DOCTOR OF PHILOSOPHY

A Portfolio of Original Compositions (Andrew Dolphin)

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2.3 Collaborative composition through play

SpiralSet and *ResOscope* offer individual playful composition experiences. The sound toy work presented here, entitled *MagNular*, incorporates the option for collaborative[77] composition and play. The aim being to create a framework for composition which accommodates multiple player interactions, offering shared experiences, and facilitating collaborative and playful sound generation. *MagNular* may also be explored by an individual player, and has scope for use as a studio composition tool. The system employs a physics engine as a form of semi-generative compositional agent that is symbolically represented in the visual domain.[78]

MagNular

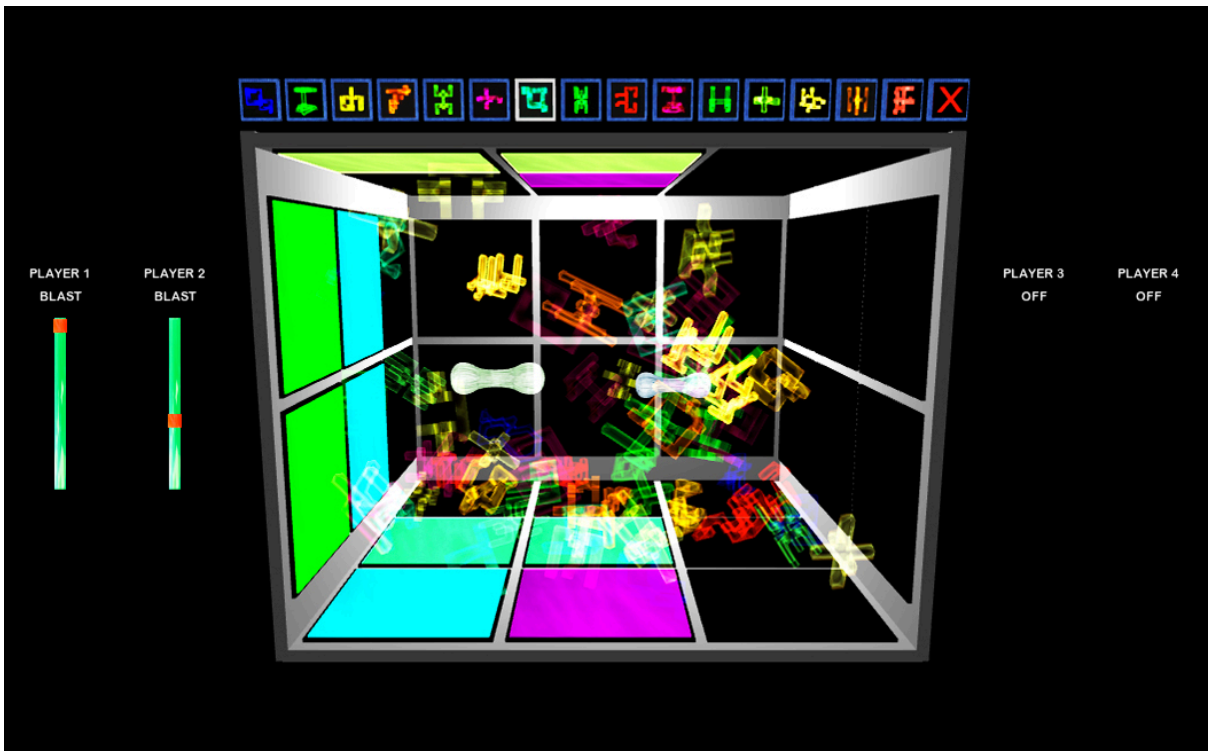

Figure 12. Screenshot | MagNular

Introduction

MagNular is a sound toy and compositional tool that uses an animated interface for symbolic generation of sound. The player controls virtual magnets that attract or repel numerous sound particle objects, allowing the particles to be moved freely around the virtual space, creating

[77] Or 'multiplayer'.

[78] See Figure 2 in 2.1 for a representation of the three compositional forces relevant to the work.

player controlled clusters of sonic events on each particle collision. The user(s) compose by controlling, or influencing the simulated physical behaviours of the particle objects using virtual magnets in the animated interface. Interactions and subsequent object collisions are not a basic cause and effect system, as the trajectory of one object may interrupt the path of another, causing unanticipated deflections and multiple subsequent collisions and trajectories.[79] *MagNular* is an exploratory sonic play space in which sound is experienced through the semi-compositional interactions of the player(s). The overall design and visual aesthetic exhibits some similarities with computer games, but the work is most appropriately defined as a *sound toy*, as its primary purpose is the generation and transformation of sound.

