Full-Body Interaction for Live Coding

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ABSTRACT

This paper describes the integration of a full-body interactive system for its use in live coding performances. The system has an interactive mat of grid layout, which is divided in 17 areas. The body gestures made by the user are mapped to modify the execution of the algorithms that generate the sounds and the visuals in real time. Thus, the audience can participate in the improvisation through full-body interactions and without having programming knowledge. It was noted that users recognize the interactive mat as a space of interaction with the system and also that users move intuitively on the mat. In addition, we found that the users recognize the feedback of their body gestures, by observing the change in the outcomes of the visuals and sounds, during a live coding performance.

INTRODUCTION

Live coding focuses on the possibility of generating visual and sound compositions in real time, using algorithms or programming codes. This practice focuses on the person or group of experts, live coders/performers, who use the code to generate the visual and sound sets, without taking into account the participation of the audience, whom cannot be part of the creation of the composition.

In this work we explore the possibility of intervention of the audience by body gestures, within a practice of live coding. This project seeks a symbiotic performance between a person of the audience and the live coders in real time.

PROBLEM AND MOTIVATION

The processes of improvisation in live coding are executed by specialists in the generation of sounds and visuals. However, during the live coding performances, a high interest of the audience in participating in the improvisation has been observed. Nonetheless, the lack of specialized knowledge does not allow the audience to participate in the improvisation.

A system was developed in order to let the audience to participate in the composition of a live coding performance. It allows the user to use the movements of its body to modify the algorithms, which are being written by the live coders in real time. This system is able to modify the outcomes of the visuals and the sounds of a live coding performance without knowledge about programming languages.

BACKGROUND

There is a broad debate about the study of Human Computer Interaction (HCI) for live coding performances, and specifically, this debate focuses on analyzing how the different types of interaction can influence the outcome of the performance. Therefore, there is a clear interest in researching and experimenting with unconventional forms of interaction in the practice of live coding (Collins and McLean 2014; Baalman 2015; Salazar and Armitage 2018; Sicchio and McLean 2017).As described by Sicchio, the performance was:

"A feedback loop between the movement code and the sound code is thus created … In this piece, both the dancer and the live coder were manipulating the code and changing the performance in real time". (Sicchio 2014)

DEVELOPMENT

According to the problems raised, for the development of this project, it was necessary to integrate the following tools: Microsoft Kinect as a full body tracking system, the SuperCollider audio synthesis software (McCartney 1996), the live coding software for sound improvisation TidalCycles (McLean and Wiggins 2010), the visual generation tool Hydra (Jackson 2018) and the in-house software Dosis for the integration (Nemocón 2018) which was developed in Processing (Reas and Fry 2006). The following is the description of the development process of each system module and its integration process.

TRACKING SYSTEM

In order to recognize the full-body gestures made by the user, the Microsoft Kinect device was selected to support this process. This device is a specialized 3D camera for the detection and tracking the whole body, which capture the user's gestures and their location in the space. The information detected by this device is sent using a network communication protocol, to the different modules of the system, where it is used to modify the outcome of the visuals and the sounds.

INTERACTIVE MAT

IIn the field of Immersive Virtual Reality (IVR), human-scale applications have been developed for the purpose of navigating within virtual buildings (Dam 2000) or exploring large-scale 3D reconstructions (Betella et al. 2014). To navigate these virtual worlds have been used devices such as: motion platforms (Shanklin 2016) or pneumatic gloves (Connelly et al. 2010).

The interactive mat developed for this project is inspired by the concepts of navigation used in the field of (IVR). We define this passive device with a grid layout, which is divided in 17 areas. Each area has a color and allows the user to move the objects in 4 directions and apply behaviors on the objects as can be seen in Figure 1.

The user's movements in each area are detected and converted into information by the tracking system. Then, this information is used to modify parameters and therefore the execution of the algorithms that generate the visuals and the sounds. These algorithms are also being manipulated simultaneously, by the live coders in real time.

