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Simulation and Computer Experimentation in Music and Sound Art

Convenors

Jonathan Impett (Orpheus Instituut)
Hanns Holger Rutz (University of Music and Performing Arts Graz)
David Pirrò (University of Music and Performing Arts Graz)

Venue

Orpheus Instituut
Korte Meer 12, 9000 Ghent (Belgium)



Network: Orpheus_guest
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Simulation and Computer Experimentation in Music and Sound Art

Computational methods have made their way into most of scientific and artistic fields; simulation has become a paradigmatic mode in contemporary practices. In science, in design, in medicine and in art, simulations of natural, human, technological or abstract systems (or techniques derived from simulation) are ubiquitous. The development of new methods of computation and simulation in the natural sciences initiated an ongoing discussion about the relationship of *in silico* experiments to empirical or theoretical modes of investigation.

The seminar aims to bring together practitioners and scholars to discuss the wide-reaching implications of the 'agential cut' (Barad) or 'ontic cut' (Rheinberger) – the separation between operationalised model or abstract theory and perceived or experimentally verified 'reality', the fissure already indicated by Husserl and realised in experimental computational systems. These introduce a new type of interface between the machinery and what is implemented, allowing for the ongoing production of new data and going beyond the traditional atemporal theoretical models; crucially, simulations also allow new and mobile perspectives onto the 'object' modelled by tracing contingent, situated, multiple paths through what DeLanda describes as 'a space of possibilities' – alternative realities within a space that displays stability or consistency at another level. In Rheinberger's words 'it becomes urgent to ask whether computer simulations represent a new category of epistemic object altogether.'

Computational models afford a way to test theoretical constructs or observe the consequences of non-physical or even imaginary hypotheses. One arrives at a critical conception of computation, situating it beyond the dualism of a deductive, representational approach and an inductive, empirical approach, acknowledging a speculative quality of algorithms that 'are not simply the computational version of mathematical axioms, but are to be conceived as actualities, self-constituting composites of data' and 'equipped with their own procedure for prehending data.' (Parisi) The very activity of experimentation and augmenting the language of artistic creation is exposed through the use of algorithms.

Barad, Karen (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Durham and London: Duke University Press.

DeLanda, Manuel (2011). *Philosophy and Simulation: the Emergence of Synthetic Reason*. London: Bloomsbury.

Husserl, Edmund (1970). *The Crisis of European Sciences and Transcendental Phenomenology*. Evanston, IL: Northwestern University Press.

Parisi, Luciana (2017). 'Computational Logic and Ecological Rationality' In: Hörl, Erich and James Burton (eds.), *General Ecology. The New Ecological Paradigm*. London: Bloomsbury Academic.

Rheinberger, Hans-Jörg (2018). 'Transpositions: from traces through data to models and simulations' In: Schwab, Michael (ed.), *Transpositions: Aesthetico-Epistemic Operators in Artistic Research*. Leuven: Leuven University Press.

Music, Thought & Technology

This seminar is organised in the context of the research cluster Music, Thought and Technology (MTT) at the Orpheus Institute. MTT posits a fundamental relationship between these three aspects of human behaviour. Taking its cue from recent research in technology theory, in new media and digital culture, MTT proposes a radical reorientation of the space and terms in which we think about music, exploring these ideas through creative projects.

Put simply, our common repertory of operational concepts is largely derived from technology; this therefore seems the natural place to look for constructive or explanatory models. Technology is fundamentally constitutive of music, its experience, practices and culture. Like all art, music could be seen to function in the context of a common sense of the possible, of the operations and relationships that it might embody, extend or reveal. This sense of the possible derives primarily from science, technology and their cognates such as natural philosophy or cosmology. Music is literally inconceivable without technologies. They participate in the imagining and apprehending of music, but in a bidirectional process also become part of the broader repertoire of conceptual operations that inform human thought at any given cultural moment. There is a continuum from the 'hard' technologies of instruments or reproduction through the materials of composition to the mental models we use to understand music. Engagement with music is thus also technical. The techniques of music are inseparably linked with its technologies of imagining, creation and production.

In our self-consciously technological age above all, technology provides a common set of ideas, metaphors and behaviours. It is the natural place to look for discourse that reaches across the many approaches to composition, sound art and improvisation that characterise contemporary musical activity irrespective of style or genre – including the vast body of inherited work for which we constantly search for new relevance.

At the same time, researchers investigating new areas of computer science and artificial intelligence are posing new questions about the nature of digital objects, concepts and experience. Musical works, we suggest, have much in common with virtual or digital objects. They exist in a unique state of materiality/immateriality: while they are intensely bound to direct experience, to technologies, techniques and materials, this physicality can exist in multiple instantiations, they can be manipulated, engaged with and acted upon as cultural abstractions. In cultural terms, music is the area of human activity in which we deal with the virtual, with the constructive relationship between human affect and abstract structures or formal systems. Digital humanities research and computer-based creation use the same repertory of tools; both are acts of musical imagination extended and explored through technology. The boundaries become increasingly blurred.

More info: www.orpheusinstituut.be/projects/music-thought-and-technology

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Algorithms that Matter

Algorithms are everywhere today, and at the same time they are hidden. We perceive them when we are presented with “related” items of interest in an online store or on a social media site, whenever we query a simple term on the web. Nonetheless, we would find it hard to exactly describe how any of these algorithms work. We take them for granted, accept that we are subject to their analysis and decision-making.

How can art contribute to understand the increasing influence of algorithms
and translate them into aesthetic positions?

Algorithms have been used in music even before the emergence of “computer music” in the 1950s, but today we witness an entire new wave of interest, reflected in festivals, genres, publications and research projects. Interactive and real-time control of compositions has been possible already for two decades, so the reason must be sought elsewhere. It is the very notion of algorithms that is shifting. They are no longer an abstract formalisation, the image of thought, immaterial, static and timeless. Instead of being givens, algorithms emerge from artistic praxis and experimentation, they become entangled in material processes that produce space and time.

The project “Algorithms That Matter” (Almat) is grounded in this new idea that algorithms are agents that co-determine the boundary between an artistic machine or “apparatus” and the object produced through this machine. The central question is: How do algorithmic processes emerge and structure the praxis of experimental computer music? The hypothesis is that, instead of being separated from the composer—generators and transformers of infinite shapes—they exhibit a specific force that retroacts and changes the very praxis of composition and performance.

A series of methodical artistic experiments is carried out by the project team together with guest composers. Over defined periods of time, they develop series of interrelated sound pieces. The work process is observed and transcribed into complementary forms of presentation and discourse on which future research projects can build. This includes concerts and exhibitions, an online public “continuous exposition”, and gatherings and symposia that connect researchers across various institutions in Europe. The project not only aims at extending the praxis of experimental computer music using algorithmic processes, but also at contributing to the scope and methodology of artistic research, introducing a field of research so far disregarded.

Almat is hosted by the Institute of Electronic Music and Acoustics (IEM) at the University of Music and Performing Arts Graz, where it is integrated with ongoing research and teaching and performing activities. It seeks not only to be visible in the related research community, but also to reach out to young researchers and a general audience across different fields, raising the awareness of artistic research praxis.

More info: www.almat.iem.at



Convenors

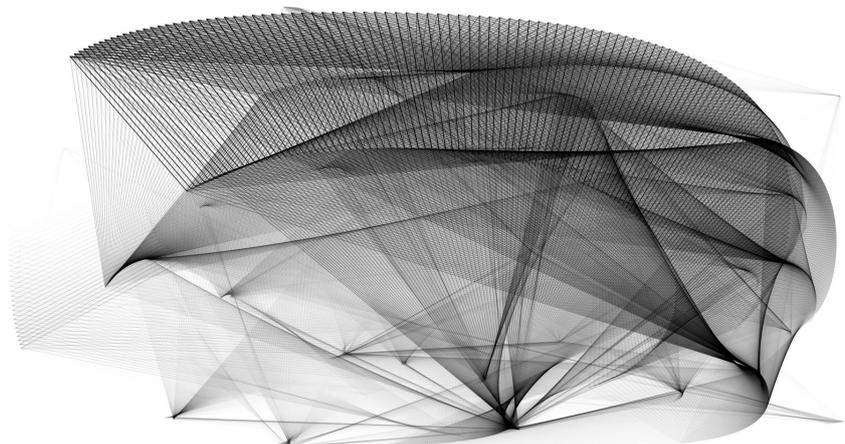
Jonathan Impett - Director of Research, Orpheus Institute

Jonathan Impett is Director of Research at the Orpheus Institute and Associate Professor at Middlesex University (London, UK).

