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The purpose of my thesis is to create an interactive environment between a saxophonist and computer operator via a musical composition. The composition, *4thoughts*, consists of written music for the saxophonist, performance directions for the computer operator and a “patch” (created in the computer application Max/MSP) that generates sounds based in part on the input of the live performer. The goal of the composition is to attain the subtleties that are common in acoustic music within an electroacoustic composition. In this composition, the computer modifies the product of the saxophone performance, while the computer operator uses a MIDI controller in order to communicate with the computer. This approach indeed leads to a greater degree of interaction between the electronic sounds and the performer.

INTERACTIVITY BETWEEN A SAXOPHONE PERFORMER AND A COMPUTER
OPERATOR

by

Cameron Bryan Ward

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Approved by

Committee Chair

APPROVAL PAGE

This Thesis has been approved by the following committee of the Faculty of The University of North Carolina at Greensboro.

Committee Chair _____

Committee Members _____

Date of Acceptance by Committee

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CHAPTER I

INTRODUCTION

Interactivity in *4thought* between the saxophonist and the computer operator is linked aurally, much like two acoustic instrumental players interacting while playing a duet. The score acts as the foundation for both of the performers, graphically representing the directions for the saxophonist, but presenting no such explicit directions for the computer operator. That said, the computer operator uses the operator instructions along with the saxophone score to be able to see what the saxophonist is performing, and to react to the score or to the performance itself. The saxophonist then can interact with the computer operator via listening to the audio output from the computer. While the saxophonist is locked into certain actions as indicated by the score, he or she is also free to change certain aspects of performance to interact with the computer operator, such as articulation, dynamics and phrasing.

One may see this form of interaction as a simple cause and effect scenario. That is where the second movement of the composition comes into play. The second movement is *tacet* for the saxophonist, and is solely the production of the computer operator. The material of the second movement is based on an audio recording of the saxophonist playing the first movement. The computer operator then can control certain parameters (such as pitch and speed of progression) of the second movement as long as

the music remains “*tranquilissimo*” in accordance with the movement title. Much like the saxophonist in other movements, the computer operator is here locked into similar decisions because of the design of the Max/MSP patch.

The third movement contains a similar relationship between the saxophonist and the computer operator that is present in the first movement, but with the addition of a coda section that mirrors the second movement in regards to the relationship of interactivity between the performers.

CHAPTER II

MAX/MSP PATCH

Both the written portion of the composition and the Max/MSP patch are separated into three movements, with an identifying name associated with each: *harsh*, *tranquillissimo* and *frenzy*. Within the patch different parameters can be controlled in each section, which parallel the movement titles that are outlined in the score.

The first section, *harsh*, allows the computer operator to manipulate the audio from the saxophonist in real-time. The computer operator can manipulate the live audio by inducing a sample-rate reduction or word-size reduction, both of which can be controlled independently. These particular manipulations can be used effectively to create a harsh sound. During this movement, the patch is also recording the saxophonist before any electronic manipulations are implemented for use in the second movement.

The second movement, *tranquillissimo*, uses the sounds recorded during the first movement as its sound material. The patch allows for a 600 millisecond (ms) portion of the audio file to be looped and allows for control of loop progression, that is, which 600ms segment of the file is looped. The looping always starts at the beginning of the audio file, and progresses 1ms when directed by the operator, or by default every 10ms. For example the beginning of the loop starts at 0ms and ends at 600ms which is looped until told otherwise. When given the appropriate command the loop will move from

1ms-600ms to 2ms-601ms. Upon another command the loop will move from 2ms-601ms to 3ms-602ms and so on. During the looping process transposition can be done in real-time by the computer operator. The sample can be transposed into two pitch areas, one area where the octave is divided into 12 equal divisions and the other area where the octave is divided into 24 equal divisions; both pitch areas can be performed at the same time. The computer operator is essentially improvising during this movement, with the idea of tranquility as the basis for the aural result.

The third section, *frenzy*, allows the computer operator to manipulate the live audio via granular synthesis. The grain size, grain transposition and randomness of the granular sampling can all be controlled in this movement. The computer operator is free to modify the sound as needed to fit within their concept of frenzy. The third movement is followed by a short coda section, where the Max/MSP patch runs a portion of the recording of the final movement through various reverberation units. The computer operator and the saxophonist essentially have no active role in the coda section, as the section is intended to be the output of the computer as a soloist.

Chapters III through VIII represent the performance materials for the composition *4thought*.

