

STATEMENT OF GRANT PURPOSE

Kyle Vinton, The Netherlands, Computer Science

Real Time Computer Aided Composition:

Form Within the Machine and an Archetype for Musical Decision

In performance, musical decision-making is much more immediate than it is in traditional composing. Many snap judgements are made. Some kind of context control is necessary, and I'm trying to help my machines understand musical context. George E. Lewis (1987)

From its room-sized, vacuum tube infancy, to the surge of portable, personal technology, the ascension of the computer has constituted and nurtured numerous facets in contemporary society. In the mid twentieth century, as applications of the computer still lay mostly uncharted, a group of musicians and composers began to lay the foundation of computer music. As these early creators searched for an idiomatic means in which to compose for computer, a new paradigm within the realm of composed music was introduced. Algorithmic, or computer aided compositions, were programs created by composers—each software system having the ability to output multiple pieces of music depending on the conditions of their rendering.

I seek a Fulbright Full Grant to research the forms of past algorithmic compositions with the aim of creating my own real time, interactive software structure. This research will be used both as the foundation of my graduate studies and the continuation of research already made possible by the Towson University Undergraduate Research Committee (URC).

This inquiry stems from a long tradition of investigations into computer music. Experiments in computer synthesis began in 1957 at Bell Laboratories, New Jersey with Max Mathews. Lejaren Hiller began experimenting with algorithmic composition the year before and was followed by Iannis Xenakis in 1960. In the 1970s, Gottfried Koenig and Barry Truax, two composers at the Institute of Sonology in the Netherlands, established another generation of algorithmic archetypes for composition. In 1987, with an increase in available computational power, George E. Lewis was one of many composers to expand the paradigm of algorithmic composition to include a live performer. Since then algorithmic systems have entered the world of real time performance and are connected to an international community of contemporary practices.

This project will study past archetypes in order to expand and implement future ones. Where George E. Lewis used exclusively the analog signal of his trombone to shape and affect his software program, control through pressure sensors on the performer's instrument will be introduced as well. Through these sensors and an attached microphone, both sound and data will feed a newly constructed software paradigm. The hardware for such a system is already in place, provided by a grant from the Towson University URC.

The composer's interest in computer music and improvisatory trumpet performance will be used in tandem to create an interactive, real time composition system. This software environment will employ concepts of algorithmic technique and—the creative routing of an audio signal through multiple transforming processes—modular synthesis. As sound is produced from the composer's trumpet, the fundamental frequency of each note will be recorded and stored. Intervals will be determined from those frequencies and used to map patterns of motif. The amplitude of sounds produced will be placed into control structures. Spectral analysis—the distribution of a signal's amplitude over its frequency spectrum—will be compared to a library of values and cause a change in software presets. The duration of time between trumpet notes will determine the speed in which an audio signal produces rhythm and drives other musical events. Three pressure sensors will first be calibrated to determine their minimum and maximum values before every performance. Their output will then be scaled either logarithmically or drawn by hand using a table function—allowing non-traditional methods of scaling such as visual shape. The output of these pressure sensors will be stored and recalled as well.

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Modular units will be programmed to receive both stored and real time audio and sensor data. The order or signal flow of these units will be derived from conditions of the composer's performance. A technique that uses millisecond sized audio envelopes and allows for creative signal manipulation—real time granular synthesis will break sections of audio apart to be stretched and bent. Analog-modeled distortion will blur the edges of each performance discretely. A fast Fourier transform—similar conceptually to spectral analysis—will analyze the trumpet's signal and be used to transpose the performance an octave above. A variable low pass filter will crop high-frequency bands as spatialization moves the performance's location out into the audience. Based on the input of instrument and sensors, any number of musical events may occur.

Each modular unit will require different controls on a number of levels. An example of one of many possible units, granular synthesis would require: total envelope duration; envelope wave shape; starting and ending position or duration of trumpet sample to be processed; delay, if any, between received and output audio; speed and playback-direction of output audio as compared to source; degree of frequency variation between grains; and number of total sounding grains. Using live data, or the average of a period of time, the above mentioned parameters will be given information based on what is presented from the trumpet and sensors.

This research is specifically geared toward the pairing of trumpet and computer, but the resulting software designs and compositional techniques of this purposed project will have applications in contemporary practices both present and future. Composers and performers will have gained further research in real time, interactive composition systems so that their music may continue to explore the next generation of algorithmic techniques. In order to outline the successes and shortcomings of such a system, this research will be presented via live performances; article submissions to *Computer Music Journal* and *Journal of New Music Research*; and possible presentations to the international community at conferences such as *New Interfaces for Musical Expression (NIME)*, *International Computer Music Conference (ICMC)*, and *Society for Electro-Acoustic Music in the United States (SEAMUS)*.

The Netherlands has held a historically significant role in the field of computer music and algorithmic composition. The Institute of Sonology is part of the Royal Conservatory at the Hague. It is one of the most widely known institutions for international research in algorithmic composition. If given the opportunity to study at the Institute, composer and computer musician Paul Berg has shown an interest in supervising my research. Paul Berg is a scholar in algorithmic techniques and prior algorithmic software systems. He is also professor of the computer assisted algorithmic composition course at Sonology.

Many well known algorithmic systems of the 1970s were developed at the Institute including Gottfried Koenig's Project 1 and Barry Traux's POD system. Recent graduates from Sonology continue to study these systems while also expanding their own ideas. The institute's library contains rare materials on computer music dating back to the 1960s, further allowing one to study both past and present software systems. The composer's proposed project requires sensors to be attached to the exterior of an acoustic instrument. Sonology houses a workshop designed specifically for creating sensor interfaces and hardware input devices. Most importantly, Sonology offers a one year program, conducted in English, for visiting researchers. It is one of the few institutions to offer courses in algorithmic composition and voltage control techniques. Sonology is very well suited for this project's needs. The Institute's program begins in September and lasts one academic year.