Jonathan's professional and research activities cover many aspects of contemporary musical practice, as trumpet player, composer and theorist. He also leads the research cluster "Music, Thought and Technology" at the Orpheus Institute. His research is concerned with the discourses and practices of contemporary musical creativity, particularly the nature of the contemporary technologically-situated musical artefact.

In the field of historical performance, he is a long-standing member of both The Orchestra of the Eighteenth Century and The Amsterdam Baroque Orchestra. He is also a member of the experimental chamber ensemble Apartment House. As a soloist he has given premieres of works by composers including Scelsi, Berio, Harvey and Finnissy. He directed the live electronic chamber ensemble Metanoia, and was awarded a Prix Ars Electronica for his development of the metatrumpet. His compositions have been broadcast throughout Europe. As an improviser he has played with musicians as diverse as Paul Dunmall and Amit Chaudhuri.

Work in the space between composition and improvisation has led to continuous research in the areas of interactive systems and interfaces. The current 'active sound space' project uses ALife populations of wave models to create interactive works combining aspects of composition and sound art. A monograph on the music of Luigi Nono has recently been published by Routledge, and Jonathan is currently working on a project considering the nature of the contemporary musical object, 'The work without content'.



David Pirrò - Research Fellow, Institute of Electronic Music and Acoustics, University of Music and Performing Arts Graz, Austria

David Pirrò is a sound artist and researcher based in Graz, Austria. His works include interactive compositions and sound installations as well as audiovisual and electroacoustic pieces in which aspects of performance and spatialisation of sound are central. Departing from a radical inclusive point of view, he seeks ways of composing by which the work of art becomes an emergent phenomenon of the mutual interactions between all the elements involved in its construction, performance and perception.

David is currently working at the IEM (Institute of Electronic Music and Acoustics) as lecturer and collaborating in various scientific and artistic research projects.

www.pirro.mur.at

Hanns Holger Rutz - Research Fellow, Institute of Electronic Music and Acoustics, University of Music and Performing Arts Graz, Austria

Hanns Holger Rutz is a sound artist, composer/performer, researcher and software developer in digital art. Since 2013, he works as researcher at the Institute of Electronic Music and Acoustics (IEM) in Graz, where he currently runs, conjointly with David Pirrò, the FWF-funded artistic research project Algorithms that Matter (Almat). He holds a PhD in computer music from Plymouth University, UK. His work centres around sound and installation art, and extends to live improvisation and electroacoustic music, in all of which the development and research on software and algorithms plays an important role. The central theme in the recent works is the materiality of writing processes, and how compositional processes can be rendered perceivable in the display of art.

www.sciss.de

Schedule

DAY 1 / Thursday 21 March

13.00	Welcome by Jonathan Impett, David Pirrò, Hanns Holger Rutz and Luc Döbereiner	Concert Hall
14.30	<p>Paper session 1</p> <ul style="list-style-type: none"> • Bjarni Gunnarsson – <i>Synthetic environments and compositional context</i> • Iain Emsley – <i>Distant Sonification: Creating and transforming practice and meaning through algorithmic processes</i> • Dolores A. Steinman, Peter Coppin, David A. Steinman – <i>Re-imagining Blood Flow at the Blurry Border between Simulation and Simulacrum</i> 	Concert Hall
16.00	Break	Basement
16.30	<p>Paper session 2</p> <ul style="list-style-type: none"> • Hanns Holger Rutz – <i>Computing at Intrinsic Speed within a Culture of Real-Time</i> • David Pirrò, Luc Döbereiner – <i>Contingency and Synchronisation</i> 	Auditorium
17.30	Break	Basement
18.30	<p>Performances</p> <ul style="list-style-type: none"> • Rebekah Wilson – <i>Beyond Isomorphism: transformation of human/machine agency</i> • Juan Parra, Fernando Rosas – <i>On Timbre Networks: Between Metaphor, Simulation, and Model (and Metaphor)</i> • Robert Lisek – <i>Meta-learning in Music</i> 	Concert Hall
20.00	Dinner	1st floor

DAY 2 / Friday 22 March

09.00	Paper session 3 <ul style="list-style-type: none"> • Mark Pilkington – <i>Current 9 – Graphical Notation in Music</i> • Eric Maestri – <i>Simulation as intimate transformation of the existential experience</i> • Olaf Hochherz – <i># Hiller and Isaacson’s misleading representations of their experiments</i> 	Concert Hall
11.00	Keynote: Geoff Cox - <i>The Now of Computer Experimentation</i>	Concert Hall
12.00	Lunch	1st floor
13.30	Performances <ul style="list-style-type: none"> • Magno Caliman – <i>squareFuck</i> • Kiyoshi Furukawa, Haruyuki Fujii, Takayuki Hamano – <i>The “ARCHITECTURE DREAMS MUSIC” Project</i> 	Concert Hall
14.30	Break	Basement
15.00	Paper session 4 <ul style="list-style-type: none"> • Tom Mudd – <i>Algorithms playing Algorithms: coding music via the algorithmic creation of score and instrument files for the NESS physical models</i> • Michele Del Prete – <i>The supplement of simulation. Klang, Ton, and the agency of sound algorithms</i> • Jari Rinne – <i>Sound Art as Simulation</i> 	Concert Hall
16.30	Round table + wrap up	Concert Hall
18.00	End	

Keynote speaker

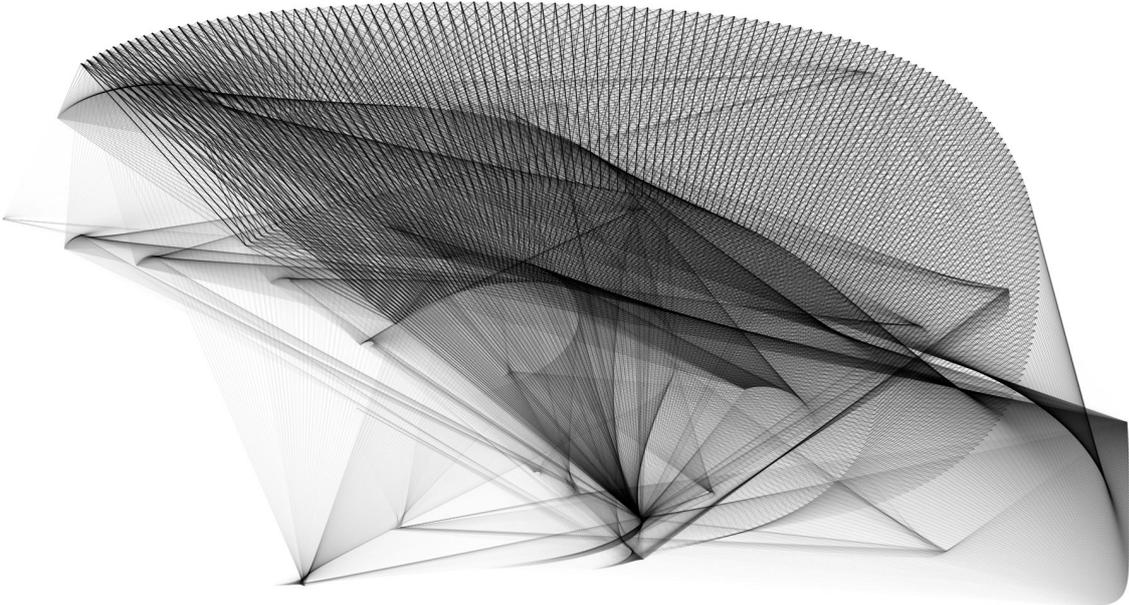
Geoff Cox - Plymouth University / Aarhus University

The Now of Computer Experimentation

The paper takes its point of departure from the research project *The Contemporary Condition*, to discuss the ways in which our conception of time relates to computer experimentation in art and music. Live coding is clearly a practice of time, and it seems commonsensical to say that live coding operates in, and expresses, the present but we might seek more detail on how live coding enacts a particular sense of the present in the coming together of different temporal registers. Live coding might offer some insights into our disjunctive experience of time where humans and machines run in — and out of — synchronous time, and where temporal complexity is actualized. A better (diffractive) understanding of how the present is rendered might then allow us to challenge and extend our understanding of change and action in ways that would have implications for computer experimentation and its effects.

