music proceedings

2019

Music Proceedings of the International Conference on New Interfaces for Musical Expression, NIME'19, June 3-6, 2019, Porto Alegre, Brazil

Edited by Federico Visi

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Introduction

Porto Alegre, Brazil, 30 May 2019

Since NIME began nearly two decades ago, this is the first event where composers and creators of the music pieces in the concert programme have been invited to publish an extended abstract of their work. These documents, describing the aesthetic and technical characteristics of the music pieces, are collected here, in the Music Proceedings.

We believe Music Proceedings are an important step towards a consistent and richer means of documenting the performances taking place at NIME. This will be a useful resource for researchers, and provides an alternative voice for contributors to speak about their artistic practice in NIME research.

The Music Programme of NIME 2019 includes an audacious mix of performances. They feature digital and traditional musical instruments, experimental hardware, unusual interfaces, live coding, and much more. Established practices and adventurous explorations come together, resulting in a broad aesthetic spectrum that demonstrates how lively and diverse NIME artistic practice has become over the years.

We have faith that this new approach of documenting the concert pieces presented at NIME will be further enhanced and refined by the community in the future. That being said, no form of documentation, no matter how sophisticated and detailed, can replace being present in the audience as the performance unfolds. These abstracts are blueprints of the creators' thoughts and ideas, which come to life every time the pieces are performed. We sincerely hope that these Music Proceedings will inspire future NIME research and artistic work, and we look forward to experiencing the pieces that will be performed soon at NIME 2019 in Porto Alegre.

Federico Visi
NIME 2019 Music co-chair

Rodrigo Schramm
NIME 2019 General co-chair

NIME 2019 Concert Program

Salão de Atos of UFRGS, Porto Alegre, Brazil – Monday, 3 June 2019, 20:00

TROIS MACHINS DE LA GRÂCE AIMANTE (CORETET NO. 1)
ROB HAMILTON, Rensselaer Polytechnic Institute, Troy, United States

iCONS
RODRIGO F. CÁDIZ, Pontificia Universidad Católica de Chile, Santiago, Chile

UNCERTAIN RHYTHMS
PAUL STAPLETON, Sonic Arts Research Centre, Queen's University Belfast, United Kingdom

VERSE N.1
LUIZ NAVEDA, State University of Minas Gerais, Belo Horizonte, Brazil State University of Minas Gerais, Belo Horizonte, Brazil
NATACHA LAMOUNIER, State University of Minas Gerais, Belo Horizonte, Brazil State University of Minas Gerais, Belo Horizonte, Brazil

VRENGT: A SHARED BODY-MACHINE INSTRUMENT FOR MUSIC-DANCE PERFORMANCE
ALEXANDER REFSUM JENSENIUS, University of Oslo, Norway
CAGRI ERDEM, University of Oslo, Norway
KATJA HENRIKSEN SCHIA, University of Oslo, Norway

TANTO MAR
ANDRE LOPES MARTINS, Universidade de São Paulo – USP, Brazil
PAULO ASSIS, Universidade de São Paulo – USP, Brazil

TEMPO TRANSVERSAL – FLAUTA EXPANDIDA
CASSIA CARRASCOZA BOMFIM, Universidade de São Paulo – USP, Brazil
FELIPE MERKER, Federal University of Pelotas, Pelotas, Brazil

Salão de Atos of UFRGS, Porto Alegre, Brazil – Tuesday, 4 June 2019, 20:00

GIRA
JOÃO NOGUEIRA TRAGTENBERG, SENAI Innovation Institute for ICT, Recife, Brazil
FILIPE CALEGARIO, SENAI Innovation Institute for ICT, Recife, Brazil

BAD MOTHER / GOOD MOTHER – AN AUDIOVISUAL PERFORMANCE
ANNINA RÜST, Florida Atlantic University, Jupiter, United States

COLLIGATION
JAMES DOOLEY, Royal Birmingham Conservatoire, Birmingham, United Kingdom

SELF-BUILT INSTRUMENT
JIYUN PARK, Academy of Media Art Cologne, Cologne, Germany

BORROWED VOICES: PERFORMATIVE SINGING SYNTHESIS FEATURING T-VOKS AND C-VOKS
CHRISTOPHE D'ALESSANDRO, LAM, Institut Jean le Rond d'Alembert, Paris, France
XIAO XIAO, MIT Media Lab, LAM, Institut Jean le Rond d'Alembert, Paris, France
GRÉGOIRE LOCQUEVILLE, LAM, Institut Jean le Rond d'Alembert, Paris, France
BORIS DOVAL, LAM, Institut Jean le Rond d'Alembert, Paris, France

DIY BIONOISE
SABINA HYOJU AHN, Kunstuniversität Linz, Linz, Austria

MUSICURSOR
MARTIM GALVÃO, Brown University, Providence, United States

PYTHAGOREAN DOMINO
ANA DALL'ARA-MAJEK, CIRMMT, Montreal, Canada
TAKUTO FUKUDA, CIRMMT, Montreal, Canada

Agulha Night Club, Porto Alegre, Brazil – Thursday, 6 June 2019, 20:00

KEYNOTE PERFORMANCE
ANA MARIA ROMANO GOMEZ, Universidad El Bosque, Colombia

WE BASS: INTER(ACTIONS) ON A HYBRID INSTRUMENT
MIGUEL ANTAR, University of São Paulo, São Paulo, Brazil
PAULO ASSIS, University of São Paulo, São Paulo, Brazil

FLEXSYNTH: BLENDING MULTI-DIMENSIONAL SONIC SCENES
TOM AJIN JIJI, McGill University, Montreal, Canada

FIBER OPTIC MIDI CONTROLLER
JESSE SIMPSON, New York University, United States

SOUND OF COMPUTING THE SIGNAL ANALYSIS OF GRAVITY WAVES
EDGAR BERDAHL, School of Music, Louisiana State University, Baton Rouge, Louisiana, United States

PANDEMONIUM TRIO
BARRY J. CULLEN, Sonic Arts Research Centre, Queen's University Belfast, United Kingdom
MIGUEL ORTIZ, Sonic Arts Research Centre, Queen's University Belfast, United Kingdom
PAUL STAPLETON, Sonic Arts Research Centre, Queen's University Belfast, United Kingdom

OPEN JACK NIGHT
Live collective improvisation event organised in collaboration with members of the Sonic Arts Research Centre, Belfast, United Kingdom.

Analogue to common "open mic" events at traditional venues, open jack is an open forum for musicians and audiences interested in electronic music. From known personalities to local electronic music enthusiasts, open jack is for all to join, jam, improvise and share music making in real-time.
The idea is simple: Electronic Art Music lives outside academia, open jack is all about the music. No prizes, no awards, no recognition, no building up your CV, no 3-page program notes explaining why anyone SHOULD like a performance or piece, no bringing your rehearsed stuff, no overthought overstructured compositions, no theories behind. Just live improvisation in a collective environment following the groove of the night.

Rules are straightforward:

- *Up to 4 performers on stage at a time.*
- *First come first plays basis.*
- *Performers are replaced one by one. Whomever enters the jam must join the music being played at that time.*
- *Any necessary setup is done by yourself as others are playing. You literally get one input into the mixer and are faded in when you are ready to play*

Program Committee Members

Aviram, Shani
Barton, Scott
Bellona, Jon
Blaine, Bean (Tina)
Bolles, Monica
Bussigel, Peter
Coffey, Ted
Donnarumma, Marco
Fefferman, Lainie
Gormley, Gerard
Greenlee, Shawn
Gurevich, Michael
Hagan, Kerry
Hatakeyama, Akiko
Hayes, Lauren
Hege, Anne
Hoffman, Elizabeth
Hsu, Aurie
Jackson, Yvette
Jaimovich, Javier
Jude, Gretchen
Kemper, Steven
Kimura, Mari
Kojs, Juraj
Leider, Colby
Masaoka, Miya
Monaghan, Úna
Parker Woods, Seth
Pluta, Sam
Scaletti, Carla
Schedel, Meg
Schramm, Rodrigo
Sonami, Laetitia
Stapleton, Paul
Stolet, Jeffrey
Warren, Kristina
Weisling, Anna

Bad Mother / Good Mother - an audiovisual performance

ANNA RÜST, Harriet Wilkes Honors College, Florida Atlantic University, Jupiter, FL, USA

1. PROJECT DESCRIPTION

Bad Mother / Good Mother is an audiovisual performance involving a projection, a modified electronic breast pump as a sound generator, and a sound-reactive LED pumping costume. The project has four songs that critically explore technologies directed specifically at women like breast pumps and fertility extending treatments such as egg-freezing (social freezing). Depending on the song, the breast pump is either a solo instrument or part of an arrangement. The idea is to use workplace lactation as a departure point to uncover a web of societal politics and pre-conceived perceptions (pun intended) of ideal and non-ideal motherhood.

Fig. 1. A still from a performance at the Situation Room in Los Angeles in February 2018

2. THE SONGS

The audiovisual performance has four “songs” consisting of sound and connected visuals that are projected during the performance. In the first and last song, the breast pump is treated as the solo instrument, in the two middle songs, the breast pump sound is part of an arrangement.

The first song uses the breast pump sound as a solo instrument. Thematically, the song is about different aspects of pumping breastmilk at work. It has two basic sounds: the sound of the milk letdown which is slower and the sound of the pumping which is faster. In the performance, I am switching between the two modes, playing them at different intensities. The visuals are still images of different breast pumping situations and the stresses related to extracting milk in a work environment.

The second song is about maternity leave. In the US, parental leave is not mandated by law. The visuals show (US) politicians displaying fake reverence towards women. The breast pump is playing in the background, defamiliarized by vocoding.

The third song is about freezing eggs to delay motherhood. Egg freezing is an elective medical technology that is sold to women as empowering because it allows women to delay motherhood by freezing their eggs. Because the motivations are social and not primarily medical, the procedure is also called “social freezing”. It is big business especially since large tech companies like Facebook have announced that they will pay for employees’ eggs to be frozen. Facebook was criticized for using this “benefit” to pressure women to delay motherhood. As if successful employeehood was not compatible with motherhood. The song uses the breast pump as the heavily vocoded lead vocals in a cover of Daft Punk’s “Get Lucky”.

The fourth song is improvisation, using filters to distort different aspects of the sound signal. The visuals are of a woman pumping. Individual movements are repeated rhythmically along with the sound. It signifies the repetitiveness of the pumping routine.

Fig. 2. The costume.

3. THE COSTUME

The costume is an exaggerated pumping top. Around the cut outs where the breast pump shields attach to the breast, it has seven rows of LEDs pointing outward like a star. The LEDs are attached to a microcontroller board. Each arm represents a frequency band. The LEDs therefore pulse along with the sound. However, the bands are lit individually depending on the energy content in this frequency band. It is designed similar to a rock star's costume. It ironically glamorizes the profoundly unglamorous act of using a breast pump in a world where women are encouraged to breastfeed or pump in private rather than use their pump in public.

4. TECHNICAL NOTES

The technical requirements for this performance are a projector, a PA system, and space on a table ca. 0.75m x 0.5m.

5. PROGRAM NOTES

Bad Mother / Good Mother is an audiovisual performance involving a projection, a modified electronic breast pump as a sound generator, and a sound-reactive LED pumping costume. The project has four songs that critically explore technologies directed specifically at women like breast pumps and fertility extending treatments such as egg-freezing (social freezing). Depending on the song, the breast pump is either a solo instrument or part of an arrangement. The idea is to use workplace lactation as a departure point to uncover a web of societal politics and pre-conceived perceptions (pun intended) of ideal and non-ideal motherhood.

6. MEDIA LINK(S)

- Video: https://vimeo.com/262568142

Borrowed Voices

CHRISTOPHE D'ALESSANDRO, LAM, Institut Jean le Rond d'Alembert, Paris
XIAO XIAO MIT Media Lab, LAM, Institut Jean le Rond d'Alembert, Paris
GRÉGOIRE LOCQUEVILLE, LAM, Institut Jean le Rond d'Alembert, Paris
BORIS DOVAL, LAM, Institut Jean le Rond d'Alembert, Paris

1. PROJECT DESCRIPTION

Borrowed voices is a performance featuring performative voice synthesis, with two types of instruments: C-Voks and T-Voks. The voices are played *a cappella* in a double choir of natural and synthetic voices.

Performative singing synthesis is a new paradigm in the already long history of artificial voices. The singing voice is played like an instrument, allowing singing with the *borrowed voice* of another. The relationship of embodiment between the singer's gestures and the vocal sound produced is broken. A voice is singing, with realism, expressivity and musicality, but it is not the musician's own voice, and a vocal apparatus does not control it.

The project focuses on ***control gestures***: the music explores vocal sounds produced by the vocal apparatus (the basic sound material), and "*played*" by the natural voice, by free-hand Theremin-controlled gestures, and by writing gestures on a graphic tablet. The same (types of) sounds but different gestures give different musical "*instruments*" and expressive possibilities.

Another interesting aspect is the distance between synthetic voices and the player, the voice being at the same time embodied (by the player gestures playing the instrument with her/his body) and externalized (because the instrument is not her/his own voice): ***two different voices sung/played by the same person***.

Fig. 1. T-Voks (Theremin + button, right) & C-Voks (stylus/tablet + button/surface, left)

2. TECHNICAL NOTES

Borrowed voices is part of a long-term research project on performative voice synthesis initiated at the *Speech Conductor workshop [1]*. Previous systems *Ramcess [2], Cantor Digitalis [3],* and *Vokinesis [4][5]*, explored various synthesis engines (formant synthesis, concatenative synthesis) and control interfaces (graphic tablet, MIDI and MPE keyboards, pedals, Puce-Muse MétaTouche, Touché, Expressive-E Touché, Theremin …).

This research has been accompanied by several musical performances and concerts featuring the ***Chorus Digitalis***, an experimental musical choir of synthetic voices. Note that performative voice synthesis systems have been developed in other research groups: the *Voicer [6]* or *Handsketch [7],* or for musical projects like *Luna Park* [8].

T-Voks (presented in an accompanying paper [9] is a Theremin-controlled voice synthesizer. This will be the first public appearance of this new instrument, with its impressive visual and sound presence. For T-Voks the Theremin's frequency antenna modifies the output pitch of the target utterance while the amplitude antenna controls not only volume as usual but also voice quality and vocal effort. An additional pressure sensor attached to the player's volume-control hand handles syllabic sequencing. Metrical control is needed for accurate syllabic timing control. A pair of control points defines each syllable, considered as the basic rhythmic frame. The *"arsis"* corresponds to the constriction (weak beat of the syllable) and the *"thesis"* corresponds to the vocalic nucleus (strong beat of the syllable). The left hand uses a force sensitive resistor (FSR) button for biphasic sequencing of rhythmic units (see Figure 1, left).

