2014

The Electroacoustic Bassoon: An Exploration of a Modern Use for the Traditional Instrument

Bradley S. Behr

FLORIDA STATE UNIVERSITY

COLLEGE OF MUSIC

THE ELECTROACOUSTIC BASSOON: AN EXPLORATION OF A MODERN USE FOR THE TRADITIONAL INSTRUMENT

BY

BRADLEY S. BEHR

A Treatise submitted to the
College of Music
in partial fulfillment of the
requirements for the degree of
Doctor of Music

Degree Awarded:
Fall Semester, 2014

Bradley Behr defended this treatise on November 10, 2014.

The members of the supervisory committee were:

Jeffrey Keesecker
Professor Directing Treatise

Evan Jones
University Representative

Deborah Bish
Committee Member

Eric Ohlsson
Committee Member

The Graduate School has verified and approved the above-named committee members, and certifies that the treatise has been approved in accordance with university requirements.

ACKNOWLEDGMENTS

First, I would to thank Michael Burns, Paul Hanson, Jeffrey Lyman, and Jim Rodgers for their efforts and contributions to this treatise.

I wish to thank my committee members, Deborah Bish, Evan Jones, Eric Ohlsson, Seth Beckman, and my advisor, Jeffrey Keesecker, for all of their dedication throughout my time at Florida State University.

I am truly thankful for my bassoon teachers, Jason Worzbyt, Jim Rodgers, and Jeffrey Keesecker. Thank you for your tireless hours of instruction and mentorship.

I am extraordinarily grateful for my family's unwavering encouragement and support throughout my entire musical journey. From driving me weekly into Pittsburgh, to traveling across the country to attend performances…Thank You!

Finally, I would like to thank Jennifer for always being beside me, even when we were thousands of miles apart.

TABLE OF CONTENTS

ABSTRACT

The inclusion of electronic equipment in the performance of traditionally acoustic instruments has sparked a new genre of musical possibilities. Through an exploration of the history of the electroacoustic musical genre, the technologies employed, performance practices, and the experiences of a representative sample of bassoonists currently performing within the field, this treatise demonstrates how the addition of electronics in music has developed the genre of electroacoustic bassoon performance.

The experiences of four representative bassoonists, Michael Burns, Jeffrey Lyman, Jim Rodgers, and Paul Hanson, are highlighted to demonstrate how each uses electroacoustic performance in his career, as well as the specific technologies and equipment employed to transform the traditional acoustic bassoon into an electroacoustic instrument.

CHAPTER ONE

INTRODUCTION

The use of the bassoon has expanded significantly throughout the development of western art music. Precursors to the modern bassoon, like the dulcian of the 15th and 16th centuries, were used frequently as a means of reinforcing elements of the bass line. In the 17th century, the dulcian evolved alongside the jointed bassoon, and its role was further expanded. These centuries also saw the development of the dulcian as an instrument capable of being a leading musical voice. Although the exact type of bassoon used by Antonio Vivaldi is unknown, his 39 existing concerti demonstrate the instrument's capacity for solo performance. During the 18th century, the jointed bassoon, a more direct ancestor to the modern instrument, was utilized in a wide array of musical ensembles.

The music written for the bassoon, as well as the demands placed on the performer, continued to evolve as late 18th and early 19th century composers such as Wolfgang Amadeus Mozart, Ludwig van Beethoven, Carl Maria von Weber, and Hector Berlioz wrote challenging solo and orchestral parts for the instrument. The composers of the 19th and 20th centuries provided music that helped to further develop the bassoon's role as both a soloist and ensemble member. The adaptability and flexibility of the bassoon progressed as the level of performance rose and composers place additional demands on both the performer and instrument itself. The 20th and 21st century addition of electronics to musical composition created a new means of musical expression as well as a new performance possibilities for performers in a traditionally acoustic medium.

Although the literature and performance demands for the bassoon have expanded over four hundred years of development, there are nevertheless some inherent limitations in traditional performance. The combination of the bassoon and electronics has created a compositional genre which allows for the instrument to be utilized in conjunction with an ever-increasing palette of electroacoustics. Although traditional performance practices will not be replaced, the addition of electronics to the bassoon has inspired a genre of seemingly limitless possibilities. By exploring electroacoustic musical performance as a whole, as well as a representative sample of bassoonists currently performing within the genre, this treatise will illustrate how the inclusion of electronics in music has developed electroacoustic bassoon performance.

1.1 Electronics in Music

The development of technology, as well as the evolution of the definition of music in the 20th century, has allowed composers to experiment with novel concepts which generated new repertoire for all instruments. Aside from the use of extended techniques, e.g., flutter-tonguing, multiphonics, intentional key noises, and harmonics, the most notable addition to the composer's potential sound palette comes from the use of electronics. While certain schools of composition focused on using only electronic sounds, other interested composers began to combine electric and live acoustic sounds for their works. Although the resulting compositions often stretched the limits of both performer and available technology, a new subset of musical expression was created.

The implementation of electronics in music has resulted in a wide variety of terms to describe the genre. As the technologies employed have changed, and definitions have been proposed in an attempt to account for this evolution, there is often confusion in the semantics

when referring to music that incorporates electronics. The definition of electro-acoustic music, as given by Emmerson and Smalley in *Grove Music Online* is:

> Music in which electronic technology, now primarily computer-based, is used to access, generate, explore and configure sound materials, and in which loudspeakers are the prime medium of transmission. There are two main genres. Acousmatic music is intended for loudspeaker listening and exists only in recorded form (tape, compact disc, computer storage). In live electronic music the technology is used to generate, transform or trigger sounds (or a combination of these) in the act of performance; this may include generating sounds with voices and traditional instruments, electro-acoustic instruments, or other devices and controls linked to computer-based systems. Both genres depend on loudspeaker transmission, and an electro-acoustic work can combine acousmatic and live elements.[1]

There are many terms that remain in frequent usage to label the various types of electronically produced sounds. The nomenclature which has become commonly accepted through the genre's development include *elektronische musik*, *musique concrète*, acousmatics, radiophonic art, tape music, electroacoustic music, and electronic music. While the word electroacoustic (or electro-acoustic) is "often, and mistakenly, defined as compositions that include both one or more live performers on an acoustic instrument along with electronically-generated sounds,"[2] for the purpose of this discussion, the term "electroacoustic" will refer to any type of music that utilizes acoustic bassoon performance in combination with any electronic component. Although the focus of this treatise is not on the canon of music for electronics and bassoon, a knowledge of the history of the genre as is relevant to electroacoustic bassoon performance will assist in the comprehension of the existence of the medium today.

---

[1] Emmerson, Simon and Smalley, Denis. "Electroacoustic music." *Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/08695 (accessed August 19, 2014).

[2] Bassingthwaighte, Sarah Louise. "Electroacoustic Music for the Flute." *www.subliminal.org.* n.d. http://www.subliminal.org/flute/dissertation/TOC.html (accessed September 19, 2014).

1.2 History of Electroacoustic Music

The advent of electroacoustic music is often dated to the late 1940s and early 1950s, but none of the musical advances of that time would have been possible without the development of the recording and amplification technologies of the previous fifty years. Although the first recordings of sound came in 1867 from a device created by Leon Scott de Martinville which used carbon coated cylinders, the first apparatus for practical commercial use, the phonograph, was invented a decade later by Thomas Edison.[3] In 1888, Emile Berliner patented a disc phonograph that employed a technology called "lateral cut recording" that would become the standard for commercial recording until the 1950s.[4] The first playback machines were sold in Germany by 1889, and similar devices were available in the USA by 1893. While these machines weren't electronic, they laid the foundation for the future of electronic recording. By the turn of the century numerous companies had been established to manufacture recording and playback equipment based on these designs.[5] The biggest step in the inclusion of electronics in music came in 1914 when General Electric began to mass produce vacuum tubes based on a 1907 patent by Lee de Forest for electronic amplification.[6]

Along with the commercial advances in both sound amplification and recording playback came an interest in utilizing this technology in the composition of new music. The appeal for novel expressions in music is most notably found in Ferruccio Busoni's *Sketch for a New*

---

[3] Bassingthwaighte, Sarah Louise. "Electroacoustic Music for the Flute" (accessed September 19, 2014).

[4] Mumma, Gordon, et al. "Recording." *The New Grove Dictionary of Jazz, 2nd ed.. Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/J371600 (accessed September 20, 2014).

[5] Ibid.

[6] Dunn, David. "A History of Electronic Music Pioneers." *Pioneers of Electronic Art.* Linz, 1992: 22.

Aesthetic of Music, in which he proposed the use of new sound sources for the musical lexicon.[7] A group of artists calling themselves "Futurists" best encapsulated this aspiration for the "new." Led by Luigi Russolo, the musical division of this aesthetic positioning was defined by his 1913 manifesto, "L'Arte dei Rumori," (The Art of Noises) in which Russolo calls for artistic merit to be placed on the value of noise.[8] In addition to the desire to organize "noise" as music, Russolo defined the sounds of the orchestra as "a limited circle of sound" and further explained that, "the variety of noises is infinite. If today, when we have perhaps a thousand different machines, we can distinguish a thousand different noises; tomorrow, as new machines multiply, we will be able to distinguish ten, twenty, or thirty thousand different noises, not merely in a simply imitative way, but to combine them according to our imagination."[9]

In March of 1914 Russolo produced the first concert of noises, held under the same name as his manifesto, using hand activated mechanical instruments which produced sounds that were projected through horns and megaphones.[10] While this concert did not feature electroacoustic instruments, its governing aesthetic helped lay the foundation for electronic art music.

The 1920s brought the development of purely electronic instruments that, in contrast to the Futurists' repurposed machines and noise makers, were created solely for the purpose of musical composition. Early electronic instruments such as the Ondes Martenot, Trautonium, and Theremin were used by prestigious composers such as Darius Milhaud, Edgard Varèse, Olivier

---

[7] Busoni, Ferruccio. "Sketch of a New Esthetic of Music." In *Source Readings in Music History*, by Oliver Strunk, edited by Leo Treitler. New York, New York: W.W. Norton & Company, Inc, 1998: 1321-1328.

[8] Russolo, Luigi. "The Art of Noises." In *Source Readings in Music History*, by Oliver Strunk, edited by Leo Treitler. New York, New York: W.W. Norton & Company, Inc, 1998: 1329-1334.

[9] Ibid.

[10] Russcol, Herbert. *The Liberation of Sound: An Introduction to Electronic Music.* Englewood Cliffs, New Jersey: Prentice Hall, 1972: 67-68.

Messiaen, Andre Jolivet, Arthur Honegger, and Richard Strauss.[11] The continued desire to employ technology in the composition of music was realized further in 1939 when John Cage composed *Imaginary Landscape no.1*, the first of a series of four works. This piece, which was scored for muted piano, cymbal, and two variable speed turn tables playing frequency recordings, may be considered one of the first electroacoustic compositions to utilize pre-recorded sounds and traditional acoustic instruments.