Geoff Cox is Associate Professor/Reader in Fine Art at Plymouth University (UK) and Associate Professor/Lektor in Digital Design at Aarhus University (DK), where he is currently engaged (with Jacob Lund) on a research project *The Contemporary Condition* funded by the Danish Council for Independent Research. As part of this, he recently published *The Contemporary Condition: Introductory Thoughts on Contemporaneity and Contemporary Art* (with Jacob Lund) as the first in a series of small co-edited books published by Sternberg Press (since 2016). He co-runs a yearly workshop/publication in collaboration with *transmediale* festival in Berlin (since 2012) and is co-editor of the associated open access online journal *APRJA* (with Christian Ulrik Andersen), as well as editor for the open access *DATA* browser book series (Open Humanities Press; with Joasia Krysa). He wrote *Speaking Code: coding as aesthetic and political expression* (MIT Press 2013; with Alex McLean), and amongst other things is currently working on a multi-authored book project about live coding, a book on aesthetic programming (with Winnie Soon) as well as developing a project on machine seeing.

Presenters



Magno Caliman - UNIRIO Federal University of the State of Rio de Janeiro

squareFuck

squareFuck is a performance that extends the live coding act to outside of the software IDE, by integrating real time assembly and manipulation of electronic circuits to the traditional “show us your screen” code display. Two main sound sources will be utilized, both on the hardware realm.

Firstly several Arduino boards will be used to drive bare speakers. The Arduinos will be live coded, using a few small and simple algorithms, such as small delays along with loops, to directly feed quick 5V pulses from the digital pins on the board to the speaker, generating square waves. Since the loudspeakers are bare, as in “no amplifier circuit”, the amplitude of the generated sound is very low. Lavalier mics and coil inductors will be used to send sound back into the computer, in SuperCollider, for further manipulation, looping, and routing to a house mix. The second sound source will be a Texas Instrument CD4060B Integrated Circuit. Technically a “CMOS 14-Stage Ripple-Carry Binary Counter/Divider and Oscillator”, in practical terms the 4060 is a square wave generating IC, with around 10 frequency dividers, capable of subsonic/rhythmic pulses, up to ultra high pitched sounds. The 4060 has a working principle that makes it land itself very well to random patching and trial-and-error component switching on the circuit. Different electronic components can be inserted in several of the IC pins, at will, with different sounding results. Backward LEDs will create regular rhythms, capacitors will generate pitch glides, etc. With that in mind, a circuit around the IC will be constructed and modified live, and showed on the screen via a downward-facing webcam.

Besides receiving both of the sound sources, SuperCollider will also be in charge of generating the performing directives for the piece, by printing actions that the performer should follow. Those actions can be as strict as “add two resistors to the circuit”, or as broad as “make it groovy...”. Those actions will be pre-written beforehand, and selected at random at a faster and faster pace as the performance evolves, up to a point where it is physically impossible for the performer to follow all the instructions. That impossibility is to be shown via the circuit and/or code manipulation. The process unveiled to the audience, ultimately, is the process of failing.

This approach of setting up a constrain system, creating an automata, setting it in motion, and managing it during the performance, speaks to previous works I’ve done, such as the 2016 International Conference in Live Coding performance screenBashing [vimeo.com/212694246]. I’m very interested in the creation of automatons and autonomous systems where I, as a performer, am in charge only of managing those systems, up to an inevitable point to failure. squareFuck builds upon that premise.

Magno Caliman - Creative coder, educator and sound artist from Brazil, currently living and working in Austria. Both his artistic and research activities have a focus on the intersection between art and technology, and are heavily rooted in the embracing of programming languages as places for poetical speculation, as well as the construction, modification and manipulation of electronic circuits. Has a master’s diploma in Education, where he development and researched learning and teaching methodologies for programming languages in the context of the arts, with emphasis on the specificities of the learning dynamics of code for non-computer scientists.

Michele Del Prete - Academy of Fine Arts Lecce

The supplement of simulation. Klang, Ton, and the agency of sound algorithms

In this paper we attempt to induce a reaction between two traditions (continental and analytical philosophy) in order to investigate the agency (i.e. the ontology) of sound algorithms.

In her *Contagious Architecture*, Parisi proposes a model of algorithm in which prehension of incomputable data – and thus novelty – plays a crucial role. This model leads Parisi to two conclusions (one ontological and one epistemological): 1.1) the algorithm unfolds itself as *speculative reason*; 1.2) algorithm *aesthetics* play a special role in researching the nature of algorithms.

Following this line, we examine a text by Derrida (*The Pit and the Pyramid*) pertaining to the agency of speculative reason in Hegel, as this allows to assess the difference between *Klang* (a physical sound event) and *Ton* (a sound event producing feedback within an interiority, in other words, an *adaptive sound algorithm*). As Derrida remarks: 2.1) in Hegel thinking (i.e. agency) results from the elaboration of perceived (self-emitted) sounds as self-reflection; 2.2) in Hegel computing machines cannot think, as computing (*Rechnen*) is a sheer mechanical procedure (i.e. computing machines lack self-reflection).

Within such a framework, the challenges that *sound computation* poses to classical (Hegelian) ontology are enormous thus also disqualify any understanding of simulation as *mimēsis*.

Michele Del Prete holds a Ph.D. in Philosophy from the Freie Universität Berlin. He studied Viola da Gamba with Nanneke Schaap in Verona and graduated in Electronic Music in Venice studying with Alvis Vidolin and in Composition in Graz studying with Beat Furrer. Conferences (continental philosophy, music/space relation) in Paris, Cambridge (UK), Harvard, Madrid, Jerusalem, Toronto, Venice, Helsinki, Darmstadt, Birmingham, Kassel, Rome etc.; performances in Venice (Biennale Musica, Scuola Grande di San Giovanni Evangelista, Fabbrica del Vedere, Conservatorio di Venezia, Teatrino Groggia), Barcelona (Zeppelin), Boston and Montevideo (Csound International Conference), Graz (Signale), Glasgow, Milan, Rome, Saarbrücken, Padua, Rio de Janeiro, Kansas City, University of Wales, Sassari, Bari, New York, Pompei, Essen, Berlin and elsewhere.

He performed his electroacoustic works in complex spatialisation settings in Graz (IEM Cube), Madrid (Auditorium Museo Reina Sofía), Chatham (Symposium of Acoustic Ecology, Historic Dockyards).

Together with Pierluigi Billone he organized two conferences in Palermo and in Venice (*Space: Two Positions and Dialogue with Luigi Nono, on the occasion of Risonanze erranti*); he works on poems by Roberto Bacchetta and collaborates with Igor Imhoff on audiovisuals projects.

He is currently investigating the understanding of the organ in Western music (sound identities, spatial values, performance practices) both as theoretician and as composer/performer; see for example his recent site-specific work *Lontanissimo oro (concertar)*, for Nacchini organ (1757) and 8-loudspeaker system, Basilica di San Giorgio Maggiore, Venice, June 2018.

He teaches Aesthetics at the Academy of Fine Arts of Lecce; he lives in Venice.

Iain Emsley - Sussex University

Distant Sonification: Creating and transforming practice and meaning through algorithmic processes

This paper presents a method called distant sonification as a way of analysing complex cultural forms. Situated within computational practices, such as distant reading or listening, it aims to support and critique the exploration of data. My aims in this paper are to think about the practice as a reflexive analytical technique and to raise questions about how the digital medium affects the epistemological process to understand cultural data. Firstly, I present simulations and algorithms as using models of the world and thought within them and raise questions about how this affects critical practice. Secondly, I develop the argument that meaning is added to these through the structure imposed by both computational and human processes, placing them in the materiality of the medium.

