Samsara - a virtual interactive soundscape

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Abstract. In this article, we present Samsara, a virtual interactive system for multiple real world performers to create a dynamic collaborative soundscape. They interact in a simple physics based system, with each performer having their own type of virtual atoms - *creator* atoms, *preserver* atoms and *destroyer* atoms. The performers interact with the system via TouchOSC through a mobile device controller contributing to the soundscape. We explain the design and implementation of this system and how the visuals are mapped to a pure data patch for generating the sounds.

Keywords: Real time interaction, collaborative soundscape, Musical Expression, Physics and Music

1 Introduction

Samsara means "world" in Sanskrit. It also refers to the theory of rebirth and "cyclicality of all life, matter, existence", a fundamental assumption of various Indian religions [1]. The concept of our project is built around this idea of having a world with atoms of different kinds interacting with each other, dying and being born again. There are three deities which are considered supreme in Hindu mythology. They are Brahma, the creator, Vishnu, the preserver, and Shiva, the destroyer. Our performers have similar roles in this virtual world we create.

We have used common human computer interaction (HCI) mediums like mobile phones, tablets etc. to allow the performers to create constantly changing minimal music in a virtual physics based environment. The system is targeted towards music and technology enthusiasts with no prior formal musical training, having the system take care of all the musical details like being in tune, rhythm etc. allowing them to focus on their expressivity and collaborating with other performers. One of the most well-known attempt at making a multi-user musical instrument is the reacTable[2] which is a translucent round table top with a camera underneath to track the different objects, their movements, orientations. The sound is created by the sound synthesizer whose parameters are controlled by the interactions and movements of these objects. An even earlier attempt was the Audiopad [3] by the MIT Lab that used Radio Frequency tracking of objects

on a tabletop surface. These systems need a dedicated hardwares to work upon, a limitation which we try to solve by using phones and computers.

CollideFx [4] is an audio processor which uses the physics of the real objects to control the audio effects. They use unit generators(audio and their effects), and their interactions to create complex sound effects. One of the major differences with Samsara is the collaborative aspect of our system.

We used openframeworks, an open source C++ toolkit for creative coding of the physics and the graphics used in our project, Pure Data for generating sounds, and Open Sound Control (OSC) [5] for messaging between each performer and the virtual world running on a dedicated system. The pipeline for the project is as shown in Figure 2. Section 2 explains the workings of the Samsara and each individual process is explained in Section 3. In Section 4, we discuss the conclusions and ffuture work that can be a continuation of the work done.

2 Design and concepts

Samsara is composed of three types of performers each controlling their respective atoms. Fig. 1 shows a simple version of the system. The white atoms are the creators/ sound generators, green atoms are preservers/ audio effects and orange atoms are destroyers.

Fig. 1. Samsara and the three types of atom; a) White - Creator, b) Green - Preserver/Effects c) Orange - Destroyer

Each performer interacts with their respective atoms based on the role of the performer. There is a predefined time signature (16/16) for the percussion produced by Samsara, which is a time varying syncopated version of a commonly occurring 16/16 groove. These syncopations depend on the total number of atoms present in the system. At every beat location, a creator atom is created at the creator's cursor. Each preserver atom is a unique effect and is applied to all the present creator atoms and the amount of the effect is weighted by their relative distances. LFO, Moog, amplitude modulation are some examples of such effect entities. The destroyer performer can choose to destroy creator at any given time of the performance by forcing a collision with the creator atom producing a bell sound, providing feedback to the performers.

3 Implementation

The process flow for Samsara is shown in Figure 2 and each individual part of the implementation pipeline is explained in the following subsections.

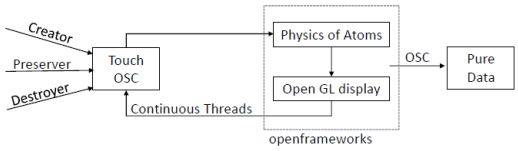

Fig. 2. Flowchart of processes

3.1 Performer Interaction

The performers' interaction with the system starts from a TouchOSC controller on a mobile device. The performer can use the mobile device's screen to move anywhere on the virtual world and manipulate their atoms. This information is sent through Open sound control (OSC) to a central computer that runs the virtual world on openFrameworks.

3.2 Physics of Atoms

At every frame, distances are calculated between creator and preserver atoms and are continuously communicated to the Pure Data patch through OSC to contribute the main soundscape. All collisions are "elastic" in nature and each atom has a unique velocity that at collision leading to interesting evolutions of the Samsara. A collision leading to the destruction of an atom is handled separately through a dyingAtom class. An instance of a creator atom is destroyed when a destroyer atom comes in contact with the creator atom slowly fading out its presence out of the system.

3.3 Soundscape generation

Parameters required for sound creation (relative distances, flags for creation of atoms, flags for destruction of atoms, the number of atoms in the system etc.) are received by Pure Data through Open Sound Control (OSC). For the creator atoms, multiple instances of the same Pure Data patch are created dynamically in time with reference to a metronome which can be set before the performance. Each instance corresponds to the sound of the creator atom and is a simple sound based on additive synthesis. The amount of filtering by each effect is controlled by mapping the relative distances between the position of these effects and the unit generators to the parameters that control each of the effects described in Section 2. Each collision between a destroyer atom and a creator atom is mapped

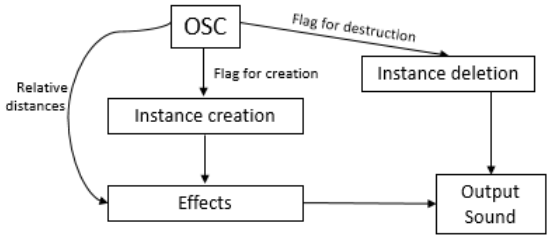

Fig. 3. Pure Data flow

to a transient bell sound. The musical key of the soundscape can be set before the performance.

The percussion sounds (kick drum, snare drum and hi-hat) have been synthesised in Pure Data and follow a 16/16 time signature. The amount of syncopation in percussion is mapped to the number of atoms in the system by probability sampling of probabilities obtained by [6], which defines a metrical hierarchy for strong and weak beats in a 16/16 rhythm pattern.

4 Future Work

Samsara can be extended to a virtual web host to have a massive multi-player performance following the three performer role paradigm. More intuitive sounds that connect directly to the visual processes of collisions and trajectories would also make the performance more impactful. Interesting visuals borrowed from Physics like black holes and spirals can also be incorporated.

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