C-Voks is a voice synthesizer controlled by a pen on a graphic tablet, using drawing gestures and a new version of the Vokinesis system [6][7]. Different modes of timing control are available: speech rate, scrubbing and metrical control. The speech rate mode corresponds to direct control of the signal playback speed. Scrubbing corresponds to direct control of the playback time position. Metrical control is the same mode as used in T-Voks. The non-preferred hand or feet using a button or pedals perform biphasic sequencing of rhythmic units. Vocal effort or voice quality is controlled by pressure on the tablet and settings.

The sound engines for C-Voks and T-Voks are similar: pitch, time scales, vocal effort, voice quality are modified according to these gestural controls with the help of a real-time high-quality vocoder (WORLD).

This gives an interesting confrontation of free hand gestures of the Theremin and calligraphic gestures for singing or speaking.

3. PROGRAM NOTES

The piece played at NIME'19, entitled ***"Borrowed Voices"*** is especially composed to explore the various possibilities of vocal instruments played in double a choir of natural and artificial voices. It is a collective creation of the ***Chorus Digitalis,*** featuring Xiao Xiao (T-Voks, voice), Grégoire Locqueville (C-Voks, voice), Christophe d'Alessandro (C-Voks, voice), Boris Doval (C-Voks, voice). The players' natural voice join occasionally the synthetic vocal quartet in a double choir formation (8 voices). New musical possibilities opened by performative singing synthesis are explored in prepared improvisation and compositions. The sound and gestural material offered by this musical formation allow for :

- ***Voice deconstruction*** sounding like “computer music” or “electroacoustic voice.” Parametric representation and modeling of the voice allows for extreme variations. Specific features of the voice can be emphasized (formants, pitch, voice quality, vocal tract size, roughness), and a rich sonic material based on the voice can be worked out in real time.
- ***Voice imitation*** on the contrary privileges the proximity between natural and synthetic voice. How close to a natural voice can a synthetic voice be? In some situation, a realistic voice is desirable. It is at the (possibly interesting) risk of an “uncanny valley” effect.
- ***Voice extension*** in between deconstruction and imitation, the augmented voice is a realistic-sounding voice with augmented (naturally impossible) features: for instance, a voice with a very large register, a male/female voice, a very slow, very rapid pronunciation, small and large vocal tracts. Another aspect of voice augmentation is the specific vocal gestures allowed by the control interfaces: here the Theremin and graphic tablet.

Borrowed Voices is composed of four clearly contrasted movements rolled into a single unbroken piece. Like previous works of the ***Chorus Digitalis*** the music is polystylistic: it makes use of multiple styles and techniques, and various languages, i.e. pieces of *Borrowed Styles*. The four movements of ***Borrowed Voices*** are braid together as follows. The introduction, or **Movement 1,** is an 8-voice motet written by Christophe d’Alessandro. This movements are based on English textual material, a 15th century poem by Julian of Norwich. The motet is designed as a contrapuntal vocal game, based on the strong rhythmic and verse structure of the text, and on the synthetic/natural dialectics both at the choir level (4 + 4) and at the individual level (double voice). After a short transition comes **Movement 2.** It is a solo French song: La vie en rose (Edith Piaf, Louis Guglielmi, arranged by Boris Doval), sung by T-Voks, with a 3-voices accompaniment. The solo voice is sung in an impersonation paradigm, with the typical vocal expressiveness and musicality of the French “chanson réaliste”. The vocal arrangement (3 C-Voks) by Boris Doval for the accompaniment explores freely the sounds and gestures of the synthetic choir. **Movement 3** is a Chinese poem recitation, performed by Xiao Xiao on T-Voks. It shows the musicality of Chinese speech recited using Theremin gestures. The hand motions are drawing in space a gestural equivalent of Chinese tones and vocal expression. **Movement 4** concludes the piece in a prepared improvisation, featuring T-Voks, 3 C-Voks, and natural voices of the 4 musicians. The improvisation is prepared in the sense that the texts (and moods) of Movements 1, 2 and 3 are reused (English, French and Chinese) by the 4 singers in this conclusive part.

4. MEDIA LINK(S)

- Video: https://youtu.be/XxIz6MnT9HM
- Video: https://www.dropbox.com/s/4xyvyv0e5jyy2b3/TVoks%20NIME19%20submission.mov?dl=0

ACKNOWLEDGMENTS

Part of this work has been done in the framework of the SMAC (FEDER IF0011085) project. Xiao Xiao was partially supported by the MIT-France program during her stay at Sorbonne Université.

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[3] L. Feugère, C. d'Alessandro, B. Doval, and O. Perrotin. Cantor digitalis: chironomic parametric synthesis of singing. EURASIP Journal on Audio, Speech, and Music, 2017.

[4] S. Delalez and C. d'Alessandro. Adjusting the frame: Biphasic performative control of speech rhythm. In Proc. INTERSPEECH 2017, Stockholm, Sweden, pages 864-868, 2017.

[5] S. Delalez and C. d'Alessandro. Vokinesis : syllabic control points for performative singing synthesis. In Proc. NIME 2017 Aalborg University Copenhagen, Denmark, pages 198{203, 2017.

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[7] N. D'Alessandro and T. Dutoit. Handsketch bi-manual controller: investigation on expressive control issues of an augmented tablet. In Proceedings of the 7th international conference on New interfaces for musical expression, pages 78{81. ACM, 2007.

[8] G. Beller, « Gestural Control of Real-Time Speech Synthesis in Luna Park », Proc. Sound and Music Computing, Padova, 2011

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colligation

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1. PROJECT DESCRIPTION

colligation (to bring or tie together) is a physical performance work for one performer that explores the idea of sculpting sound through gesture. Treating sound as if it were a tangible object capable of being fashioned into new sonic forms, "pieces" of sound are captured, shaped and sculpted by the performer's hand and arm gestures, appearing pliable as they are thrown around and transformed into new sonic material.

colligation uses two Thalmic Labs Myo armbands, one placed on the left arm and the other on the right arm. The Myo Mapper [1] software is used to transmit scaled data via OSC from the armbands to Pure Data. Positional (yaw, pitch and roll) and electromyographic data (EMG) from the devices are mapped to parameters controlling a hybrid synth created in Pure Data. The synth utilises a combination of Phase Aligned Formant synthesis [2] and Frequency Modulation synthesis [3] to allow a range of complex audio spectra to be explored. Pitch, yaw and roll data from the left Myo are respectively mapped to the PAF synth's carrier frequency (ranging from 8.175-12543.9Hz), bandwidth and relative centre frequency. Pitch, yaw and roll data from the right Myo are respectively mapped to FM modulation frequency (relative to and ranging from 0.01-10 times the PAF carrier frequency), modulation depth (relative to and ranging from 0.01-10 times the PAF carrier frequency), and modulation wave shape (crossfading between sine, triangle, square, rising sawtooth and impulse). Data from the left and right Myo's EMG sensors are mapped respectively to amplitude control of the left and right audio channels, giving the performer control over the level and panning of the audio within the stereo field. By employing both positional and bio data, an embodied relationship between action and response is created; the gesture and the resulting sonic transformation become inextricably entwined.

2. TECHNICAL NOTES

colligation is for a single performer and would suit either a gallery or concert hall performance space. An earlier version of the work waas publicly performed in June 2018 at Supersonic Festival, Birmingham, UK. Setup and rehearsal time requires approximately 30 minutes. The duration of the performance is circa 6 minutes.

The technological requirements for performance of the work follows:

2 x Myo Armbands
1 x Laptop with Myo Mapper and Pure Data "colligation" patch
1 x Audio interface with TRS or XLR outputs
Stereo PA/Sound system with two audio inputs taken from the audio interface (TRS or XLR).

Two instances of the Myo Mapper software should be running: the first instance communicates with the right hand Myo; the second instance communicates with the left hand Myo. Additionally, the *colligation* patch (available from the author upon request) should be opened in Pure Data (Pd) with the patch interface visible. Once opened, select the "MYO_CONNECT" toggle button to connect Pd to both instances of the Myo Mapper software. Data from both armbands should now be received by Pd. Finally, position and calibrate the armbands before performance. The armbands should be placed below the elbows with the blue Myo logo facing upwards when the arms are positioned straight in front of the body, parallel to one another, with the palms facing downwards and perpendicular to the floor. The "CALIBRATE" button should then be pressed and this position should be maintained by the performer for at least four seconds. Once calibration is complete, the system is ready for performance.

3. PROGRAM NOTES

colligation (to bring or tie together) is a physical performance work for one performer that explores the idea of sculpting sound through gesture. Treating sound as if it were a tangible object capable of being fashioned into new sonic forms, "pieces" of sound are captured, shaped and sculpted by the performer's hand and arm gestures, appearing pliable as they are thrown around and transformed into new sonic material. Using two Thalmic Labs Myo armbands, one placed on the left arm and the other on the right arm, positional data from the devices (yaw, pitch and roll) are mapped to parameters controlling a hybrid synth created in Pure Data. The synth utilises a combination of Phase Aligned Formant synthesis and Frequency Modulation synthesis to allow a range of complex audio spectra to be explored. Additionally, data from the left and right Myo's electromyographic (EMG) sensors are respectively mapped to amplitude control of the left and right audio channels, giving the performer control over the level and panning of audio within the stereo field. By employing both positional and bio data, an embodied relationship between action and response is created; the gesture and the resulting sonic transformation become inextricably entwined.

4. MEDIA LINK(S)

- Video: https://vimeo.com/255817503

5. REFERENCES

[1] B. D. Donato, J. Bullock et A. Tanaka, "Myo Mapper: a Myo armband to OSC mapper", in the proceedings of *New Interfaces for Musical Expression*, 2018.

[2] M. Puckette, "Formant-based audio synthesis using nonlinear distortion", *Journal of the Audio Engineering Society,* vol. 43, pp. 40-47, 1995.

[3] J. Chowning, "The synthesis of complex audio spectra by means of frequency modulation", *Journal of Audio Engineering Society,* vol. 21, pp. 526-534, 1973.

DIY BIONOISE

SABINA HYOJU AHN, University of Art and Design Linz, Austria

1. PROJECT DESCRIPTION

DIY Bionoise (2018) is an instrument in which the performer can generate sound and noise, deriving from their own body. It contains a circuit that can measure the bioelectricity from living beings to control the instrument by tactile sense. This instrument has two functions – a modular synthesizer with an eight-step sequencer and a bionoise control mode.

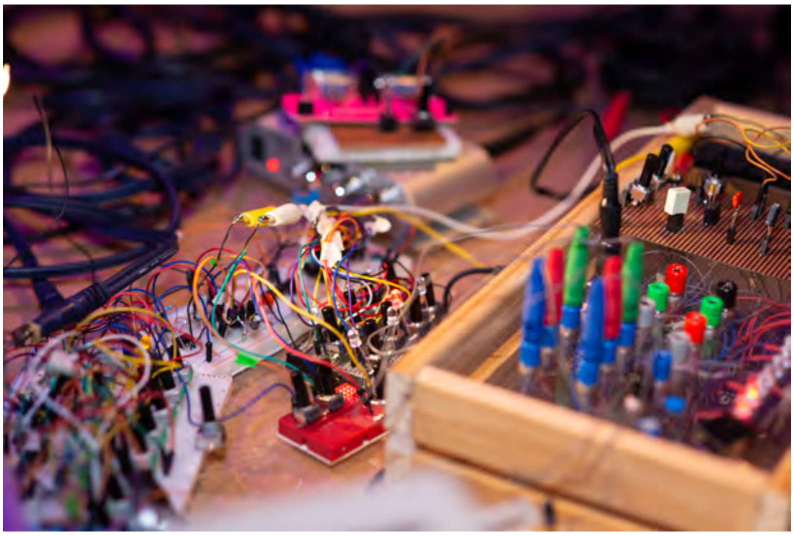

Fig. 1. DIY Bionoise Instrument

DIY Bionoise is developed from my previous work *Sonomatter* [1] which explored the transformation of bioelectrical energy from soil bacteria to sound. In my previous work *Sonomatter*, I used microbe's bioelectrical energy as Control Voltage (CV) to operate custom designed *Bioelectricity-Controlled-Oscillator (BCO)* module, and it translates electrical signals into sound of oscillator, therefore the amount of voltage, measured from soil bacteria, influences on the duration of the sound.

Bioelectricity can be produced by any kinds of living organisms. It is an evidence of life activity especially in the microscopic world. Biosignals have been implemented not only for medical devices such as Electroencephalogram (EEG), Electromyography (EMG) and Electrooculography (EOG), but also it have been used in artistic works. For instance, Alvin Lucier used certain brain signal to control percussion instruments in his performance *Music for Solo Performance (1965).* Like he explained that it is about energy control rather than making sound, he picked up alpha wave from his brain through meditational status [2].

In recent years, many artists have created artworks related to biological materials and technological experiments. Furthermore, advanced bio-technologies have inspired artists and researchers, and enable them to create unique artworks. For example, artist Guy Ben-Ary used his own stem cell to make an autonomous synthesizer, controlled by electrical signals from neural network [3].

DIY Bionoise also used biosignals as a musical expression. *BCO* module has been modified to create noise from performer's tactile senses. The instrument interface design adopts electronic music devices such as modular synthesisers and step sequencers as well as devices emerging from the DIY culture. This instrument can easily be customised by changing different values of electronic parts such as capacitors and sensors. It creates systems to a musical instrument that can interact with bioelectrical energy from the human body.

2. TECHNICAL NOTES

The technical implementation of DIY Bionoise is developed from a customized circuit called *Bioelectricity-Controlled-Oscillator (BCO)* module, which use bioelectricity as CV (Control Voltage) to operate an oscillator. BCO has an instrumentation amplifier chip (AD620) for amplifying bioelectricity, and Hex Schmitt oscillator chip (CD 40106) to make sound.

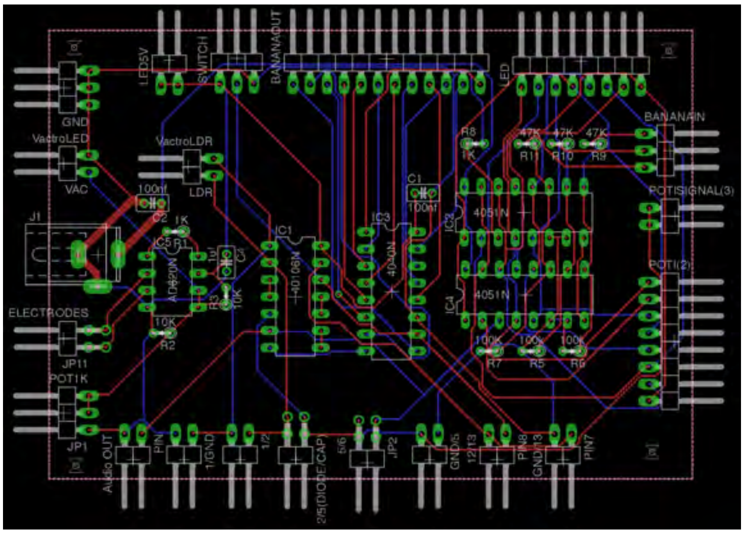

Fig. 1. PCB design

In this work, I have reformulated this BCO module to be used with bioelectricity from human tactile sense, and to mingle with DIY fun. With this instrument, performer can choose between modular synthesizer mode and bionoise mode.

