THE MTU LAPTOP ENSEMBLE: INTEGRATING HYBRID SYNTHESIS, SPECTRAL SONIFICATION AND GESTURE ANALYSIS INTO PRACTICE-BASED PERFORMANCE

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ABSTRACT

The MTU Laptop Ensemble (MTULE) was formed in 2025 to translate several concurrent lines of research inquiry into live performance practice through the medium of laptop orchestra. In this paper, we first offer a brief overview of laptop orchestra performance as a computer music aesthetic, highlighting key characteristics, technologies, and historical developments. We then describe the research topics currently being investigated by three members of the ensemble, including a Granular-Markov hybrid synthesis system, spectral-based data sonification, and real-time gestural control using Bluetooth Low Energy (BLE) Inertial Measurement Unit (IMU) sensors. We then give a narrative account of the co-creative experimental process of integrating these separate approaches, that resulted in the iterative development of a cohesive composition, since presented at several public performances. We reflect on how the interplay between performer input and algorithmic response, and the constraints and affordances of each system, shaped both the compositional process and its outcomes, positioning the laptop orchestra as a productive format for research-led artistic practice.

1. INTRODUCTION

Founded in 2005, the Princeton Laptop Orchestra (PLOrk) [1] is widely regarded as one of the first ensembles of its kind, though precursors such as the San Francisco-based League of Automatic Composers (1975–1987) [2] were already incorporating microcontrollers into collective performance, describing their work as a kind of “silicon orchestra”, and “[approaching] the computer network as one large, interactive musical instrument made up of independently programmed automatic music machines, producing a music that was noisy, difficult, often unpredictable, and occasionally beautiful.”. PLOrk established several baseline characteristics that have influenced similar ensembles worldwide. A key early challenge was sound propagation: acoustic instruments radiate sound diffusely and three-dimensionally, whereas laptop setups rely on directional loudspeakers at source or front of house. To address this, PLOrk developed open-source "hemispherical loudspeakers" with six distributed cones that approximate the radiation properties of acoustic instruments. Other ensembles have since proposed simpler alternatives, such as using Ikea salad bowls as speaker cavities [3].

Figure 1: PLOrk in performance with hemispherical speakers (Image from Seth Cluett: `https://sethcluett.com/works/zero-point/`)

Considerable academic discourse has emerged concerning the practice of composing for laptop ensemble [4–6], improvisation [7–9], conducting [9, 10], creativity [11] and its pedagogy [12, 13], including the integration into programme curriculums [14]. As well as sound propagation (as touched on above), musical improvisation has been noted in this discourse as an important tool for the exploration of newly-developed digital instruments, and also intentionally as a compositional technique. The laptop ensemble also brings into question the role of musical conductor. Traditional conducting (with one person providing gestural cues to an ensemble of performers) is still an effective technique, but network and sensor technologies open up many new possibilities: for example a computer program can automatically conduct a human ensemble visually or over the network, or a human can conduct an ensemble of autonomous digital instruments equipped with visual sensors. Digital instrument control is also discussed frequently. The laptop itself is often used as the primary controller by ensemble members, through the touchpad, mouse and keyboard. A large number of off-the-shelf Human Interface Devices such as game controllers have been used successfully in performance, and it is also common for ensembles to implement their own custom controllers. The development of novel digital instruments is obviously a fundamental part of many laptop ensembles, and so the roles of composer, performer and instrument maker often overlap. Bespoke laptop orchestra oriented tools and platforms have been developed that extend existing multimedia languages and environments such as Max/MSP or Pd. For example Virginia Tech's Linux Laptop Orchestra (L2Ork) [15] have built up a considerable software ecosystem around their practice, centred around a custom version of Pure Data titled 'Pd-L2Ork' [16] that ships with many externals and redesigns the UI front-end using HTML5, that since has produced the offshoot 'Purr Data' [17].