A major advancement in the composition of electroacoustic music came with the development of a steel wire magnetic tape for recording. Although a patent was issued in 1898 to Vlademar Poulsen for magnetic tape recording, "it was not until the advent of electronic amplification that the music potential of the technique could be realized."[12] Thanks to its ease of editing and significantly lower cost, by the 1950s magnetic tape recording (on a plastic or paper base) became the predominate medium for recording sound. Composers experimenting with tape and disc processes were also drawn to the technology of magnetic tape for its ability to be easily manipulated through editing.

In the late 1940s and early 1950s, there were two schools of electroacoustic composition working within the medium of magnetic tape. In 1948, the term *Musique Concrète* was developed in Paris by Pierre Schaeffer who was soon joined by Pierre Henry. Their aesthetic for musical creation relied on the idea that, "a composer was working concretely with the sound material, in contrast to the composer of instrumental or vocal music who was working indirectly using a symbolic system of notation which represents the sounds to be made concrete by instruments and/or voices."[13] In general, *Musique Concrète* was based on the juxtaposition and

[11] Bassingthwaighte, Sarah Louise. "Electroacoustic Music for the Flute" (accessed September 19, 2014).

[12] Mumma, Gordon, et al. "Recording" (accessed September 20, 2014).

transformation of natural sound (real, pre-recorded sounds, not necessarily those sounds made by natural forces) recorded to tape or disc.

Beginning in 1949, another school of electronic composition was developed in Cologne by Herbert Eimert and physicist Werner Meyer-Eppler. They began to pioneer a tape music based solely on electronically generated (synthetic) sounds that they called *Elektronische Musik*. Considered by Eimert to be the perfection of serialism, which was dominating instrumental composition at the time, this aesthetic positioning was governed by the use of electronically constructed timbres to control not only the musical structure, but also the creation of the sound itself.[14] Similar electroacoustic musical developments were occurring across the United States, but contrary to the European tape studios which were often state supported, the experimentation in the United States was primarily being conducted within the halls of academia.

The use of the computer as an aid in musical composition may be traced as early as 1954 when composer Yannis Xenakis employed an early computer to "calculate velocity trajectories of glissandi for his orchestra composition *Metastasis*."[15] The first computer generated sound was produced in 1957, and over the next decade the computer was rapidly applied in the domain of musical composition. From its inception, the computer has generally been used by composers in two distinct ways. The computer is often used either as a mathematical aid for complex compositional calculation, or for a means of generating new "synthetic waveforms and timbres."[16]

---

[13] Emmerson, Simon and Smalley, Denis. "Electroacoustic Music" (accessed August 19, 2014).

[14] Dunn, David. "A History of Electronic Music Pioneers": 22.

[15] Ibid.: 44.

[16] Ibid.: 48.

Building upon the framework of the *Imaginary Landscape* series by Cage, the 1950s and 1960s brought about two approaches to unite live performers with electronics. In 1952, Bruno Maderna, in collaboration with Meyer-Eppler, composed *Musica su due Dimensioni* for flute, percussion, and loudspeaker, and composer Henk Badings wrote *Capriccio for Violin and Two Soundtracks*.[17] The following year brought a composition by Schaeffer and Henry, *Orphee 53*, for soprano and tape. This new genre, then called "mixed music," embraced divergent aesthetics ranging from works focusing on instrumental extended techniques and new electronic sounds, to works that explore the pitch and rhythmic complexities of serialism with taped electronic sounds as an accompaniment to the performer.[18]

The combination of live performers and pre-recorded sounds as a new means of chamber music can be seen as an evolution of, and reaction to, the often perceived sterility of tape music in performance. For many composers, live performers with pre-recorded tape was a "means of expanding the timbral possibilities they had been writing for, and for others it was a way to expand structural aspects of performance in physical space."[19] Composer Mario Davidovsky developed and further explored the complex relationship between performers and pre-recorded tape in his series of compositions titled *Synchronisms nos. 1-8*, of which *Synchronisms no. 6* won the 1971 Pulitzer Prize. From the 1960s through the present day, the number of works similar to these has grown to produce an immense repertoire of electroacoustic music.

Aside from the timbral expansion possible through the performance of a live musician with pre-recorded track, composers of the 1950s and 1960s developed the ability to alter the

[17] Bassingthwaighte, Sarah Louise. "Electroacoustic Music for the Flute" (accessed September 19, 2014).

[18] Emmerson, Simon and Smalley, Denis. "Electroacoustic Music" (accessed August 19, 2014).

[19] Dunn, David. "A History of Electronic Music Pioneers": 49.

performer's sound immediately through the use of electronics. This process is often referred to as using "live electronics." While the simplest example of live electronics in performance extends back to the electronic amplification of acoustic instruments in the 1930s, numerous innovative applications of these technologies were rapidly developed. Many composers began to experiment with a vast array of electronic control devices in the 1960s which required audio engineers and musicians to become technologically competent with the applied effects.[20] Some of the most common examples of live processing are the use of filtering, flanging, phasing, panning, echo, and delay effects.[21] Although these effects are still prominent in much of the electroacoustic music produced today, the 1960s processing technology often created an unwanted delay in the application of the effect. It was not until the development of faster computer microprocessors in the 1970s and 1980s that these effects could be used in "real time."

The growth of electroacoustic music and the technologies which made its composition and performance possible, namely the development of the personal computer, continued rapidly throughout the 1970s and 1980s. The creation of a technology called Musical Instrument Digital Interface (MIDI) in 1983 revolutionized electroacoustic music as MIDI standardized the software for the electronic communication of musical data. A continued acceptance and availability of these digital technologies through the 1980s and 1990s further contributed to the general accessibility of the composition and performance of electroacoustic music.

Currently, a common means of electronically processing the sound of an acoustic instrument comes in the form of computer programs. One of the most widely used software systems is called Max/MSP (Max Signal Processing). The roots of this visual programming

[20] Dunn, David. "A History of Electronic Music Pioneers.": 52.

[21] See glossary for definition of terms.

language for music extends to the mid-1980s, but the current iteration of the software may be traced to the late 1990s.[22] Max/MSP and other similar computer programs provide composers with a system to write for interactive computer music. Essentially, Max/MSP works by recording live sounds, processing those sounds in real time, and then producing new sounds within a pre-determined framework of possible responses in reaction to the performer.

Today, the relative affordability of equipment, a ubiquitous familiarity with the available computer driven interfaces, and the ease of disseminating new information, provide a rich environment for the continued evolution of electroacoustic music.

Although there are numerous subgenres within electroacoustic music as a whole, the application of electronics in music over the last century has produced a significant change in the field. The combination of bassoon and electronics has created a compositional genre which allows the traditional acoustic instrument to be paired with an infinite palette of electroacoustic sounds in addition to its potential for even greater musical flexibility as the bassoon's tone may be altered through new electronic processes.

1.3 The Bassoon in Electroacoustic Music

It is difficult to determine the first instance in which the bassoon was used in electroacoustic composition. Technically one could consider Schaeffer and Henry's experimentation with the manipulation of orchestral and instrumental recordings to be the first example of the bassoon in electroacoustic music, but as the resulting works significantly altered the original material, the identification of the bassoon's timbre in these compositions is impossible. Some of the earliest pieces which include live bassoon and pre-recorded accompaniment are chamber works like Paul-Heinz Dittrich's *Kammermusic I,* composed in

[22] Cycling '74. *FAQ: Max 4.* n.d. http://cycling74.com/support/faq_max4/ (accessed October 2, 2014).

1970, for flute, oboe, clarinet, bassoon, piano, and tape.[23] Elliot Schwartz's *Aria no. 4* of 1972, and Bjørn Fongaard's multiple works for solo bassoon and tape of 1976, are notable examples of some of the earliest works for solo bassoon and pre-recording.[24]

Electroacoustic compositions for solo bassoon and pre-recorded tape have evolved since the late 1970s. Prominent works for this medium includes such as bassoonist Michael Burns's *Swamp Song* for bassoon and tape of 1986. According to bassoon professor Christin Schillinger, "this piece remains one of the most aurally accessible works to a young student. In addition, it is not difficult to coordinate with the included tape."[25] Another composition by a bassoonist for bassoon and pre-recorded tape is Knut Sönstevold's *Chewing Bassoon Burger* of 1990. Pierre Boulez transcribed his piece for clarinet and electronics, *Dialogue de L'Ombre Double*, for the bassoon in 1995, and between 2010 and 2011 Filippo Zapponi composed *Hypérion-Éos*, described by Professor Jeffrey Lyman as a "uniquely interesting take on the genre."[26]

In addition to these aforementioned works, another distinctive example of composition for bassoon and electronics includes Edward Diemente's *For Lady Day: a trio for one player*, which is a work for solo instrument and live electronics. In Diemente's 1972 work, the solo voice pre-records and layers two accompanying lines and performs the melody live.[27] Arne Mellnäs's 1976 work *Solioquium IV*, for solo bassoon with optional electronics, is an example of a piece that can be performed as either an unaccompanied solo piece or as an electroacoustic

---

[23] *The University of Michigan Bassoon Studio.* n.d. http://www-personal.umich.edu/~jlym/pages/new_bsn_cd.html (accessed September 27, 2014).

[24] Ibid.

[25] Romine, Ryan D. "ElectroBassoonica." *The Double Reed* Vol. 36, no. 1 (2013): 110.

[26] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014).

[27] Diemente, Edward. "For Lady Day : a trio for one plyer." New York, New York: Seesaw Music, 1972.

composition.[28] Donald Chamberlain's *Beck and Call*, written in 1990, utilizes an amplified solo bassoon in addition to a pre-recorded accompaniment. Finally, three examples of electroacoustic composition which utilize the bassoon, live electronics, and pre-recorded sounds are found in François Bousch's 1988 *Espace-Temps*, as well as compositions from 2007 like Michael Rothkopf's *At a Crossroads for Bassoon and Computer*, and David Hurdy's *Impromptu pour un Monodrame*.[29]

Aside from the electroacoustic works for bassoon that are composed for performance in the recital hall, the instrument has found a voice in non-traditional ensembles as well. The development of the amplified and processed bassoon coincides with bassoonists' desires to use their instrument outside of western art music in genres such as jazz and rock.[30] While the bassoon has been used in various degrees of nearly all forms of jazz throughout the 20th century, the application of electronics to the bassoon in this medium was pioneered by bassoonists such as Paul Hanson, Ray Pizzi, and Michael Rabinowitz.[31] In addition to the use of amplified and electronically processed bassoon in different types of jazz, the bassoon has been used in rock-and-roll ensembles as well. One innovative example of the electroacoustic bassoon's use in a rock setting is Herbert Diamant's performance with the San Francisco based art-rock band, Cartoon.[32] Although it is possible for other members of ensembles such as these to play at a soft

[28] *The University of Michigan Bassoon Studio* (accessed September 27, 2014).

[29] Bousch, Francois. "Espace-temps : pour basson, dispositif et bande magnetique." Paris: Salabert, 1988; *The University of Michigan Bassoon Studio* (accessed September 27, 2014); Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[30] Wells, David Atkinson. *A History and Discography of the Bassoon in Jazz.* DMA Dissertation, Madison Wisconsin: University of Wisconsin-Madison, 2010: 1-15.