In the noise mode, when the performer touches the touch pad, performer's bioelectricity is feeding to the circuit therefore the performer can control sound of their own bionoise. Technically, a performer's electrical energy is interrupting the sound of oscillator.

For the synthesizer mode, I added an 8 step sequencer, made of a CD 4040 (14 stage binary counter) and a CD 4051 (8 channel multiflexer). The bioelectrical signal from a performer is amplified by an instrumentation amplifier and routed to an oscillator. The oscillator is connected to a counter and a multiflexer, so that the sound of pitch and duration can be controlled by customisable knobs. The parameters of Low Frequecy Oscillation (LFO) and pitch are controlled with 100K potentiometers, and performer can choose among various sensors such as Light Dependent Register (LDR). As a result, *DIY Bionoise* has a mono output, bionoise control pad, 12 different time divide mode with banana connectors and an eight-step sequencer with pitch and LFO control.
The touch pad is installed as electrodes similar to BCO module in *Sonomatter*, however, its function is more focused on touching the surface as tactile interface rather then the measuring certain amount of electrical energy.

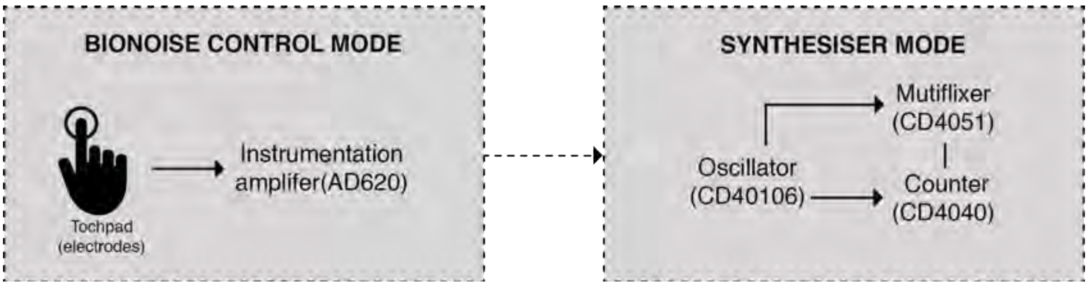

Fig. 1. Two modes of DIY Bionoise: Bio-control mode and Synthesiser mode.

3. PROGRAM NOTES

My works are related to finding multi-layered relationships between human and non-human living beings by translating imperceptible data in natural elements into different perceptual experiences. Biological materials often used, combined or connected to machines, and transformed. I have used bioluminescent algae, soil bacteria, my breathing data, and bioelctricity as well as technology including computational and analog methods. For this project, I wanted to use bioelectrical energy as joyful musical expression that can be performed by human beings.
This project design is inspired by DIY cultures such as hardware hacking, custom designed modular synthesisers and circuit bending experiments from Nicolas Collins [4] and many other DIYers communities. Those hands-on techniques are revived recently with the Post digital media concept, brought us a new creation of physical interfaces, modular systems [5] and combination of different mediums [6]. *DIY Bionoise* is a musical interface built based on the post-digital media philosophy that is connecting electrical energy of living beings to a circuit board. Also, this instrument focuses on enjoying making music out of performer’s own body energy with a customisable interface.

For the live performance, I add a visual element by connecting a custom designed video synthesiser from a workshop by Wolfgang Spahn [7], so the audio signal is visualized, and the audience can watch how the performer can customise the instrument in real-time.

Media Link(s)

- Video: https://sabinaahn.com/bionoise/
- Audio: https://soundcloud.com/sabinaahn/diy-bionoise-ulsan-new-music-live

ACKNOWLEDGMENTS

This work was supported by V2 in Rotterdam, Netherlands and Nabi Art Center in Seoul, South Korea.

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FlexSynth – Blending Multi-Dimensional Sonic Scenes

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1. PROJECT DESCRIPTION

FlexSynth is an interpretation of The Sponge [1], a DMI embedded with sensors to detect squeeze, flexion and torsion along with buttons to form an interface using which musical sounds are generated and the sound is sculpted. The key idea of the sponge is to harness the properties of a retractable, flexible object that gives the performer wide range of multi- parametric controls with high resolution in a maximized gesture space, considering its high manoeuvrability. One of the main differences between Martin's Sponge and the FlexSynth is the spatial multiplexing of different synthesizers and virtual instruments, where the controls of each set of sounds exist in different regions of space, i.e. the orientation of the FlexSynth measured by the Inertial Measurement Unit (IMU: accelerometer, gyroscope, magnetometer) determines the sound/patch it controls. With apparent transfer of control from one instrument to another it is possible to achieve some level of transparency as compared to buttons for mode switches in multi-modal instruments [2], which make mode selection arbitrary and hidden from the audience.

The main artistic goal is to perform polyphonic electro-acoustic music. Considering the manoeuvrability of this DMI, it was really useful to have quick mode/patch changes with gestures such as rotating the sponge along the planar axis. This way the performer would be able to have different sound synthesis mappings with the ability to change them quickly to generate polyphonic sounds. Considering the different kinds of sensors that could measure force applied, elevation, tilt amount and switches triggered, the performer has several degrees of freedom while allowing both separable (mode switches) as well as integral (control tremolo depth while changing LFO parameters) control. An example from one of the performances include: triggering a huge percussion hit (jab: z-axis acceleration) with a long reverb (adjusting the dry-wet mix amount using the FSR) and quickly rotating the instrument once to play a melody while triggering a stereo-delayed drone sound using the switch matrix. This kind of spatial multiplexing of various synthesizers and sound samples allow dynamic mappings that could change over time.

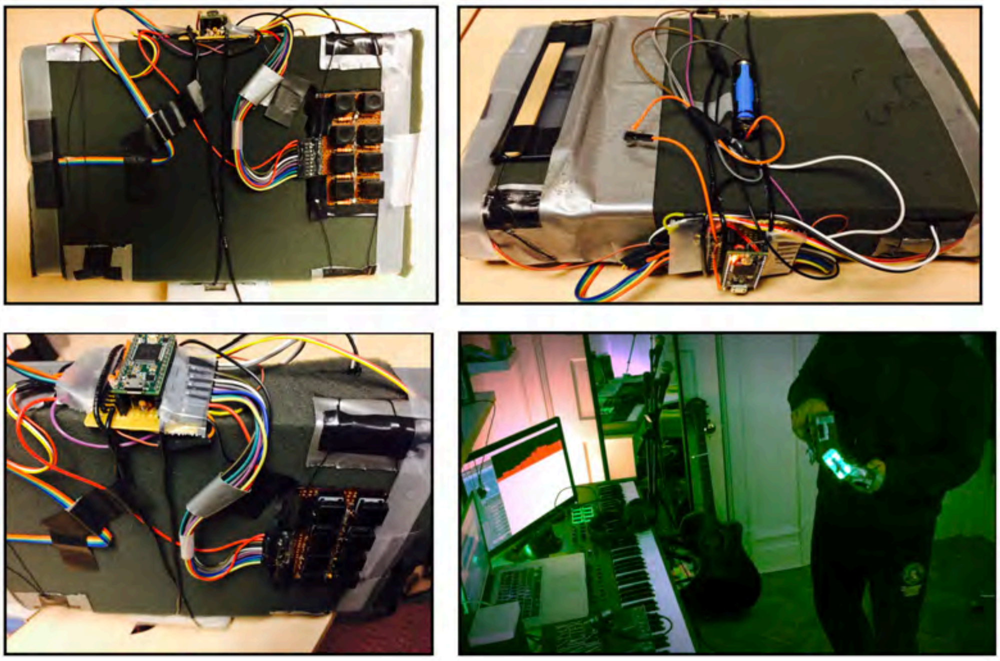

Fig. 1. FlexSynth – bottom view, top view, isometric view, during performance.

2. TECHNICAL NOTES

The Hardware includes a Teensy 3.2 microcontroller that performs signal acquisition by collecting all the data from all the sensors: switch button matrix, a slide bar using force sensing resistors and IMUs. All the sensor data is transmitted via an HC-05 Bluetooth transceiver and received on the laptop's native Bluetooth port. All intermediate calculations and signal conditioning, such as implementation of filters, sensor fusion computations of roll, pitch and yaw from the IMU data and position of press on the slide bar are carried out on the Teensy before transmission, hence reducing the amount of data to be transmitted. The sound synthesis is carried out in MaxMSP. A wireless vibrotactile feedback actuator (Vibropixel [3]) is placed in the front face of the foam to enhance the 'feel' of the instrument. Vibration feedback also eases playability as the vibrations are mapped to the orientation sensors; this will help performer to navigate the multi-parameteric sound space through the multidimensional gesture space. As the pitch and roll measured by the IMU changes away from the equilibrium position, the amplitude and frequency of the actuator increase, thus helping the performer get to various absolute positions and orientations easily. The Vibropixel also includes RGB lighting, which can be used as an additional visual feedback mechanism to improve the transparency and communication of musical gestures with the audience.

Detailed hardware and software description of the FlexSynth is available in [4].

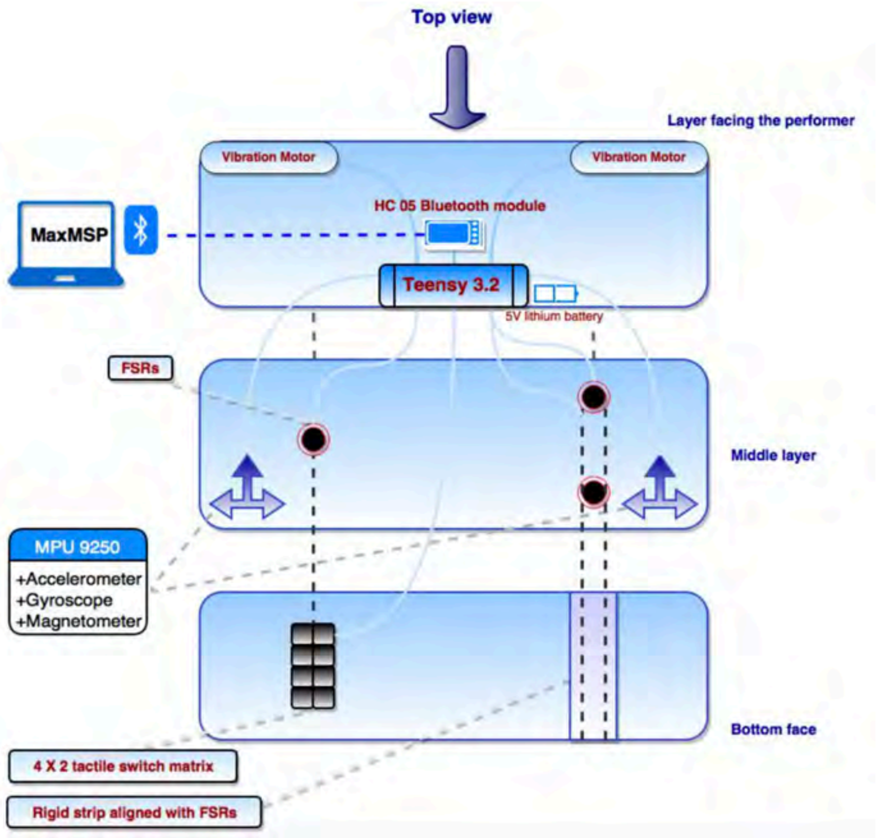

Fig. 2. FlexSynth – block diagram

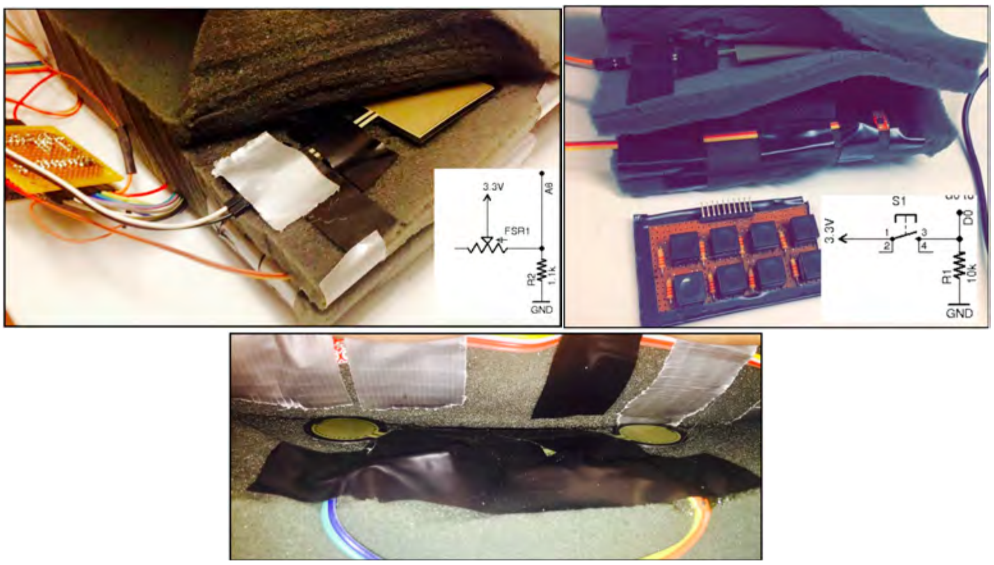

Fig. 3. FlexSynth – inside the FlexSynth
Left – large FSR, Right – switch matrix and IMU, bottom – small FSRs (slide bar)

3. PROGRAM NOTES

The FlexSynth creates lush and fantastical soundscapes, evoking the stillness of deep space and the turbulence and tumult of an ocean storm. Haunting melodic themes interweave with pure timbral modulations blending seamlessly with synthetic drones and acousmatic sonic gestures. The subtle orientation changes by the performer create smooth transitions between soundscapes while blending and exploring the multi-dimensional gesture space. The sound delves into dramatic crescendos, subtle delicately restrained silences, and all the vast dynamic range between. Every performance is an exciting journey and sonic experience.

4. MEDIA LINK(S)

- Video – solo performance: https://youtu.be/U7UMkQxeKC4
- Video – group performance: https://youtu.be/6C0c8fTA1eU

ACKNOWLEDGMENTS

I would like to thank my professor Dr. Marcelo Wanderley for his supervision on this project.

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Gira

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1. PROJECT DESCRIPTION

Gira is a music and dance performance with Giromin, a wearable wireless digital instrument. With this Digital Dance and Music Instrument a gesture is transformed into sound by motion sensors and an analog synthesizer. This transmutation of languages allows dance to generate music, which stimulates a new dance in an infinite feedback loop.

This instrument was created inspired by a research with the musical community from the Northeast of Brazil's relationship with their instruments. It was noted how the body expressivity was an issue for musicians both from acoustic instruments as well as for electronic music performers[1]. The intention to create this instrument was to amplify the small gestures of a table-top DJ controller into free space. Together with the first prototypes of this instrument began the composition of this performance as a natural creative consequence.

