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Aubiome:
A Performer-centric Approach to Interactive Electronics

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Abstract:

Aubiome for saxophone and live electronics is the result of a five-year doctoral research project aiming to investigate the possibilities of extending the saxophone by use of live electronics processing. This research is based on the proposition that a performer-based system of live electronics would look and sound distinctly different from what a composer would design on his own. This premise leads us to reconsider the traditional roles of performer and composer, ultimately leading to a different approach to collaboration, which we termed "performer-centric". *Aubiome* is meant to serve as a "proof of concept" for this type of collaboration, and we hope it might inspire other performer / composer teams to further explore the integration of acoustic instruments with computer-based audio processing.

1. INTRODUCTION AND RESEARCH CONTEXT

Computers have become ubiquitous in all kinds of music production and performance, ranging from Electronic Dance Music (EDM) which relies heavily on computer-generated sound, to pop music, famous for the use of digital "auto-tune" tools, to classical music, where computers are an important part of the recording, mixing and mastering process. Computers have also taken on a major role in the realm of contemporary classical music, where many musicians are looking to computers as a means of expanding the palette of sounds available to them.

The first composers of electronic music followed one of two paths: 1. analog synthesis, 2. sound recording and collage. The first approach being associated with Karlheinz Stockhausen and the electronic music studio at WDR Cologne. The second was adopted by Pierre Schaeffer in France, resulting in the style of music he named *musique concrète.* For decades, both approaches relied on tape as the medium of production, and the term "tape piece" is sometime still used today. Of course tape fell by the wayside with the move toward digital technology, and computers eventually took over. First these were massive mainframe computers, later laptops and smartphones.

There has also been a concurrent interest in the idea of integrating electronic music with traditional instruments. This type of experimentation has taken various forms, all part of an ongoing evolution shaped by the progressively sophisticated technology available. The first 'electronic' instruments can be traced all the way back to the end of the 19th century with the Telharmonium, a type of electric organ thought to be the first instrument to produce sound by combining electric and mechanical elements. A few decades later the Theremin was patented in 1928: another example of an early electronic instrument, particularly interesting for its interface that allows the performer to control the instrument's pitch and volume by the position of his hands in space.

John Cage's *Imaginary Landscape No. 1* (1939) made use of two variable-speed phonograph turntables treated as instruments and performed alongside two other performers playing a muted piano and cymbal. In 1966 Karlheinz Stockhausen's *Solo, für Melodie-Instrument mit Rückkopplung*, followed in Cage's footsteps, experimenting with the tape player in order to produce a real-time feedback delay line. An instrumentalist performed a notated score, which was recorded and manipulated by the tape system, controlled by four assistants. After having a difficult time realizing the piece as originally conceived, Stockhausen would later combine fixed media elements with the live instrument and feedback system.

In the meantime, another type of electronic instrument, the electric guitar, was becoming increasingly popular, and musicians were experimenting with a variety of

analog techniques for producing and manipulating sound. Guitarists were able to devise a wide range of effects configurations by chaining effects pedals (sometimes known as 'stompboxes'), resulting in an enormous variety of producible sounds. In the late 60s and 70s, instruments using analog synthesis, such as the Moog Synthesizer, became popular. Many features of analog electronic instruments were carried over to the digital systems that began to take over in the 1980s.

The 1983 publication of the MIDI standard was another major step in the development of electronic instruments, allowing new ways to design interfaces connecting the performance and computer. Michel Waisvisz's instrument 'The Hands' was developed at the STEIM research lab in Amsterdam and was premiered just a year after the introduction of the MIDI standard. Waisvisz continued to develop the instrument and to perform on it extensively for the next twenty years. Countless other interfaces have been designed in the following years, with a conference dedicated to the particular topic: 'New Interfaces for Musical Expression' (NIME), which had its first edition in 2001.

A great deal of experimental work has also been done with the aim of integrating electronic music and traditional, acoustic instruments. The series of 'hyperinstruments' developed by Tod Machover at the Massachusetts Institute of Technology include the Hyperviolin, Hyperbow, Hypercello and Hyperpiano. These instruments are all based on the fundamental acoustic instrument, with the addition of sensors to generate control data that can be used to manipulate the resulting sound. A more recent experiment based on a similar working model is the 'Sensor Augmented Bass Clarinet' (SABRe) developed between 2010 and 2014 at the Institute for Computer Music and Sound Technology (ICST) in Zürich.

On the software side, the open source software, *Pure Data*, became available in 1996, followed by *MAX/MSP* the following year. These applications, and others which have been developed since, grant composers and performers convenient access to digital signal processing algorithms. During the first decade of the 2000s, computer processing power advanced quickly, enabling increasingly sophisticated methods of manipulating and generating sound in real-time. And this was expected to lead to a revolution in music making, where the computer could play a more engaging role in live performance than it had previously. In the twenty years since the release of *Max/MSP*, the software has become ubiquitous, and it is now par for the course for composers to integrate computer software into their working process as they produce new works. However the promise of real-time electronics processing to bring the computer on stage as a 'living' musical voice has remained elusive.