[31] Ibid.: 1-15.

[32] Hanson, Paul. "My Life as a Bassoonist and Improviser." *The Double Reed* 28, no. 3 (2005): 98

enough volume for the bassoon to be heard, it is the use of electronic amplification that has made it possible to potentially incorporate the bassoon into all of these musical settings.

From the initial use of the bassoon and the dulcian as a means to reinforce the bass line of early musical compositions and its use as a soloist and permanent member of the orchestral complement, to the application of electronics in conjunction with the instrument, the use of the bassoon has evolved significantly over a four hundred year period. As the current generation of instrumentalists are often well versed in the use of new technologies, and electroacoustic bassoon performance becomes more common in both western art music and popular genres, there is great potential for the expansion of the medium.

CHAPTER TWO

PERFORMERS, AMPLIFICATION, AND ELECTRONIC EFFECTS

2.1 Basis for the Inclusion of Four Representative Electroacoustic Bassoon Performers

A bassoonist looking to delve into the genre of electroacoustic performance for the first time may have many questions about exactly where and how to begin. Rather than attempting to start from scratch, it is often helpful to look to others who have been performing within this medium for guidance. One solution is to survey a limited number of active electroacoustic bassoonists who would provide a representative sample of how the medium is approached. For this reason, four performers' experiences are highlighted within this document.

As much of the experimentation within the genre occurs in the academic setting, the experiences of two university bassoon professors shall be representative of how the electroacoustic medium often exists in academia. They are Michael Burns, currently the Professor of Bassoon at The University of North Carolina Greensboro, and Jeffrey Lyman, currently the Associate Professor of Bassoon at the University of Michigan. These two are the epitome of teaching artists who utilize electroacoustic performance, not as their primary means of bassoon performance, but as a result of their interest in the genre and as a method of representing the medium within their studios.

Another facet of electroacoustic bassoon performance is represented by Jim Rodgers, principal contrabassoon of the Pittsburgh Symphony Orchestra. In addition to performing on the bassoon at the highest levels in a standard orchestral setting, he is also active within the medium of electric-acoustic performance. Rodgers's experience illustrates how a professional performer may utilize the electroacoustic bassoon to complement his daily symphonic duties.

The fourth proponent of electroacoustic performance, Paul Hanson, is representative of a musician who has made electroacoustic bassoon the most significant pursuit in his career. Both Rodgers and Hanson have an extensive knowledge about the use of electronic effects and the amplification of the bassoon.

Although all four of the musicians surveyed have diverse experiences with the electroacoustic bassoon, they (and all who are looking to experiment within the medium) have at least one element of performance in common: the application of some manner of electrical equipment to the acoustic bassoon.

2.2 Amplification in Bassoon Performance

There are many instances when the acoustic bassoon sound may need to be amplified and/or processed. In ensembles like a rock band, jazz ensemble, or other louder groups, the acoustic bassoon might normally be inaudible. For music that is scored for bassoon and pre-recorded track, the bassoonist is called on to match the level of the recording yet can easily be overtaken by the amplified part. In order to play loud enough in these types of settings a bassoonist may attempt to force the instrument's volume to uncharacteristic levels, resulting in a compromised tone that does not honor the composer's intentions. Through the use of amplification systems, the bassoonist may now become a contributing member to such ensembles and provide new sonic possibilities for composers.

As the bassoon's sound comes from many tone holes facing different directions over the entire length of the instrument, it can be a difficult to capture the instrument's full tone for the purpose of amplification. Taking this into consideration, a bassoonist has basically two approaches to the amplification of the instrument: the use of a traditional external microphone, or a drilled bocal mounted "pickup." Although both of these options have their respective

advantages and disadvantages, each may be utilized in different settings of electroacoustic bassoon performance.

The use of a high quality traditional stationary microphone amplified through a Public Address (PA) system will provide the most natural acoustic sound of the bassoon. According to Dr. Trent Jacobs, "the microphone should be placed at approximately head level, pointed slightly downward toward the center of the bassoon." [33] In "Bassoon Amplification in Jazz and Popular Music," a chapter contributed in Maarten Vonk's A Bundle of Joy, A Practical Handbook for the Bassoon, jazz bassoonist Michael Rabinowitz details how he often uses two microphones. One is placed near the bell and another is placed near his right hand in an attempt to amplify the instrument as completely as possible. To achieve this, Rabinowitz utilizes small microphones that can be mounted to the bassoon with flexible clamps.[34]

For the performance of music that requires only simple amplification, and no further processing, Jeffrey Lyman employs a system of two microphones as well. He uses two lavalier type microphones (also known as "lav" or "lapel" microphones), of which one is attached by rubber band near the bell, while the other is clipped to the lapel of his shirt.[35] When performing he conceals the transmitter packs of these microphones in his pockets or on his belt. Lyman feels that "this set up generally gives the engineer a good spectrum of the bassoon sound to put through the mixing board."[36] The use of the two microphones is intended to capture a truer

[33] Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire.* DMA Dissertation, Urbana, Illinois: University of Illinois at Urbana-Champaign, 2010: 60.

[34] Rabinowitz, Michael. "Bassoon Amplification in Jazz and Popular Music." In *A Bundle of Joy. A Practical Handbook for the Bassoon*, by Maarten Vonk, 109-110. Nederland: FagotAtelier Maarten Vonk, 2007.

[35] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014).

[36] Ibid.

acoustic tone while still providing the bassoonist the freedom to move naturally during a performance.

As the amplification of the bassoon is always a balance of compromise, the external microphone set up does have some issues to be considered. Although the use of a stationary microphone may be the simplest form of amplification, it does not allow the bassoonist to move naturally when performing. Due to the length of the instrument and placement of tone holes that change the point from where sound escapes the bassoon depending on the note fingered, any variation in the position of the instrument in relation to the microphone may result in a change in what is being amplified. In addition to the potential restriction of movement, the use of only one microphone may not necessarily amplify the bassoon evenly throughout the instrument's entire range, thus creating an unintentional variation in dynamics as the performer moves through the bassoon's different tessituras.

Regardless of whether a bassoonist is amplifying the instrument with one external microphone or two, the microphone levels (or gain) will often have to be turned up to higher than normal settings in order to capture all sounds coming from the bassoon. This higher microphone sensitivity can increase the potential for feedback, and, if performing with multiple instruments, may result in the unintended amplification of others in the ensemble. An additional issue created through the use of two external microphones is the difficulty to process the signal for the use of electronic effects. As both microphone signals would have to be blended and then processed through the desired effect, this again creates a greater possibility for issues with unwanted feedback.

The second potential method of bassoon amplification is the use of a bocal-mounted pickup. Trent Jacobs, creator of the "Little Jake" bassoon pickup, explains that "Technically

there is no way that a 'pickup' in the true technical sense of the word is possible on the bassoon."[37] A pickup is a magnetic coil excited by a vibrating string as in an electric guitar. The available technology is more accurately described as a microphone, but is commonly referred to by bassoonists as a pickup due to the nature of its use."[38] This sort of microphone attaches directly to the bassoon through a drilled and soldered (or threaded) adapter in the bocal. As the pickup is inserted into the bassoon's bore it almost entirely isolates the source of the sound to be amplified, and therefore eliminates much of the potential for feedback in comparison to the external microphone. Although the issue of feedback is limited, the bocal pickup does not reproduce the natural acoustic sound of the bassoon as accurately.

While there are many details to take into consideration when using a bocal pickup for electroacoustic bassoon performance, the concept of drilling into the bassoon or a bocal is always an issue to be considered. Burns indicates that he has "thought about getting a pickup mounted to one of his bocals but has yet to do so…You want to use a nice enough bocal but it may compromise it a bit for non-electroacoustic purposes."[39] In relation to the required drilling for the pickup Rodgers says, "This was a bit of a leap of faith, especially since I had this done to a very good Heckel bocal. Other than that, there are no modifications that need to be made to the bassoon itself."[40] Hanson contends, "I would never, ever drill into the wood of an instrument. You don't have to, so I would say there's nothing I'm apprehensive about doing. If you have a

[37] Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire*: 61.

[38] Ibid.

[39] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[40] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

good bocal you will sound better; even when you use an electric pickup."[41] But in Lyman's opinion, "drilling anything causes apprehension."[42]

The benefit of this manner of bassoon amplification is the ability to be amplified to louder levels and to become more compatible with the use of processing and effects. Michael Burns indicates that he does not currently own any specific amplification equipment. Although he has utilized a bocal of his former teacher with a Barcus-Berry pickup soldered into it during the mid-1980s. For most of Burns's electroacoustic performances he has borrowed equipment from composers and the technical assistants at different venues.[43] While Lyman uses the bocal pickup specifically for pieces that require effects, Hanson and Rodgers use this method as their primary means of electroacoustic bassoon amplification. Currently, Lyman employs the Telex brand S-29 bocal pickup (now discontinued) attached to a Püchner bocal, and Rodgers utilizes the same model pickup soldered to a Heckel bocal; Hanson currently uses the Little Jake.[44]

Although the Telex S-29 is recently discontinued, they are still in common use with bassoonists who purchased them in prior years. While this pickup is the easiest bocal-mounted microphone to use, it tends to favor the higher frequencies and therefore tends to sound much brighter than the bassoon's natural acoustic tone.[45] It is also prone to feedback which may produce inconsistent results with effects.[46] The Little Jake pickup is mounted in a similar manner

---

[41] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[42] Lyman, Jeffrey, Interview by Author. *Electronic Survey* (August 24, 2014).

[43] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[44] Lyman, Jeffrey, interview by Author. *Electronic Survey* (August 24, 2014); Rodgers, Jim, interview by by Author. *Electronic Survey* (October 1, 2014); Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[45] Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire*: 62.

[46] Ibid.

as the Telex but due to the specific microphone used, it highlights the lower frequencies of the sound.[47] Unlike the Telex model, the Little Jake must be run through an impedance buffer, commonly referred to as a preamp, to be used effectively. The Little Jake pickup is currently sold with a small Gigpro brand L.R. Baggs preamp that has controls for treble and bass attenuation in addition to volume and equalization.

In his use of the Little Jake pickup, Hanson further enhances his ability of control through the utilization of an Avalon U5 brand preamp in addition to the L.R. Baggs module.[48] Specifically, Hanson sets the treble on the Baggs unit to about 4 and the bass at about 1.[49] For his electroacoustic performance, Hanson does not like his sound to be turned up through the Little Jake's preamp as he feels the sound can become easily distorted. He instead uses a combination of the Avalon 5 preamp, his processing unit, and the front of house (if available) to turn up his volume level in an attempt to try for the best acoustic tone he can achieve with the bocal pickup.[50]

In addition to using either a bocal-mounted pickup or an external microphone, an amalgamation of methods may be utilized to account for the advantages and disadvantages of each. This set-up better allows the performer to capture the natural acoustics of the bassoon's sound through the external microphones in combination with the direct signal of the bocal pickup. While this option may seem like the best compromise of amplification possibilities, the complexity of the system, the necessity of a sound technician to blend the multiple signals, and

[47] Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire*: 62.

[48] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[49] Ibid.

