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Speculative Sound Synthesis: Synchronization

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Speculative Sound Synthesis: Synchronization is a live electronic performance by four interlinked players exploring ways of coupling sound synthesis systems, algorithmically, performatively, and sonically. The performance is part of the artistic research project *Speculative Sound Synthesis* hosted at the Institute of Electronic Music and Acoustic in Graz. The project challenges established patterns of interaction between technology and artistic practice. Standardized processes in computer music are probed, destabilized and reshaped through speculative re-questioning, thus allowing new aesthetic potentials for experimental musical practice to emerge. Rather than focusing on making the instruments produce specific results, the performers aim to make their instruments' material qualities, assumptions, errors, and even failures sensible and experienceable. By putting their instruments and their respective developers in interaction with each other, creating a feedback loop of sorts, the performance explores questions of interplay, materiality of digital and analog sound synthesis, interaction with algorithms and machine learning, employing combinations of nonlinear oscillators and analog circuits based on fundamental digital components. The instruments flow into each other, opening up new sonic and musical possibilities through their coupling, thus creating a laboratory where they can experiment, manipulate, observe and speculate on different aspects of the artistic practice of sound synthesis they consider crucial.

Keywords: Sound Synthesis, Live-Electronics, Non-linear Oscillators, Speculation, Artistic Research.

Overview

Speculative Sound Synthesis: Synchronization is a live electronic performance by four interlinked players that deals with ways of coupling sound synthesis systems, algorithmically, performatively, and sonically.

The four performers are part of the team of the artistic research project *Speculative Sound Synthesis*.[1] The project started in November 2022 and it is hosted at the Institute of Electronic Music and Acoustic (IEM) in Graz. It is funded by the Austrian Science Fund (FWF) for a period of three years. The project questions established patterns of interaction between technology and artistic practice. Standardized processes in computer music are probed, destabilized and reshaped through speculative re-questioning, thus allowing new aesthetic potentials for experimental musical practice to emerge.

Traditionally, speculation is used to describe a sort of conjecturing or formulation of theories on the basis of unsure or insufficient knowledge. On the contrary, in the context of this project we depart from Alfred North Whitehead's description of the speculative endeavor as as a journey starting "from the ground of particular observation; it makes a flight in the thin air of imaginative generalization; and it again lands for renewed observation rendered acute by rational interpretation" (Whitehead 2010, 5). Thus, we understand speculation as a process oscillating between imagination, experience, observation and rationalization, capable of bringing forth new forms of knowledge. We take speculation to describe the active, material, aesthetic experimentation we perform while trying to uncover unexplored spaces of artistic practice that could otherwise remain unexplored by the traditionally accepted methods of deduction and induction.

Within the context of this project, we consider artistic practice one part of our artistic research practice. We plan to engage in different performative settings, each of which may be considered in itself a case study or one particular experimental system. The situations we stage are to all effects a laboratory where we experiment, manipulate, observe and speculate on different aspects of the artistic practice of sound synthesis we consider crucial.

In practice, each of the performers takes care of setting up one sound producing instrument with input and output that embodies and focuses on a set of questions and practices in sound synthesis. Rather than trying to make the different instruments "function" properly, in the sense of letting them produce the forms ("results") the various methods they employ intend to achieve, we search for

1. https://speculative.iem.at/

ways to make their essential qualities, assumptions, errors and even failures sensible and experienceable. Using historian of science Hans-Jörg Rheinberger's words, we attempt to transform "technical objects" into "epistemic objects" (Rheinberger 1997) by making their materiality re-appear. Through experimentation, we have found that the strategy best suited for exploration is achieved by putting our instruments (and their respective developers) in interaction with each other: the output of one instrument is used as input to another and vice versa, creating a feedback loop of sorts. The instruments react to their inputs, which are in turn generated by their respective partners by replying to their output.

The performance we present here explores questions of interplay, materiality of digital and analog sound synthesis, interaction with algorithms and machine learning. In particular, for this performance, the members, in constructing their instruments, are employing combinations of nonlinear oscillators, processes which are able to react and synchronize to outside signals. The four different sound synthesis systems are connected, flow into each other and open up new sonic and musical possibilities through their coupling. By opening up their instruments to both affect and being affected by the others', this particular setup hails back to practices of experimental music performers of the '70s and '80s like, for instance, "The Hub". The performing attitudes of the four players are very different and range from an attitude of minimal intervention and observation to physical manipulation of the analog signal flow. However, all the four performers share a fascination for the encounter of complex sounds and the creation of systems that are open to the outside world .

Instruments

There are four entangled instruments performed by each of the four players. David Pirrò performs with a network of coupled non-linear oscillators implemented in his programming language *henri*. These networks react to the input by Ji Youn Kang's, Leonie Strecker's and Luc Döbereiner's instruments. Kang's instrument explores the threshold of analog and digital sound synthesis using analog circuits based on fundamental digital components that offer entry points for a more bodily interaction. Döbereiner's system makes use of digital waveguides, chaotic maps and machine learning to translate aspects of the other players' sounds onto his instrument.

henri[2] is a text based compiled programming language for sound synthesis by David Pirrò and is named after mathematician, physicist and philosopher Henri Poincaré. The language focuses on the formulation of temporal behavior: statements in *henri* closely resem-

2. https://git.iem.at/davidpirro/henri

ble differential equations, the mathematical expressions describing change and evolution. Rather than reaching a specific aim, realizing a priori known objectives, programs written in *henri* are processes that generate evolving temporal forms without a predetermined end. These forms are translated into sound and, while unfolding, they can be pushed or pulled towards one direction or another by sending impulses into them or by acting on their parameters. Therefore, these are processes open towards the "outside" of the machine performing them, allowing for interaction or for coupling with humans or other computational processes, thus taking part in more complex and chaotic aggregates. In particular, for this performance, David Pirrò will implement and perform with a network of mutually interacting so-called *Kuramoto* (Kuramoto 1975) oscillators.

