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Signal to Noise Loops i++: *Noise Water Air*

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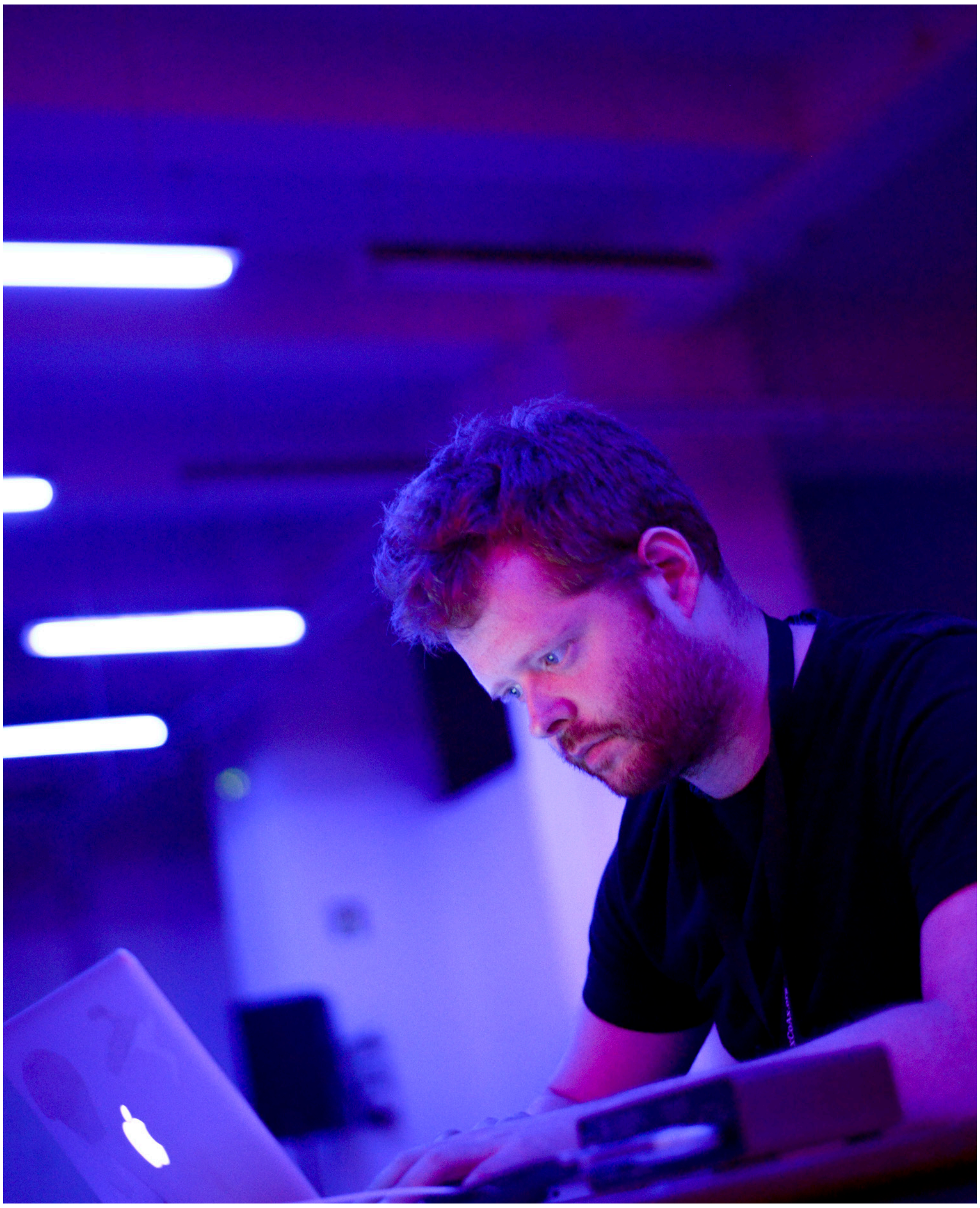

Abstract:

Signal to Noise Loops i++ is a live performance for the PerformIOT system. This system involves the application of techniques and concepts from the field of data-driven music to achieve a balanced co-ordination between algorithmic composition, live looping and improvisation in the context of live electronic music performance. The performance utilises Smart City IoT data drawn from sensors placed around Dublin City. From January to May of 2018 Ireland experienced a number of unusually strange weather events. Devices monitoring ambient noise levels, water levels and air quality measured the effects of these events on the city. While each of these streams of data represents an independent set of measurements for unique phenomena, they nonetheless share a commonly interrelated structure as they have been shaped by the recent history of strange weather events. This makes them useful for coordinating and balancing our live performance system because while they share similar characteristics and trajectories there is also enough variance between the different data streams to prevent the system from sounding too static and homogenous.

1. BACKGROUND AND MOTIVATION

Brian Eno used the term "Generative music" to refer to system-propagated music that is in a state of constant flux. He was one of the pioneers of this new form of music producing numerous generative music compositions across his career (Collins 2008). As evidenced in Music for Airports Eno's approach is informed by phase shifting looping processes similar to those exhibited in the work of Steve Reich. Reich's 1965 *It's Gonna Rain*, (Scherzinger 2005) an oft-cited example of a generative music system, involved two Wollensak tape recorders playing back a 1964 recording of Pentecostal preacher Brother Walter ranting about the end of the world at San Francisco's Union Square. On playback the recorders increasingly fall out of sync with one another and this process, phase shifting, results in the emergence of novel and unexpectedly complex sonic content. Another important work to inform the current piece is William Basinski's Disintegration Loops. This album resulted from a 2001 attempt to digitize some ambient recordings he had made in 1982, but during recording the tape began to deteriorate and as Basinski allowed the loops to continue to play a novel sonic result emerged from the decaying of the original materials (Hegarty 2008). The concepts of the generative music system, disintegration and looping are critical to this performance and have informed the design of, and mapping strategies involved in, the system described below. Collins (2003) argues that live laptop performance presents an exceptionally well tailored medium for the deployment of generative music systems albeit one with that comes with a number of problems. The medium has been criticized for being inherently "disembodied" insofar as it is difficult for audience members to understand what exactly the performer is doing to cause the sounds that they are hearing (Roddy and Furlong 2013). Solutions to this problem often focus on the concept of the acoustic sound generating instrument. They argue that live electronic music should develop new instruments for musical expression which might render the processes by which the sonic materials are controlled and generated more transparent to the audience (Hunt et al. 2003). The performance system defined here attacks this problem form a different angle by deploying data-driven music techniques. Rather than attempting to render the workings of the performer more transparent the system asks the performer to relinquish further control by allowing the data to define many of the performance parameters. In order for this process to work the data in question must be suited to the task. Data-driven music generally involves the mapping of some form of data to musical parameters but differs from the practice of Sonification which is concerned with the representation of the original data for interpretation by a listener (Scaletti 2017). Important pieces of data driven music include John Dunn's Life Music an album of soundscapes derived from the mapping of protein data to sound and the works of Natasha Barret and Andrea Polli who make extensive use of environmental data in their compositional practices (see Barret and Mair 2014, Polli 2012). Deriving from Henri Lefebvre's (2004) *Rhythmanalysis,* the concept of rhythmicity has become a crucial theoretical tool for making sense of the complex big data flows of the modern Smart City (Drakopoulou 2012, Pafka 2013) allowing researchers to model and understand urban environments in terms of Lefebvre's rhythmic categories. The piece aims to harness the unconventional rhythmic patterns that emerged across Dublin city in response to an abnormal pattern of weather phenomena in the first quarter of 2018. The role of the live performer is mostly relinquished to the data, with the performer seeding musical ideas that are then further developed by the generative system.