I introduce distant sonification within the context of computational approaches to culture that focus on abstractions and patterns rather than close analysis methods. Worldviews are embedded into the computation through data and the design processes, creating the constraints and languages that imagine a potential set of abstract models. As external processes act on the data, social and political contexts are encoded into its structure and the concepts that underpin them are re-presented in the sonification to create a machine interpretation of meaning.

Interaction allows human agency into the algorithmic loop to alter the processes and reveal and mix human and machine discourses. By using filters, creating virtual instruments, or editing code, human models are translated into the algorithm through the computation. This experimental interaction encourages a reconfiguration of critical forms and logics to create an interpretative gap within the model. Open to technical and nontechnical readings, the model's meaning is decentred and made playful. The act of grammatology reveals the digital as a metamedium, simultaneously representing and creating new data and tools, raises questions about hermeneutics and critical practice required to understand the sound.

The medium becomes the site of cognitive practice where both technical and non-technical sides interact through practice and meaning. Discourse and theory are created and altered through play and grammatology. As a 'co-generative' process, I suggest that distant sonification affords the potential to prepare a model that can be imposed onto the data to support the creation of new forms. Through experimentation, it is possible to explore this model and sonification's logics to provoke questions about audiation and epistemology and rethink practice and meaning as created by machine and the human.

Iain Emsley is currently researching distant sonification as a method for a PhD in Digital Media at the University of Sussex. His work into experimental sonification began in between working on projects for the Oxford e-Research Centre. Having gained a degree in English and worked in publishing, he became a software engineer in academia and financial services before gaining an MSc in Software Engineering from Oxford University. His research interests are sonification, digital methods, humanities, and reproducibility.

Kiyoshi Furukawa - Tokyo National University of the Arts **Haruyuki Fujii, Takayuki Hamano**

The "ARCHITECTURE DREAMS MUSIC" Project

Concept: This project aims to explore the methods of linking architecture and music on the levels of structure and cognition. We realize that the relationship between music and architecture is not just a matter of musical/ architectural structure or musical/ architectural material. Rather, utilizing the researches of cognitive science, an exploration of how humans experience and recognize music and architecture. We plan to advance our research by utilizing our program that we have developed, which maps the principles of architectural concept onto the principles of musical concept. One of this project's objective is to verify our hypothesis – the modality of architecture and music that contradicts, however, the perceptual cognition and the perception of aesthetical order maintains a bridge in the deeper structural levels. By simultaneously generating the architectural and spatial sequences, and musical works using the computer program, it enables the viewers to see, and the listeners to hear, concluding with verifying the cognitive hypothesis.

Realization: By utilizing the self-developed computer program for simultaneously autogenerating architectural spaces and musical works, we are developing a system that expresses the perceptual perception, as well as decoding the link between our hypothesis, that both architecture and music have the same fundamental structure of aesthetical order. Throughout this process of development, we have reiterated countless experiments using our eyes and ears. The work is finally at the stage of it being able to present the first version. Our computer program auto-generates both the architectural space and music by maturing parts by parts, perceiving spatiality and musicality, as well as offering interactive experiences by mapping multidimensionality.

Software: The software, as of now, is being developed as a web application. The user constructs the architectural elements (e.g. pillar, floor, wall, roof or abstract forms etc..) by creating a patch. The patch, which utilizes the files for 3D-CG animation software BLENDER and PNG files, create the architectural space. After selecting the patch and delivering the BUILD commands, music – MIDI file, mp3 sound files, and the musical scores in PDF format – is automatically generated. These are all rendered online, and only the files will be delivered to the user. You can play the MIDI file directly or use its data as control-signals to synthesize sounds.

Kiyoshi Furukawa was born 1959 in Tokyo, Japan. Studied composition with Y. Irino in Japan and with I. Yun and G. Ligeti at the Music Academy in Berlin and Hamburg. Artist in residence at the ZKM Center for Art and Media Technology in Karlsruhe, Germany. He has been awarded numerous awards and scholarships. Since 2000 he is a Professor at the Tokyo National University of the Arts (Inter-Media Art).

Haruyuki Fujii, Professor of Architecture and Design Science, Tokyo Institute of Technology, Ph.D, Architect. Born in Tokyo, Japan. Studied architectural design and engineering at Waseda University, Japan, and philosophy focusing on computational linguistics at Carnegie Mellon University, USA. Studied design computing and cognition at the University of Sydney, Australia. Have been constructing a methodology for design science that bridges the subjectivity in designing, such as subjective insight, illogical thinking, and individual localization, and the objectivity in natural science, such as objective grounding, logical thinking, and universal explanation.

Takayuki Hamano (*1985) is an art creator specializing in digital media art born in Tokyo, Japan. He has studied composition, computer music and real-time image processing at the Sonology Department of Kunitachi College of Music in Tokyo. He has studied sonology at the Royal Conservatory in The Hague. He had been a researcher at Japan Science and Technology Agency. He has completed a doctoral course at Graduate School of Fine Arts at Tokyo University of the Arts. He has created many collaborative works such as interactive music and installation.

Bjarni Gunnarsson - Institute of Sonology, Royal Conservatory The Hague

Synthetic environments and compositional context

The context of generative processes encapsulates relevant data that influence the behavior of an algorithm including mental domains and 'internal' dimensions of a particular context such as goals and decision making. Of creative importance is how an algorithmic process reacts to the influence of its environment, the enclosing conditions from which it emerges. Given a clearly defined set of resources, a variety of processes can operate within the boundaries imposed by a certain context. Such a shared space can be seen as a composable structure, a space where both composition and generative activity take place. Contributing to the evolving properties of a certain situation, the persistence of state means that an environment behaves according to the previous activity that has occurred within it. Opposed to an amnesic situation, a persistent environment can resume previous developments, adapt to long-term interactions and evolve over time. Based on persistence and gradual change, the temporal unfolding of generative processes has an important impact on the becoming of compositional algorithms and the sound material they create.

For this presentation, concerns of persistent storage related to computer music will be discussed as well as how the idea of a 'synthetic environment' can be introduced to algorithmically generate surrounding conditions of a compositional process. A software framework (ADEC, written in SuperCollider) will be presented that implements of these ideas and a short performance will be made that demonstrates its principles.

Bjarni Gunnarsson is an Icelandic composer, coder and sound artist involved in electroacoustic and computer music. He is a faculty member at the Institute of Sonology, Royal Conservatory in The Hague where he teaches algorithmic composition and computer music. Bjarni studied composition with computers at the CCMIX music center in Paris and holds a masters degree from Sonology. Currently concerned with generative environments, algorithmic intervention, and process-based ideas. Sounds focusing on internal activity and motion. Compositions that put into foreground behaviors, actions, fluid sound structures, fuzzy materials or forms. His music has been published by LMALC, 3Leaves, Granny and Tartaruga Records.

www.bjarni-gunnarsson.net

www.sonology.org

Olaf Hochherz - City University of Hong Kong

Hiller and Isaacson's misleading representations of their experiments

This presentation discusses the early practice of Hiller and Isaacson on the Illiac Suite. Their documentation of the project in their book "Experimental Music" ([1959] 1979) describes the project as a successful experiment. In the discussion of their practice they seem to not recognize the difference between simulations and experiments. The difference between simulation and experimentation is that unlike experiments simulations do not interact directly with the material reality. Hans-Jörg Rheinberger proposed that for experiments to be epistemically productive the experiments have to be thought as a practice of technology formation rather than an application of technologies. (2015) Simulations for themselves are limited by the operation of the technology enacting them. Because Hiller and Isaacson did not recognize this difference they do not see that their simulations of practices of composition are not able to contribute to the question in how far music can be formalized. When they summarize insights gained from the simulations they reiterate the claims and values associated with the formalizations of music they implemented. The problem is that such an argument is circular. But the documentation of their practice contains many more details of their practice and how they relate it to music making. They discuss three points central to the reality of music making: (1) the efficiency of the used algorithms, (2) importance to present the work to an audience and (3) the ideas they developed after they got their first results. It is only in the context of those interaction of the simulation with the reality of music making that the practice of simulation can be considered epistemically productive. It is not the result of the simulation itself, but the result in interaction with the practice of music making, consumption, and reinterpretation of their own practice, in which simulations become epistemically productive.