MagNular Media

MagNular Software
MagNular Demonstration Video

Overview

The player is presented with a 3D virtual room. A variety of particle objects may be selected from the object palette (as seen in Figures 12 & 14) and dropped into the room by the player. Each particle represents a specific sound type. Player controlled magnets can be activated to attract particles within their immediate vicinity. Once attracted, the particles may be dragged around the space causing the particles to collide with the 36 tile objects mounted on the walls, floor and ceiling of the virtual room (as shown in Figures 13 & 14), resulting in corresponding synchronised sonic events and sound transformation processes. Each magnet can be set to repel objects at varied intensities, resulting in clusters of player timed collisions around the room. The velocity of impact of each collision is mapped to multiple sound parameters.[80] Single or multiplayer options are included allowing the sound toy to be used for collaborative play/ performance, (up to 4 players).

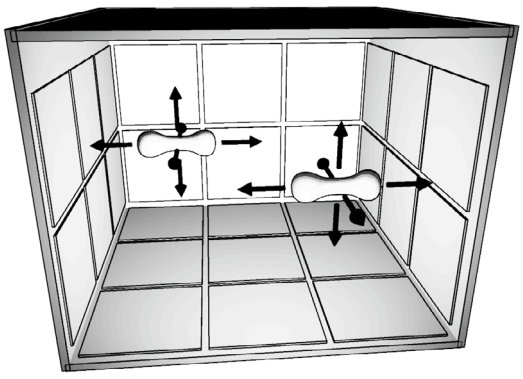

Figure 13. Room, Tiles & Magnets

[79] Ideas of determined indeterminacy discussed in 1.1 are relevant here.

[80] A one to many mapping strategy.

Player control of the sound world is symbolic, with no sound or digital signal processing parameter names included in the virtual space. This allows the virtual space and sound world to be discovered by the player. The project is designed to be an exploratory experience, and is not a sound design tool where the sonic results can be predetermined before use. The system may be influenced by the player(s), but not fully deterministically controlled. The symbolic animated interface draws on the player's basic understanding of gravity and the behaviour of magnets. These behaviours are simulated and extended, and used as the primary basis for interactions.[81]

Figure 14. Screenshot | MagNular

Magnet Behaviours

Each magnet may be moved freely around the room in three dimensions using a gamepad. The magnets are used to energise or stimulate the simulated physics behaviours of the particle objects, with the resulting collisions generating sound. Each magnet has three active magnet states that are operated by the player(s). These are:

Magnet Attract Mode - attracts particles within the vicinity of the magnet, allowing clusters of particle objects to be collected and moved around the space, resulting in collision based sound events.

[81] A player's prior experience of computer games may aid comprehension of the control systems employed.

Magnet Power Up Mode - cumulatively energises the magnet over time. The longer this mode is activated, the greater the velocity of the particles when repelled. The amount of energy set for each magnet affects the timings and intensities of the resulting sound clusters when the magnet repel mode is triggered.

Magnet Repel / Blast Mode - triggers the repelling of the particles away from the magnet, instigating clusters of effected sound onsets.

Once a player has become accustomed with the sonic behaviours of each particle object and collision tile, compositional decisions can be made (by the player) regarding the types of particles and collision objects to interact with using the virtual magnets.