[50] Ibid.

the need for up to three separate cables to be attached to the bassoon may make this option unrealistic for most performers.

Aside from the microphone needed for the amplification of the bassoon, some mode of amplifier is also a necessity. For their electroacoustic bassoon amplification needs, Michael Burns and Jeff Lyman prefer to utilize a performance venue's PA system as well as the technical assistants provided. In doing so, they allow the people most familiar with the house technology to be in control of much of the mix.[51] Paul Hanson prefers to go through the house PA as well, with the addition of a monitoring wedge so he may hear his own sound.[52] When Hanson does use an amplifier, he currently plays through a Mackie SM450 powered wedge with a 10" speaker and horn.[53] For his purposes, Jim Rodgers uses a Roland keyboard amplifier.[54]

2.3 Electronic Effects

Whether a bassoonist utilizes a house PA system or his own amplifier, the electronic signal provided for the sound reinforcement equipment is also suitable to be used in conjunction with signal processing effects. These effects, although originally designed to be used with electric guitars, vocals, and synthesizers, may be applied to the electric bassoon signal. While the techniques used in audio signal processing are the same for the electroacoustic bassoon as they are for their original use, the complexity of the bassoon's sound means that the applied effects may respond differently than they would for a guitar or synthesizer. Although the best means of learning which type of effect produces a particular timbre, an understanding of how different

[51] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014); Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[52] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[53] Ibid.

[54] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

categories of processors are intended to interact with the original tone will assist in obtaining a practical understanding of the most commonly applied effects.

Distortion effects are one of the most frequently used sort of signal processing devices for guitarists. The distortion effect works by both boosting the input signal, and clipping the sound's waveform while adding overtones. Jacobs details some issues with the use of distortion effects for the electroacoustic bassoon application. He says, "Because the bassoon's harmonic content is already quite complex, distortion effects need to be chosen carefully or the sound can easily become over-saturated with harmonics resulting in a harsh white noise. Distortion effects also increase the gain of the signal which will promote feedback issues already problematic with current pickup units."[55] The overdrive and fuzz effects are both related to the distortion effect, but as they alter the level for the signal that goes into an amplifier, they are subject to the same feedback issues.

A compressor will make loud sounds quieter, and quiet sounds louder by decreasing (or compressing) the dynamic range of an audio signal. In practice, this effect will dampen a note's beginning then amplify its sustain.[56] Dynamic effects, also called amplitude or volume effects, modify the volume of the instrument. A volume pedal will amplify or decrease the amplitude of the audio signal depending on its setting by the performer.

Pitch shifting and harmonizing effects are also frequently used in conjunction with the electroacoustic bassoon. A pitch shifter raises or lowers the played pitch by a pre-set interval. Octave shifts are the most common use for this effect, but more sophisticated pitch shifting

[55] Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire*: 64.

[56] Reese, David, Lynne Gross, and Brian Gross. *Audio Production Worktext: Concepts, Techniques, and Equipment.* Waltham, Massachusetts: Focal Press, 2009: 149.

devices offer many more intervallic options. A harmonizer is a sort of pitch shifter that combines both the original pitch with an altered pitch in order to add one or more harmony notes.

Filter effects alter the audio signal by either weakening or boosting specific frequencies or ranges of frequencies. One of the most common of these types of effects is called a Wah-wah pedal. These pedals are often explained as being a tone control with a rocking foot pedal attached, which controls a filter that creates a peak in the frequency depending on the position of the pedal.[57] Graphic equalizers are also a type of filter effect commonly used to mix the different ranges of the instrument. As these effects feature sliding controls that are divided into different frequency bands, they provide a simple means of adjusting the tone of the sound produced in the different ranges of the bassoon.

Modulation effects, such as flanger, phaser, and chorus effects add "depth, dimension, and movement" to the bassoon's sound through electronic processing.[58] A flanger effect processes the input signal by adding a variable delay to that original signal. The phaser effect works by splitting an audio signal in two parts and altering the "phase" of one of the splits, then combines both altered and unaltered signals in the output signal.[59] Both of these types of effects create a vowel shifting, or a "swish," in the tone color of the bassoon.[60] The chorus effect adds a constantly delayed signal to the original signal, but is a short enough delay that the sound is not perceived as an echo.

---

[57] Hunter, Dave. *Guitar Effects Pedals the Practial Handbook.* San Francisco, California: Backbeat Books, 2004: 40.

[58] Ibid.

[59] Reese, David, Lynne Gross, and Brian Gross. *Audio Production Worktext: Concepts, Techniques, and Equipment.*: 167.

[60] Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire*: 65.

Time-based processing can be used in many different ways in conjunction with the electric bassoon. The most well known of the time-based effects is referred to as reverb. This effect produces a large number of echoes that gradually fade away depending on the device's setting. Delay and echo effects are created through a duplicated signal at a slight time delay, in the case of the echo effect, or up to sixteen seconds for the delay pedal. These effects can produce single or multiple echoes. Another type of time-based electronic process, the looping effect or phase looper, is a pedal or computer-based effect that allows the performer to record and store a phrase that can then be played back verbatim. This storage and playback ability allows for new material to be performed over top of the original "loop." As these units permit a performer to record multiple tracks one over the other, a single bassoonist using this device could play both the harmony and melody of a specific piece.

Hanson and Rodgers frequently use signal processing in their electroacoustic bassoon performance. Hanson has explored the possibilities of effect processing and looping in both his recorded albums and live performance. Currently, Hanson uses a TC Helicon brand VoiceLive-2 vocal unit as his primary processing equipment.[61] In addition to this effects unit, he employs an MXR brand bass envelop filter which allows the performer to blend how much of the pickup's signal is processed, and how much is direct or un-processed. For phase looping, Hanson currently prefers the Boomerang III Phase Sampler pedal, but has also used computer programs such as Ableton Live and Logic 9.[62]

As a bassoonist who often participates in the electroacoustic medium as solo performer, Rodgers's specific set-up and his experience in the selection of his equipment may serve as a

[61] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[62] Ibid.

reference for those looking to begin experimentation with the use of looping and effects. In addition to his Telex S-29 bocal pickup and Roland keyboard amp, Rodgers employs several different effect pedals. Currently, he uses Boss brand pedals such as a phaser, digital delay, harmonist, and echo, as well as a Digitech brand bass multi-effects processor.[63] For his phase looper, Rodgers selected a Boss RC 20XL.[64] Unique from the other bassoonists surveyed, Rodgers also uses a Line 6 brand wireless transmitter for better freedom of movement.[65] The signal from Rodgers's wireless transmitter is run to his floor pedals, usually set with the cable running from right to left, "beginning with the whammy pedal and always ending with the looper before going to the amp."[66]

Rodgers decided on his current equipment for many reasons. He explains, "The Forrests microphone [Telex S-29] and pickup worked best for what I wanted to do with the electronics. I found the Roland amp to be the best for the range and sounds I wanted to use, since keyboard amps handle everything a full-range synthesizer can produce. After trying many different pedals, the Boss and Digitech choices were the best for my objectives and the most user-friendly. I would always test any new pedal across the entire bassoon range and with different dynamics and attacks, to see how the pedals reacted given the sensitive nature of the bocal pickup. My looper gives me the most flexibility without any extra frills, allowing me to focus on the loops and layers."[67] He continues, saying, "I am always experimenting and trying new gear. Most other

[63] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

[64] Ibid.

[65] Ibid.

[66] Ibid.

[67] Ibid

pedals are too sensitive or produce sounds that are incompatible with my setup, or sounds I'm not interested in. Boss pedals seem to work best for me as well as my original Digitech multi-effect pedal, which can be programmed to accommodate the sensitivities and 'spikes' that the microphone/pickup can produce."[68] With regard to trying new equipment, Rodgers contends that, "there are rarely drawbacks to experimentation, and always benefits; if nothing else to validate my current choices [of equipment]."[69]

Speaking further about equipment issues faced in electroacoustic bassoon performance, Rodgers expounds:

> Mostly the challenges have been related to the bocal mic sensitivity, finding gear that will not 'spike' or distort, and learning the gear itself. Since I was not trying to reproduce an actual bassoon sound, timbre issues were not as challenging. Learning to use the gear, a skill not generally part of a bassoon performance degree, was a huge challenge, but a welcomed one. Using my feet to work the pedals was something I had never needed to do before, and the coordination required was more than I could have imagined. I had to seek out individuals outside of the orchestral world to teach me about the gear. Fortunately there were several such individuals who were very helpful.[70]

[68] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

[69] Ibid.

[70] Ibid.

CHAPTER THREE
MICHAEL BURNS

Dr. Michael Burns is the Professor of bassoon at the University of North Carolina at Greensboro. Prior to his current position, Burns taught at the Cincinnati College-Conservatory, Indiana State University, Midland College, and numerous summer festivals and schools. He holds a Bachelor of Music degree from Victoria University of Wellington, New Zealand, a Masters of Music from the New England Conservatory, and a Doctorate of Musical Arts from the University of Cincinnati College-Conservatory of Music. Burns's bassoon mentors and teachers include William Winstead, Sherman Walt, Leonard Sharrow, Sidney Rosenberg, and Colin Hemmingsen. Burns has performed with the Cincinnati and New Zealand Symphony Orchestras, the Indianapolis Chamber Orchestra, and has held principal positions with the Cincinnati Chamber Orchestra, Midland/Odessa, Richmond, Abilene, and Asheville Symphonies, the North Carolina Opera, and the Carolina Ballet.[71]

As a soloist and Yamaha Performing Artist, Burns has recorded on numerous labels and released a solo CD in 2009 titled, *Primavera: Music for Bassoon and Piano by Bassoonists*. He has also presented recitals and master classes at the International Double Reed Society conventions and throughout North America, Germany, Italy, China, and the South Pacific. An active composer, Burns has published many works that are frequently performed nationally and internationally. In addition to his work as a teacher, performer, and composer, Burns is a

[71] Burns, Michael. *Michael Burns, bassoon.* 2009. http://www.michaelburnsbassoon.com/Bio_Resume/Bio_Resume.html (accessed August 21, 2014).

frequent contributor to publications such as the *Double Reed*, *TBA Journal*, and *NC Music Educator*.[72]

Burns's first experience with the electroacoustic bassoon came during his undergraduate studies when he was asked to perform the piece *Demiola for Bassoon and Tape* by Karl Korte, a visiting Fulbright composition professor from the University of Texas at Austin, on a concert of the composer's works.[73] After this performance, Burns, who was double majoring in bassoon and composition while also studying electronic music, was inspired to compose his own piece for bassoon and pre-recorded tape.[74] The resulting composition, *Swamp Song*, would become a staple of the electroacoustic bassoon medium.

Burns has played several works for bassoon or contrabassoon and electronic media. Aside from *Demiola* and *Swamp Song*, some of Burns's favorite electroacoustic pieces to perform are, *At a Crossroads* by Michael Rothkopf, *ContraMax* by Mark Engebertson, and Felipe Pérez Santiago's *Iftira*.[75] Burns says that *At a Crossroads*, a work for bassoon and interactive electronics, is "fun because the computer part is essentially artificial intelligence and will react differently on different occasions. It is designed such that if the bassoonist plays conservatively then the computer part becomes more adventurous and vice-versa…essentially you improvise with the computer."[76] He also states that *ContraMax*, a piece for contrabassoon and electronics, is enjoyable to perform as it not only utilizes a contrabassoon, but also "you

[72] Burns, Michael. *Michael Burns,* (accessed October 1, 2014).