Closer to home, here in Ireland the now defunct Dublin Laptop Orchestra was set up by Alex Dowling and Dan Trueman in 2011, with a focus on "bringing theatricality and physical presence into electronic music performance". [1] They have collaborated with other ensembles including Crash Ensemble and our state broadcaster's RTÉ National Symphony Orchestra. The Cork Audio Visual Ensemble (CAVE) [2] meanwhile sets out to "explore the relationship between the physical (carbon-based) and the digital (silicon-based) worlds" and have developed specialised hardware controllers such as "The Box" using piezo transducers along with temperature and light sensors. Notably, CAVE was invited to perform at ICMC / SMC 2014. [3]

Knotts & Collins [18] carried out a survey of 160 laptop ensembles worldwide from the perspective and lens of their organisational structures and the concept of democracy which they define as the "governance by members of the group". They further drill down into key facets that include the number of members, whether there is a specific conductor role, software usage heterogeneity and extent of networking (i.e. how connected is the computer infrastructure). One crucial aspect that wasn't considered in this survey is the sound propagation method used by each ensemble. Different organisations also diverge in their use of sound propagation approaches as alluded to earlier. The survey and the ensembles we have highlighted reveal the unique culture and identity inherent to each group. This understanding has been at the forefront of our thinking as we begin to define our own collective. Initially formed as a creative outlet for the funded research and collaborative projects we were undertaking, the ensemble has gradually developed its own distinct character and direction.

This framing also bears on how we understand the ensemble's music itself. A recurring theme in the aesthetics of generative and computer-based art is that the most compelling results tend to emerge at the boundary between order and disorder [19]. In music cognition the same intuition appears as the idea that listening pleasure depends on a balance between expectation and its violation [20]. This principle, that aptly-judged unpredictability (as opposed to novelty as such) sustains interest, informs out attention to systems that couple performer input with algorithmic response, an idea we explore further under the umbrella of structured uncertainty in Section 2.1.

The paper is structured as follows. Section 2 will discuss each technical approach taken by the performers and co-composers of the ensemble, stemming from their individual lines of inquiry. Section 3 then describes the coming together and co-creative collaborative process that led to the devising of a 20-minute composition. We conclude in Sections 4 and 5 with some reflections on our first two public performances and a look towards the future.

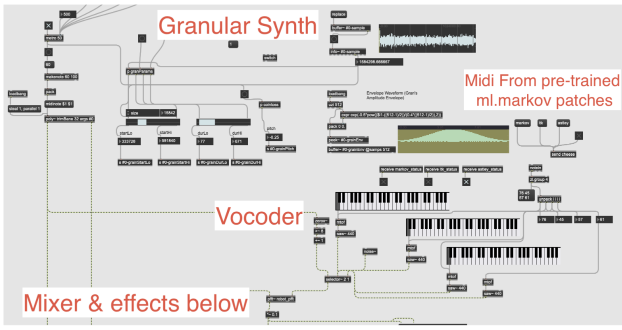


Figure 2: Granular-Markov Hybrid System

2. TECHNICAL APPROACHES

In this section we summarise the separate strands of research that members of the ensemble have been working on that are brought together in collective performance, including:

1. A Granular-Markov Hybrid System
2. Spectral-based Data Sonification
3. Gesture Analysis with BLE/IMU Sensors

2.1 Granular-Markov Hybrid System

Providing a clear and consistent timbral anchor within the ensemble, this instrument is implemented as a Max/MSP patch comprising four modular components: (1) a granular synthesiser, (2) a Markov-based symbolic system (running in a separate patch), (3) a vocoder module, and (4) a mixing and effects stage for shaping and blending outputs (see Figure 2). The basic patches are also included in a Github repo. [4]

At its core is a granular synthesis engine, developed over several iterations and informed by approaches outlined by Oliver Thurley [5] (building on Curtis Roads' foundational work [21, 22]). The design incorporates high-level control over grain position and duration while deliberately incorporating stochastic variation in playback. The system allows material to emerge within bounded constraints, producing continuously shifting textures from a shared pool of source audio.

[1] https://www.alex-dowling.com/laptop-orchestra
[2] https://cave-art.com/
[3] https://www.icmc14-smc14.net/program/conference-program/music_program.html
[4] https://github.com/plurdist/markovular_synth
[5] https://www.youtube.com/watch?v=g3nAeDWgf9Y

Alongside this, a separate patch hosts a Markov-based musical system centred on the ml.markov object (part of the ml.* family of objects developed by Benjamin Day Smith [23], following principles demonstrated by Samuel Pearce-Davies. [6] Markov chains model the likelihood of one musical event following another, based on patterns learned from training data [24]. As a classical and computationally lightweight form of AI, they are well suited to real-time musical applications where responsiveness and stability are important [25]. In practice, this means the system generates new note sequences that retain stylistic traces of the source material without reproducing it exactly. The system is trained on MIDI material prior to performance and, once activated, automatically generates note streams at a controllable cadence, which are routed to the main patch.