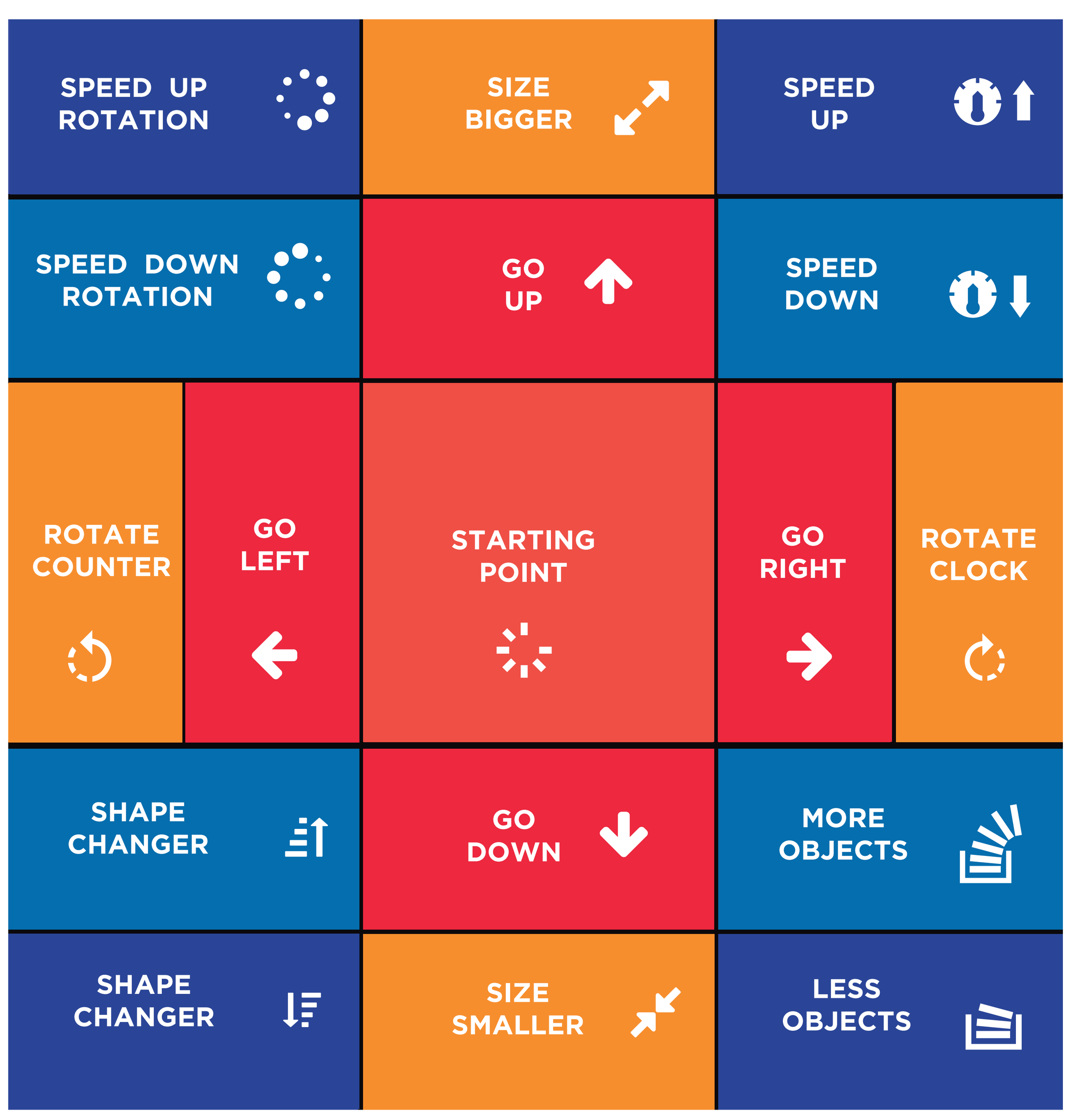

Figure 1. Interactive mat design

SOUND GENERATION

One of the main challenges in this project was to develop a system that would allow a user from the audience to intervene the sound directly. To achieve this challenge, several SynthDef were developed in SuperCollider, which receives the information of the corporal gestures sent by the Dosis system (Nemocón 2018). These SynthDef modify the sound variables: pitch, frequency, amplitude and harmonics.

In a performance as the used for this project, the live coder associated with sound generation is not only focused on the execution and reproduction of the SynthDef from TidalCycles. He or she must also balance the level of control over the algorithms associated with the actions of the external user. The audio control is not only based on the live coder, the outcome of the sound is the integration of the live coder and the user from the audience.

To develop a friendly interaction between the user and the sound variables, we adopted a system similar to Theremin. The system of this project uses both hands as described below:

HAND	VARIABLE
Right X-axis	Frequency
Right Y-axis	Amplitude
Left Y-axis	Dynamic effect

Table 1. Mapping between hands and sound variables

VISUALS

The visuals of this project have been developed on the framework for live coding Hydra, using Atom as text editor. These tools allow to implement and execute p5.js code on live. P5.js is a JavaScript library of Creative Coding for visual arts (McCarthy 2017). For this project, we implemented the code in accord-ance with the paradigm of Object-Oriented Programming (OOP) (Greenberg 2007; Antani and Stefanov 2017). The use of this programming paradigm in p5.js allows us to represent each geometric figure through objects using OOP classes, which implement the methods to handle behaviors such as resizing, color, direction, speed or rotation (Olaya 2018). These methods allow us to map the body gestures of the user with the behaviors of the geometric figures. Figure 2 shows some of the visuals used in this project implemented in Hydra using the principles of OOP for JavaScript:

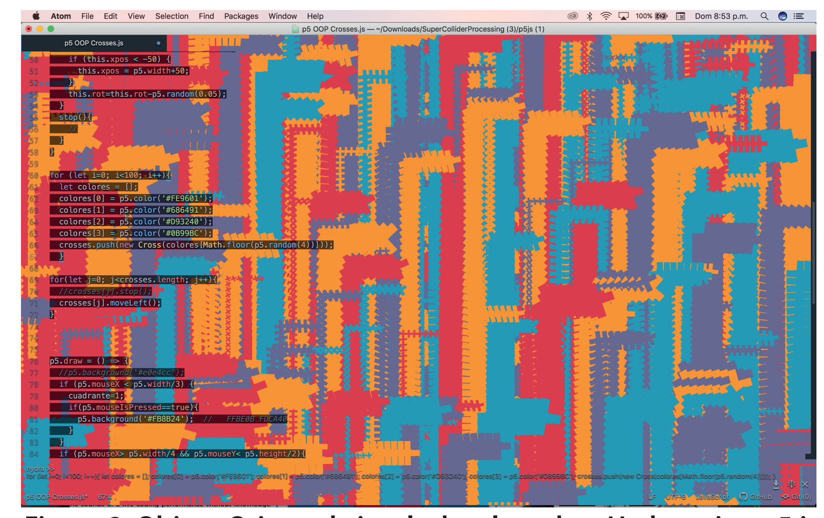

Figura 2. Object-Oriented visuals developed on Hydra using p5.js

INTEGRATION

The last stage of this project involved to communicate the three system modules: sound, visual and tracking to achieve an organic and understandable result.

Each software used in each system module, such as: SuperCollider + TidalCycles, Hydra and Dosis, are hosted in different computers allowing a collaborative work between three livecoders and the user from the audience that interacts with the gestures of the body. Communication between the three computers is done through the OSC communication protocol, Open Sound Control (Schlegel 2015), which allows the flow of information to be transparent and work as a single system. The Figure 3 shows the communication diagram between modules.

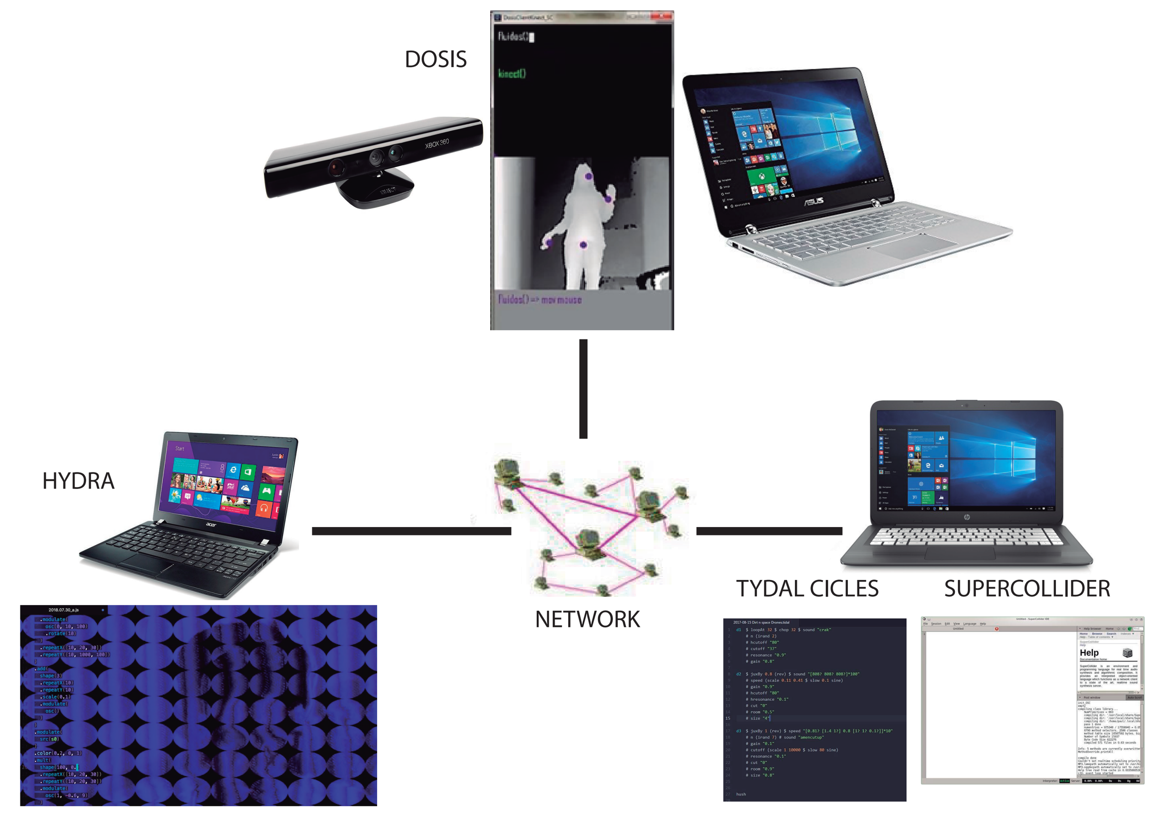

Figure 3. Communication diagram between modules

CONCLUSIONS

Including a person from the audience as another member of the group of performers, involved a creative, analytical and perceptive exercise. It required us to think about what parameters could be modified by the user and to what extent. We had to imagine the user as an instrument that is activated by the movement of his or her body. Nevertheless, because the body is the instrument and the creator at the same time, it goes beyond the functional or creative.

This project allowed the inclusion of the audience within the sound and visual composition hosted by the live coders, through a body tracking device. As a result of the integration between the tools used in this project, a collaborative audiovisual composition system was created, where live coders create sounds and visuals and which can be modified by a user from the audience in real time.

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