CHAPTER III
PERFORMANCE NOTES

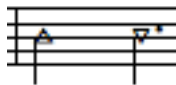
The Max/MSP patch has been designed and tested to run under Macintosh OS X 10.4.6 on an Apple G4 1Ghz computer with at least one gigabyte of RAM running Max/MSP version 4.5.7. While the patch may work on other configurations, including Windows XP, they have not been tested.

Necessary technical equipment includes: an audio interface capable of two channels of simultaneous analog output, a microphone, MIDI interface (preferably the KORG Microkontrol) and an appropriate computer as described above. The included materials are the Max/MSP patch and the Korg Microkontrol scene settings.

“X” shaped noteheads as shown below indicate a keypop, with the notated pitch indicating the appropriate fingering.



Triangle shaped noteheads as shown below indicate breathing. The first triangle (point at the top) indicates to inhale through the instrument while the second triangle (point at the bottom) indicates to exhale through the saxophone. The breathing effect should be exaggerated.



The notations in the score, growl, *mitsingen* and flutter describe three distinctly different effects. Phrases in the score marked “growl” should be played with the soft palate sympathetically resonating while playing. Phrases marked “*mitsingen*” indicate that the written note is to be played simultaneously while singing an undefined pitch. Flutter should be performed by rolling the front of the tongue while playing. If any of these techniques is not possible for the performer, similar techniques can be substituted.

The computer operator is free to use whatever MIDI interface that he or she chooses. If the Korg Microkontrol is chosen, then loading the included scene setting (called “live”) onto the controller will allow the performer to control all aspects of the patch without any alterations either to the patch or the MIDI controller. If another MIDI controller is chosen the following MIDI assignments need to be made:

Toggle/Pad Encoders:

Controller Number (cn) 48-arm Mvt I, cn 49-arm Mvt II, cn 50-arm Mvt III, cn 51-arm codetta, cn 52-record Mvt I, cn 53-play Mvt II, cn 54-record mvt III, cn 55-play codetta, cn 56-select 12 tone/octave transposition control (Mvt II only), cn 57- select 24 tone/octave transposition control (Mvt II only)

Rotary Encoders:

MIDI Channel (mc) 9-degrade sampling rate (Mvt I), mc 10- degrade word size (Mvt I), mc 11- grain size (Mvt III), mc 12- grain transposition (Mvt III), mc 13- grain randomness (Mvt III), mc 14- reverb time (Codetta), mc 15-pre-reverb time (Codetta), mc 16- dry/wet (Codetta)

Slider Encoders:

mc 1- Mvt I volume, mc 2- Mvt II volume, mc 3- Mvt III volume, mc 4- Codetta volume, mc 7- Live input volume, mc 8- Master volume

Keyboard:

MIDI note numbers to Mvt II

CHAPTER IV

Baritone Saxophone

HARSH

♩ = 80-84

mf

f

mf Mitsingen

f

ff sf Mitsingen

sf

3

15

Growl

fff mf

18

Growl

ff

21

Growl

24

Flutter

5:4 5:4

Mitsingen

Growl

fff

28

Growl

fz

31

Growl

mf

33 33 4:3 *f*

36

39 39 3 *ff*

44

47 47 *ppp* Mitsingen *ffff*

CHAPTER V
TRANQUILLISSIMO

SAXOPHONE TACET

CHAPTER VI

FRENZY

Baritone Saxophone

$\bullet = 80$

The musical score is written on a single treble clef staff in 4/4 time. It begins with a tempo marking of quarter note = 80. The piece starts with a dynamic of *f* (forte) and features a series of eighth-note runs. Measure 1 contains a triplet of eighth notes. Measure 2 has a triplet of eighth notes, a quintuplet of eighth notes, and another triplet of eighth notes. Measure 3 features a quintuplet of eighth notes and a triplet of eighth notes. Measure 4 includes a quintuplet of eighth notes and a triplet of eighth notes. Measure 5 has a triplet of eighth notes. Measure 6 contains a triplet of eighth notes. Measure 7 has a triplet of eighth notes. Measure 8 begins with a triplet of eighth notes, followed by a trill, and then two 4:3 grace-note patterns. The dynamics progress from *f* to *ff* (fortissimo) in measure 4, to *fff* (fortississimo) in measure 5, and finally to *mp* (mezzo-piano) in measure 8. The score concludes with a 5/4 time signature.