Fig. 1. Gira Performance Picture

The central concept of Gira is the transcendence of space and time. Spinning around the spinal axis for a long time builds up a trance involving the performer and the audience in this state of space-time suspension. The music and light dialogues with this state, using repetitive loops and circular movements.

The Giromin is sometimes played with a musical intention, searching for specific sounds that naturally create interesting dancing patterns. In other moments the focus is on a dance intention, which produces music that surprises the performer and makes him move differently. These feedback loops between dance and music help to build this transcendence. They represent a loss of control along the performance and promotes a connection between the dancer-musician and the audience.

While the dancer-musician defines the timbral and rhythmic space, another performer the more precise controls, with a Pandivá (described below) connected to the same synthesiser. We can consider all the interfaces and synthesiser as a collaborative wirelessly connected instrument. One of the performers is related to the intuitive control (or lack of control), while the other is not interested in performing expressive gestures, but to control the precise timing and note selections.

The relationship between music, sound and lighting are analogous to one another. This gives a strong sense of liveness and a synesthetic experience. In Choreomusicology literature this relationship has been referred as an “Intrinsic mimetic”, “sound is movement, movement is sound” and “analogue interactions and direct correspondences between musical rhythm and movement rhythm often referred as ‘mickey-mousing’”[2]. These classifications have been created for a context where different performers play music and dance. For a context where there is a dancer-musician these categories are interesting but have different roles.

The analogue connection of the rotation speed of the body around its axis, the tempo of the music, and the rotating speed of the circular alternating flashing LED reflectors to amplify the change of perception of time, suggesting its compression and dilation with the performer’s movement. The direct correspondence between the height of the arm, the spectral centroid of the sound and the overall light brightness change the perception of space in a similarly expansive and contractive movement. The analogy between vertical movement and spectral centroid were shown to be common by an experimental procedure[3]. The lowest position of the arm has a low-frequency sound and no light, while the highest position of the arm gives the brightest light and sound.

2. TECHNICAL NOTES

The Giromin Instrument is a set of two (or more) nodes with Magnetic, Angular Rate and Gravity (MARG) wirelessly connected to an analogue synthesiser. On the performance, one node is attached to João Tragtenberg’s right upper-arm and another to his torso. The body controls the timbral parameters of the subtractive synthesiser, while the Pandivá Instrument [4] controls the notes by Filipe Calegario.

Fig. 2. Pandivá Instrument

Pandivá is an instrument inspired on the gestures of a trombone and a Brazilian Tambourine from piston-like controllers and 12 buttons grouped in three sections of a circle. The pistons select a set of notes, and each button plays each of the notes from the set. It was designed in a similar way to a guitar, where one hand selects the chords, and the other excites each note of the chord in a rhythmic pattern. Instead of complex guitar finger dispositions, the 4 piston controllers allow 16 different combinations and buttons afford a tambourine rhythmic gesture to play them.

Giromin has a gestural sensing unit that gives out the orientation data from sensor fusion algorithms into angles between the three orientation angles (Euler angles), the absolute accelerometer value, and the gyroscope data of rotation around each axis with a smoothing filter. The mapping was made to have analogue relations between gestures and sounds.

The rotating speed around the spinal axis with a smoothing filter controls the BPM parameter of the arpeggiator, changing the duration of each bar based upon the duration of each whirling movement. This parameter also controls a DMX interface that programs a sequence of PAR LED reflectors placed in a circle around the dancer to light one after the other. The rotating speed also controls the speed of the sequence.

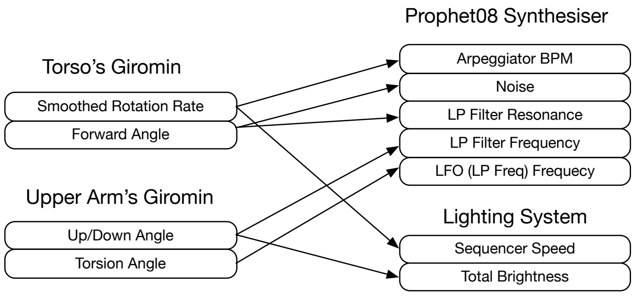

Fig. 3. Giromin mapping strategy

The height of the arm is mapped to the frequency of a low-pass filter and the intensity of the stage lighting. The rotating of the arm around its axis increases the frequency of a LFO and the forward inclination of the torso increases the resonance parameter of the low-pass filter and increases the amount of noise of the timbre.

3. PROGRAM NOTES

"Gira" is a 15 minutes music and dance performance with Giromin, a wearable digital dance and music instrument that controls the electronic production of sounds from body movement.

The central concept of "Gira" is the transcendence of space and time. Spinning around the spinal axis for a long time provides a trance involving the performer and the audience in this state of space-time suspension. This performance dialogues with this state using repetitive loops, circular movements, closely connected gestures and sounds. The compositions came as much of musical intentions as of dance.

4. MEDIA LINK(S)

- Video: https://www.youtube.com/watch?v=AwQjhSw0phU
- Shorter version: https://www.youtube.com/watch?v=juIXJZ66Vys

ACKNOWLEDGMENTS

The authors would like to thank Miguel Mendes and Tomás Brandão for the collaborative composition of this performance.

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iCons

RODRIGO F. CÁDIZ, Pontificia Universidad Católica de Chile

1. PROJECT DESCRIPTION

iCons is an interactive multi-channel music piece for live computer and a gesture sensor system designed by the composer especially for this piece, called *AirTouch*, shown in figure 1. Such system allows a much more musical approach to controlling sounds than the computer keyboard or mouse. Using only movements of the hands in the air it is possible to control most aspects of the music, such as sound shapes in time, loops, space positioning, or create very rich spectral densities. In certain aspects, this device works very similar to a Theremin [1], with the difference that the sound production is totally separated from the control system.

Fig. 1. The AirTouch, instrument especially developed for iCons. This instrument contains three ultrasound distance sensors (labeled 1, 2 and 3 in the picture), a knob, two toggle buttons and a trigger button. The device contains an Arduino board and connects to a computer via a USB port.

2. TECHNICAL NOTES

The instrument *AirTouch* used in *iCons* consists on an Arduino board with three ultrasound distance sensors, one potentiometer, two toggle buttons and one push button. Each of the sensors can sense positions of the hands in the air with relation to the instrument. The positions of the hands in the vertical direction is analyzed by a MaxMSP patch, shown in figure 2, and velocities and accelerations are calculated in order to detect a great variety of hand gestures, as shown in figure 3. The trigger button is used to change sections in the piece and the toggles are used to loop sounds. The knob controls the amount of reverberation and convolution used along the piece.

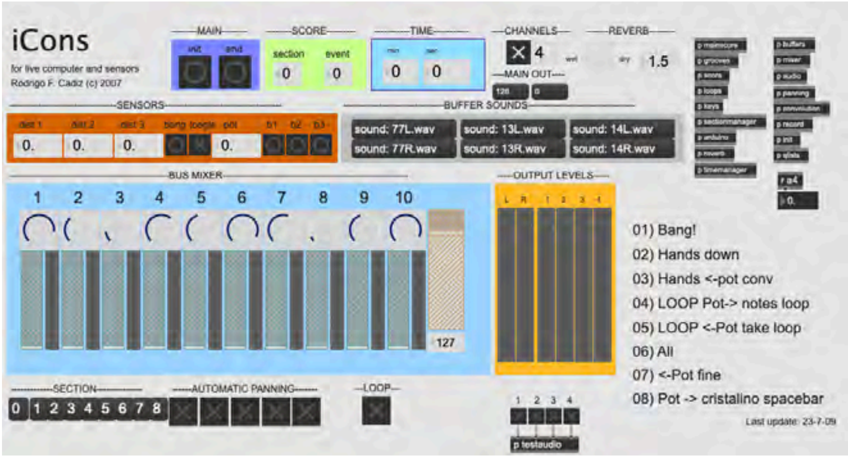

Fig. 2. MaxMSP patch. AirTouch data is displayed in the orange box. The patch also displays sounds currently being triggered, audio output levels, time, and section number. An abbreviated score is displayed in the bottom right corner.

Fig. 3. The composer performing iCons. Gestures of both hands moving in the air are captured by the AirTouch instrument and sent to the computer for further processing. The vertical distance of the hand with relation to the instrument is one the most important measurements used in the piece.

3. PROGRAM NOTES

The piece is based on a single source of sound, a coin, that resonates and interacts with different media. The exhaustive exploration of a single sound source is a common trend in many of my electroacoustic compositions. The sounds produced by the coins are presented, transformed and spatialized live via several signal processing algorithms controlled by a gesture sensor system designed by the composer. *iCons* is originally a 4-channel piece, but its design allows for 8-channels or a stereo presentation as well. It can be performed live on stage using the sensor system or it can be presented as an acousmatic piece. *iCons* was composed at the facilities of the Center for Research in Audio Technologies at Pontificia Universidad Católica de Chile and premiered at the VII Ai-maako International Electroacoustic Music Festival of Santiago de Chile, in 2007. It was also presented at Silencio 08, Reunión de Compositores, in Santa Fe, Argentina and Electrónica Viva, Santiago, in 2008, at Sound and Music Computing in Porto, Portugal, in 2009 and Sesiones Piso 3 in Santiago in 2010. A stereo version was released as a part of the double CD Unisono, available at CD Baby, Spotify, Apple Music, Google Music and other streaming applications.

4. MEDIA LINK(S)

- Video: https://www.youtube.com/watch?v=-z2uwYiSqHw
- Audio: https://open.spotify.com/track/4LY2uh1szMSuJApBunSJHG

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MusiCursor

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1. PROJECT DESCRIPTION

MusiCursor is an interactive multimedia performance/interface that reimagines consumer-facing technologies as sites for creative expression. The piece draws inspiration from established UI/UX design paradigms and the role of the user in relation to these technologies.

The performer assumes the role of a user installing a musically-driven navigation interface on their computer. After an installation prompt, they are guided through a series of demos, in which a software assistant instructs the performer to accomplish several tasks. Through their playing, the performer controls the cursor's navigation and clicking behavior.

In lieu of a traditional score, the performer relies on text instructions and visual indicators from a software assistant. The software tracks the progress of the user throughout the piece and moves onto the next section only once a task has been completed. Each of the main tasks takes place on the web, where the user navigates across YouTube, Wikipedia, and Google Maps.

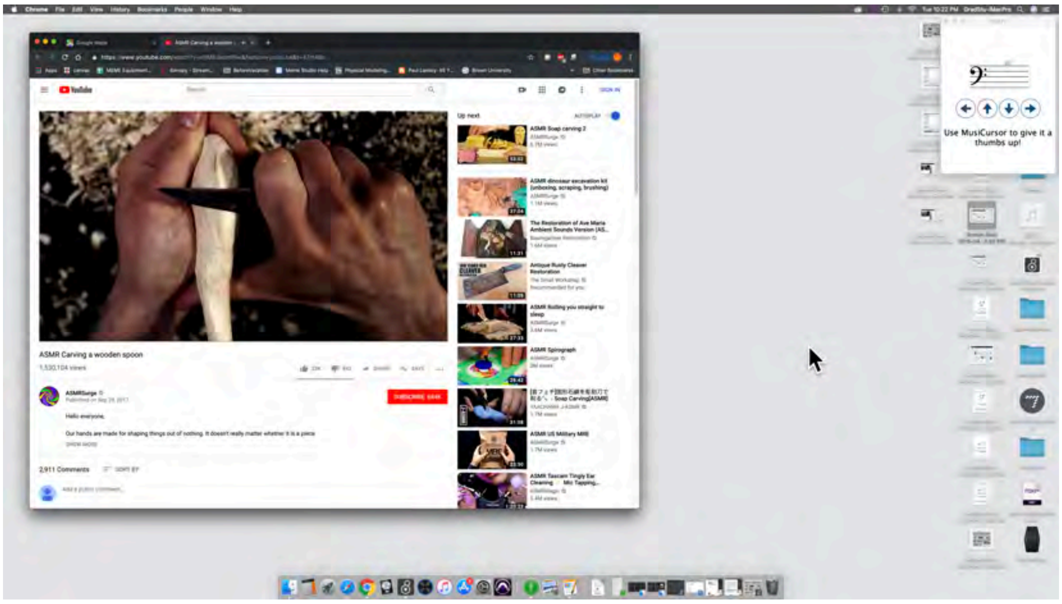

Fig. 1. Screen Shot of Desktop During Performance.

2. TECHNICAL NOTES

The system relies on pitch and amplitude tracking to convert musical gestures into cursor actions, with each section employing unique mappings.

In the first section — during which the user moves there cursor across the screen to click the 'thumbs up' button on a YouTube video — the system tracks the pitch played, interval between consecutive pitches, pitch direction (higher or lower than previous pitch), and range. Consecutive ascending pitches in the high range of the instrument move the cursor right, with number of pixels moved determined by the interval between consecutive pitches. Consecutive descending pitches in the low range of the instrument move the cursor down, again with the number of pixels moved determined by the interval. The section ends when the 'thumbs up' button is clicked.

In the second section, which takes place on Wikipedia, two oscillators (for X and Y position) move the cursor around the page. The performer triggers cursor clicks by playing above an amplitude threshold. The orbit of the cursor becomes faster as the user triggers more clicks, making it more difficult to accurately click on links embedded in the text. After 50 clicks, the system slows the cursor's orbit to a halt.

In the third section, the user's playing controls navigation in Google Maps. As in the first section, pitch tracking is used to determine direction of motion and translated into left and right movements in Google Maps. Forward movement is triggered by repetitions of the note D in any register.

The end of third section (and the piece overall) is marked by a pop-up window that displays an analysis of the data collected from the user (notes played, trends, etc..) over the course or the performance.

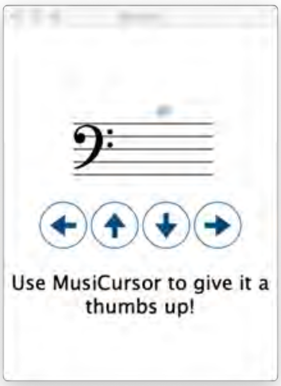

Fig. 2. System Interface During First Section.

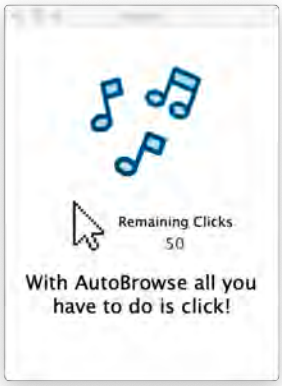

Fig. 3. System Interface During Second Section.

3. PROGRAM NOTES

MusiCursor is an interactive multimedia performance/interface that reimagines consumer-facing technologies as sites for creative expression. The performer assumes the role of a user learning to navigate a musically-driven interface on their computer. Prompted by text and visual instructions from a software assistant, the performer learns the different functionalities of the interface as they progress through a series of web-based tasks. Through their playing, the performer controls the cursor's navigation and clicking behavior; adapting as the mapping parameters change from section to section.

