Black Space

VICTOR ZAPPI, Northeastern University, Boston, MA, United States
OREN RONEN,, Northeastern University, Boston, MA, United States

1 PROGRAM NOTES

Black Space is a solo performance that presents highly correlated sonic and visual elements. The piece revolves around the manipulation of acoustic qualities of sound propagation and reverberation in a physical model, that is capable of both synthesizing and rendering sound waves. The performer gradually populates the *black space* that stretches across the surface of his instrument with sound sources, creating layered textures and percussive sounds that get trapped and resonate in different 2D shapes and materials. As the piece evolves, the performer explores the acoustic effects arising as he alters the physical properties of these materials and the shapes these sounds exist in.

Black Space was composed for a novel audio/visual digital musical instrument, whose name is anonymized for the submission.

2 PROJECT DESCRIPTION

The instrument is designed to target musical expression through the audio/visual manipulation of sound waves.

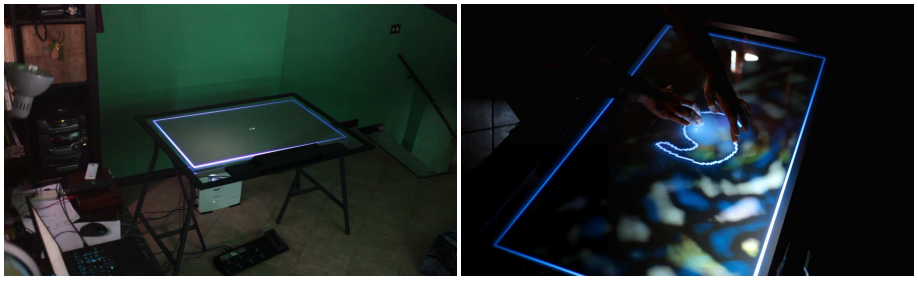

Fig. 1. Overall view of the instrument (left), depiction of colored traveling waves (right)

Its body consists of a tabletop interface, composed of a 42” retro-projected multi-touch glass display hosted in a custom raised frame. The glass surface is projected with an empty dark domain (the black space), enclosed in four boundaries and rendered by a laptop computer (Figure 1, left). Every time the glass is touched, an impulse is injected into the domain and an innovative physical model computes in real-time how the resulting sound waves propagate across the space.

Licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0). Copyright remains with the author(s).

Music Proceedings of the International Conference on New Interfaces for Musical Expression
NIME’20, July 21-25, 2020, Birmingham, United Kingdom

The model runs on the parallel cores of an onboard GPU, allowing for the audio/visual simulation of sound propagation within the massive domain. The traveling oscillations are depicted in real-time as colored waves (Figure 1, right), while virtual microphones pick up their local amplitudes and turn them into audio samples—which are then diffused via an audio interface. By drawing boundaries it is possible to split the domain in several areas, whose local physical parameters can be modified to simulate the acoustics of different materials. This transforms every area into a different percussion instrument (Figure 2, left), as the injected impulse resonates in relation to the geometry of the area as well as the simulated material.

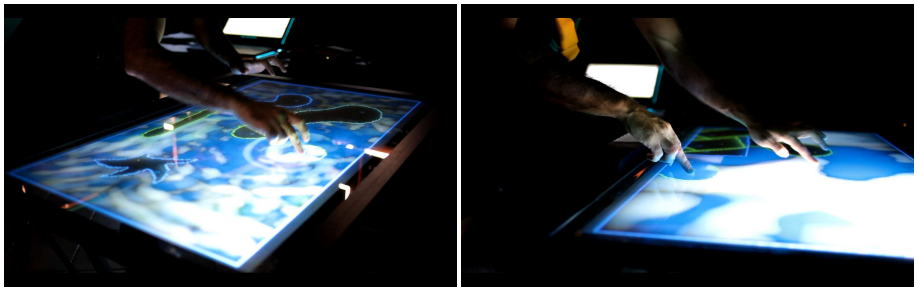

Fig. 2. Examples of a domain split into several areas: percussions (left) and continuous timbral explorations (right).

The impulse can be replaced by any other waveform, including audio files, which can be dragged around the space and across the areas. The position of the microphones can also be changed in real-time and new boundaries can be drawn while the areas are excited; this allows to explore the resonances of the designed geometries and materials, and continuously shape the timbre of the chosen sounds (Figure 2, right). The responsiveness of the instrument (which runs with an audio buffer of 64 samples) allows for the discovery of idiomatic playing techniques, inspired by augmented/hyper instruments but leveraging the tremendous flexibility of physical modeling synthesis.

4 MEDIA LINKS

A video collecting several excerpts of the piece can be found here: https://youtu.be/GiJC_A0c_d4