[73] Ibid.

[74] Ibid.

[75] Ibid.

[76] Ibid.

have to negotiate the foot-pedaling which adds a new challenge."[77] The composition, *Iftira*, is also identified as one of Burns's favorite electroacoustic works to perform as it is scored for a bassoon quintet and electronics.

While Burns has enjoyed performing many electroacoustic compositions for different reasons, his favorite memory of electroacoustic bassoon comes from when he was beginning to experiment within the medium. He says that he is "quite proud of" the moment when "recording bassoon elements to be incorporated into *Swamp Song*, I realized that the heavily processed 'normal' bassoon sound (ring-modulation, filtering, slowed down, etc.) greatly resembled some multiphonic sounds that I was able to produce 'live' on the bassoon leading to a duet in the middle of the piece."[78]

Burns admits that he may have a bias towards *Swamp Song*, but the reviews of the work demonstrate its success. In a review published in Volume 23 no. 2 of *The Double Reed*, Ronald Klimko states;

> Bassoonist-composer Michael Burns, has written a fascinating, ca. 10 minute work for bassoon with an electronic music tape for accompaniment. Although decidedly modern, with a few sections in multiphonics, (all carefully fingered for the performer in the appendix), the style is still quite lyrical at times and is not overly disjunct or pointillistic. It is fairly demanding technically, however, ascending to a high e-flat2. It is a strong level IV in difficulty, demanding a definitely advanced bassoonist. Coordination with the tape is carefully indicated in the score generally, but there is a long 44 second section where the composer instructs the performer to: "improvise: GO WILD! Start frantic and gradually get softer and more spasmodic." Overall, it is a very attractive composition, ending in a lovely lyrical theme, followed by the bassoonist tonguing on the reedless bocal in the bass register, following the gradual fadeout of the taped sounds; nice touch! I strongly recommend this modern but accessible new work to the advanced bassoonist for his or her next recital.[79]

[77] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[78] Ibid.

[79] Klimko, Ronald. "Bassoon Music Reviews." *The Double Reed* Vol. 23, no. 2 (2000): 24.

As a work by a bassoonist for bassoon, it seems fitting that all of sounds on the pre-recorded tape part for *Swamp Song* were originally created in different manners on the bassoon. Techniques used include, "normal playing, multiphonics, key clicks, singing into the bell, playing from the bell like a didgeridoo, etc.," all recorded to analog tape.[80] Burns then applied tape manipulation techniques, such as cutting and splicing, looping, speeding up and slowing down, as well as other processing effects. He used a bocal borrowed from his teacher, Colin Hemmingsen, with a Barcus-Berry pickup soldered into it with the signal passing through a pitch to voltage synthesizer to record this material.[81]

Burns indicates that his "goal was to create a work that blended electronics with live bassoon in such a way that at times the audience might not know which is which."[82] To help achieve this effect, Burns included motivic material in the original source material of the tape in the live bassoon part as well. In order for the performer to "gain some agility," the composer designed the melodic material to lie well on the instrument.[83] As much of the material for *Swamp Song* grew out of an earlier composition for unaccompanied bassoon, and the composer's own "noodling on the instrument," Burns feels that the bassoon part should be "somewhat idiomatic."[84] He says that although being familiar with the bassoon's capabilities "absolutely helped in the compositional process," that he "sometimes finds as a composer that he does not make decisions based on what would necessarily work best on the instrument if that will create

[80] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[81] Ibid.

[82] Ibid.

[83] Ibid.

[84] Ibid.

the wrong notes or patterns."[85] "However," Burns says, "when the two coincide (lies well and is also the desired pitches) that is ideal." [86]

As a performer of electroacoustic music for the bassoon, Burns has had to resolve certain issues that he faced in performance. He explains that one common issue is for the performer not to be able to hear the electronic media clearly enough for cues. This is "sometimes due to speaker quality, placement, volume, the acoustic space, a lack of monitor, and so on."[87] Burns suggests that a sound check can often resolve these concerns by simply changing volume, equalization, or adding a monitor for the performer. When using live electronics that actively respond to the performer, sometimes the computer may not correctly interpret signals to move on to a new section. He suggests that this complication is often due to foot pedal issues, software issues, and performer error.[88] Another common issue, according to Burns, is the ability of the bassoonist to read the notation of the electronic sounds, resulting in the performer not being able to determine where they are in the piece.[89]

For works similar to *At a Crossroads*, Burns says that these pieces are somewhat difficult to prepare due to the nature of the artificial intelligence element of the computer and the improvisatory nature of the composition.[90] In addition, he cites the tendency for "live interactives to have a mind of their own and will not always respond in predictable ways."[91] In preparation

---

[85] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[86] Ibid.

[87] Ibid.

[88] Ibid.

[89] Ibid.

[90] Ibid.

[91] Ibid.

for a performance with electroacoustics Burns says that, "As with non-electroacoustic music a lot of preparation can be broken down into sections to work on."[92] Specifically, "works like *Swamp Song* and *ContraMax* have well-defined sections that you can practice separately and cue up for rehearsal."[93]

In reflecting on the evolution of the medium of electroacoustic bassoon and its relation to acoustic performance Burns says that he, "thinks that electroacoustic bassoon performance supplements and augments the traditional," but he does not see it replacing established performance practices.[94] He continues on the subject saying, "I don't find playing electroacoustic pieces makes me change how I play...as with any genre, I try to approach them with different style aesthetics."[95] In relation to change in electroacoustic performance Burns details that he has "definitely seen the medium change from the use of recordings that are prepared in advance, to interactive [composition/performance] particularly using Max/MSP."[96] He continues, "This is exciting but also creates new and different challenges and problems for the composer and performer to contend with."[97] In his opinion, Burns feels that "the sound palette of Max pieces seems more limited than the purely tape pieces, "but imagines this can be addressed." [98]

When asked for suggestions for the bassoonist who may want to experiment with electroacoustic performance Burns says, "Go for it! There are some wonderful pieces out there

---

[92] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[93] Ibid.

[94] Ibid.

[95] Ibid.

[96] Ibid.

[97] Ibid.

[98] Ibid.

and you can add some great variety to a program."[99] Burns also mentions that "there are a number of pieces that require no modification to the bassoon, just playing along with an accompanimental track."[100] In a similar vein, he illustrates one specific benefit of performing with bassoon and electronics saying, "Many bassoonists (including me) have found that when traveling to present a recital in an unknown venue it is reassuring to take pieces with tape/cd."[101] He points out that, "Assuming a decent playback setup, it gives great timbral variety and yet is familiar and consistent. Not only that, but you do not have to contend with an unknown accompanist or piano (either of which can sometimes be dubious!) but is different than doing an all-unaccompanied work."[102]

Another advantage of performing electroacoustic music according to Burns, "is that many composers in the medium are currently alive so you have the opportunity to interact with them, email, call, or visit in person and ask questions."[103] In a final thought about electroacoustic bassoon performance Burns suggests, "Don't be scared of the technology, embrace it. In some cases it is not that different from working with a pianist except a tape stays the same every time or an interactive pieces reacts in a predictable way…except perhaps the Rothkopf, but that also adds some charm."[104]

---

[99] Burns, Michael. Interview by Author. Electronic Survey (September 27, 2014).

[100] Ibid.

[101] Ibid.

[102] Ibid.

[103] Ibid.

[104] Ibid.

CHAPTER FOUR

JEFFREY LYMAN

Dr. Jeffrey Lyman has been the Associate Professor of Bassoon at the University of Michigan since 2006. Prior to his appointment to Michigan, he held similar positions at Arizona State University and Bowling Green State University. Lyman was a pupil of Bernard Garfield during his bachelor degree at Temple University, and studied with Richard Beene and L. Hugh Cooper while earning his masters and doctorate at the University of Michigan. In addition to his professorships, Lyman has also been a member of several American orchestras and substituted with groups such as the Los Angeles Philharmonic, the Detroit Symphony Orchestra, the Metropolitan Opera Orchestra, and the Philadelphia Orchestra. Lyman is also known as an author and advocate of new music. He has published several articles, recordings and web pages (most recently on compositions for bassoon from the former Soviet Union and Mexico) in addition to commissioning works from composers such as Yuri Kasparov, John Steinmetz, and Bill Douglas.[105]

In his current position, Lyman performs with electronics frequently. He indicates his interest in the medium of electroacoustic bassoon stems from being alive in the 20th and 21st centuries, his own interest, and the interest of his students.[106] Lyman's curiosity was sparked in high school when he first heard the music of Mario Davidovsky, an Argentine-American composer best known for his series of compositions titled *Synchronisms* that incorporate both

[105] Lyman, Jeffrey. *The University of Michigan Bassoon Studio* (accessed August 21, 2014).

[106] Romine, Ryan D. "ElectroBassoonica": 108-109.

acoustic instruments and prepared audio recording.[107] Although Lyman did not know of any electroacoustic music for the bassoon at the time, he looked forward to playing similar works.[108]

As a bassoonist who has performed and taught much of the instrument's repertoire, Lyman has a unique perspective on the catalogue of music written for electroacoustic bassoon. In commenting on the canon of electroacoustic repertoire, he remarks that he is still surprised by the lack of a large body of electroacoustic music for the bassoon despite half a century of active composition in the genre.[109] In a 2012 interview published in Vol. 36, no. 1 of *The Double Reed*, Lyman says that, "much of the existing literature does not truly move me, but often only attracts my attention for a brief moment." He continues, "I am able to describe some works as 'cool' or fun, others as interesting and challenging, but I still look forward to the piece that I can return to time and again for its musical attributes rather than its being simply an example of a genre."[110]

While these observations may seem critical, Lyman explains:

> I consider working with electronics the same as working with any other instrument or sound source, and I expect the same of "electronic" composers as I do of "acoustic" composers. That is, I believe that music is good if it is communicative in some way. I look for great phrases in electronic music the way I do in acoustic music, and unfortunately, I rarely find such phrases. I believe that too often our electronic repertoire still focuses on the creation of interesting sounds rather than the organization of said sounds…Sound is sound, but labels and old-fashioned distinctions among musical styles and genres seem to affect how we listen, how we create, etc. I wish I could work with a composer so comfortable with electronic and acoustic composition that the label "electroacoustic" could go away.[111]

---

[107] Zahler, Noel B. "Davidovsky, Mario." *Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/07281 (accessed September 4, 2014).

[108] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014).

[109] Romine, Ryan D. "ElectroBassoonica": 108-109.

[110] Ibid: 109.

[111] Ibid.