4. MEDIA LINK(S)

- Video: https://www.youtube.com/watch?v=z9C1W5_5YSQ

ACKNOWLEDGMENTS

The author would like to thank Will Yager for premiering this work at SPLICE Institute 2018.

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Pandemonium Trio perform Drone and Drama v2

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MIGUEL ORTIZ, Queen's University Belfast
PAUL STAPLETON, Queen's University Belfast

1. PROJECT DESCRIPTION

Pandemonium Trio is Barry Cullen, Miguel Ortiz and Paul Stapleton. Our performance research trio has been set up to explore multiple instantiations of custom-made electronic instruments through improvisation. We are particularly interested in exploiting irregularities in the qualities of circuit components (e.g. imprecise tolerances/values), and how this allows for the development of stylistic differences across multiple instrument-performer configurations. We are also interested in how skill, style and performance techniques are developed in different ways on similar devices over extended periods of time, and how our existing musical practices are reconfigured through such collaborative exchanges.

For this musical performance each performer will use an instrument developed by Barry as part of his research. The instrument is called 'Drone & Drama v2', and features circuit bent companion units, devised to be patched together in a modular fashion, using the data from a clock crystal and RAM chip. The instrument lends itself to being played slowly, due to the parameters and controls available. The non-intuitive interface does not encourage a player to learn quickly but invites her to spend time finding connections between controls and sounds. Over time the tone shaping affordances are understood and shared, while simultaneously inviting surprises, discovery, confusion; all are the desired outcomes of play.
These modified circuits have been selected to promote *productive instability* within a restricted set of timbral possibilities. The aesthetic of our performance is informed by noise and free improvised musics and is offered as a response to the history of electronic music experimentation [1, 2].

2. TECHNICAL NOTES

Version one of the instrument for this project was presented as a demo at NIME 2018 as Tri-Sine & Noise Siren. It used the same building blocks of function generators (drone section), circuit bent siren (drama section), mixer and filter. The latest version (Drone and Drama v2) retains most of the form and functionality of the initial design, with changes in interface, connectivity and circuit fabrication.

The instrument consists of several circuits. The function generators [3] and noise siren (which consists of a phase locked loop [4] and timer [5]) create sounds which are then modified (mixed and filtered) before the output can be sent to an amplifier. The combination of these circuits was the result of the creative studio practice of tinkering with tools and materials: making and modifying. The schematics of the circuits used in the current iteration are below:

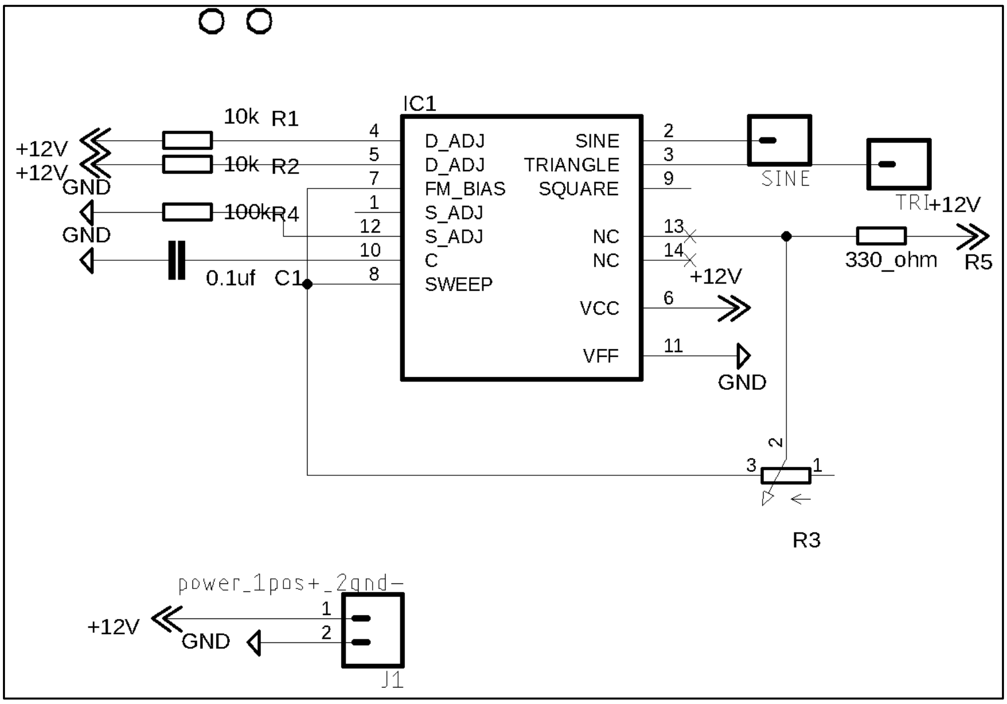

Fig. 1. Sine / Triangle Function Generator.

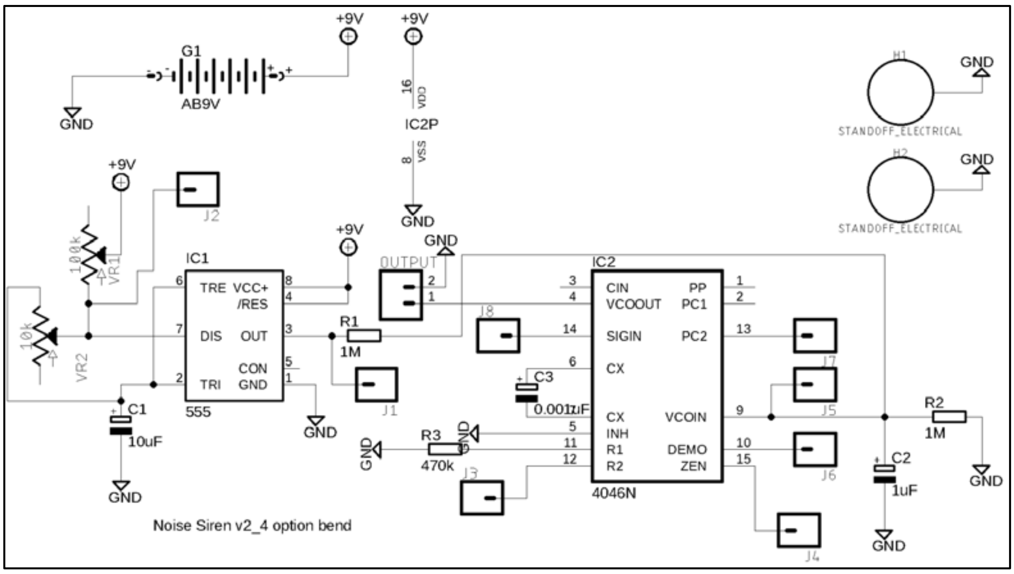

Fig. 2. Circuit bent “Dub siren” (a.k.a. Noise Siren).

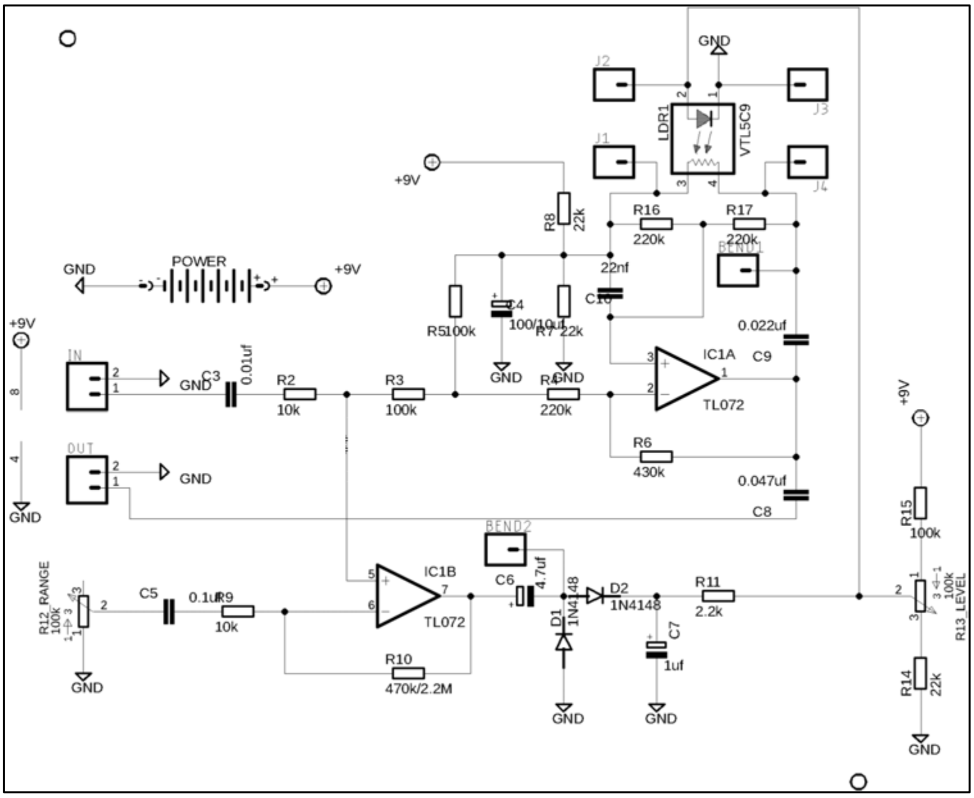

Fig. 3. Circuit bent “440” D.O.D Envelope Filter

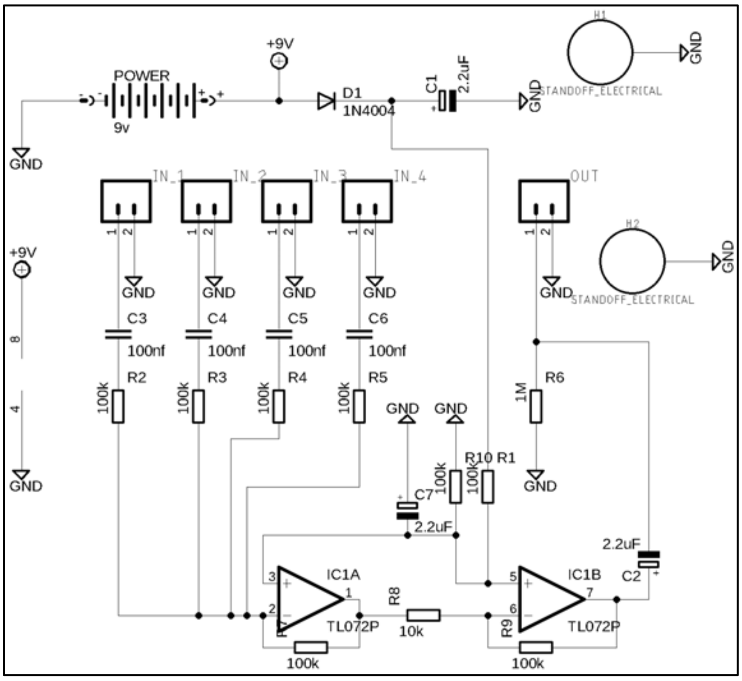

Fig. 4. Four-channel mixer.

The sounds produced by Drone and Drama V2 can also be influenced by external inputs. To expand the range of tones they are fed data from circuit-bent

multi-effects units. The instruments have banana sockets to allow the connections between them to be stacked, which can lead to more complex interaction between the circuits.
The first version of the instrument used touch points instead of banana socket connections. Frequency range toggle switches were removed from the oscillators, and the filter and siren sections were also revised. The latest instrument now uses PCBs instead of vero board for each circuit.

3. PROGRAM NOTES

Pandemonium Trio is a new group based at the Sonic Arts Research Centre (SARC), dedicated to bring audiences the finest in folktronic audio and cybernetic signals, vibrating together in heart-warming 12V ballads, oscillating between the sacred and the profane.
Barry Joseph Cullen is an audio and video worker who has exhibited, performed in Europe, the Middle East, North and South America. His practice includes; DIY electronics, audio technology and motion graphics, interactive AV installation work, foley, print, sound tracks, DJing, VJing, circuit bending, creative technical support and amplified junk. He has recently began research at Sonic Arts research Centre at Queen's University Belfast.
barryjosephcullen.wordpress.com
Miguel Ortiz is a Mexican composer, sound artist, and Lecturer at Queen's University Belfast. His work focuses on the use of sensing technologies for creative applications, specifically Digital Instrument Design and its intersection with Composition and Improvisation. miguel-ortiz.com
Paul Stapleton is an improviser, sound artist and instrument inventor originally from Southern California. He performs with a variety of metallic sound sculptures, custom made electronics, found objects and electric guitars in a diverse range of projects. Paul is currently based at SARC in Belfast, where he teaches and supervises research in improvisation, performance technologies and site-specific art. paulstapleton.net

4. MEDIA LINK

- Video 1: https://vimeo.com/313209363

ACKNOWLEDGMENTS

This work is supported by the Department for the Economy in Northern Ireland (DfE), the School of Arts, English and Languages (AEL) and the Jack Kerr Fund in Music at Queen's University Belfast.

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Pythagorean Domino

ANA DALL'ARA-MAJEK, CIRMMT, University of Montreal
TAKUTO FUKUDA, CIRMMT, McGill University

1. PROJECT DESCRIPTION

Pythagorean Domino is an improvisatory composition composed in 2019 for an augmented Theremin and a gyro-based gestural controller. This work aims to integrate music concrete techniques and an algorithmic compositional approach in the context of composition for gestural controllers. While music concrete compositional practice brings out the concept of "composite object"—a sound object made up of several distinct and successive elements [1]—in the piece, our algorithmic compositional approach delivers an interpolation technique which entails gradual transformations of the composite objects over time.
Our challenge is to perform a chain of short fragmental elements in tandem in the way to form a single musical unit, while the algorithms for transformation are autonomously changing synthetic and control parameter settings. This approach derives closely interconnected triangular interactions between two performers and a computer.

2. TECHNICAL NOTES

2.1 Setup

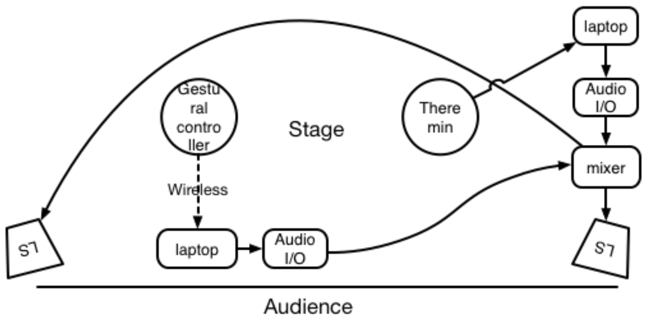

Fig. 1. The system configuration for Pythagorean Domino

We both stand on stage during performance. The required equipment is below; 1 stereo PA system which projects the two stereo outputs from two laptops (we both use an RME Babyface audio interface), 2 monitor speakers (one for each of us), 1 small table for Ana's laptop and audio interface, 1 microphone stand for the Theremin. The system configuration is illustrated in Figure 1.