Keeping the Markov system external (as opposed to embedding it as a subpatch) serves two purposes. Practically, it increases modularity, allowing flexible routing, duplication, or substitution. More importantly, it introduces a degree of operational opacity: once initiated, the system runs as semi-autonomous musical influence. While its general behaviour is modulated through training and parameterisation, its moment-to-moment output remains, at best, only partially predictable. This aligns with what has been theoretically framed as structured uncertainty - a set of conditions in which nuanced and contextual constraints within an otherwise stochastic space can encourage fruitful co-creative sessions with AI music systems [26].

A vocoder module links these two domains, using the Markov-generated MIDI as control data for material derived from the granular engine. This produces hybrid textures in which continuously generated symbolic musical structures can be mapped onto the granular sonic palette. The result is a distinctive voice that can be sculpted, controlled, and blended via the mixer module. [7]

The final stage consists of an eight-channel stereo mixer and effects chain incorporating reverbs, glitch processing, and additional VST-based treatments. Each channel represents a different "view" of the same underlying material; for example, untreated granular output, time-stretched or reversed variants, and vocoded signals. This structure allows for nuanced control over density, spatialisation, and spectral balance during performance.

Taken together, these components present an opportunity to explore a series of slowly evolving sonic environments that are internally stochastic, while also subject to higher-level guidance from an autonomous generative process. The result is a more performative sense of uncertainty, where the system produces outcomes that are not fully determined in advance but remain musically coherent and usable in performance. In the context of the ensemble, this functions as both a stabilising timbral layer and a source of subtle variation. This works well with the broader thematic direction of the work, where ambiguity, drift, and mediated control emerge through the interaction between human performers and generative systems, reflecting wider concerns around societal systems that can influence human experience in unpredictable and often opaque ways.

[6] https://www.youtube.com/watch?v=LG-GYFyJw74
[7] https://www.youtube.com/watch?v=7j201PMRiH8

Figure 3: Granular-Markov Hybrid System Prototype v0.1 in performance at Cork Midsummer Festival, 2024

The instrument has undergone several iterations. An early version was developed for a collaborative performance at Cork Midsummer Festival 2024 [8] (Figure 3), after which additional control was introduced over temporal behaviour in the granular engine, alongside expanded mixing and effects capabilities. A subsequent iteration was presented at the NIME 2024 workshop *First-person and second-person perspectives for ML* in NIME [27] [9], where feedback led to a simplification of the Markov system (from multiple interacting chains to a single model) in order to reduce unnecessary complexity in performance.

In its current form, as used in MTULE, the system has proven well suited to ensemble work. Source materials include self-recorded percussive sounds, archival music and speech (e.g., from `archive.org`), and Uilleann pipe recordings [10], all of which are recontextualised through the granular process into a cohesive but continuously shifting sonic field.

2.2 Spectral-based Data Sonification

Auditory displays and data sonification can be thought of as counterparts to visual representation, and attempts have been made to apply visualisation theory directly to data sonification. Rather than adopting theory from one domain and applying it to another, this line of research uses visualisation theory (e.g. [28]) as a benchmark, and explores how theories of sonic representation and an awareness of established listening practices might be usefully applied to auditory display design and data sonification.

The spectrograph has become ubiquitous in scientific and engineering contexts to allow the time-varying frequency components of a signal to be visualised [29]. Spec-son is an exploratory sound analysis-resynthesis tool built in

[8] https://triskelartscentre.ie/9-57-sunset-at-triskel/
[9] https://pelinski.github.io/first-and-second-person-perspectives-ml-nime/assets/7_eric_browne.pdf
[10] The Uilleann pipes are Ireland's native bagpipes and recognised as a UNESCO Intangible Cultural Heritage. They are quieter sounding than the Scottish Great Highland bagpipe, with air being pumped through via the elbow ('uilleann' is the Irish word for 'elbow'.)