Another issue with electroacoustic music raised by Lyman is the obsession with the new. He comments on the evolving nature of electroacoustic composition, and its accompanying software, indicating that the performer often must purchase new equipment or learn new technological requirements for [seemingly] each piece by each composer.[112] He illustrates this by saying that after thirty years of collecting electroacoustic music, and with the constant change in technology, he may have more "obsolete" electroacoustic music in his library than music that is easily performable with current technologies.[113] While this fascination with the "new" may harken back to a Futurist aesthetic, Lyman says he "finds most works to be ephemeral and uninteresting from a composition standard, regardless of how unique the electronic sounds might be."[114]

Although Lyman expressed dissatisfaction with much of the available electroacoustic music in the 2012 *Double Reed* article, he indicates in the 2014 survey for this treatise that he recently performed and recorded a significant work by Italian composer, Filippo Zapponi.[115] The work *Hypérion-Éos* integrates live bassoon and prepared electronics in a manner that, in Lyman's opinion, features the best aspects of both.[116] Lyman says the composition uses the bassoon in both traditional and innovative ways that allows the instrument to, "wail, sing, fly, and soar." He continues, "It's one of the only works for bassoon and electronics I've ever played that is truly satisfying to me as a musician and that I would listen to simply as an enjoyable work

[112] Romine, Ryan D. "ElectroBassoonica": 109.

[113] Ibid.

[114] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014).

[115] Ibid.

[116] Ibid.

of music, not as some show piece or as some demonstration of a particular software program or device.[117]

One of the main issues faced in the performance of electroacoustic music for bassoon and prepared recording is the challenge of timing. In addition to the stresses of live performance, it can be difficult for the bassoonist to coordinate the synchronization of the two parts. A performer must become fluent with the score and aural cues. In the work by Zapponi, the vital and sometimes tricky coordination between electronics and the bassoon is established through the use of an in-ear click track that assures the "subtle connections between the solo part and the prepared electronics in live performance without it being distracting to the listener."[118] Lyman says that, "the super-slow tempo of the final coda would be nearly impossible to assure in live performance without the use of the click."[119] The other main issue faced in the live performance of music for bassoon and prepared recording, according to Lyman, is the balance of volume levels. He says of this challenge, "leave it to the tech assistants."[120]

In discussing the established repertoire and the future of the electroacoustic bassoon medium, Lyman notes that if more people would explore the genre, it would make it less of an oddity. To that extent, he says, "I wish composers who were fluent in electronic music were equally fluent in working with acoustic instruments and vice versa, and that any composer using any instrument or sound source would do so to create interesting music, not 'acoustic' music and not 'electroacoustic' music."[121] When asked for suggestions to give to a bassoonist who wanted

---

[117] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014).

[118] Ibid.

[119] Ibid.

[120] Ibid.

[121] Romine, Ryan D. "ElectroBassoonica": 109.

to delve into the electroacoustic medium, Lyman gives two suggestions; first, "don't necessarily ask other woodwind players about electronic equipment; instead, speak directly with the 'tech' people who use this sort of technology and are fluent with what the equipment can do."[122] Finally, and perhaps most importantly, he says, "treat it [electroacoustic performance] like any other genre and play well."[123]

[122] Lyman, Jeffrey. Interview by Author. Electronic Survey (August 24, 2014).

[123] Ibid.

CHAPTER FIVE

JIM RODGERS

Jim Rodgers is currently the Principal Contrabassoonist of the Pittsburgh Symphony Orchestra. Formerly, he was the Principal Bassoonist with the Jacksonville Symphony, Associate Principal Bassoonist with the Florida Orchestra, Second Bassoonist with the Houston Symphony, and Contrabassoonist with the Colorado Symphony. In summers, Rodgers has participated in festival orchestras, such as Grand Tetons Music Festival, Cabrillo Festival of Contemporary Music, Colorado Music Festival, National Orchestral Institute, and Tanglewood Music Center.[124] He studied bassoon with Norman Herzberg at the University of Southern California and with Benjamin Kamins at the Rice University Shepherd School of Music. Rodgers also studied bassoon with Andrew Radford and contrabassoon with Gregg Henegar.[125]

A frequent chamber musician, Rodgers is a founding member of the Pittsburgh Reed Trio, which has performed to critical acclaim.[126] Their many and varied concerts have been heard locally, nationally, and abroad. An avid early music enthusiast, Rodgers likes to perform on dulcian whenever possible, and within the medium of electroacoustic bassoon and contrabassoon, Rodgers is, "ever creatively exploring the possibilities of his instrument's capabilities, both in sound and genre."[127]

---

[124] Pittsburgh Symphony Orchestra. *James Rodgers, Principal Contrabassoon.* 2014. https://www.pittsburghsymphony.org/pso_home/biographies/musicians/rodgers-james (accessed August 21, 2014).

[125] Ibid.

[126] Ibid.

[127] Ibid.

Rodgers has used the electroacoustic bassoon in a number of different settings. He has performed for community center demonstrations, pre-concert lobby performances, recitals, International Double Reed Society conferences, fundraisers, museum events, for recruitment of students, and with the Pittsburgh Symphony Orchestra.[128] His interest in the medium began in the summer of 2004 when, as Rodgers says, "I first became aware of the possibilities while performing a concerto at an outdoor concert and realized the potential of amplification. This idea blossomed into using effects and looping, in addition to amplification."[129]

Having performed electroacoustic bassoon in diverse settings, Rodgers explains that he has many good memories of performances, but one in particular stands out. He recalls:

> My favorite [memory] happened at a run-out concert with the PSO, conducted by Marvin Hamlisch. The PSO was performing a pops concert called "Broadway Rocks", which called for electric bass. Our electric bass player got a flat tire on the way to the concert and, with no time to find a replacement, I decided to approach Marvin and tell him that I was able to 'plug in' my bassoon to the bass amp. I ended up playing the electric bass part for the entire concert on my electric bassoon. Marvin gave me a solo bow and later told the PSO administrators that I 'saved the show'.[130]

When asked if performing within the electroacoustic medium has influenced his acoustic bassoon performance, Rodgers responds, "Definitely! …When using a looper, every loop must be very well in time and very well in tune. Working with the looper has sharpened both my rhythm and intonation skills considerably."[131] He explains that, "when using the harmony pedals, I get to apply, on the spot, some useful theory skills as well."[132] In addition to these benefits, Rodgers also says, "I now think of almost all of the solo pieces I play in terms of their potential

---

[128] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

[129] Ibid.

[130] Ibid.

[131] Ibid.

[132] Ibid.

in the electroacoustic medium, as well as songs and brief classical pieces being ripe for solo looping arrangements and performance."[133]

For his first piece arranged for looping, Rodgers applied the electroacoustic bassoon to a classical composition to create a version of Pachelbel's *Canon*. *Bolero*, another classical work that lent itself well to looping, is an arrangement that Rodgers is "fond of" since he finds the performance of the piece "gets the widest range of reactions."[134] Other favorite works of Rodgers include his cover of *Morning Apology* by Angela Sheik, who is described by Rodgers as "one of the world's best loopers," as well as his original composition, *The Flea*.[135] He explains that, "*The Flea* is dear to me since it represents a synthesis of many aspects of my life and profession."[136]

As a composer for the electroacoustic bassoon, Rodgers's works include loops which often "present interesting challenges."[137] While writing and performing in this subset of electroacoustic bassoon music, he has had to resolve a number of specific issues. In addition to recognizing and working within the limits of the looper itself, Rodgers points out that, "the loops must be in tune and in time," a skill that may be difficult to coordinate with the feet.[138] He also explains that "understanding polyphony and knowing how dense a series of layers can be is very important when using the looper and effects."[139] Rodgers says that improvisation, as well as a knowledge of how to implement different effects during improvisational performance, is another

---

[133] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

[134] Ibid.

[135] Ibid.

[136] Ibid.

[137] Ibid.

[138] Ibid.

[139] Ibid.

key issue in his composition and performance of electroacoustic bassoon music.[140] For all of these issues Rodgers suggests that "trial and error was the best way to see what worked best." [141]

As a performer composing for his own instrument, Rodgers has found this familiarity with the bassoon to be beneficial. He explains, "It definitely helps to know what the bassoon can (and can't) do. It also helps to know what the gear can (and can't) do. With the gear there is a lot of sound and range opportunity that can augment the bassoon, expanding its potential in every direction. The bassoon's technical limits are still there, however, but I am always working on this."[142]

In speaking about the possibility of change in the field of electroacoustic bassoon performance, Rodgers says, "I think the medium itself represents change and it is always evolving. There isn't really a 'standard' for this yet. I feel like we are all creating our own way, our own path, experimenting in our own ways with experiences shared amongst each other. The idea of the gear unites us, but its applications are all unique among us."[143] When describing what changes he would like to see within the medium, Rodgers suggests that he "would love to see more bassoonists doing this," and, "would like to see more of us adding this to the traditional approach."[144] To help achieve this change, Rodgers foresees "that when more composers write more pieces for this medium, it will necessitate a familiarity with the medium and the genre."[145]

---

[140] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

[141] Ibid.

[142] Ibid.

[143] Ibid.

[144] Ibid.

[145] Ibid.

For the bassoonist looking to experiment with electroacoustic bassoon performance, he suggests, "first and foremost: know your instrument."[146] As his final words of wisdom, Rodgers states:

> Be the best bassoonist you can be so that you can implement these skills in an electric environment. Think very outside the box and take as much opportunity to try as many things as you can with regards to the gear…If you can borrow a modified bocal, and some simple gear (amp, cables, effects, and looper), this will give you an idea if this sort of thing is good for you. Try to get together with an expert so that you understand how to use the gear and recognize its limitations…Don't be afraid to seek the advice of people who have done this before. Learn from their success and from their mistakes. Stay open to performing music outside of your traditional training and to working with non-classical musicians. Above all – have fun![147]

[146] Rodgers, Jim. Interview by Author. Electronic Survey (October 1, 2014).

[147] Ibid.

CHAPTER SIX

PAUL HANSON

Paul Hanson is an independent music professional who has sculpted one of the most diverse musical careers of any bassoonist to date. Growing up in a musical family in Berkley, California, Hanson began playing clarinet and saxophone in intermediate school. He took up the bassoon while in high school after being, "hit over the head by the beauty of woodwind quintet music," at a summer music camp.[148] He attended the New England Conservatory, initially majoring in Third Stream studies, but soon changed to bassoon performance.[149] For his sophomore year, he was recruited by Steve Paulson, Principal Bassoon of the San Francisco Symphony, to return to the Bay area and attend the San Francisco Conservatory.

While in San Francisco, Hanson played numerous gigs on both bassoon and saxophone. As a saxophonist, he achieved much success, and was even hired to play the saxophone solo on Eddie Money's 1986 hit, *Take Me Home Tonight*. In addition to Eddie Money, Hanson has performed or recorded saxophone and bassoon with artists such as Bela Fleck and the Flecktones, Wayne Shorter, Ray Charles, The Temptations, Tower of Power, and What It Is.[150]

Hanson has given numerous university master classes specializing in modern performance techniques and improvisation for bassoonists. He has performed at International Double Reed Society conferences from Rotterdam to New York, and in 2004 taught bassoon for a semester at the Ithaca College in Ithaca, New York.[151] Active in the recording studio as well,

---

[148] Hanson, Paul. "My Life as a Bassoonist and Improviser": 97.