2.2 Augmented Theremin

Augmented Theremin is an integrated analog/digital musical instrument, which consists of an Etherwave Plus Theremin used as a controller to detect performer's hand motions and body localization, an iPad-mini running Mira application to control the computer at a distance, and Max for sound synthesis (Figure 2).

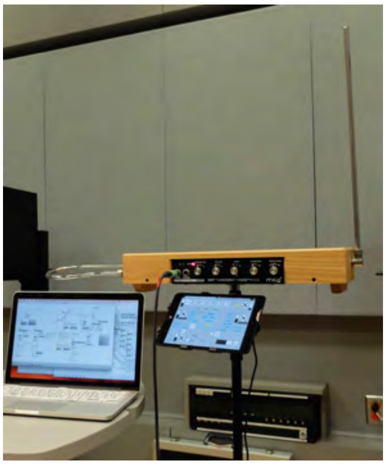
Fig. 2. The augmented Theremin

Audio signal from the Theremin is converted into data via *peakamp~* and *sigmund~* objects in Max. At the first level, the Max patch collects amplitude and frequency values from the Theremin. For each antenna, the values' delta can be adjusted by the user in order to reduce the field of detection of the instrument and thus avoid parasite triggering by nearby people or objects in case of a small or crowded stage.

The Max patch consists of five modules. The first one is a classic audio processing module. It includes a granular synthesis submodule and a frequency shifting submodule that process the incoming signal from the Theremin. Both antennas keep their original function (amplitude and pitch variation) and the control of the submodules' parameters are accessible via the iPad which is displaying a set of presets buttons.

The second module consists of pre-recorded sound file players (*sfplay~*). The iPad controller is used to select a specific sound file and a default pitch. The Theremin's amplitude and pitch antennas control respectively amplitude and speed parameters of the players. The pitch antenna also controls the size of grains of an optional granular synthesis submodule. Furthermore, this module can invert the antenna's detection. Originally the Theremin's signal amplitude is at its maximum when the distance with a body is bigger, but this can be swapped for instance for scenography or theatrical purposes.

The third module is a speed detector: it detects the speed of hand motion and when a specific threshold is exceeded it triggers - or otherwise stops - a pre-recorded sound file picked randomly from a folder in the computer's hard drive. This module also detects the direction of hand motion and can be set on "push" or "pull" mode to play/stop a sound file by using only one specific direction besides of speed. In the case of slow motion, the module only vary the sfplay~ speed parameter without triggering any other sound. In addition, this module activates a specific values threshold that takes into account when the user touches an antenna.

The fourth module is a sample player that reads and loops a fragment of a sound file stored in a buffer (using *groove~*). The amplitude and pitch antennas control respectively the onset and length parameters of the sample.
The fifth module is an elaborate speed module in which the user can choose between two folders (A with attacks sounds and B with resonance sounds) in the computer’s hard drive by touching or releasing the pitch antenna.
Finally, the patch Max offers the performer a choice between a free improvisatory mode or a concert mode. The first mode displays on the iPad a maximum of controls for improvisation or “unexpected” situations. The second mode only displays buttons of presets or automations according to the piece’s chronology in order to limit the iPad’s interventions during the performance and thus let the musician focus on gestures.

2.3 The gyro-based gesture controller

The gyro-based gestural controller is a wireless Digital Musical Instrument, which senses its tilt and transpositions.

Fig. 3. The gyro-based gestural controller

This DMI consists of a physical controller and a Max patch. The physical controller is covered with a boxy form exterior (Figure 3) and constitutes an accelerometer, a gyro-sensor and a Wi-Fi module built in a Wemos microcontroller as well as two buttons underneath. The accelerometer is used to detect the performer’s shake motion three dimensionally, in response to which, the Max patch triggers sounds. The gyro-sensor detects the controller’s tilt of the controller also three dimensionally, according to which the triggered sounds transforms. The two buttons are used to recall preset settings. The Wi-Fi module transmits all the data collected by the sensors and buttons to the Max patch in a computer.
The Max patch constitutes four modules. The first module is a set of detectors for gesture acquisition. The detectors classify acceleration of the controller into six distinct categories of shake gestures: to the left, to the right, up, down, forth and back. The tilt on the yaw-, pitch- and roll-axis of the controller are, without classification of gesture types, mapped with a preset storage, the master volume and a pitch shifter, respectively.
The second module is a set of sound generators: granular oscillators and pre-recorded sound file players. Both of which generate various sounds in response to every shake and vary their synthetic parameters according to a preset recalled from the preset storage or a sequence generated by an indeterminate automator.

The third module is a real-time pitch shifter mapped with the tilt on the roll-axis of the controller for transposing sounds produced by all the sound generators.

The fourth module is the preset storage mapped with the two buttons underneath the controller and with the tilt on the yaw-axis for recalling presets for the sound generators. The preset storage imports one preset file selected by the two buttons from a preset library. Each of the files consists of two preset states, which are interpolated according to the tilt on the yaw-axis, thus creates a gradual transition of the parameters. This Max patch offers a graphical user interface, which shows a current state of the parameters, as well as enables to store a desired state of parameters during a compositional process and rehearsals.

3. PROGRAM NOTES

Pythagorean Domino is a work for augmented Theremin and gyro-based gestural controller. This work aims to integrate music concrete techniques and an algorithmic compositional approach in the context of composition for gestural controllers. We construct a dialogue of fragmented sounds forming "composite objects" (sound objects made up of several distinct and successive elements). Our materials transform gradually from one state to another as if metamorphoses of a living figure, thanks to an algorithmic system that we developed specifically for this project. Our sounds are scattered through the loudspeakers system as an extension of our bodies and a way to enhance our gestural performance on stage.

Our challenge is to perform a chain of fragmental elements in space as a single musical unit in tandem, while the algorithms for transformation are autonomously changing synthetic and control parameter settings. This approach derives closely interconnected triangular interactions between performers, computers and a performance environment.

4. MEDIA LINK(S)

- Video: https://vimeo.com/312451384

ACKNOWLEDGMENTS

The authors would like to thank the Centre for Interdisciplinary Research in Music Media and Technology, McGill University and the University of Montreal.

This work was supported by the Centre for Interdisciplinary Research in Music Media and Technology, and the Conseil des arts et des lettres du Québec.

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River

YIYAO NIE, New York University, Tisch School of Arts, ITP Program

1. PROJECT DESCRIPTION

"No one can step into the same river twice."

This instrument, named as River, contains rules and randomness.
What exactly is music and how does it connect to and shape our form? Traditional musical instruments always have fixed physical forms that require performers to adjust to them. How about making a musical instrument that is more fluid and more expressive via deforming according to performers' movements? This was the question I attempted to explore when I started making this project. For this project, I combine the movement of dancing with music to present a fluid and dynamic shape of musical instrument. The fabric of this instrument can be separated as an extension to wash. It's portable, wireless, chargeable, stable and beautiful.
This musical instrument generates sound by detecting different movements of the performer. It has four different modes selected by toggling the switches on the instrument interface. Each mode has different movement detection methods, generating various sound and music. Moreover, it can be played as a transmitting Tambourine.
As for the music in my performance, it's all played by myself lively, consisting of different sound triggered and changed by performers' gestures and melody composed myself.
Like the name of this instrument River, the four toggles and their detection methods and their corresponding generated sounds are intentionally designed. From simple node, beat, loop, drum, to various node, melody, music, the detection methods and their triggered sounds are becoming more and more complex and various, developing like a journey of a river.

Fig. 1. River.

As for the performance, it tells a story about a river.

River knows this: there is no hurry. We shall get there some day. I see the river as the extension of my body. More intuitive than narrative, more fleeting than infinite, the river rises, falls, flows and meanders, and I follow the journey.

Fig. 2. Performance.

Fig. 3. Performance.

Fig. 4. Performance.

Fig. 5. Performance.

Fig. 6. Performance.

2. TECHNICAL NOTES

The core of this instrument is comprised of Arduino, multiple sensors and fabric. Bluetooth is used in the instrument to send data from sensors in real time to computer. Once the computer gets the signal, it categorizes the gesture and movement of the body and the state of the instrument by machine learning and some programming algorithms made by the author. Then the author used Max/Msp and Ableton Live to make sound and music based on the categorized result.

3. PROGRAM NOTES

4. MEDIA LINK(S)

- Video: https://vimeo.com/306346063
- Video: https://vimeo.com/327361203

ACKNOWLEDGMENTS

The authors would like to thank Tong Wu, Dreamy Sun, Mingna Li, Eric Wenqi Li, Greg Shaker, Mimi Yin, Tom Igoe, Yen-an Chen and also other people who have been giving the author feedbacks and inspiration for her project. Without their help, the author couldn't make this instrument and performance.

Self-Built Instrument (sound performance)

JIYUN PARK, Academy of Media Arts Cologne, Germany

1. PROJECT DESCRIPTION

Self-Built Instrument project is focused on sound performance with an experimental instrument which is composed of strings and metallic sound box, producing overtones, harmonics and feed- back. It is capable to play with different sound colours : Resonances by cooper, bowing on strings, overtones and feedback. All of factors triggers each other's sound. It is not a point to play a specific tone or to make a musical harmony, because the instrument is not able to perfectly control. Playing this Instrument is a challenge to your capacity, such as gestures and sonic phenomenon following sense and space. The artist composed a piece and use few repertoire partly, however, mostly it is interesting to find what kind of sound comes to nest in mesh.
The Artist tried to get over typical aesthetics of classical music, such as using precise pitches, melodies, and read scores. Instead of that, her approach towards to discover unusual sound elements which are considered as mistake in traditional way. And play with them, for instance, strings without tuning, hitting a stuffs, unorganized pitch, also so-called clicker which happens unskilled.

Fig. 1. A performance, Self-Built Instrument, Rundgang KHM, 2017

It is musically composed of circulation of swerving sound and embrace internal and external sound in space. The coupling of acoustic and electronic resonances in a performable instrument that has an almost sculpture like quality is intriguing. The sounds range from complex and exquisite to banal and cliché, and therefore, keep the interest going.

The artist experiments various way to perform this instrument and grow up continuously in sound and improvisation. Specially she drew her own notation for the instrument and it is carved on the cooper sheet which is intuitively readable to play feedback with microphone. Once sound of the instrument is buildup by her activating movements to play, and feedback starts sustaining. Then, she should deal with whole this circulation of interaction, because the wave of feedback is continually changing, even by extremely small factor.
'Don't command obedience : Welcome to intruder' - Frederic Rzewski-

Also, the artist did collaboration concert with New Music ensemble, which is from Music university and her own audio-visual performance group, Formalhaut. Through this collaborative performance, she expands herself to handle with external sound elements, interactions between computer data and an instrument, combination with visual effects, and mutual relation with other players.

Fig. 2. A performance, Self-Built Instrument, Neues Kunstforum, 2017

2. TECHNICAL NOTES

Techrider

Size of work	0,5 m x 0,5 m x 1,5 m (width x length x height)
Techrider	2 Speakers
	1 Mixer (2 input, 1 aux)
	2 XLR Cables
	1 Chair
	Electricity with a socket (or extension cable)
	Hanger (minimum 2 m) or possibility to hang from ceiling
Set-up time	20 minutes

3. PROGRAM NOTES

Self-Built Instrument Performance is included disassemble part, and after that it keeps performing further with changed form of the instrument. Total time is around 30 - 40 minutes.
*It can be changed depends on time schedule of NIME 2019 program.

4. MEDIA LINK(S)

- Video: https://www.youtube.com/watch?v=6_wREiPDlbk&t=69s
- Video: https://vimeo.com/250951871
- Audio: https://soundcloud.com/jiyun-park-671604301/exhale-into-nowhere

ACKNOWLEDGMENTS

The authors would like to thank prof. Hans w. Koch
This work was supported by Academy of Media Arts Cologne (KHM), Germany

Tanto Mar

ANDRÉ L. MARTINS, Universidade de São Paulo
PAULO ASSIS BARBOSA, Universidade de São Paulo

1. PROJECT DESCRIPTION

"*Tanto Mar*" seeks to recreate the properties present in history between Portugal and Brazil, embracing the idea of an aqueous sound that dances and moves as much by cadence as by voluminous waves. The Atlantic Ocean, which separates and unites the two countries, serves as an inspiration for this quadraphonic performance, involving musical instruments and live electronics, where the sounds move through the four speakers. Each speaker symbolizes the paths that the sea travels uninterruptedly, in a unique dance of latitudes and longitudes.

The intersection of sounds occurs through processes of reverberations, spatializations, echoes, modulations and grains that slowly form the sound material, composing, decomposing and manipulating the sound waves. Sound characters such as wind, oars, storms, calm, among others, are metaphorically evidenced through the sound material, creating a kind of rhythmic movement of a caravel at sea. The sounds of "Tanto Mar" move between entropy and chaos, between stillness and tsunami, between starboard and port, culminating in a textural dance where the objective is to take the listener away from electronic processing, and propose a dive in an intensified, attentive, deep and involving listening.

New musical possibilities can happen through the experimentation of new routes, unusual routes and horizons not yet covered. The sea and its imprecise distances represent permanent challenges. "Tanto Mar" seeks to revive the feeling of the Portuguese poet Fernando Pessoa, when he wrote: "*to dream even if it is impossible*".

Fig. 1. Paulo Assis and André Martins, performing live

2. TECHNICAL NOTES

A nylon acoustic guitar electrified by an electromagnetic pickup coupled inside its body construction serves as input for the sound material that will be manipulated and processed during performance by both musicians. Some software used are: *Max MSP, Ableton Live, LiveProfessor* and *Logic Audio* and *Michael Norris* and *D16 Sigmund* plug-ins.

The piece lasts between four and eight minutes, and is scheduled to be performed on four channels. The musicians will only need the amplification and speakers, providing four audio signals, through the notebook audio interface. The setup assembly consists only of positioning the equipment and passing sound.

3. PROGRAM NOTES

This performance proposal consists of a live electronics improvisation processing an acoustic nylon string guitar, played live in a concert environment, with sound interactions between the two performers.

An environment between acoustic musical instrument and digital instruments, performers, musical improvisation, live-electronics and exploration of the idea of sound. We give the name of a hybrid machine to an interactive musical system that is constituted from the inclusion of digital tools with the objective of favoring sound creation and its subsequent flows in the human-machine relationship. The connection of all these devices, interactively managed by the performer(s) in a given environment, is what we call a ***hybrid machine***. This machine embraces the idea of an acoustic instrument that preserves its original characteristics of construction, materiality, physicality, corporeality, etc., and incorporates the potentialities of adigital instrument, transforming enormously the interaction between musician and instrument.

4. MEDIA LINK(S)

- Audio: https://vimeo.com/327069466

ACKNOWLEDGMENTS

This work was supported by University of São Paulo, institution that helped in the funding of stay and locomotion of both performers, during their stays in Porto Alegre.