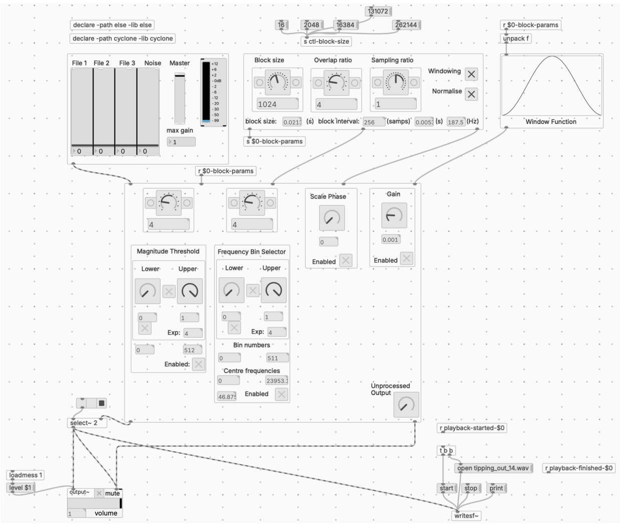


Figure 4: Spec-son Performance Patch

plugdata [11] (Figure 4) that attempts to allow the spectrographic process to be heard rather than seen. A Github repo for the Spec-son patches is provided. [12] It draws inspiration from previous work on the recursive concept of sonifying acoustic data [30, 31]. As with a traditional spectrograph, short-time Fourier analysis is performed on the input signal to calculate magnitude and phase values for each frequency bin in the analysis window, using the builtin `rfft~` object. Instead of using the magnitude values to plot a spectrogram, they are used to resynthesise the input signal with `rifft~`, while allowing the phase values for each frequency bin to be set to zero. In this way, Spec-son can discard the input signal's phase information, to produce a sonic representation of the spectrographic process. It employs exaggerated FFT sizes alongside configurable parameters for selective bin peak-picking to allow a wide palette of sounds to be generated. In this sense, Spec-son is a sonification approach that extracts and transforms information from existing sound, for example, uncovering latent tonal patterns within rhythmic material, or revealing fundamental rhythmic qualities embedded in sustained tones. Depending on the parameter space, this process can produce curious spectral smearing and resonant effects that drastically alter the timbral and tonal character of the input signal.

When applied to speech, the resulting resonant accumulation is reminiscent of the latter half of Alvin Lucier's iconic process piece *I am Sitting in a Room*, in which repeated playback and re-recording of the artist's voice gradually surrenders its linguistic content to the resonant frequencies of the space, foregrounding the psychoacoustic and phenomenological qualities of the room itself [32]. In the case of Spec-son, artifacts introduced by spectral analysis and re-synthesis with the Fourier transform are emphasised, allowing the sound of the spectrographic process to be heard and used in a musical context.

A first experiment with Spec-son was carried out on the audio of a TED talk titled The Tipping Points of Climate Change and Where We Stand, given by Johan Rockström, Director of the Potsdam Institute for Climate Impact Research. [13] In the talk, Rockström explains how Earth systems that support and regulate the biosphere (climate stability, biodiversity, ocean chemistry) are being pushed beyond safe limits by human activity, approaching tipping points beyond which the equilibrium that has sustained life for millennia may be irreversibly disrupted. Spec-son was used to warp the talk's audio using an automated but chaotic control process that enacts an analogue of this very dynamic: at certain parameter configurations the system rests at an equilibrium that preserves the intelligibility of Rockström's speech, but when critical thresholds are exceeded, comprehension collapses - mirroring, in sonic form, the destabilisation the talk describes.

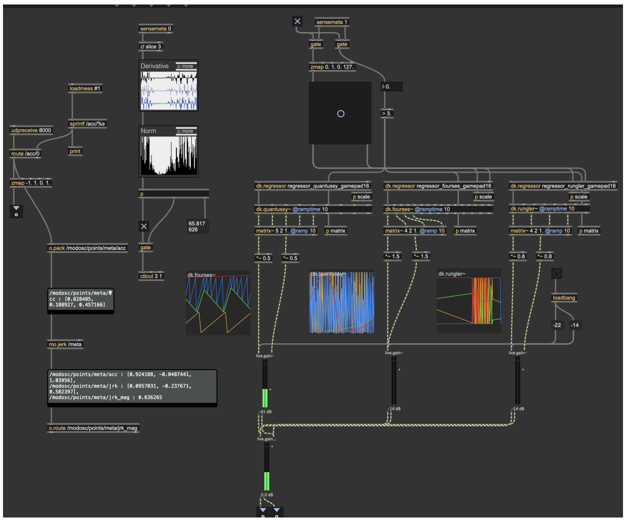
In the context of MTULE, Spec-son has been used with a variety of long (> 20 minutes) speech audio samples which are manipulated in real-time by the performer using the laptop as an inferface. This allows a palette of abstract 'spectrographic' sounds to be explored and improvised with musically in response to the other sonic elements generated by the co-creative ensemble. It also allows this abstract content to be intentionally morphed back into the intelligible source audio, adding a layer of symbolic textual meaning to performances.