Hiller, Lejaren A., and Leonard M. Isaacson. (1959) 1979. *Experimental Music: Composition with an Electronic Computer*. Westport, CT: Greenwood.

Rheinberger, Hans-Jörg. 2015. "Preparations, Models, and Simulations." *History and Philosophy of the Life Sciences* 36 (3): 321–34.

Olaf Hochherz holds a PhD from City University of Hong Kong. His thesis examined the conditions of interpretations of music as experimental. His research interests focus on the intersection between studies on technology and music. He got educated at Folkwang Hochschule Essen in electronic composition, Humboldt University Berlin in philosophy and computer science and at Bauhaus University Weimar in sound-art/media-art. He holds a BFA and MFA in Mediengestaltung (Media-Art). He is working as a improvising musician and sound artist.

www.hochherz.klingt.org

Robert Lisek

Meta-learning for art and music

We observe the success of artificial neural networks in simulating human performance on a number of tasks: such as image recognition, natural language processing, etc. However, there are limits to state-of-the-art AI that separate it from human-like intelligence. Humans can learn a new skill without forgetting what they have already learned and they can improve their activity and gradually become better learners. Today's AI algorithms are limited in how much previous knowledge they are able to keep through each new training phase and how much they can reuse. In practice this means that it is necessary to build and adjust new algorithms to every new particular task. This is closer to a sophisticated data processing than to real intelligence. This is why research concerning generalisation are becoming increasingly important. A generalization in AI means that system can generate new compositions or find solutions for new tasks that are not present in the training corpus. General Neural Model and intelligent agent should have very general learning capabilities, should not just be able to memorize the solution to a fixed set of tasks during creating of stories, but learn how to generalize to new problems it encounters. It can generalize problem in the sense that solving one or more of tasks should make solving other task easier. There is domain called Meta-learning where will be possible to find solutions for this problems. Meta-learning describes research that aims to create machines capable of general intelligent action. "General" means that one AI program realizes number of different tasks and learn to learn by transforming machine learning algorithms. We must focus on self-improvement techniques e.g. Reinforcement Learning and integrate it with deep learning, recurrent networks, etc.

Robert B. Lisek is an artist, mathematician and composer who focuses on systems, networks and processes (computational, biological, social). He is involved in a number of projects focused on media art, creative storytelling and interactive art. Drawing upon postconceptual art, software art and meta-media, his work intentionally defies categorization. Lisek is a pioneer of art based on Artificial Intelligence and Machine Learning. Lisek is also a composer of contemporary music, author of many projects and scores on the intersection of spectral, stochastic, concret music, musica futurista and noise. Lisek is also a scientist who conducts research in the area of foundations of science (mathematics and computer science). His research interests are category theory and high-order algebra in relation to artificial general intelligence. Lisek is a founder of Fundamental Research Lab and ACCESS Art Symposium. He is the author of 300 exhibitions and presentations, among others: SIBYL - ZKM Karlsruhe; SIBYL II - IRCAM Center Pompidou; QUANTUM ENIGMA - Harvestworks Center New York and STEIM Amsterdam; TERROR ENGINES - WORM Center Rotterdam, Secure Insecurity - ISEA Istanbul; DEMONS - Venice Biennale (accompanying events); Manifesto vs. Manifesto - Ujazdowski Castel of Contemporary Art, Warsaw; NEST - ARCO Art Fair, Madrid; Float - Lower Manhattan Cultural Council, NYC; WWAI - Siggraph, Los Angeles.

www.fundamental.art.pl

Eric Maestri - Université de Lorraine, Metz

Simulation as intimate transformation of the existential experience

In my recent pieces I use simulations to play with writing and think i.e the contact of instrument and electronics through their perception. This personal practice represents a current paradigm which uses computers to project and test the results of the compositional choices. As Rheinberger claimed, the Derridean concept of *trace*¹ can be mobilised². Following this author, I argue that this concept, can be understood as *archi-écriture*³. Simulation, as *archi-écriture* operates as a dynamic foundation of compositional practice, synthesising the operational and the perceptive aspects performatively⁴. The performance changes in type: it is a scaled and projective performance, a trace of a trace. The studio is the reality. This practice, pushed by the technological innovation, is not innocent: it concerns aesthetics. The musical practice can be seen as an *existential trace*. As Martin Heidegger claimed, the existential constitutive elements of the Being-here (*Dasein*) are defined by the coexistence of emotive situation, comprehension, dejection and interpretation⁵. In my case, music acts as means of the comprehension and interpretation of the existential musical condition. It is an isomorphic emergence of the temporal profile of my existence. In this sense, the utilisation of simulations enters in the existential hermeneutical cycle and transforms the artistical existential experience. In this presentation I will show how the computer is used in my compositional practice. Starting from two recent pieces (*Trans* for saxophone and electronics⁶ and *Comme le vent*, for ensemble and electronics⁷), I will show how the interpretation of my intimate musical experience is transformed and impacted by the simulative means. Under a Heideggerian light, I will concentrate on the practical aspect of their implementation and suggest an existential perspective.

¹ Jacques Derrida, « La différence », in *Marges de la philosophie* (Paris: Les éditions de minuit, 1972).

² Hans-Jörg Rheinberger, « From Traces through Data to Models and Simulations », in *Transpositions: Aesthetico-Epistemic Operators in Artistic Research*, éd. par Michael Schwab (Leuven: Leuven University Press, 2018), 215-25.

³ Jacques Derrida, *De la grammatologie* (Paris: Les éditions de minuit, 1967).

⁴ Andrew Sorensen et Henry Gardner, « Programming with Time. Cyber-physical programming with Impromptu », in *Proceedings of OOPSLA10: ACM International Conference on Object Oriented Programming Systems Languages and Applications* (New York: ACM, 2010), 822-34.

⁵ Martin Heidegger, *Sein und Zeit* (Tuebingen: Max Niemeyer Verlag, 1927).

⁶ Commissioned by saxophone player Philippe Koerper and Ensemble l'imaginaire, Strasbourg. Premiere: march 9th 2019.

⁷ Commissioned by Ircam-Centre Pompidou and ensemble l'Instant Donné. Premiere: June 15th 2019.

Eric Maestri is composer and researcher in musicology. He holds two Ph.Ds. in musical composition (Huddersfield) and musicology (Strasbourg) and works widely in composition and research. He taught at Strasbourg Conservatory and University, University Paris 8 (Lecturer in computer music) and is now Lecturer in music at University Lorraine, Metz. Eric writes for instruments, voices and electronics. He develops a creative, imaginative and free approach to music and works using various kind of sounds, from environmental to synthetic. As researcher he mainly concentrates in electroacoustic music from an analytical and artistic point of view, stressing the fundamental aspects of the musical symbolic fabric and the hermeneutical aspect of its creativity.

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Tom Mudd - Edinburgh College of Art

Algorithms playing Algorithms: coding music via the algorithmic creation of score and instrument files for the NESS physical models.

This talk will reflect on my recent explorations of the Next Generation Sound Synthesis set of physical models created by researchers at the University of Edinburgh. These models are sophisticated numerical simulations of a range of acoustic situations, notably guitar/fretboard interactions, brass instruments, bowed strings, 2D membranes, and diffraction models of sound propagation in acoustic spaces.