This work was financed in part by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES) - Brazil - Finance Code 001

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Tempo Transversal – Flauta Expandida

CASSIA CARRASCOZA, São Paulo University
FELIPE MERKER CASTELLANI, Federal University Of Pelotas

1. PROJECT DESCRIPTION

“Tempo Transversal – Flauta Expandida” aims to establish a computer-controlled catalyzer, which simultaneously combines and extends the flutist body actions, electronic sounds and the performative physical space.

Some flute performance fragments, captured in real time by video cameras, besides pre-recorded images, built the visual projection.

The flute player develops two pieces of experimental music for flute and electronic. All these heterogeneous elements are interrelated with each other in a network mediated by the computer. The result is a continuously unfolded interactive performance, which intends to manipulate settings of space-time perception. Brazilian contemporary repertoire for amplified bass flute and electronic sounds establishes the proposal.

Khorwa-Myalwa (Samsara – the Hells) for bass flute and electronic sounds by Mikhail Malt 8 ' 44 ". The work is written for amplified bass flute with expanded techniques. Its structured is given by the resulted sonority of reading out a fragment of *Longchen Nyingtik Ngöndro*, which does reference to the *Eighteen Hells of Tibetan Buddhism*.

Both composer as flutist have a collaborative work regarding expanded techniques and bass flute amplification. This recording was done at IRCAM (Studio 8, December 2016), with two cardio microphones (DPA4099). One microphone is positioned on the head joint flute and another one goes inside the tube, besides the two microphones there is an Omni, Neumann MK 184 one. The composer has mixed and worked out with the recorded material in order to use it in the electroacoustic part of the piece.

The electroacoustic *Khorwa-Myalwa* material has also several instrumental samples like as flute sounds, bell sounds, Chinese bowls, concrete samples of knife sounds, hammer sounds, sword sounds, synthesized sounds (OM > Csound) and transformed sounds (Max, SuperVp, Factoring, etc.).

The second work is an improvisation with fixed electroacoustic support (tape) on the research material based on the project called: “Development of recorded samples bank based on extended techniques for transversal flute", in partnership with LaFauta - Flute laboratory at Music Department, FFCLRP-USP. Recording samples of double bass flute and bass flute, as well as composition in fixed support was carried out in collaboration with Danilo Rossetti, composer who currently develops a postdoctoral research at NICS-Unicamp (with FAPESP support) regarding music sound spatialization, besides creation and analysis of this repertoire. Fixed electroacoustic support was created as a fabric of noises and sounds of flutes (double bass and bass flute) which were processed with a spatial designed for eight channels. The improvisation is settled on a

sound texture that configurates a game which is created from pre-recorded material like a tape and images, as well images and sounds in real time.
A profusion of expanded and amplified techniques allows the expansion of sounds, including some almost inaudible ones in an acoustic setting. As in the musical discourse, the images seek to give visibly details, often invisible in the performance itself. Slap-tongues, multiphonics and very fast fingerings are enlarged, processed and digitally transformed in order to become the primary source of the visual work.

Fig. 1. Photography of the performance's scenic space

2. TECHNICAL NOTES

The stage device developed for this purpose consists in the use of a projection screen and translucent fabrics hanging, on which performer's images are projected, captured and processed in real-time (Fig.2). Throughout two webcams arranged at the two opposite sides of the performer, the performer's actions are multiplied and extended throughout visual delay lines (Fig. 3). These images are flutist details, which intend to spatialize and to fragment her corporeal presence during the performance.

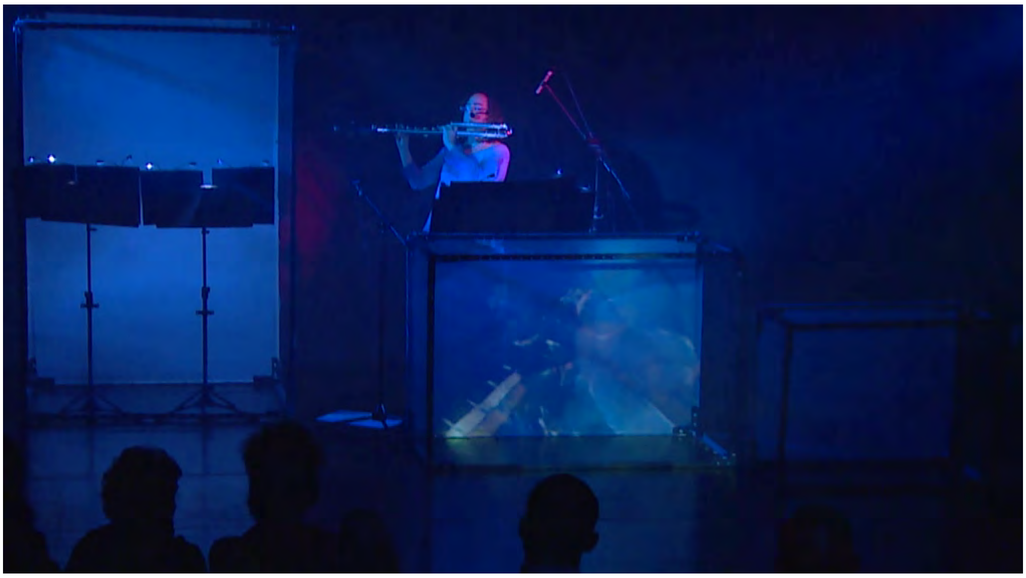

Fig. 2 Representation of the visual delay lines

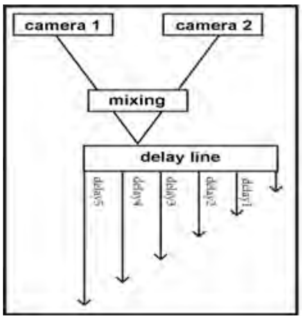

Fig. 3. Photography of the performance

A software designed for this performance identifies instrumental dynamic variations and uses this information in order to control and manipulate the audio-visual settings. The primary image sources are textures of different fabrics, which pass again throughout an overlapping process by delaying lines. In its totality, there are five image layers that are gradually superposed. The intensity of the flute sound is mapped, and when its touch a series of predetermined thresholds, new delayed layers of the primary image are gradually mixed (Fig.4). Reaching the highest level of the musical pieces, the four layers are all overlapping.

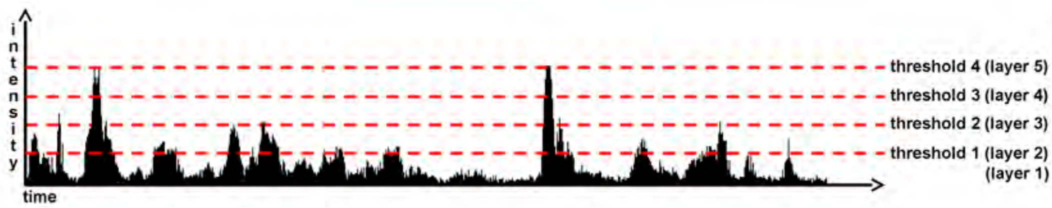

Fig. 4. Representation of the mapping process

The use of these devices is highlighted by the relationships between many heterogeneous elements that compose the performance: the instrumental and electroacoustic discourse; the physical presence of the flutist and her enlarged images which are fragmented and projected on the stage area; sound spaces created by each one of the pieces and the physical space in which the performance takes place. The network, where these elements interact with each other, forms a performance that unfolds continuously different space-time settings.

3. PROGRAM NOTES

Tempo Transversal – Flauta Expandida (Transversal Time – Expanded Flute) consists of a CD with Cassia Carrascoza in charge of artistic direction and interpretation. It is based on works written for flute (some with electronics) by Brazilian contemporary composers and recorded in 2016 in São Paulo and Paris, at IRCAM. It was released by SESC label. The Bravo magazine has nominated it among the ten best classical music recordings of the year.

The proposal presented for NIME2019 establishes a computer-controlled catalyser that simultaneously combines and extends the flutist body actions, electronic sounds and the performative physical space. The scenic device developed by Felipe Merker Castellani enhances the relationship between the heterogeneous elements that compose the performance: the instrumental discourse, the physical presence of the flutist and her images, captured by cameras, fragmented and projected on the expanded stage area, following a script for improvisation created by the two artists.

During the performance of *Khorwa-Myalwa* by Mikhail Malt, a software developed for the project identifies the variation of instrumental dynamics and uses this information to control and manipulate the audio-visual settings. The result is a continuous change of configurations that unfolds with the interactive performance and aims to manipulate the settings of our space-time perception.

The second work is an improvisation on a fixed support electroacoustic (tape) composed on the flutist research material in collaboration with the composer Danilo Rossetti, which establishes an improvisation game settled on a sound texture created from the sound material manipulated from the game of pre-recorded images and propagate in real time simultaneously.

4. MEDIA LINK(S)

- Video: https://www.youtube.com/watch?v=sy6uPIbZz4o
- Audio: https://www.youtube.com/watch?v=Y2FsVPMagew

Trois Machins de la Grâce Aimante (Coretet no. 1)

ROB HAMILTON, Rensselaer Polytechnic Institute

Fig. 1. Performers wearing Oculus Rift head-mounted displays perform *Trois Machins de la Grâce Aimante*.

1. PROJECT DESCRIPTION

Trois Machins de la Grâce Aimante is a composition intended to explore Twenty-First century technological and musical paradigms. At its heart *Trois Machins* is a string quartet fundamentally descended from a tradition that spans back to the 18th century. As such, the work primarily explores timbral material based around the sound of a bowed string, in this case realized using a set of physically modeled bowed strings controlled by Coretet [1], a virtual reality string instrument and networked performance environment. The composition - for four performers, preferably from an existing string quartet ensemble - takes the form of three distinct movements, each exploring different capabilities of the instrument itself and requiring different forms of communication and collaboration between the four performers.

Fig. 2. Coretet preset configurations from left to right: orb, violin, viola, cello and the Coretet bow [left]. Coretet server view of performer playing the cello [right].

Movement I serves as an introduction to the performance, with performers first engaging Coretet using its Orb configuration. The structure of Movement I is improvisational and rhythmic with a metronomic pulse being established by the ensemble. Notes on the Orb are triggered by the collision of the avatar's skeletal mesh and the surface of the Orb generating pitched percussive sounds. Performers move from performing rhythmic hand strikes to bowing the Orb, creating a single pitch similar to that of a bowed steel plate or saw. The movement concludes as each performer bows the Orb, resolving to a static four-note chord across the ensemble.

Movement II explores a function of Coretet that allows finger positions activated along each instrument's neck to be quantized to a variety of modes and scales. To denote each selected mode or scale fret markings similar to those found on a viola da gamba or guitar are made visible along the instrument's neck. These modes and scales include:

- *Octave*: the neck is divided into two regions
- *Triad*: major triad built on a string's root pitch
- *Pentatonic*: a five note scale
- *Whole-tone*: a six note whole tone scale
- *Chromatic*: a single octave chromatic scale
- *Quantized*: the full range of the instrument with pitches quantized to the nearest note in a chromatic diatonic scale
- *Free*: the full continuous range of the instrument without quantization

A composed improvisation within each selected mode is performed by the ensemble for movement II and focuses on different rhythmic, harmonic and melodic ensemble performance practices. A traditional graphic score (see Figure 3) was prepared for Movement II and used by the composer and ensemble outside of the virtual environment for the preparation of concert performances.

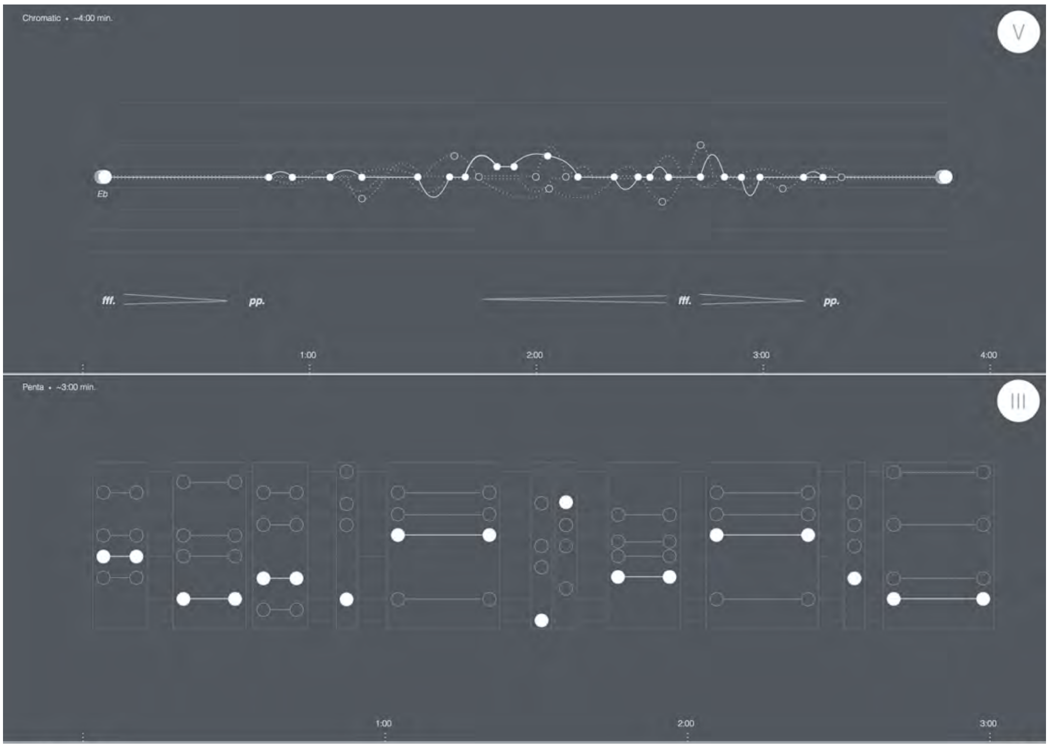

Fig. 3. Two sections from the graphic reference score for Trois Machins de la Grâce Aimante, Mvt. II

Whereas the first two movements of *Trois Machins de la Grâce Aimante* are largely improvisatory in nature, **Movement III** was composed using traditional notation practices and focuses on vertical harmonic structure and rhythmic synchronicity. Within a virtual reality environment where performers wearing head-mounted displays are unable to view notated scores in a traditional manner, Coretet instead displays notes from a musical score in real-time as glowing blue pitch location indicators along the instrument's neck. Scores are synchronized across each of the clients and read individual MIDI tracks exported from a parent score using music notation software such as Finale.

2. TECHNICAL NOTES

Trois Machins de la Grâce Aimante is performed entirely using Coretet, a virtual instrument which can be shaped and scaled by performers wearing Oculus Rift head-mounted displays into different configurations (see Figure 2). Parameters such as neck length, body size, and number of strings are manipulated to recreate traditional stringed instruments such as violin, viola or cello or to create new and physically impossible instruments. Performers use a virtual bow which activates the bowed string physical model when it comes into contact with a specific bowing bar on the instrument. By pressing buttons on the Oculus Touch's left hand controller, performers choose which string will be activated. By moving their left hand along the instrument's neck and pressing each string's associated button, performers change the pitch of the current sounding note.

