences are generated.

2. PROTOTPE SYSTEM

2.1 CONCEPT

In our system, users generate music by inputting rhythm freely through any combination of the 4 devices shown in Figure1. For example, if a user users a switch , a note is generated at the push(onset) time. While a user continues pushing a switch, notes generated from the computer form a rhythm sequence, ending when the switch is released(o set). This added rhythm sequence hints to the user how they should continue their play on the devices to hear good musical results. Here, "a decent tempo "or "good sense of tempo"is de ned as intervals between the onset time (IOI)

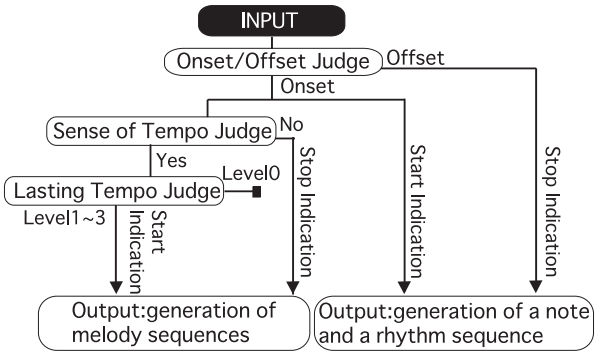

Figure 3: Flow processs of the system

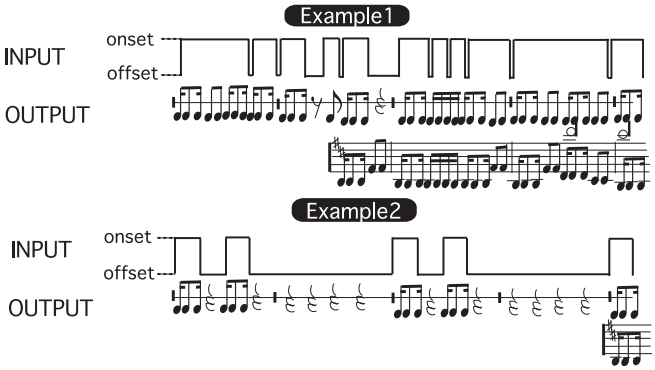

Figure 4: Examples of inputs and generated music

are integer multiples or the fractions of the interval of basic tempo.If a user does not continue to push but hits a switch for a split second, rhythm sequences will not be added and a user can play their own rhythm without the software's in u-ence. This additional rhythm sequence's hint is to those who needs. Furthermore, depending on the length of the decent tempo, di erent melody sequences can be generated. The longer user produces a decent tempo, the more expressive and unique the musical results.

2.2 HARDWARE DESIGN

A necessary feature of our hardware is that it must offer various methods to input rhythms, thus giving the user more creative liberty. Therefore, our system has four input devices as shown in Figure2. These devices include "pushing (single switch)" , "pushing (multiple switches)" , "shaking" and "blowing." The actions on these devices are sensed and transmitted to a personal computer using wireless technology. Pushing data is transmitted via Bluetooth modules and PIC microcontrollers. For shaking, a wireless acceleration detecting sensor senses and transmits acceleration values of three stems. For blowing, a wireless headset microphone senses and transmits the input values. For both shaking and blowing, we set a threshold and decided onset and o set time arbitrarily. The digitized data that represents players' onset and o set time is transmitted to a computer running a Max/Msp Patch. This patch then maps the digitized data into musical output.

2.3 SOFTWARE DESIGN

The main challenge in designing the software is mapping the user's rhythmic input information interactively and effectively in order to generate sounds. The onset time, the o set time ,IOI(Inter-onset-Interval) and a quality of the IOI are constantly detected and managed as shown in Figure3.

- A singular tone is generated at the user's onset time.
- A rhythm sequence is generated depending on the length of input (cease at the user's o set time).
- Melody sequences are generated if the IOIs are successively decent tempo. If the IOI lacks a good sense of tempo, the melody sequences cease.

If several of the input devices are used simultaneously, rhythm sequences are generated interdependently, whereas melody sequences are generated by combining the data from each of the devices. We determine whether the IOI is a decent tempo using a wide range of possible rhythm inputs. Basic tempo is decided by the rst four inputs of the user or a prede ned setup and is then applied to create rhythm and melody sequences.

3. EVALUATION

We evaluated our system's software with 8 users, all of di ering musical abilities. Each user played with our system for one minute. As a result, all users were able to generate at least one melody sequence and 75% of the users were able to generate three melody sequences. Those users who input many di erent rhythms were able to generate more various rhythms and melodies and the start point for the melodies generated was early shown in Example1(see Figure4). Also of note was that the total length of a decent tempo for all users averaged 10 to 30 sec. Compared to the pop music with same tempo, it was equal with from 1 phrase to minimum size of a piece. Finally most of user's said that this kind of musical expression system was pleasant and they wanted to try again.These results indicate that both novice and expert musicians have fun creating their own music on our system's software.

4. CONCLUTION

We have thus proposed the musical expression support system that enables both novice and musically trained users to perform to create their own music through simple rhythmic inputs. Both software improvements and other musical expression applications will be addressed in future work. The main software-oriented improvement would involve a better implementation of a sequence database so that the software could provide a more ideal environment for choosing a user's preferred sequences. We are also interested in using this system as synchronous multi-player instrument. This system also has possibilities to provide an infrastructure for interdependent group playing. and those that made more frequent use of the devices had better musical results.

5. REFERENCES

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