System Structure

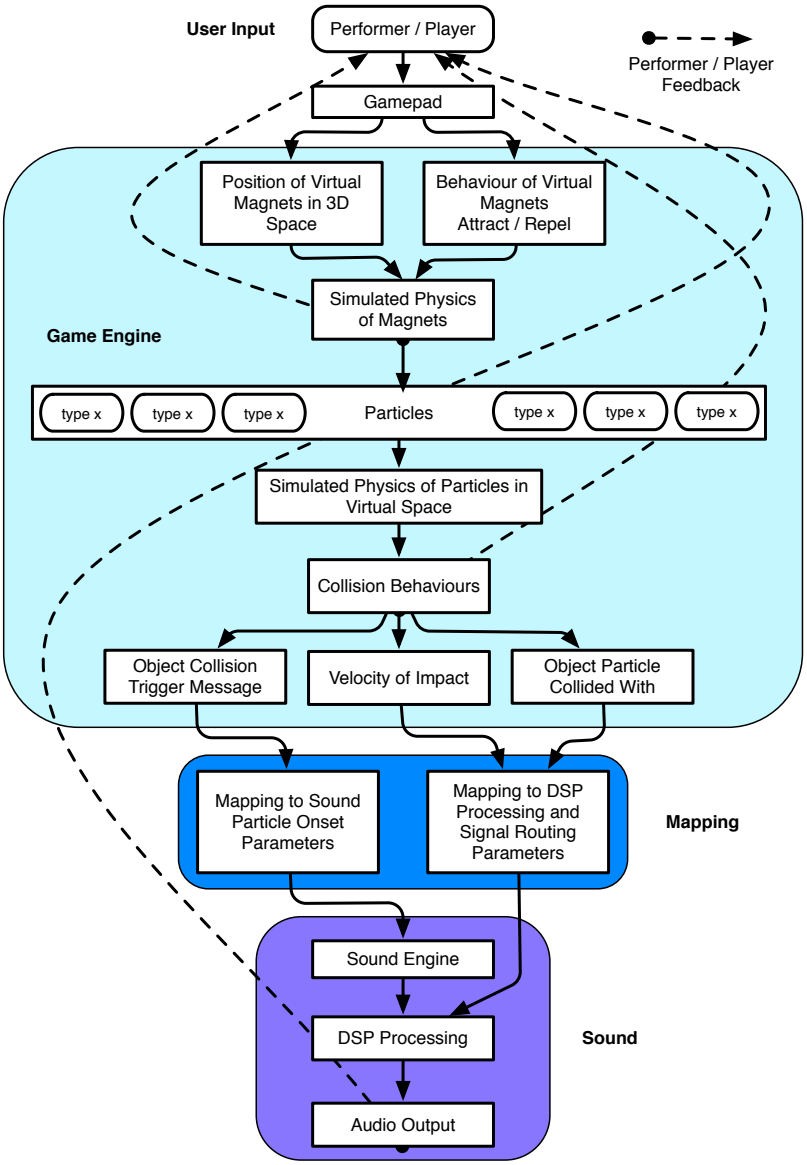

Figure 15. System Structure | MagNular

MagNular utilises a computer game and physics engine technologies to create the animated interface, and this is used in conjunction with an external sound engine developed within *Max/MSP*. The system utilises an internal network connection on a single computer for the communication of data from the game engine, *Unity 3D*, to the sound engine. Data is forwarded from *Unity 3D* to *Max/MSP* on each collision event, and particle object collision data is mapped to control sound onsets and DSP (Digital Signal Processing) parameters. In addition to using game object collision onset data for triggering sound onsets, the game engine outputs additional collision parameter data for mapping and control of sound, as shown in Figure 15. Data sent from the game engine to the sound engine includes the object collision onset message, particle index value, tile collided with index value, and the velocity (or force) of impact.