My use of the models is as a musician interested in sonically exploring via algorithmic processes. My process has generally involved the iterative creation of a range of algorithms that attempt to play the NESS instrument algorithms: simulations of performers playing simulations of instruments. A notable aspect of this process is that the results are very difficult to hear in terms of digital synthesis processes. Due to the convincing nature of the simulations the results are much more suggestive of the logic and culture of the instruments being simulated. For example, if the model is of a guitar, the listener will likely picture a human performer, or at the very least, a physical instrument, as the source of the music, even if they are very much aware of the digital nature of the process. Along with this comes the whole culture of strumming and plucking string instruments: the variations in the simulated instrument and the simulated performance conjure different waypoints from the histories of guitar cultures and guitar performances. Even for me as the creator, it is very difficult to conceive of the results as digital synthesis rather than instrumentally created music, opening up a strange aesthetic space.

Despite their simulated nature, I will elaborate the material-oriented nature of my own use of the algorithms, in the mould of Keep's notion of instrumentalising (Keep, 2009). Comparing my own work with that of others who have used the NESS models is instructive in trying to unpick just how the nature of the models—and the nature of the interaction with these models—shapes the outcome, shedding light on the capacities and tendencies that emerge when composers engage with the models.

Excerpts of my work with the models can be heard here (guitar): soundcloud.com/tommudd/guitar-next-generation-sound-synthesis-various-excerpts and here (brass): soundcloud.com/tommudd/brass-next-generation-sound-synthesis-excerpt

The models themselves can be explored at www.ness.music.ed.ac.uk.

Keep, A (2009) Improvising with sounding objects in experimental music. In *The Ashgate Research Companion to Experimental Music*, page 113 – 130. Ashgate Publishing Limited.

Tom Mudd is a musician and programmer interested in relationships between software, composition and improvisation. His recent work revolves around physical models: digital synthesis processes based on numerical simulations of acoustic objects and instruments. His recent release on Fancyyyyy uses massed brass synthesis: digital models of physically improbable brass instruments being played by algorithms. Previous work released on the Entr'acte label explored similar territory with his own synthesis processes. He currently lectures in sound and algorithmic music at Edinburgh College of Art.

Juan Parra Cancino - Orpheus Institute

Fernando Rosas - Centre of Complexity Science and Department of Mathematics,
Imperial College, London

On Timbre Networks: Between Metaphor, Simulation, and Model (and Metaphor)

Timbre Networks is a creative method that aims to integrate a tele-communicative, algorithmic, and poetic understanding of the concept of "networks". This is done by applying dynamic mappings of control streams, which are synthesized from live and telematic musical sources, to network-based synthetic sound agents, such as stochastic synthesis and Boolean network pattern generators (Ref. 1). From an artistic and performative perspective, this setup aims to expose the multithreaded role of the computer music performer, blurring the boundaries between composition, digital lutherie (Ref. 2) and performance into an integrated entity. Linearly-structured composition procedures are replaced by networks of interdependent sound engines and manipulators, and rules that determine the initial states of each element and the thresholds where those states are transformed. Performances correspond to the unfolding of this network over time and space, according to the notion of "self-organisation" recently developed in (Ref. 3).

The sensorial result of the Timbre Networks are complex (and confusing) by design. Therefore, a purely perceptual evaluation of how the metaphoric elements negotiate the decision making process would not suffice, and additional methods are necessary. We propose to perform comparative data analysis over digital traces left by the sucesion of performances that serves as "digital archeology", giving account of evolving traits throughout the various renditions.

[1] S.A. Kauffman. The origins of order: Self-organization and selection in evolution. OUP USA, 1993.

[2] S. Jordà . Digital Lutherie: Crafting musical computers for new musics' performance and improvisation. PhD. Thesis. Pompeu Fabra University, 2005.

[3] F. Rosas,, P. Mediano, M. Ugarte, and H. Jensen. "An information-theoretic approach to self-organisation: Emergence of complex interdependencies in coupled dynamical systems." Entropy 20, no. 10 (2018): 793.

Juan Parra Cancino (b. Chile, 1979) studied Composition at the Catholic University of Chile and Sonology at The Royal Conservatoire The Hague (NL), where he obtained his Masters degree with focus on composition and performance of electronic music. In 2014, Juan obtained his PhD degree from Leiden University with his thesis "Multiple Paths: Towards a Performance practice in Computer Music". His compositions have been performed in Europe, Japan, North and South America in festivals such as ICMC, "Sonorities", "Synthese", and "November Music", among many others.

His acousmatic piece *Serenata a Bruno* obtained a special mention at the Bourges electroacoustic music competition of 2003 and in 2004, his piece *Tellura* was awarded with the residence prize of the same competition. Founder of The Electronic Hammer, a Computer and Percussion trio and Wiregriot, (voice & electronics), he collaborates regularly with Ensemble KLANG (NL) and Hermes (BE), among many others. His work in the field of live electronic music has made him recipient of numerous grants such as NFPK, Prins Bernhard Cultuurfonds and the International Music Council. Since 2009 Parra is a fellow researcher at the Orpheus Institute (Ghent, BE), focused on performance practice in Computer Music.

Fernando Rosas received the B.A. degree in music composition and philosophy, the B.Sc. degree in mathematics, and the M.S. and Ph.D. degrees in engineering sciences from the Pontificia Universidad Catolica de Chile. He is currently a Marie Curie Research Fellow at the Department of Mathematics and the Department of Electronic Engineering of Imperial College London. Previously, he worked as a postdoctoral researcher at the Department of Electrical Engineering of KU Leuven, and as Research Fellow at the Department of Electrical Engineering of National Taiwan University. His research interests lie in the interface between communication and information theory, complexity science and computational neuroscience."

Mark Pilkington - University of Manchester

Current 9 – Graphical Notation in Music

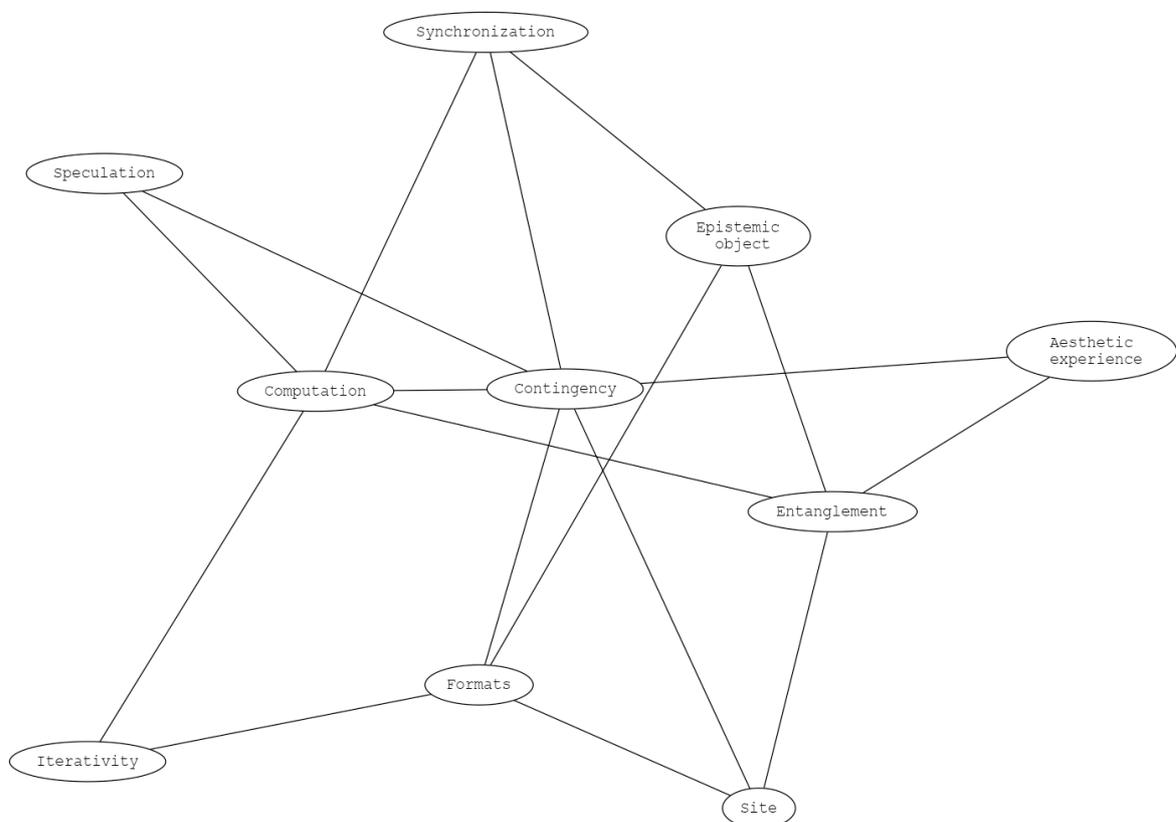
This paper discusses compositional approaches of working with audio-visual media to create electroacoustic music. The focus will be primarily on the composition *Current 9* (2018): an algorithmic composition that integrates non-representational imagery and electronic sound. The piece integrates sound synthesis, stop motion animation and computer graphics to form an interactive graphic score-in-motion. Outlining the shared similarities of movement, identity and algorithmic space. These entities form the basis for the creation of visual music through the appliance of interdisciplinary methodologies to establish morphological behaviors across audio-visual events.