2.3 Gesture Analysis with BLE IMU Sensors

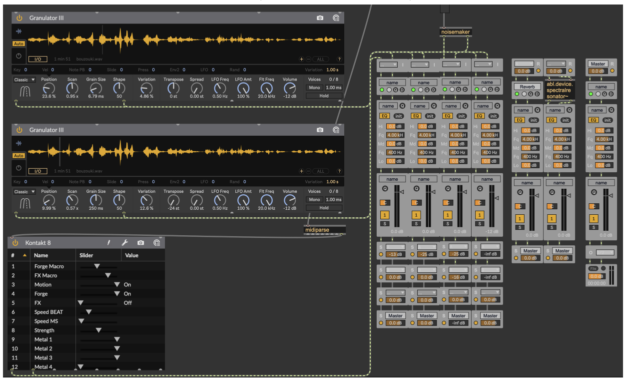
Since the emergence of the first laptop orchestras, its practitioners have been exploring more expressive ways for interacting with live performance, integrating extensive research from the New Interfaces for Musical Expression (NIME) community. Early footage from the PLork for example show the repurposing of gaming-focussed Human Interface Devices (HIDs) like the Wiimote or even the built-in accelerometers in older model Macbooks [14] to provide more expressive, embodied control of computer music software.

In collaboration with the Nimbus Research Centre at MTU, which specialises in cyber-physical systems (CPS) and the Internet of Things, we are developing an extensible wearable sensor ecosystem designed to capture environmental and biometric data from performers in real time. The long-term goal is to incorporate diverse sensing modalities - including environmental lighting, air quality and temperature, as well as electromyography (EMG), electroencephalography (EEG), and electrocardiography (ECG) - as expressive control sources for sound spatialisation and synthesis. While the current implementation instruments the performers themselves, the architecture is being designed to also support distributing sensors among audience members, enabling them to become active contributors to the sonic output. This participatory model blurs the conventional boundary between performer and spectator, fostering collective creative agency and ensuring that

[11] https://plugdata.org/
[12] https://github.com/briansheehan/spec-son-plugin
[13] https://www.youtube.com/watch?v=Vl6VhCAeEfQ
[14] used at the time to detect shocks to spinning Hard Disk Drives (HDDs)



(a) Gesture analysis and chaotic synthesisers



(b) Granular synthesis, effects and mixer

Figure 5: Gesture Sound System

each performance is shaped by a unique, unrepeatable configuration of human input.

As an initial proving ground for the signal acquisition and audio processing toolchain, we focused on motion capture using body-worn inertial measurement units (IMUs). For this first implementation, lightweight BLE-connected IMU sensor boards were selected for their low power consumption and minimal form factor, both critical requirements for unobtrusive attachment to performers during live movement. Building on prior work in IMU-driven spatial audio - notably the Mach1 Spatial System's head-tracking examples [15] - we developed a purpose-built JUCE command-line application [16] that acquires data from multiple IMU devices simultaneously and distributes it via OSC to an arbitrary number of listeners defined in a JSON configuration file. The application streams three-axis accelerometer and magnetometer data at 100 Hz and gyroscope data at 25 Hz. In addition, on-board sensor fusion provides nine-degree-of-freedom (9-DoF) absolute orientation output (NDoF), yielding more stable heading estimates than raw gyroscope integration alone.

The choice of mapping strategy is one of the crafts that make up an expressive and virtuosic NIME, and Hunt and Wanderley have shown [33] that complex mappings that use one-to-many or many-to-many offer the most rewarding experiences for the electronic musician. For this work we experimented with a number of different techniques combining simple mappings to higher-level feature-based gestural analysis, in the control and interaction with two sound generation methods (Figure 5a).