[149] Wells, David Atkinson. *A History and Discography of the Bassoon in Jazz*: 41.

[150] Hanson, Paul. *Paul Hanson Music.* n.d. http://paulhansonmusic.com/bio (accessed September 7, 2014).

[151] Ibid.

Hanson released three albums in the early 1990s for the Japanese label, MIDI, and has recorded three more solo albums, *Voodoo Suite, Frolic in the Land of Plenty,* and, *Ukiah Morning*, since 2000.[152]

In addition to his solo bassoon work, Hanson has carved out a career by playing the bassoon in many unique settings and ensembles. In particular, he performed electroacoustic bassoon with a leading contemporary performing group called The Paul Dresher Ensemble. Hanson was also featured in the Middle-Eastern crossover ensemble, Davka, as well as Cirque du Soleil's production titled, *ZED*. Despite such performing experiences, Hanson credits as one of his greatest achievements to be recording and touring with Bela Fleck and the Flecktones.[153] This album and tour prominently featured the electroacoustic bassoon, as each show included effect processing and amplification of the acoustic bassoon.

As someone who has always been fascinated by a variety of musical genres, his love for Jimi Hendrix was influential in his discovery of the "electric" bassoon medium. Shortly before going off to the New England Conservatory, he stuck a small microphone on a cable down the bell of his bassoon, attached it to a Wollensack reel-to-reel tape recorder, and then into a large Roland Jazz Chorus amp.[154] Describing the sound as very "Jimi Hendrix-ian," Hanson says he was smitten with the result.[155] While at NEC, in addition to his classical bassoon practice, he

[152] Wells, David Atkinson. *A History and Discography of the Bassoon in Jazz*: 183-184.

[153] Hanson, Paul. "My Life as a Bassoonist and Improviser": 105.

[154] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[155] Ibid.

would experiment with this electric bassoon set-up in the practice room and, unbeknownst to him, would draw a crowd outside the door trying to figure out what was making that sound.[156]

After returning to the San Francisco Bay area, Hanson heard bassoonist Herbert Diamant play with an art-rock band called Cartoon while using a FRAP (Flat Response Acoustic Pickup) device that allowed the bassoon to be amplified to high levels. Although performing regularly with louder bands on the saxophone, Hanson knew he wanted to make electric bassoon his life's calling; the FRAP gave him the tool to pursue this dream.[157] His interest in the electric bassoon stems from a combination of the instrument's "role in baroque music as a parallel for funk music" in addition to the "beautiful tone, range, and sonic possibilities of bassoon when combined with amplification."[158]

As the majority of the last 15-20 years of Hanson's musical career has consisted of electroacoustic bassoon performance, he has had some extraordinary and unique experiences within the medium. Although there are many memories of electroacoustic performances that he describes as "mind blowing," a few stand out in particular.[159] After sitting in on several jam sessions with the band Bela Fleck and the Flecktones, Hanson was included in the lineup in 2000 to record and tour with the group for the album *Outbound* which won a Grammy Award. He recalls the experience saying, "When one plays an electric bassoon funk solo for 10,000 people with Victor Wooten accompanying you and people are raising their lighters in the audience, normal rock concert stuff, it really stands out…I know that in the symphonic world people do

---

[156] Erato, David M. "Interview with Jazz Bassoonist Paul Hanson." *www.daviderato.com.* January 18, 2010. http://www.daviderato.com/blog/2010/1/18/interview-with-jazz-bassoonist-paul-hanson.html (accessed August 8, 2014).

[157] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[158] Ibid.

[159] Ibid.

cheer for a great performance, so in some ways it wasn't that different. But believe me, it was different."[160]

In addition to his memories with the Flecktones, Hanson also fondly recalls his time spent performing in Tokyo with Cirque Du Soleil as an amazing experience. Hanson states that he has "many great memories of playing with bands on the road and at home where the music was just incredible."[161] Most recently he recalls performing at the New York City venue Subculture with jazz bassoon greats Michael Rabinowitz and Alexandre Silverio, in conjunction with the 2014 International Double Reed Society conference.

With such a diverse range of experiences, Hanson is one of the few performers to explore the full potential of the combination of electronics and the bassoon. Aside from the use of signal processing in live electroacoustic performance, his solo works are often a vehicle for demonstrating the possibilities of electronic effects with the bassoon. The track "Voodoo Logic," from the album *Voodoo Suite*, features the use of many electronically processed bassoon tones. Most noticeably, he employs a "highly distorted tone reminiscent of a hard rock electric guitar."[162] A large range of effects are represented in the 2007 album, *Frolic in the Land of Plenty*. Specifically, the album's title track features heavy use of delay and looping effects that create simultaneous lines without the use of multi-track layering. In addition to time-based processing, harmonizing and distortion effects, as well as "extreme frequency equalization," are used to further alter the bassoon's acoustic tone.[163]

---

[160] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014); Romine, Ryan D. "ElectroBassoonica": 104.

[161] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[162] Wells, David Atkinson. *A History and Discography of the Bassoon in Jazz*: 27.

[163] Ibid.: 87.

As a performer who has played the electroacoustic bassoon in a variety of settings and genres, Hanson has faced many issues with the medium throughout his career. The primary vehicle for Paul's electroacoustic "classical" composition performance was with The Paul Dresher Ensemble. Hanson says the most challenging issue with a group like this was the huge amount of time spent detailing the mix of live performance.[164] He explains, "when you play with a band of samplers, synths, electric drums, processed violin, mallet instruments, etc., it's easy to miss a sound here or there…not only must the front of house be mixed, the monitors have to be mixed so everyone hears everything they need to hear."[165] This would be especially pertinent to a bassoonist trying to fit into a rock setting, or any other amplified large ensemble.

Another issue faced is how other bassoonists perceive the sound of his electroacoustic bassoon playing. Although Hanson says he can somewhat understand their concern, he makes a point to clarify this issue. For example, when he was signed to a Japanese record label, "they tried on purpose to equalize me like a sax player. They were afraid to have me sound like a bassoon player as that sound did not fit the style of the music I was recording. Or so they felt."[166] He continues, stating, "Personally I am very excited that the sound of the acoustic bassoon is going to become more popular in groups that play improvised-based or groove-oriented music."[167] Over time, Hanson has made additional recordings which feature a more acoustic sound. "Still," he remarks, "I deal with engineers who want to 'brighten' my sound for the purpose of being more 'sparkly' for the point of the recording. Who's right at this point? What's

[164] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[165] Ibid.

[166] Ibid.

[167] Ibid.

good for the music? Personally, I really miss playing with the band Davka because there were NO electronics!"[168]

In regards to the differences between electroacoustic bassoon performance and traditional performance, he says, "I try not to drift away from acoustic playing as that's where it all starts."[169] Further explaining, "it's sometimes easy to get carried away playing with gear and tones when you have all those 'toys' at your disposal," and that his "regular playing can get quite affected if he is not careful to keep one foot in his classical training in terms of tone, air support, and intonation."[170] Although Hanson states, "the two modes of playing are almost different instruments…it takes good old fashioned discipline to stay centered as always."[171]

As a versatile performer who has also composed music for the electroacoustic bassoon, Hanson has unique perspective on the effects of the electroacoustic medium on traditional bassoon performance. Hanson explains that, "traditional bassoon performance is based off of the orchestral playing, and that is never going to go away no matter what people say about the future of the orchestral medium."[172] He continues, "But in addition to playing Haydn, Mozart, Brahms, Mahler, Stravinsky, there will be new music written for smaller ensembles that features a degree of electronics. That degree is adjustable depending on the player, the composer and what is intended with each composition. Music is music no matter how you slice it. Tools are just that- tools in order to coax expression and feelings out."[173]

---

[168] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[169] Ibid.

[170] Ibid.; Romine, Ryan D. "ElectroBassoonica": 102.

[171] Ibid.

[172] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[173] Ibid.

When asked about how he sees the electroacoustic bassoon medium changing, and what changes he would like to see Hanson initially responds, "I am thrilled that there is a medium in the first place."[174] He is excited to see other bassoon players in bands playing in other genres like jazz, rock, funk, electronic classical, and folk styles. In regards to the potential growth of the medium, Hanson says, "The best thing I can think of is for there to be positions that require electric bassoon playing."[175] In addition to the potential of the bassoon in the performance of electroacoustic music, Hanson speaks to the need for future performers to become more versatile. He says, "Bassoonists can always learn new musical things such as how to swing, how to groove in non-classical music, and how to improvise. This is neither electric nor acoustic, it is regardless of that."[176]

When surveyed for specific suggestions to give to a bassoonist who wanted to begin experimenting with electroacoustic performance, Hanson provides numerous recommendations. First, he emphasizes the need to go out of the ordinary and not be afraid of trying something new. He clarifies that, "styles outside of western classical music have a methodology and way of being done… there are many traditions, many different ways to phrase in different styles, and much to experience and learn everywhere."[177] Although a proponent of experiencing the bassoon in new ways, he does place a strong emphasis on remembering "the basics of bassoon playing in terms of tone and time."[178]

---

[174] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[175] Ibid.

[176] Ibid.

[177] Romine, Ryan D. "ElectroBassoonica": 103.

[178] Ibid.

As far as suggestions for the equipment needed to start the "pure amplified side of electric bassoon playing," Hanson reminds the novice that it will "take a bit of a small budget to try."[179] He recommends beginning with a pick up like the Little Jake, a set of cables, and an amp like a keyboard amp with a horn.[180] For the bocal pickup, he cautions that "if you play through a crappy bocal with an electric bassoon pickup, don't expect the bocal to sound all of a sudden great for electric playing. A great bocal acoustic is a great bocal electric."[181] He also suggests finding a way not to step on one's pickup cable and potentially rip it out of the bocal; like installing a system that loops the cable and screws it to the bell of the bassoon.[182]

In addition to these purchases, Hanson recommends experimenting with the inexpensive stomp pedals that can be easily found at a guitar store or online. The one effect pedal that Hanson states is almost mandatory, is a volume pedal. He explains:

> Once you can play as loud as an electric guitar it's tempting to just rock out. But the bassoon is really not a very dynamic instrument in terms of the difference between pianissimo and fortissimo. All those keyboardists and guitarists, they have volume knobs to turn it all down when the music calls for less volume. The louder it gets, the less dynamics you have with the bassoon. What guitarists and keyboardists do (to some degree) is turn their volume down here and there when they want to play much, much softer. With a bassoon on a pickup transducer, it's much harder to 'back off' from the sound source. The amplified difference between your forte and your piano when you play at a louder amplified concert is not much at all. There'll be times where you should be playing with a volume pedal at half depth (pressed half the way down). Think of it as backing off from the sound source.[183]

[179] Hanson, Paul. Interview by Author. Electronic Survey (August 20, 2014).

[180] Ibid.

[181] Romine, Ryan D. "ElectroBassoonica": 105.

[182] Ibid.

[183] Ibid.: 104-05.