10 $5:6$ 3 f p

13 mp 3 3 3 3 3 sfz

15

17 3 3 3

20 3

22 3 3 3 3 3 3 fff

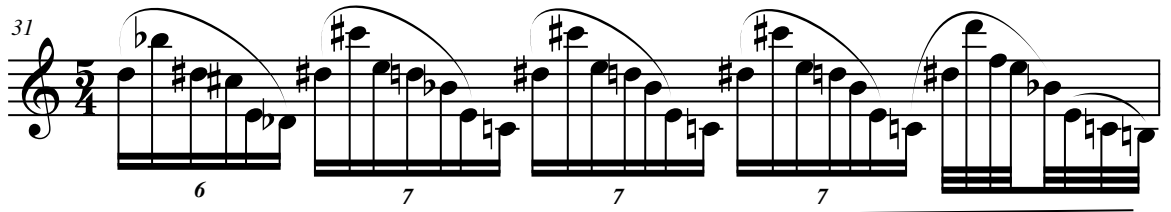
24 $pppp$

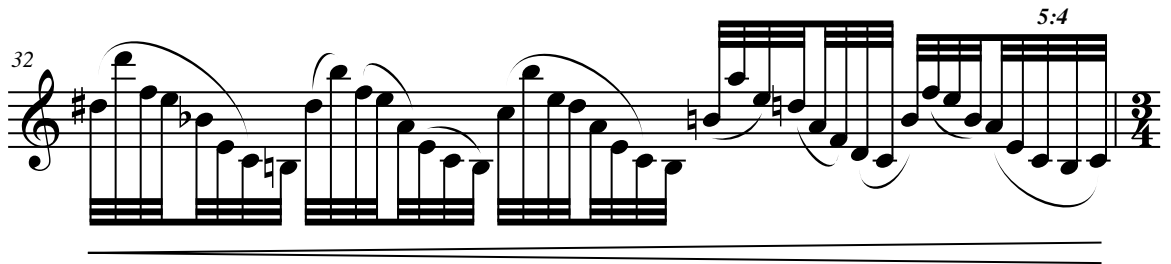
27 $4:3$ $4:3$ $5:6$

Detailed description: This musical score consists of eight staves of music in a single melodic line. The notation includes various rhythmic values, accidentals, and dynamic markings. Measure 10 features a 5:6 ratio and a triplet of eighth notes. Measure 13 includes a mezzo-piano (*mp*) dynamic and a sforzando (*sfz*) dynamic. Measure 22 is marked fortissimo (*fff*) and contains six triplets of eighth notes. Measure 24 is marked pianissimo (*pppp*). Measure 27 features 4:3 ratios and a final 5:6 ratio. The score uses a variety of time signatures, including 7/4, 4/4, 6/4, and 5/4.

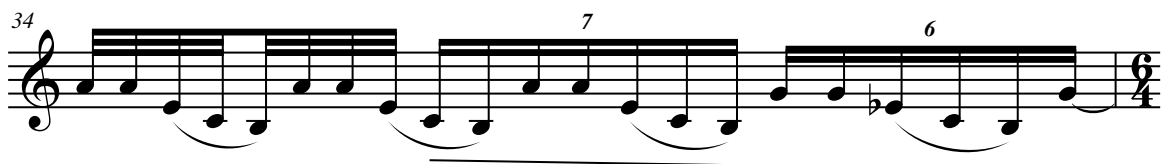
29 

30 

31 

32 

33 

34 

35 

37

pppp

39

pp *mf*

41

p *mf* *pp* *mf*

44

pppp *mf*

CHAPTER VII

CODETTA

SAXOPHONE, COMPUTER OPERATOR TACET

CHAPTER VIII
COMPUTER OPERATOR INSTRUCTIONS

HARSH: Arm Movement I and then begin recording movement I (Toggle/Pad Encoders). After the saxophonist begins gradually decrease the Word Size and Sampling Rate throughout the composition (Rotary Encoders). As this process happens the volume will automatically increase but be careful as clipping can easily occur. At the end of the movement both the Word Size and the Sampling Rate should be as low as possible.

TRANQUILLISSIMO: Arm Movement II and begin soundfile playback in movement II (Toggle/Pad Encoders). Freely adjust the transposition between the 12-division and 24-tone division (Keyboard and Toggle/Pad Encoders). The end of the movement should end with both transposition variations in unison.

FRENZY: Arm Movement III and begin recording movement III (Toggle/Pad Encoders). Gradually apply granular synthesis, and over the course of the movement raise the grain size and the transposition level higher, always raising them independently from each other (Rotary Encoders).

CODETTA: Arm codetta and begin soundfile playback (Toggle/Pad Encoders). The sound file will fade out after 35 seconds.