Firstly Robert Henke's Granulator III [17] was used with a single recording of an Irish bouzouki, but with different extended articulations and techniques like scratching, scraping, bowing and plucking behind the nut etc. to create a rich variety of timbres within the same sample. Two interaction metaphors were employed, beginning with a sort of "MIDI theremin": random MIDI notes are generated through movement detection of the sensor and sustained through continuous movement of the sensor until it falls below a lower threshold, based on the vector norm of the first derivative of the accelerometer data, computed using the Gestural Sound Toolkit [34]. This has the effect of starting a new phase of granular synthesis and scanning through the waveform while the performer is making a gestural movement.

For the second sound generation method we adapted several chaotic synthesisers available in the Data Knot library by Rodrigo Costanzo [18], a user-friendly interactive machine-learning toolkit built around the Fluid Corpus Manipulation(FluCoMa) library [35]. These include digital recreations of analog hardware modules such as the Quantussy, Fourses and the Rungler. Taking the Gamepad example as starting point, and also echoing some techniques for interacting with concatenative synthesis by Diemo Schwarz [36], we projected accelerometer forces from 2 axes to the sets of parameter spaces for each of the instruments using machine-learning regression. Finally, using the 'jerk' feature available in the GIMLeT pedagogical toolkit for Max [37], sharp movements are predicted to cause a rapid reset of the synth parameters creating a burst of randomness. In practice this was a playful and intuitive mapping to learn and perform with, and with informal testing of other users they quickly learnt to find quieter, static gestural and positional "zones" to balance the chaos and noise.

3. CO-CREATIVE COMPOSITIONAL PROCESS

3.1 First Iteration

In ensembles that do not conform to strict score-driven performance, repertoire may be entirely composed, freely improvised, or occupy positions between these poles. When we assembled as a collective with the intention of making music, we began by discussing the lines of research presented in Section 2 and attempting to establish a consensus. We were cognisant of the political facets highlighted by [18] in determining the division of roles, as well as the "scale of democracy" underpinning both decision-making and musical output. While many groups operate through clear hierarchies or explicit delineations between the roles

[15] https://www.mach1.tech/
[16] https://github.com/carthach/MetaOSC

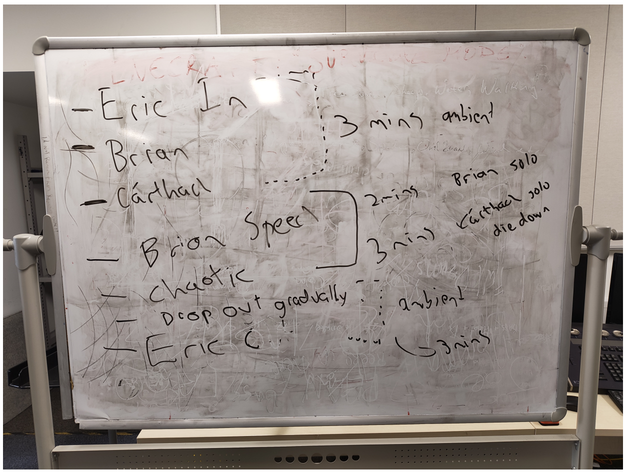
[17] https://roberthenke.com/technology/granulator3.html
[18] https://cdm.link/data-knot-for-max-machine-learning-as-musicians-want-it/

of composer, performer, and designer, this piece benefited from a flat organisational structure. This may change as new members join, more repertoire is established, or the practice becomes integrated into the pedagogical delivery of degree programmes.

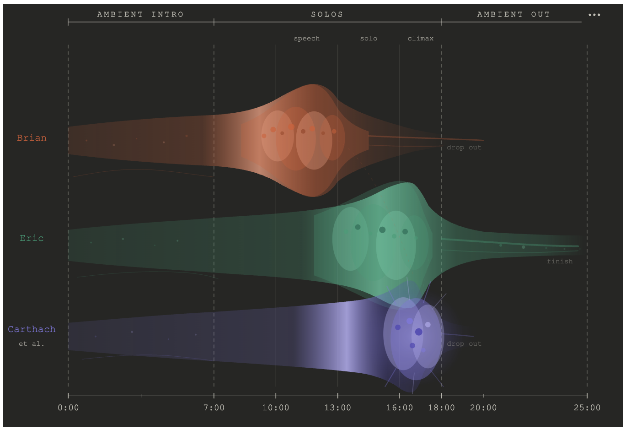
We agreed to use our respective music-making tools in creation of two contrasting sound families, one more sustained with a clear tonal centre, while the others more percussive, noise-based or drawing from everyday sounds like speech. At the time of writing we don't have access to hemispherical loudspeakers, but we were in strong agreement from the outset that we still wanted individual sound emission associated with each laptop. As a compromise each member of the ensemble used a single mono Genelec 8040a loudspeaker associated with each station, positioned strategically to afford some monitoring to the performer while directed as best as possible into the space for the audience and other performers (Figure 7).