Dr. **Mark Pilkington** is a composer and performer of electroacoustic music. His practice encapsulates sound and image in electroacoustic music, installation and screen-based works. His work have been performed, exhibited and screened at international conferences and festivals ICMC, ARS Electronica, ZKM | Karlsruhe, MANTIS festival and Open Circuit.

www.markpilkington.org.uk

David Pirrò, Luc Döbereiner – Institute of Electronic Music and Acoustics, University of Music and Performing Arts Graz

Contingency and Synchronisation



Jari Rinne - University of Lapland

Sound art as simulation

We are caked by meaningless information and surrounded with contents of fragmented collages – perfect copies, *simulacrum*s, missing the original. In this “real-world mixing” of references sound carries out its own meanings as a form. The question is not only what sounds we hear but how we hear them. Essence of sound stands in our ability stay in the middle of the soundspaces and preserve sensory openness while creating soundtracks for our possible worlds. By simulating the real the art is creating it by chasing the realities where description of concepts for sharing preliminary understandings is challenging by other means.

I approach Baudrillard's thoughts on simulation with a visual essay and a supplementary sound art installation. Starting from Marcuse's writings about art in a technology-driven society my compilation canvass how the idea of art as a form of reality is applicable to the technologybased forms of expression of the 2010s. Looking for the effects of simulation technologies on perceptions of relationship between art and reality I utilize the concept of Simulacrum ("eidolon") as it appears with Platon's. From the times of *Le Voyage Dans La Lune* possibilities of technologies have led philosophers to reflect on relationship between technology and art. In this continuity simulation can be seen as a tool for opening new possible worlds.

Jari Rinne has his background in live rock music and education. He's works are promoting artistic ways of thinking with the methods typically used in corporative environments. Alongside his professional life, he is involved with playing in a band and sound related projects. Some of the latest works: *Snow&Ice* - combining real snow and ice with synthetic spaces, *Laserrinne* - skiing slope as a canvas for reactive laser projections and kinetic light and sound works in urban space. The production and analyzing the knowledge, philosophical foundations of art based research and innovations are the main interest of his works.

He is working as Innovations Manager in Faculty of Art and Design University of Lapland. Currently Rinne is a postgraduate student in Nacer research group and giving lectures widely related to sound and sound arts. In recent years, Rinne's sound art has focused on compilations, brief descriptions of stories and natural tongues towards the characteristics of the sound itself.

Hanns Holger Rutz - Institute of Electronic Music and Acoustics, University of Music and Performing Arts Graz, Austria

Computing at Intrinsic Speed within a Culture of Real-Time

A crucial moment in my work with electroacoustic music was, when around the year 2000 I started writing software for transforming sound files on a desktop computer. Sound files are input and output, and there is “nothing” in-between, inasmuch as the software, baptised *FScap*e, runs offline—pure production or rendering and no sound reproduction. This was of course a predominant way computer music software worked historically, when machines were too slow to render at real-time speed, known examples including *CSound* and also *SoundHack*, which was a direct inspiration for *FScap*e that began its existence as a processor for *SoundHack*'s phase vocoder files. While real-time operation is often seen as superior, permitting instantaneous interaction and a short circuit for listening and adjusting or indeed performing a piece, I argue that both the successive relaying of the work from human to computer and back, as well as the manifest storage of sound in files enable a different kind of experience of and reflection on the compositional process. I have often called *FScap*e experimental software, for two reasons. First of all, the digital signal processing (DSP) modules it implements are often unconventional and embody tools necessitated by particular compositions instead of realising “known” or general transformations and effects. And secondly, the work flow tends to show patterns analogous to conducting experiments, in the way one observes and adjusts, leaves and comes back, accumulates artefacts, etc.

In this talk, I will retrace the trajectory that *FScap*e has undergone from its inception to present day. This trajectory can also be read as one describing the drift in compositional thought. For example, as I move away from electroacoustic composition to focus more on live improvisation and sound installation, one question that interests me is how the concept of sound file rendering can be incorporated in a generative setting that presents materials while it runs. What is the particularity of the interface afforded by this software, and what happens when it is coupled to other systems? Also, the radical atomicity of the number streams in signal processing permits the use with other modalities such as still image or moving image. This is especially made possible through an ongoing rewrite of the software project, in which the fixed macroscopic modules of the original standalone application are exchanged for a unit generator architecture and a domain specific language for constructing DSP programs.

Hanns Holger Rutz is a sound artist, composer/performer, researcher and software developer in digital art. Since 2013, he works as researcher at the Institute of Electronic Music and Acoustics (IEM) in Graz, where he currently runs, conjointly with David Pirrò, the FWF-funded artistic research project Algorithms that Matter (Almat). He holds a PhD in computer music from Plymouth University, UK. His work centres around sound and installation art, and extends to live improvisation and electroacoustic music, in all of which the development and research on software and algorithms plays an important role. The central theme in the recent works is the materiality of writing processes, and how compositional processes can be rendered perceivable in the display of art.

Dolores A. Steinman, Peter Coppin, David A. Steinman - University of Toronto

Re-imagining Blood Flow at the Blurry Border between Simulation and Simulacrum

Despite being produced and existing independently, images and sounds innately complement each other. As our research consists of blood flow simulations with direct and critical use in the clinic, we strive to achieve the most accurate representation that is faithful to the actuality of the process as well as being clear to interpret. Over the decades, our computer-generated simulations based on patient-collected data shifted from being solely visual to integrating aural depiction as well.

Departing from our early engineering-style visualizations, by engaging with visual and sound artists, designers and cognitive scientists, we developed our current carousel-style prototype that brings together video and audio simulations of patient data. The prototype is a novel bi-modal way of presenting bio-data based on Marey's zoetrope principle. In addition to the idea of a succession of frames that engage the viewer's (educated) imagination in filling the gaps between, the individual frames are caricature-like visualizations (i.e. emphasizing particular characteristics relevant to understanding the phenomenon) accompanied by most suggestive soundscapes, with the ultimate aim at quickly drawing the attention of the treating clinician to the fast changes in the flow pattern, changes that have been shown to bring potential fatal consequences to the patient.

From our point of view, the bi-modal representations we are generating are more aligned with the Platonic view on simulation. Our argument is based on the choices made when establishing the parameters upon which to run the simulations with the aim of getting closer to the actuality of the physiological process (without man- or machine-based mediation). We thus consider such alterations not to be rendering the model erroneous or distorted as much as being beneficial to gaining insight into the phenomenon.

On the other hand, passing critical information contained within the patient-collected data across disciplinary borders, we are careful with our representations. Each takes into account the inherent mediations that are fundamental to the Magnetic Resonance or UltraSound images (on which our simulations are based). As such, one could argue that the end result is a simulacrum in the Baudrillardian sense as the virtual patient becomes increasingly remote to the real one.

Dr. Dolores Steinman was trained as a Paediatrician and, upon relocating to Canada, obtained her PhD in Cell Biology. Currently she is a Senior Research Associate in the Biomedical Simulation Laboratory, the Department of Mechanical Engineering at the University of Toronto (UofT), part of an interdisciplinary team, also affiliated with the Ontario College of Art and Design University (OCADU). She is as well a volunteer Docent at the Art Gallery of Ontario (AGO).