2. PERFORMANCE SYSTEM

The performance will be realised through the prototype 'PerformIoT' system. PerformIoT is a simple system written in Python for leveraging IoT data in live electronic music performance. PerformIoT has grown out of work undertaken to sonify IoT network data from Pervasive Nation, a nationwide IoT network test bed operated by CONNECT, the Science Foundation Ireland Research Centre for Future Networks headquartered at Trinity College Dublin. PerformIoT retrieves data from the relevant API and maps it to OSC or MIDI for use in a live performance setting. In the case of this performance air quality and surface water level data measured by the EPA (http://www.epa.ie) and ambient sound level data provided by Dublin City Council and Sonitus Systems (http://dublincitynoise.sonitussystems.com/) is mapped to MIDI and used to control parameters of a generative music system developed for Ableton Live 10 and Max 8. There are three main generative components to the system. The performance component records and loops incoming content improvised by the player using the Lemur IOS app for iPad. The harmonic generative component generates harmonic content and the electroacoustic generative component generates electroacoustic textures and gestural motions from simple sine wave inputs. Data is mapped to control parameters on three separate levels across each component roughly comparable to micro, meso and macro levels of control: the MIDI level, synthesis level and post level. For the generative music creation process, data is mapped at the midi level to control the chance that a note will play, its possible pitches and its length. For the performative component the player performs a motif or section of music. This is then looped and the data controls how far the loop deviates from the original recording on each repetition. Drawing from the works of Reich and Eno mentioned earlier multiple loops can be created in this way allowing for a kind of evolved approach to phase shifting at the meso level. At the synthesis level the performative component and the harmonic generative components utilize wavetable synthesis. The timbres are designed to metaphorically represent the different data streams. This represents the micro level and the mapping on this level is rich and complex and will be discussed in greater detail in a future publication. Examples of parameters mapped include amplitude envelopes, filter resonance and cutoff values, delay times and most crucially the patterns of movement across the Wavetable. Mappings on this level are informed by developments in the field of embodied cognition. On the post level the data is mapped to modulate how each of the components is processed using distortion, stereo image, filtering, and reverb. This allows for the division of the piece into three distinct parts on the macro level. Mappings on this level were influenced by the Basinski pieces discussed earlier. Data can be mapped on this level to control the rate of distortion giving rise to new sonic materials controlled by the data.

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References:

Barrett, Natasha, and Karen Mair. "Aftershock: A science–art collaboration through sonification." *Organised Sound* 19, no. 1 (2014): 4-16.

Collins, Nick. "Generative music and laptop performance." *Contemporary Music Review* 22, no. 4 (2003): 67-79.

Collins, Nick. "The analysis of generative music programs." *Organised Sound* 13, no. 3 (2008): 237-248.

Drakopoulou, Sophia. "Spatiotemporal experience through the use of ICTs and smart devices: a comparative analysis of the theories of Bergson and Lefebvre." (2012).

Hegarty, Paul. "The hallucinatory life of tape." *Culture Machine* 9 (2008).

Hunt, Andy, Marcelo M. Wanderley, and Matthew Paradis. "The importance of parameter mapping in electronic instrument design." *Journal of New Music Research* 32, no. 4 (2003): 429-440.

Lefebvre, Henri. *Rhythmanalysis: Space, time and everyday life*. A&C Black, 2004.

Pafka, Elek. "Places as intersecting flows: Mapping urban morphologies, functional constellations and pedestrian rhythms." In *4th Global Conference: Space and Place. Mansfield College, Oxford*. 2013.

Polli, Andrea. "Soundscape, sonification, and sound activism." *AI & society* 27, no. 2 (2012): 257-268.

Roddy, Stephen, and Dermot Furlong. "Rethinking the transmission medium in live computer music performance." *Irish Sound Science and Technology Convocation, Dún Laoghaire Institute of Art, Design and Technology* (2013).

Scaletti, Carla. "Sonification≠ Music." *The Oxford Handbook of Algorithmic Music* (2018): 363.

Scherzinger, Martin. "Curious Intersections, Uncommon Magic: Steve Reich's It's Gonna Rain." *Current Musicology* 79/80 (2005): 207.