After spending some time gathering and tweaking these sounds and hearing how they interact with each other in the same space, we used a whiteboard to brainstorm a loose structure to guide a first attempt at performing together with a coherent arc and sonic narrative. Letting the nature and materiality of the sounds guide us they suggested a build towards a specific climax that centred around a processed speech sample giving way to a chaotic breakdown of noise and feedback, dissipating gradually to nothing with AI driven granular re-textualisation of Uilleann pipe samples as described in Section 2.1.

After this initial run through, we reflected on the process and discussed what we felt worked, what didn't and what could be improved sonic-wise and structurally. We then felt ready to run again; this time with the tape rolling (a phone recording in the middle of the room) for more focussed listening and critique. These recordings were cleaned up using automatic mastering (iZotope Ozone), archived and shared. [19]



(a) Initial whiteboard sketch of structure



(b) Claude.ai generated graphic score showing accumulated intensity curves inferred from developing textual sketches

Figure 6: Score and structure development

3.2 Second Iteration, Thematic Emergences and Visual Music

After this first iteration we spent some time listening back to the various recordings captured in rehearsals and tweaking our respective tools and technologies in our own time. When we regrouped, we discussed and compared notes, agreeing that certain thematic signs had emerged touching on climate change, dystopia and the more sinister aspects of technological progress. These thematic inspirations further shaped our sound choices and allowed us to extend the composition temporally to give them sufficient space to fully develop and evolve.

Consideration then turned to building a visual language around the sound world that reflected the aesthetics and themes through moving image. Initially, we started tinkering with the Touch Designer visual development platform, feeding abstract monochrome generative shapes that responded in real-time to the same OSC data captured from the sensor, combined with processed found footage from nature, reflecting the natural gestural arc that gradually evolves from static, slow-moving material into dynamic, fast moving gestural movement. These experiments, while highly responsive to live interaction are still in prototypical stages, but served as concept artwork for programme fliers, Soundcloud etc. (Figure 8). In the meantime, we engaged with installation artist Aoife Claffey [20] , whose visual aesthetic and creative practice-based research complemented the directions we were taking. In her own words,

> ...her work explores human sensory perception through immersive environments that merge interactive projections, sculpture, and sound. Her research engages site-specific spaces, interdisciplinary collaboration, and emerging questions of ethics and trust in technology.

For this performance, a series of projected video footage was presented, composed from slow-motion macro recordings captured during a residency at the Creative Center of Stöðvarfjörður in Iceland. The material focuses on melting ice, flowing water, natural surfaces, and fragments of architectural form, displayed to emphasise texture, distor-

[19] https://soundcloud.com/mtu-laptop-ensemble/thursday-18-12-25-1

[20] aoifeclaffeyart.com

Figure 7: Audiovisual performance at gallery for *Soft Cells*

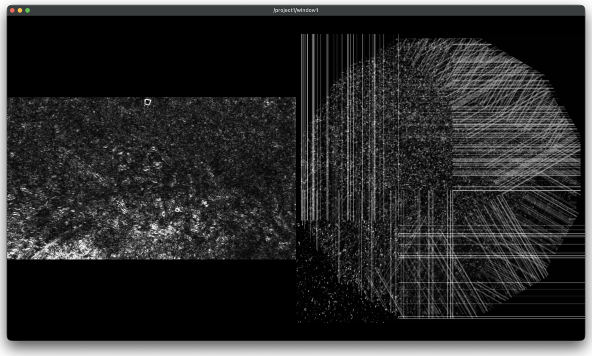


Figure 8: Generative Visual Output from Touch Designer

tion, and temporal suspension. The imagery moves between fragile, organic states and more rigid, constructed structures, blurring distinctions between clarity and flux.