In her research, Dolores is driven by her keen interest in placing the ever increasingly technology-based medical research in the larger context of the humanities. She observes the rapport and the connection between medical research and its non-medical counterparts.

Rebekah Wilson - STEIM

Beyond Isomorphism: transformation of human/machine agency

Machines are designed to replace human agency when we cannot be there to act. Machines are also designed to act in ways that humans cannot: in speed, accuracy and scope. With these machines we encode, construct, transform and transmit our agency: on our behalf, machines act. This becomes a form of 'mediated presence': the technological illusion of being present in a place other than our physical selves and actions.

Machines gather, process and transform data: they generate information along prescribed lines. Machines are ideal for data mining and algorithmic processing but not for creating meaningful observations; any meaning that is created is tangential to its purpose. Gill states that "you cannot create meaning without a tacit dimension and that there are many paths one can take and which path you take depends on your purpose" (Gill, 2015). A machine's purpose is determined by the engineer at the time of execution, while meaning is created at the time of observation by a human. A machine has no tacit knowledge from which to create meaning—it exposes explicit information to be acted on.

Isomorphism occurs when components are tightly coupled (Hawley, 1986). Isomorphism is illustrated in electronic music when a gesture is translated via a machine from one form to another and its source is readily perceived. Yet, we live in a post-digital world where there is no obligation to reproduce reality: thus, we may—and should!—uncouple components and transform reality at the whim of our curiosity. Uncoupling suggests autonomous machine interaction, however it is critical that we maintain performance cohesion. When presence is mediated by technology this means we must reproduce, generate, share the information that we need for participation: timing so that we can perform together, and musical features such as timbre and dynamics so we can experience a shared relationship. Regenerating information means accepting substitutions—substitutions derived from computational decisions made by the machine designers. While mediated presence can cause the loss of certain parts of natural presence, machines can surpass the limits of time and place, adding "elements to natural presence which natural presence otherwise would not have possessed." (Nevejan, 2007).

In this technical paper I present my current research towards building non-isomorphic musical agents. As independent agents are transmitted over the Internet, imbued with the vital information necessary for a remote musical performance, they act as co-conspirators: transforming the data they carry in correspondence with the networked performance environment.

Rebekah Wilson is an independent researcher and composer based in Amsterdam. Her current interest is in networked music performance over the public Internet where unreliability and latency is a tool to be harnessed, and questions what it means to be present and the ways in which we can digitally manifest our presence. She holds a Masters in Composition from the New Zealand School of Music in Wellington, New Zealand, is a research associate at STEIM, and is the technical director for the network remote-recording company Source Elements.

Orpheus Institute

The Orpheus Institute, founded in 1996 in Ghent, is an international centre of excellence with its primary focus on artistic research in music: “research embedded in musical practice and primarily guided by artistic objectives.”

The Orpheus Institute in short:

- an international team of senior, doctoral and visiting musician-researchers
- producing and promoting high-quality research into music
- in a dedicated educational and research environment
- generating new knowledge in-and-through musical practice
- keeping the artist’s perspective as the starting point for research

Orpheus Institute hosts the international inter-university docARTES programme for practice-based doctoral study in music, and the Orpheus Research Centre, home to around 30 artist-researchers involved in advanced artistic research. The close link between education and research within our facilities creates an inspiring environment where artists can experiment, exchange ideas and develop new knowledge.

Throughout our activities there is a clear focus on the development of a new research discipline in the arts, addressing trending questions and topics at the heart of musical practice. To promote and disseminate this knowledge, the Orpheus Institute organises seminars, study days, workshops and masterclasses and an annual Academy. Next to that, the Orpheus Institute also has its own publication series.

All these aspects have made the Orpheus Institute what it is today: a leading European centre for artistic research in music and an influential driving force for new developments in artistic practice, with an impact that is felt worldwide.

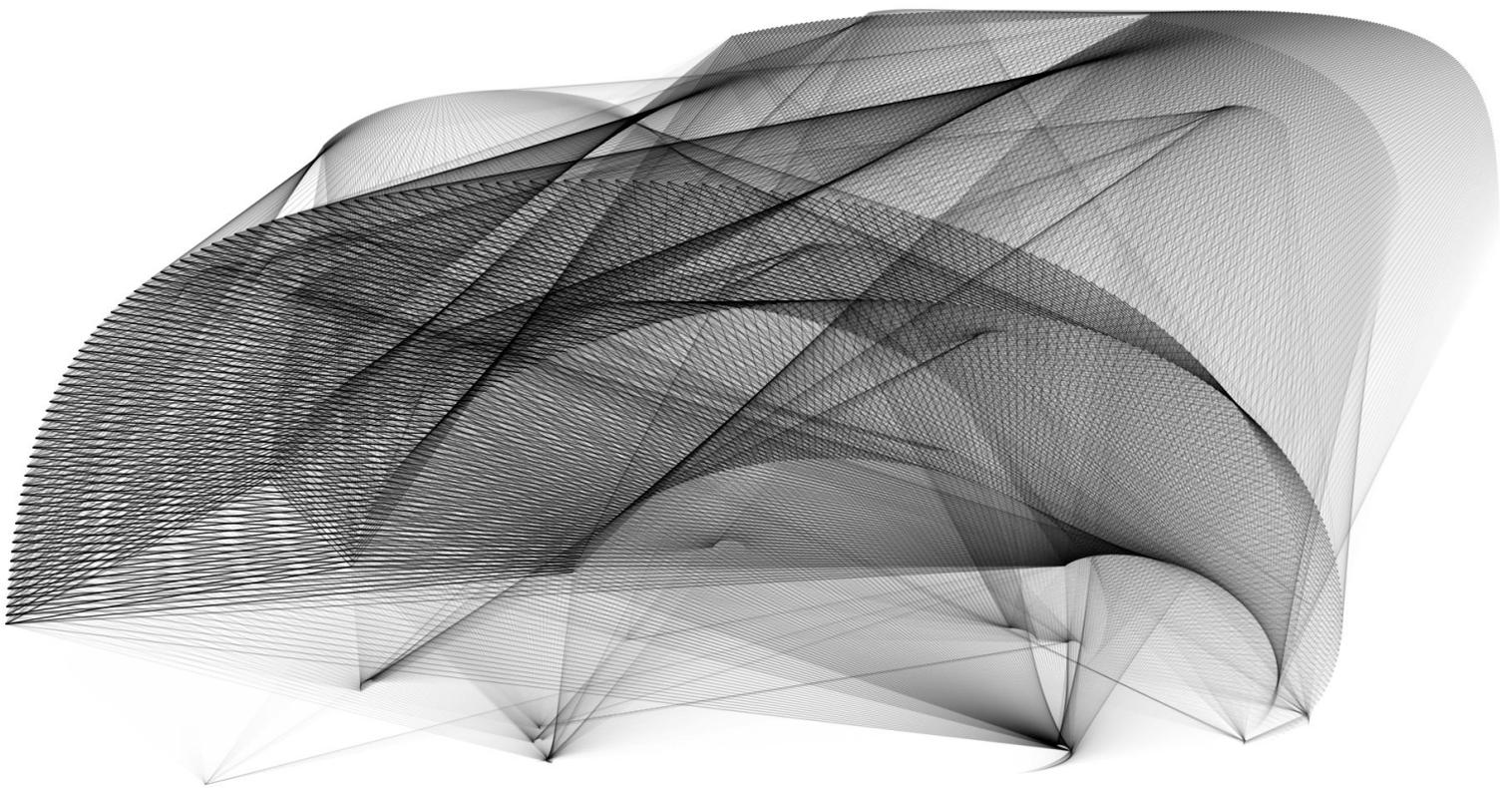
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Music, Humans and Machines

1 Sep. 2019 Open Circuit

9 - 11 Dec. 2019 DARE 2019: *Assemblage*
Machinic Assemblages of Desire / Collective Assemblages of Enunciation

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