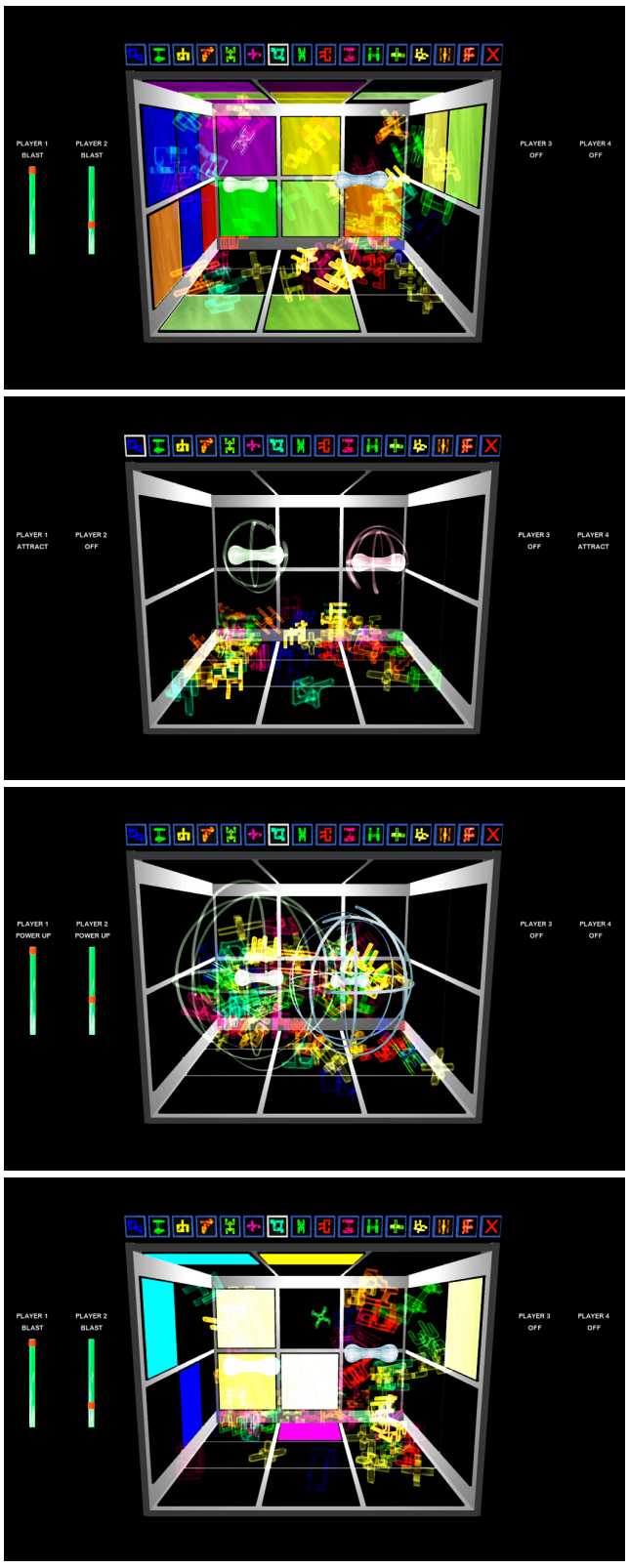

Figure 16a. Screenshots | MagNular

Sound Engine

The sound engine is constructed using a set of polyphonic samplers and varied real-time DSP processes. Using real-time DSP allows increased detail and variation in the sound output, and reduces repetitiveness. The same level of variation would be technically impractical with a solely sample based approach. DSP processes currently implemented in the system include modulating filters, multi-tap delay lines, modulating delay effects, FFT (Fast Fourier Transform) filtering processes,

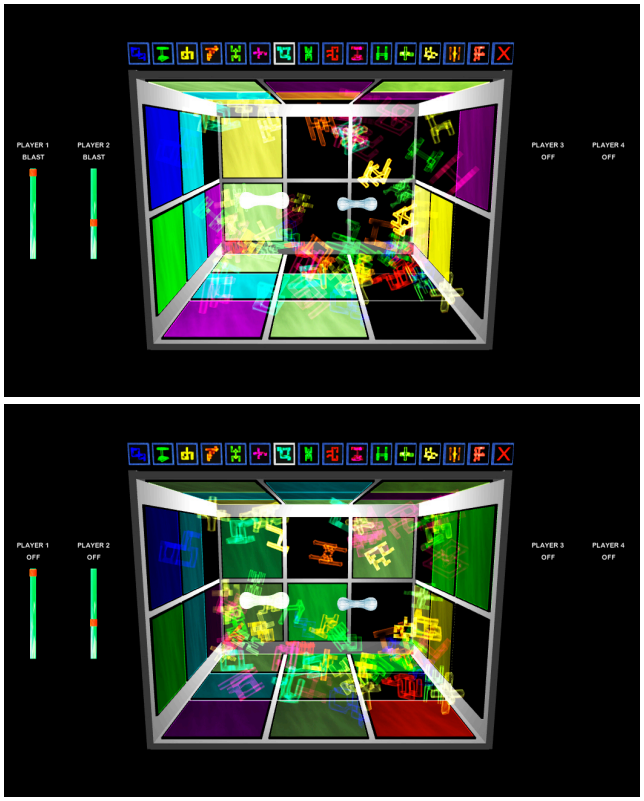

Figure 16b. Screenshots | MagNular

and multiple reverb units. The player has fifteen available sound class types to choose from when introducing sound particles into the virtual room. Each sound type consists of nine individual sound files, with a total of 135 individual sound files included in the sound engine. The quantity and types of sound class particles introduced into the room by the player has a significant effect on the character, density and variety of the sound output. All sound files are original and comprise of a mixture of purely electronic sounds, and transformed sounds derived from recordings of acoustic instruments such as a piano and kalimba.

Particle collisions with the tiles within the room initiate sampled sound onsets, with each particle assigned a specific particle identifier index that is sent to the sound engine on each collision event. Each tile within the virtual room is also assigned a unique identifier which is again sent to the sound engine on each collision event. The tile hit determines the signal routing of the respective colliding particle sound to one of the multiple DSP processes. A one to many mapping strategy is used for the impact velocity data for each collision, and this simultaneously controls a number of different sound and DSP parameters. The magnitude of each collision results in each particle sound's low pass filter cut-off and amplitude settings being adjusted accordingly. Tile specific DSP parameter values controlled by the velocity of impact of each collision include sample transposition, amplitude envelope, delay time modulation, feedback amount of delay based effects, pitch of harmonisation effects, and the manipulation of the spectral envelope in the FFT filter systems.