We argue that while the advance of technology has allowed access to live electronics tools to anyone with a laptop, it has also exposed a 'gap' between the composer and performer. The composer's creative act begins with the empty page and ends with a final score, whereas the performer's creativity is more visceral, defined moment by moment during each performance. Attempts at integrating acoustic instruments with real-time electronics processing rarely succeed in arriving at new extended instruments that are satisfying to perform with. Insofar as this integration might yield interesting new musical avenues to explore, it might be time to re-evaluate the hierarchical composer-performer relationship and investigate more collaborative, co-creative approaches.

2. PERFORMER-CENTRIC ELECTRONICS

Aubiome for saxophone and live electronics is the result of a five-year doctoral research project aiming to investigate the possibilities of extending the saxophone by use of live electronics processing. This research is based on the proposition that a performer-based system of live electronics would look and sound distinctly different from what a composer would design on his own. Some questions we addressed were:

– By enabling the performer to work hands-on with live electronics systems, what kind of musical outcomes could be achieved?
– What impact would this approach have on the performer's voice and his experience performing on stage?
– What implications would this approach have on performance practice for the wider repertoire?

These performance-related questions lead to a second line of inquiry about the role of the performer and his working relationship with composers. The suggestion here is not for the performer to take over the role of composer, but rather to interrogate the traditional roles between composer and performer.

– How could a performer-based approach to system design lead to collaborative strategies that bridge the gap between composer and performer?
– Would it be eventually possible to recapture the co-creative relationship between composer and performer?
– What effect would this working process have on the composer's voice?

The result of this research is what we call a "performer-centric" approach to the design of electronics systems. We came to the conclusion that applying real-time processing strategies to an acoustic instrument like the saxophone is often more of an instrument-building process than it is a compositional one. Our working process emerged over years of trial and error, during which time we produced many musical works, some more successful than others. The most recent of those works, *aubiome*, is our best attempt so far.

3. *AUBIOME* FOR SAXOPHONE AND LIVE ELECTRONICS

3.1. Piece overview

Aubiome for saxophone and live electronics was from the beginning a conscious effort to avert a top-down compositional approach. Musical ideas, sections, movements and the final form of the piece derive all from the intrinsic logic of a number of interaction patterns in the micro-scale. That is, the piece unfolds as an ever-mutating organism in which sound cells develop, grow, recombine, eventually peak — or reach a dead end — and degenerate to give place to the next generation, the next wave, the next musical idea.

The piece was written during a roughly five-month period from January 2017 until May 2017. We had identified several years earlier that the primary challenge we were facing was to design an electronics system that would provide the feeling of

Fig. 1. Aubiome: metabolic pathways (https://youtu.be/50fg-oBnHLA)

"liveness" as it interacts with the saxophone. During our rehearsals in 2016, we often described a desirable computer response as "organic". It was this way of thinking that eventually lead to the concept and title of the piece.

The work is not meant as an exhaustive catalog of electronics techniques, but rather one example of what can be achieved by employing a performer-centric approach to instrument design. It is the result of our specific working process, system design, and joint artistic goals. We do not offer *aubiome* as any kind of definitive work, but rather a "proof of concept" for what could be possible by rethinking the usual roles for performer and composer.

3.2. Formal structure

We did not approach writing *aubiome* with any kind of a traditional formal structure in mind. In January 2017, we only knew that it should be a substantial work connected to the current artistic research project. This was a highly contended decision to not begin with an overarching formal idea from which the piece would be derived, but rather to focus on developing material from the saxophone-electronics system instead. If the piece had been written in another context, we probably would not have adopted this approach.

Joel Ryan described it all the way back in 1991:

> "Contrary to the beliefs of some there is no crisis of formal thinking in contemporary music. We live in a structural paradise where the formalisms of a hundred different disciplines are waiting only for the novel application. Certainly in computer music the problem is not lack of form it is the immense mediating distance which confronts each composer when encountering the computer. Despite twenty years of programming for music, the territory gained seems quite small compared with the empire of musical aspiration. Many composers long to regain some sort of musical spontaneity." (Ryan 1991)

Aubiome is an attempt at closing the mediating distances not only between composer and computer, but also between computer and performer and finally between composer and performer. This search for musical spontaneity became the central focus, and the work's formal structure emerged from that working process.

Fig. 2. Aubiome: organic decay (https://youtu.be/OgiA06pJIoY)

3.3. Collaboration

The compositional structures of *Aubiome* emerged from one particular performer-composer relationship. The central place given to instrument design (or, "extended instrument design"), the development of musical material through improvisation

and experimentation, along with a co-creative approach to composition result in a kind of music that is unlikely to have been produced by either composition or improvisation alone. The performance-centric approach to extending the saxophone enables the instrumentalist to participate in the creative process, but also provides the composer with a powerful, expressive extended instrument to work with. We hope that *aubiome* will inspire other performers and composers to further explore possible ways of integrating acoustic instruments with computer-based audio processing.

Fig. 3. Aubiome: pulse interval (https://youtu.be/xw5BftIHL4k)

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