Reflecting similar thematic concerns, such as climate instability and technological mediation, the visuals shift between contemplative passages and moments of digital noise. Here, noise and processing are used not as distraction but to draw attention to material detail and perceptual change, creating a subtle connective layer that engages the audience alongside the gesture-driven sound. Projected centrally in the space, the work functions as a parallel visual layer that complements the tonal direction of the piece.

Rehearsing alongside these running visuals was inspiring and listening back to the latest demo recording [21] we were making sufficient progress and developing a confidence to perform the 20-minute work we titled *Fractures* in public.

4. PERFORMANCES AND EXHIBITIONS

4.1 Soft Cells - Exploring transitional states and biological [un]certainties from a creative perspective

The first performance of *Fractures* took place as part of the exhibition series *Soft Cells* in January 2026. Curated by Diarmuid Ó Spealáin, Dervla Baker and Nic Flanagan for the Disruptive Media Lab, this multimedia (sound art, film, VR/immersive, print media, and zine-making) and multisite (James Barry Gallery, Cork City Ireland; XAMK, Mikeli Finland and University of Rouen, Évreux, France) brought together artists, creative technologists and scientists sharing diverse 'methods materials and imaginations' [22] . This typical 'white box' gallery space proved an ideal venue for the performance, with its complete floor to ceiling projection and minimal furnishing. Our decision to use individual speakers allowed us to manage levels discreetly and adapt to the hard reflective surfaces of the space more easily than attempting to carve out clarity and coherence in a combined mixing configuration. A short promotional video highlighting the performance is available to view [23] .

[21] https://soundcloud.com/mtu-laptop-ensemble/thursday-15-01-26-2
[22] https://arts.mtu.ie/viewEvent?id=1650
[23] https://youtu.be/qLPgHpRKu_w

4.2 Le Chéile

A second performance took place a few months after Soft Cells, this time as part of an exhibition, series of talks and performances celebrating our institution as an arts-rich university [24]. This time, the audiovisual setting was much more challenging; we were performing during a reception in a typical art college classroom setting while the audience and participants freely moved and conversed outside. Hard, reflective surfaces meant volume levels were loud within the room and lacked clarity, while the performance was quite inaudible for those outside unless they stepped into the space. Lighting conditions were also poor which meant the impact of the visuals was lessened by the flood of natural light from the street outside. Still, the performance was well-received, and afterwards we played the recordings from the previous performances in a loop in an installation setting which allowed participants to come into the space, move around and inspect/interact with the technology.

5. CONCLUSIONS AND FUTURE WORK

Since the inception of the Princeton Laptop Orchestra and the flourishing of a 'scene' around laptop ensemble music making, myriad approaches have emerged that reveal the unique culture and identity of specific collectives. In this paper we have examined a few of those important developments in its history. We set out our own aims and objectives for the basis of our MTULE (MTU Laptop Ensemble), describing several disparate lines of technical research and development and how we consolidated them into practice-based creative output through iterative, co-creative collaboration. Summaries of two initial performances detail how this work was presented to the public, with several artifacts emerging that document the evolution and process.

The co-creative process of composing a piece collectively is inspiring and offers flexibility and inclusivity for diverse tools, technologies and aesthetics. In our most recent rehearsals, we have begun studying the repertoire of other composers who have written for laptop orchestra from an individualistic creative standpoint, often using simple tools that provide a more accessible pathway into laptop ensemble performance. For example, Joo Won Park has built a prolific and diverse body of work that ranges from very technical, (e.g. using Supercollider), to "low tech" pieces that use everyday web browsers. [25] We are also exploring options for building our own hemispherical loudspeakers, potentially framing the work around final year project topics for engineering or MA/MSc in Music & Technology students.

While our primary focus has been on human-human co-creative development of the piece alongside our performance system, given the semi-autonomous nature of some aforementioned computational components of the ensemble, there is clear scope to further explore human-computer co-creativity [38] by drawing on the growing awareness of interaction design [39], enactive and embodied approaches [40] as fruitful methods of interrogating the nuances of this burgeoning subfield of creativity. This is somewhat in contrast to "non-cooperative" computationally creative approaches that tend to evaluate the creativity of generative computational outputs largely in isolation [41].

[24] Le Chéile translates to 'together' in the Irish language

[25] https://joowonpark.net/ensemble/

Acknowledgments

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