Each particle sound is panned according to the position of the tile it collides with within the virtual room.[82] Multiple reverb units are included in the sound engine, with the reverb depth

[82] Tiles on the left of the room result in the particle sound being panned left, tiles on the right result in the particle sound being panned to the right.

and size also determined by the tile that the particle collides with. The reverberation processes used do not attempt to simulate the possible acoustics of the virtual space, and reverb is varied for sonic effect. The mappings are designed so that tiles closer to the viewing perspective of the player are less reverberant, with little or no reverb heard, whilst the tiles furthest from the player result in the more exaggerated reverberation effects.

Presentation and Application

During the development of the project, a number of modes of presentation and compositional applications for the project have emerged. *MagNular* was presented as a collaborative sound toy installation at *Sound and Music's Expo Leeds 2009*. The project is also made publicly available for download as a sound toy.[83] Also made publicly available is a version of the project without the completed sound engine, but instead a starter *Max/MSP* patch is provided to allow sound artists and composers to develop personal and individual sound engines for the animated interface. This provides scope for the development of varied sound systems, using alternative sound and synthesis approaches implemented by other composers or sound artists, allowing the project to be extended or adapted. Whilst the project was originally conceived and designed to include a fixed set of audio samples, *MagNular* has the capacity to be used as a studio composition tool for generating clusters of sonic events, and is currently being used by the author as a composition tool for fixed media works. In this context the project is modified and adapted to suit personal compositional requirements.

Observations and Reflection

The work was presented as a sound toy installation at *Sound and Music's Expo Leeds 2009* and a number of observations from the event are now outlined.

Whereas *SpiralSet* offers a more transparent system for interactions, the control system in *MagNular* sometimes required some explanation to allow visitors to successfully engage with the work. This is not considered to be ideal, but did result in some positive social aspects to the project's presentation. Use of the gamepads for participant/player control proved to be a familiar input device for some visitors and a barrier to others. The sound toy showed capacity for extended periods of engagement, with some visitors spending 10-20 minutes exploring the work, and these players generally offered positive verbal feedback. Other visitors played

[83] This version includes the sound engine and sound set.

for shorter periods, and some entered the space and chose merely to observe. Visitors sometimes explored individually, and other times as a group. Preconceptions of 'computer games' were a barrier for some visitors who associated the work with this medium, and were on occasion quickly dismissive. Others seemed to benefit from previous game playing experience and could more quickly adopt the gamepad control systems. Individuals who said they had never played a computer game before were seen experimenting and exploring.

The location of the installation was not known at the time of developing the project. The court prison cells in Leeds town hall are a distinctive site, especially when used as an art space, and are a prime location for site specific installations, an observation also noted by a number of visitors. *MagNular* was not designed and conceived as a site specific installation, and the placement of this type of work in these characterful and historic Victorian prison cells proved to be an unusual setting. The work and setting were not considered as being entirely aesthetically cohesive. However, despite this the location proved to be unexpectedly beneficial in some ways. Along one wall of the prison cell there was a long wooden bench, with the installation being set up against the far wall at the end of the cell, with space for up to four participants/players. During busier periods of the event, a number of players (often from different visiting parties) would engage with the work, and assist each other in understanding the control system. Other visitors would stand and watch, whilst others would sit on the wooden bench observing and chatting. This resulted in the cell becoming a dynamic social space, a contrasting role for the former incarceration space.

Despite some incongruity between the work and the space it was presented in, the project was successful in providing a collaborative experience, encouraging playful and social interactions between different visitors to the cell, and creating a surprisingly social space given the location's former function.

Notes on Subsequent Developments

The visual design of the project has been modified since its presentation as a sound toy installation. It was determined from user feedback and testing that additional visual feedback from virtual object collisions would be beneficial, cementing audiovisual relationships and providing a more dynamic visual experience. In response to this, the project has been adapted so that each tile changes colour and intensity in response to the colliding particle object type and velocity of impact. The decision to make the sound toy publicly available introduced the need for an optimised version of the system to ensure that the project runs

smoothly on lower specification computers. As a result, a modified and more efficient visual design was pursued which is in keeping with the style of some of the other sound toy works presented.