Luc Döbereiner's system is an attempt to deal with a sound ideal, characterized by unstable sound transformations that carry an inner tension, a certain contradiction. A multiphonic on a woodwind instrument could serve as an example, which is fragile, can turn over and which opens a chaotic interstitial space between stable states. The sound synthesis system used here consists of a simple digital waveguide model coupled with two chaotic maps. Through machine learning, this system is also externally affected and aspects of the other performer's sounds are transferred into its possibility space. Due to inherent biases, distortions in audio analysis, and the limited possibilities of the synthesis process, these machine learning "translations" are always distorting and performing with these distortions is a central element of the instrument. Moreover, small neural networks are directly applied on the time-domain audio signal level and Döbereiner performs by directly affecting their internal weights.

The analog instruments that Ji Youn Kang brings along have been developed on the border between time-continuous and time-discrete signal computations. She tries to navigate through minimal digital components commonly used in analog circuits such as logic gates and shift registers, looking for unusual, out-of-logic combinations that expand their original characteristics by actively creating 'errors.' Her experimentations always target musical performances by involving incoming signals i.e. from microphones, as well as her body, objects, and sensing components as part of circuits.

Leonie Strecker employs listening as a central approach: By actively choosing and loading to memory certain moments of the performance, inter-modulating these and playing with those variations of earlier sound events, she actively, yet intuitively aims to take decisions on the formal process of the performance.

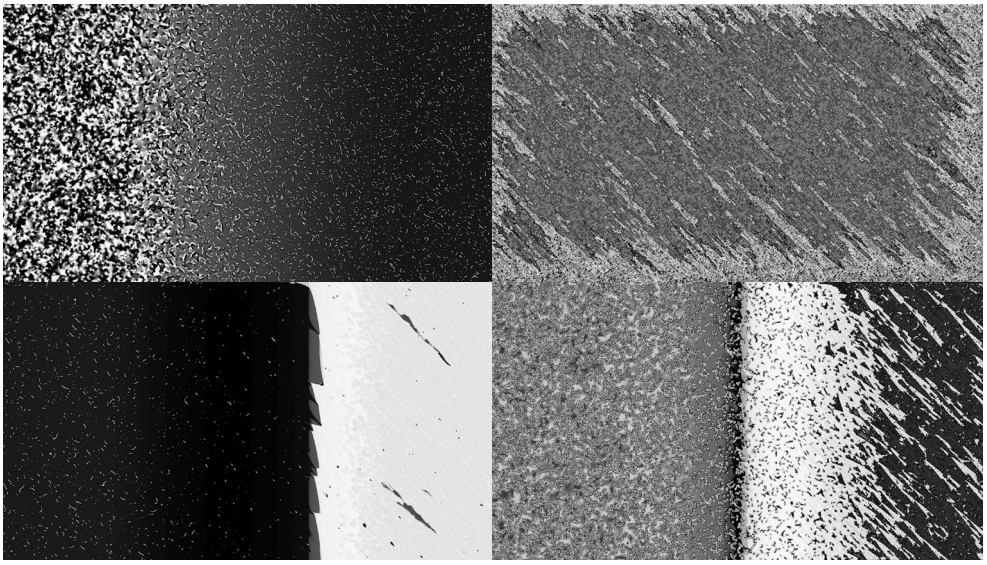

Figure 1: Visualization of a network of coupled Kuramoto oscillators.

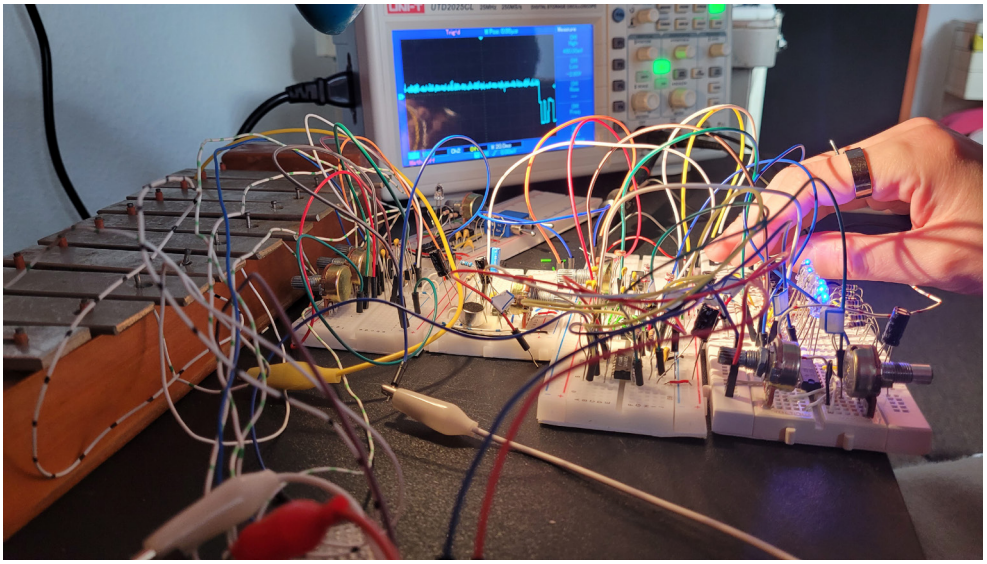

Figure 2: Ji Youn Kang working on her instruments.

Figure 3: The quartet performing in April 2023 at the IEM Graz.

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