Coretet leverages the Unreal Engine's native network layer to create a networked virtual performance environment capable of supporting and presenting a traditional four-member string quartet to performers through head-mounted displays and to audiences through an auxiliary screen or projector. In a concert performance such as is utilised for *Trois Machins de la Grâce Aimante* this game server hosts each Coretet client instance (representing each performer) connecting across a local ethernet network. Performers in Coretet see each others' head, bow and instrument in real-time within the virtual concert space, allowing for the use of communicative visual gesture both of the head and of the instrument and bow. In live concert situations, a view into the networked virtual space is presented to audiences from the game server. In a manner similar to e-Sports broadcasts of networked games, a series of virtual cameras on the server are projected in 2D for viewing by audiences seated in traditional concert halls.

3. PROGRAM NOTES

While *Trois Machins de la Grâce Aimante* is a composition intended to explore Twenty-First century technological and musical paradigms, it is at its heart a string quartet fundamentally descended from a tradition that spans back to the 18th century. As such, the work primarily explores timbral material based around the sound of a bowed string, in this case realized using a physically modeled bowed string. The composition takes the form of three distinct movements, each exploring different capabilities of the Coretet instrument itself and requiring different forms of communication and collaboration between the four performers. Coretet is a virtual reality instrument that explores the translation of performance gesture and mechanic from traditional bowed string instruments into an inherently non-physical implementation. Built using the Unreal Engine 4 and Pure Data, Coretet offers musicians a flexible and articulate musical instrument to play as well as a networked performance environment capable of supporting and presenting a traditional four-member string quartet.

4. MEDIA LINK(S)

- Video: https://www.youtube.com/watch?v=cgODPY90pAU
- More Information: http://www.coretet.io

ACKNOWLEDGMENTS

Support for the composition of *Trois Machins de la Grâce Aimante* and the development of Coretet was generously provided by a GAPPP residency and commission from the Institut für Elektronische Musik und Akustik (IEM) in Graz, Austria, under the direction of Marko Ciciliani, Barbara Lüneburg and Andreas Pirchner. Hardware support was provided by an Nvidia hardware grant and additional funding and support was provided by Rensselaer Polytechnic Institute.

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uncertain rhythms

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1. PROJECT DESCRIPTION

This work is a continuation of my research into developing new performance ecosystems for improvisation [1, 2, 3]. For this project I developed a new *volatile assemblage*, aka *VOLA* (Fig. 1). My self-designed musical instruments are shaped by my history as a performer working in acoustic, mechanical, electronic and digital musics, blending and exploring the boundaries and breaking points of these different domains. My instruments support many of my existing techniques originally developed on more conventional instruments, while also affording the development of extended and novel techniques and performance strategies. In much of my work I am particularly focused on the exploration of musical timbre and texture; however, for this project my attention is also directed towards time, flow, pulse, duration, friction, disruption – in short, *qualitative rhythms* and *defamiliarisation*.

My approach to temporality here draws on Elizabeth Grosz's *Feminist Futures?*: "An event occurs only once: it has its own characteristics, which will never occur again, even in repetition. But it occurs alongside of, simultaneous with, and in succession to many other events, whose rhythms are also specific and unique. Duration thus defines qualitative multiplicities, events, singularities; […in contrast…] the counting of time, its linear representation, reduces and extinguishes its qualitative differences and restructures them as quantitative" [4]. In this project I aim to place in dialogue the time of machines (e.g. clock time) with the felt time and irregularities of human movement. My intention is to explore a sense of rhythmic flow that blends between something like techno, scratch DJ-ing and swing time in jazz; however, I am equally interested in moments of fragmentation, chaotic feedback, noise and unpredictability, with the aim to make familiar rhythms *strange*. My motivation here is influenced by Viktor Shklovsky's *Art as Technique*: "The technique of art is to make objects 'unfamiliar,' to make forms difficult, to increase the difficulty and length of perception because the process of perception is an aesthetic end in itself and must be prolonged" [5]. My view is that if we are interested in "New Interfaces for Music Expression", we should also be developing new aesthetic forms – ones that build on diverse musical traditions while also reimagining (or perhaps *re-sounding*) the future of these traditions and yet unrealized traditions. This project is a modest attempt to search out this new terrain. I hope that it also makes for compelling listening.

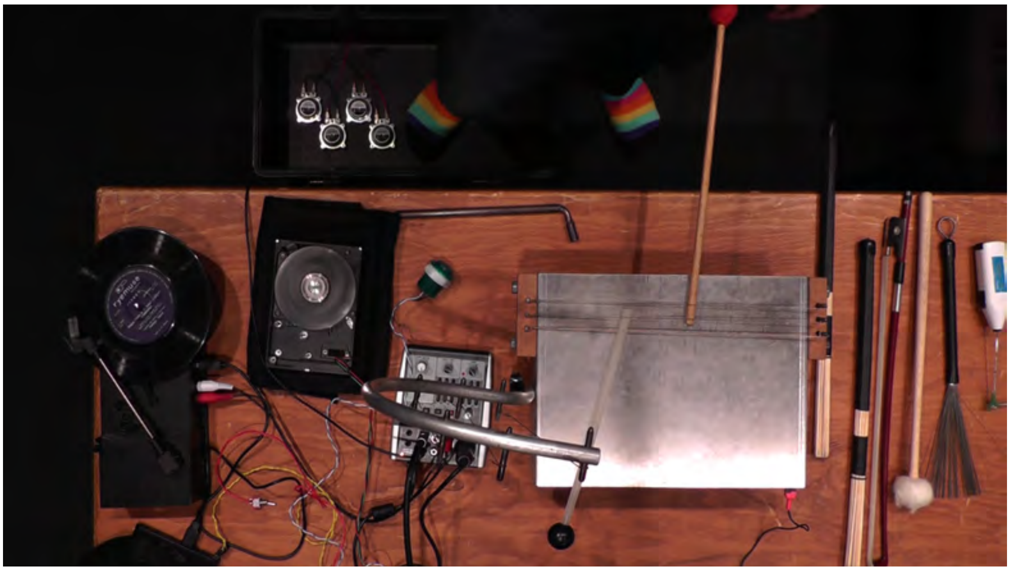

Fig. 1. *volatile assemblage*, aka *VOLA*

2. TECHNICAL NOTES

VOLA brings together a metal resonator with strings and contact microphone, belt-driven turntable with modified vinyl records, upcycled HHD drive controller with a LattePanda Alpha embedded computer running Arduino and Max/MSP patches, and two Bugbrand Postcard Weevils all connected via a mini-mixer to an amplified array of transducers, along with an assortment of actuators (e.g. bow, beaters, cappuccino whisk, ping pong balls). The system is battery powered, and fits into a carry-on size flight case. Additional audio output can be sent to an amplifier or PA for both spatialization and to allow for the system to adapt to different acoustic spaces. The portable, self-contained and adaptable features of *VOLA* are explicit design choices that I hope will assist in my aim of further developing my performance practice through diverse collaborations in diverse locations.

3. PROGRAM NOTES

Uncertain rhythms / crackling metal / improv vinyl
Human-machine disco / glitchy re-sounding futures

Paul Stapleton is an improviser and sound artist originally from Southern California. He designs and performs with a variety of modular metallic sound sculptures, custom made electronics and found objects. Paul is currently based at the Sonic Arts Research Centre (SARC) in Belfast, where he teaches and supervises research in new musical instrument design, music performance, sound design, and critical improvisation studies. He has received critical acclaim for several artistic projects, including his duo album *FAUNA* (2013, pfMENTUM), and for his sound design and composition work as part of the immersive audio theatre piece *Reassembled, Slightly Askew* (2015). His newest trio project Ens Ekt with Simon Rose and Adam Pultz Melbye has received funding for a UK tour from JazzDanmark, as well as from Initiative Neue Musik Berlin to support a forthcoming site-specific performance work.

4. MEDIA LINK(S)

- Video: https://vimeo.com/313577099
- Website: http://www.paulstapleton.net/

ACKNOWLEDGMENTS

My current performance system was developed in part during a residency at the Centre for Interdisciplinary Research in Music Media and Technology CIRMMT) in Montréal, as well as at the Sonic Arts Research Centre (SARC) in Belfast. I was able to perform at NIME 2019 thanks to funding from the School of Arts, English and Languages, and the Jack Kerr Fund in Music at Queen's University Belfast.

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Vrengt: A Shared Body-Machine Instrument for Music-Dance Performance

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1. PROJECT DESCRIPTION

What if a musician could step outside the familiar instrumental paradigm and adopt a new embodied language for moving through sound with a dancer in true partnership? And what if a dancer's body could coalesce with a musician's skills and intuitively render movements into instrumental actions for active sound-making?

Vrengt is a multi-user instrument, specifically developed for music-dance performance, with a particular focus on exploring the boundaries between standstill vs motion, and silence vs sound. We sought for creating a work for one, hybrid corporeality, in which a dancer and a musician would co-creatively and co-dependently interact with their bodies and a machine. The challenge, then, was how could two performers with distinct embodied skills unite in a continuous entanglement of intentions, senses and experiences to control the same sonic and musical parameters? This was conceptually different than they had done before in the context of interactive dance performances.

Fig. 1. The dancer, with a Myo armband on her forearm, blindfolded in the first part of *Vrengt*. (Photo: Sophie C. Barth)

2. TECHNICAL NOTES

Vrengt has been developed through an entirely situated design methodology starting from investigating the dancer's breathing and other involuntary micromotions as variations in muscle activation during standing still. We worked with sonification as an artistic-scientific tool to explore and enhance the bodily data in question. Two Myo gestural control armbands were used for sensing the muscle activity of the left forearm and right leg of the dancer, together with a wireless headset microphone for capturing the breathing in the form of audio signals. The system setup is described in the paper with the same title [1]. In short, the main musical interface is developed in the Max environment. Bioelectric signals are mapped into various sound modules, with a particular emphasis on physically-informed procedural synthesis of everyday sounds. The dancer uses the sound of breathing deliberately to create acoustic feedback loops based on the proximity to the speakers. The main interface for the purpose of shared control is a custom virtual mixer that sums the individual sound modules, allowing the musician to modify the mix levels and data processes with a MIDI controller.

Fig. 2. The dancer, *musicking* with the Myo armband and wireless headset microphone in the third part.

3. PROGRAM NOTES

The composed aspect of *Vrengt* and choreography provides a large amount of freedom in collectively exploring sonic interactions throughout the performance. The piece is structured in three improvisatory parts:

1. Breath: "The embodied sounds of the dancer." Blindfolded, she can rely solely on the kinesthetic and auditory senses. She interacts with the physical space via creating acoustic feedback loops, controlled by the musician.
2. Standstill: "A sonic exploration of the involuntary micromotions." While the dancer forces herself to stand as still as possible, the audience gradually hears the audification of the dancer's neural commands leading to muscle contractions.
3. Musicking: "Playing together!" Both performers join the active process of music-making, presenting the full potential of the shared instrument.

4. MEDIA LINK

- Video: https://youtu.be/hpECGAkaBp0

ACKNOWLEDGMENTS

The authors would like to thank Qichao Lan, who collaborated the project as the second musician, and Victor Evaristo Gonzalez Sanchez for his continuous support throughout the development. This work was partially supported by the Research Council of Norway (project 262762) and NordForsk (project 86892).

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Fig. 3. The dancer, with Myo armbands on her arm and leg, and the musician(s) perform *Vrengt* together in the first live performance.

We Bass: inter(actions) on a hybrid instrument

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MIGUEL ANTAR, Universidade de São Paulo

1. PROJECT DESCRIPTION

The key for a collective process of free improvisation is the interaction, dependence and surrender of its parts, so the resulting sound flux is more than the sum of each individual layer. The We Bass performance is an exploration of the symbiosis of two performers playing the same instrument: Their actions have direct consequence on the resulting sound, challenging the other player with instability and interference.
From the experiments of the English scientist Thomas Young (1773-1829) on the phenomena of diffraction and interference of light waves, we observe that interferences generated by overlapping light waves can have a character of annihilation, when they are out of phase (destructive interference), or a reinforcing character when in phase (constructive interference). From this reflection we try to deepen the discussion about the interferences of the performers inputs involved in a free improvisation session. We seek a model of connection between the performers that promotes processes of creation in the free improvisation, exploring the dialectics between reinforcement actions (processes of interaction that reinforces a certain sound moment) and movement actions (that destabilizes and transforms the flow).
We Bass is a duo performance exploring the interactions between the musicians playing one hybrid machine: an electric upright bass guitar with live electronics processing. The instrument consists of an electric upright bass with movement sensors and a live processing machine with a controller that interacts with the sensors, changing some processing parameters and some controller mapping settings, creating an instable ground for the musicians.

Fig. 1. Paulo Assis and Miguel Antar in Audioclicks Studio.

2. TECHNICAL NOTES

The instrument used is what we call a hybrid machine, using a wireless joystick (a Wii remote) attached to a custom built piezo-electric semi-acoustic upright bass. The audio signal and the Bluetooth connection go inside a live

electronics software inside a notebook. One midi controller (a Novation Launch Control XL) is also part of the hardware system.
The audio processing is done inside LiveProfessor, a plugin host software oriented for live performance, developed by Audioström Sound Software. Inside it, the audio signal is divided into eight independent channels, each with different processing. The main parameters of each effect channel are mapped into the midi controller, and the axis values from the Wii remote are mapped over some of these same parameters. Combined, both mappings create an unstable system where nor the bassist nor the controller players have total control over all the parameters. Not all axis movements from the bass are really mapped, and there is no movement sensor in the midi controller. Therefore, the performance also plays with the audience, tricking fake movements as musical gestures.

3. PROGRAM NOTES

We Bass is a duo improvisation work exploring the interactions between two performers playing one hybrid machine: An electric upright bass guitar with live electronics processing. Both musicians have their controls changed by other's actions and sensors, such as one's movements mapping other controls and the other's faders mapping one's pitch and intensity. The resulting sounds are consequence of their symbiosis, blurring the boundaries of their actions, inspiring and challenging each other with instability and interference.
Paulo Assis is sound artist and mix/mastering engineer based at Audioclicks Studio in São Paulo, Brazil. Graduated in Architecture (FAU-USP, 2002), participates in electronics, woodwork and software music projects. He is finishing his Master degree research at USP.
Miguel Antar is musician and researcher. Graduated in music at the Ateneo Paraguayo. He integrates the groups Ôctôctô, Joaju, DuoCoz, Camerata Profana, Filarmônica de Pasárgada, KairosPania Cia. Cênico Sonora and Orquestra Errante. He is doing his phD degree research at USP.
They are both members of the NuSom Research Center on Sonology at the University of São Paulo.

4. MEDIA LINK(S)

- Video: https://vimeo.com/webass

ACKNOWLEDGMENTS

This work was supported by University of São Paulo, institution that helped in the funding of stay and locomotion of both performers, during their stays in Porto Alegre.
This work was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001