The final words of wisdom for the aspiring electroacoustic bassoonist from Paul Hanson are, “have fun and take your time…Life is meant to be lived and experienced. Do something new; you might enjoy the bassoon more.”[184]

[184] Hanson, Paul, interview by Author. *Electronic Survey* (August 20, 2014); Romine, Ryan D. "ElectroBassoonica": 105.

CHAPTER SEVEN

CONCLUSION

Performers have had to adapt and embrace change as the role of the bassoon, and the instrument itself, has evolved over the history of western art music. Traditional solo and ensemble performance practices are well established and will not be supplanted, but the addition of electronics in music may be viewed as a modern iteration of this adaptation. The inclusion of electronic elements in bassoon performance has created a new medium by providing the bassoonist with new sound palettes and performance practices, as well as the potential to be a contributing member in new types of ensembles and genres outside of the orchestral tradition.

The experiences of performers such as Michael Burns, Jeffrey Lyman, Jim Rodgers, and Paul Hanson, represent the diversity of electroacoustic bassoon performance. A bassoonist wanting to experiment within the electroacoustic medium may look to these experts' practices, as well as the specific electric equipment which they employ, as a guide for where to begin. By understanding how electroacoustic bassoon performance currently exists, in addition to the growth and exploration of the medium by both bassoonist and composer, there is great potential for the expansion and augmentation of a modern use for the traditional instrument.

APPENDIX A

SURVEY RESPONSE: MICHAEL BURNS

General Overview:

How have you used electro-acoustic bassoon in your career?
I have used it in the composition of my piece *Swamp Song for bassoon and CD* and in performance of several works for bassoon (or contra) and electronic media (see below).

When and why did you decide to experiment with electro-acoustic bassoon? What began your interest in this medium?
During my undergraduate degree in Wellington, New Zealand we had a visiting Fulbright composition professor from UT-Austin, Karl Korte visit and presented a concert of his works. I was asked to play the piece *Demiola for bassoon and tape*. This would have been ca. 1986. After that I decided to compose a piece for bassoon and tape myself (I was a double-major in bassoon and composition and studying electronic music) and that led to the creation of *Swamp Song*.

Do you have a favorite memory of performing with the electro-acoustic bassoon?
I would say at a point during recording bassoon elements to be incorporated into Swamp Song when I realized that heavily processed "normal" bassoon sound (ring-modulation, filtering, slowed down, etc.) greatly resembled some multiphonic sounds I was able to produce 'live' on the bassoon leading to a duet in the middle of the piece. I am quite proud of that moment.

Electro-Acoustic Equipment:

What specific equipment do you currently use? I.E. Brands and models of microphone/pickup, amplifiers, effect pedals, software.
I do not personally own any equipment. I have always borrowed and used equipment from others—the composers, my teacher during my Undergrad degree, Colin Hemmingsen who in the mid-1980s had a Bocal with a Barcus-Berry pickup soldered onto it, tech guys at UNCG, etc. I know that several of the more recent composers are using Max/MSP to generate their electronics—which are therefore often interactive (e.g. Mark Engebretson: ContraMax; Michael Rothkopf: At a Crossroads, etc.), Swamp Song utilized the aforementioned Bocal with the pickup passing through a pitch to voltage synthesizer and all of the tape part was done using analog tape—cutting and splicing, looping, speeding up and slowing down, filtering and processing. A piece by a New Zealand Composer, Anthony Ritchey also used analog tape techniques to create the tape. Demiola by Karl Korte was realized on the Fairlight sampler/synthesizer. Microphones used in the past have included some by Shure, AKG, Neumann, etc. ContraMax also utilized foot pedals to cue new programs in Max.

How did you arrive at your decision to use this particular equipment?
See the answer to the previous question above—it depends on who I am borrowing from, what they have/had available and what their preferences might be.

How is your equipment set up for use? I.E. Levels of volume, proximity of microphone, pedal setup.
This was also left up to the person setting up the equipment for me except to ensure that I could play relatively unencumbered.

Have you experimented with other equipment, and were there any benefits or drawbacks?
N/A

In regards to equipment, what issues have been faced? What challenges have you had to overcome? How did you overcome these concerns?
Sometimes live interactives have a mind of their own and will not respond in predictable ways. Some mics seem to work better for bassoon and contra than others. Occasionally there are playback issues—mostly volume, sometimes distortion or feedback, sometimes CD tracks skipping. I have also performed Swamp Song (actually several times) with just a CD Boombox on a table behind me!

Are there any equipment issues that, in their application to the bassoon itself, would make one apprehensive to install?
I have thought about getting a pickup mounted to one of my bocals but have yet to do so. You want to use a nice enough Bocal but it may compromise it a bit for non electro-acoustic purposes. There is also the expense!

Is there an effective way to begin experimenting with the electro-acoustic bassoon without purchasing the usual equipment?
Absolutely! There are a number of pieces that require no modification of the bassoon, just playing along with an accompanimental track. *Swamp Song* is one but there are many others.

In electro-acoustic bassoon performance, are there reed issues that differ from traditional acoustic performance?
Not in my experience. I do know that some find that if they 'enhance' the bassoon sound (amplify) that they can use a lighter reed that will not have to produce as much volume. This can help with negotiating certain aspects of playing.

Has electric bassoon playing influenced your acoustic bassoon performance?
No

Performance Aspects:

Of the electro-acoustic compositions you have performed, what are your favorite pieces, and why?
I have enjoyed all of them and for different reasons. To be biased, *Swamp Song* is fun to play and audiences enjoy it. Also, of course, I know it like the back of my hand having painstakingly put it together. *At a Crossroads* is fun because the computer part is essentially artificial intelligence and will react differently on different occasions. It is designed such that if the bassoonist plays conservatively then the computer part becomes more adventurous and vice-versa. I have performed it before and will do so again in a recital in just over a week and it is honestly never

the same twice. Essentially you improvise with the computer. *ContraMax* is fun because of the contra and you have to negotiate the foot-pedaling which adds a new challenge. *Iftira* was fun because it is for five bassoons and electronics.

What were the issues faced in performance preparation for the electro-acoustic works, and how did you resolve them?
A common issue is for the performer to not be able to hear the electronic media clearly enough for cues. Sometimes this is due to speaker quality, placement, volume, the acoustic space, lack of a monitor, etc. If it is possible to do a sound-check then sometimes some of these can be fixed by changing the volume, equalization, adding a monitor, making the speakers closer, etc. Sometimes you just have to live with it. Other problems arise when signals for the program to move on to the next section are not registering with the computer (foot-pedal issues, software issues, performer error, etc.) Another common issue is with the notation of electronic sounds. Sometimes it is hard for the performer to tell where they are in the piece. In this instance sometimes timings can be useful. The more rhythmic the electronic sounds are, generally the easier to notate something meaningful to the player. If the electronic part is very atmospheric and sustained it becomes tricky. As with non-elctro-acoustic music a lot of the preparation can be broken down into sections to work on. Pieces like Swamp Song and ContraMax have very well-defined sections that you can practice separately and cue up for rehearsal. A piece like At a Crossroads is difficult to prepare in some ways because of the A.I. element of the computer program and the improvisatory nature. In Iftira the electronic part is basically just a recorded backing rhythm track so it is a matter of staying in time and together.

Change, and the Future in the Electro-Acoustic Bassoon Medium:

Do you see the medium changing? Would you like to see a change?
I have definitely seen the medium change from prepared in advance tapes to interactive—particularly using Max/MSP. This is exciting but also creates new and different challenges and problems for the composer and the performer to contend with. I also find that the sound palette of the Max pieces seems more limited than the purely tape pieces but imagine this can be addressed.

In your opinion, does electro-acoustic bassoon performance affect the future of traditional bassoon performance?
I think that electro-acoustic bassoon performance supplements and augments the traditional but I do not see it replacing it if that is what you mean? Also as I answered above, I don't find that playing electro-acoustic pieces makes me change how I play. As with any genre, I try to approach them with different style aesthetics. As a related tangent to this I will say that many bassoonists (including me) have found that when traveling to present a recital in an unknown venue have found it reassuring to take particularly pieces with tape/cd. Assuming decent playback setup it gives great timbral variety and yet is very familiar and consistent. Not only that but you do not have to contend with an unknown accompanist or piano (either of which can sometimes be dubious!) but is different than doing all-unaccompanied.

Composition:

Have you composed music for electro-acoustic bassoon?
Yes, the aforementioned *Swamp Song* for bassoon and CD

What were the specific issues faced, in relation to the bassoon, while composing, and how did you resolve them?
I think the bassoon is very versatile in many ways and has a large range but difficulties it presents to a composer include the difficulty with technical agility in certain ranges, keys or note patterns, and not as large a dynamic range as some instruments, etc. I feel this is the case in any genre—electro-acoustic or not. I really wrote the piece on the bassoon so on the tape part all of the sounds were originally created in some way on the bassoon ('normal' playing, multiphonics, key clicks, singing into the bassoon bell, playing from the bell like a didgeridoo, etc.) and then processed with analog tape techniques, filtering, ring modulation, etc. My goal was to create a work that blended the electronics with the live bassoon in such a way that at times the audience might not know which is which. This also meant that motivic material was already integrated into the original source material on the bassoon which was recorded to make the tape. I designed this melodic material to lie well on the instrument to gain some agility. Much of the material actually grew out of an earlier composition for unaccompanied bassoon which in turn grew out of some of my own 'noodling' on the instrument so therefore should be at least somewhat idiomatic.

Did being familiar with the instrument's capabilities help or hinder your compositional process?
Absolutely it helped. Although I do sometimes find as a composer that I have to not make decisions based on what would necessarily work best on the instrument if that will create the wrong notes or patterns. However, when the two coincide (lies well and is also the desired pitches) that is ideal.

Words of Wisdom:

What suggestions would you give to a bassoonist who wanted to begin experimenting with electro-acoustic bassoon performance?
Go for it! There are some wonderful pieces out there and you can add some great variety to a program. Another advantage is that many composers in this medium are currently alive so you have the opportunity to interact with them, email or call or visit in person and ask questions! How cool is that? Don't be scared of the technology, embrace it. In some cases it is not that different from working with a pianist except a tape stays the same every time or an interactive piece reacts in a predictable way—except perhaps the Rothkopf but that also adds some charm.

APPENDIX B

SURVEY RESPONSE: PAUL HANSON

General Overview:

How have you used electro-acoustic bassoon in your career?
Paul: I have been playing electro-acoustic bassoon as my primary profession since about 2000. I would say that however that when I became a member of the Paul Dresher Ensemble in 1991 I became first more active as an electric bassoonist than any of my other incarnations (saxophone, clarinet player with Eddie Money, The Temptations, The Klezmorim, etc). Playing electric bassoon was what I did about 50% of the time in the 1990s and about 80% of the time in the 2000s. I had a very good electric pickup (called a FRAP-Flat Response Audio Pickup) that allowed me to play in bands with high stage volume.

When and why did you decide to experiment with electro-acoustic bassoon? What began your interest in this medium?
A very good question! After about 1980-when I had graduated high school and was preparing to go to the New England Conservatory-I stuck a microphone down my bassoon's bell and played it through a Wollensak reel-to-reel tape recorder which then was fed into a big bass amp. The sound was very Jimi Hendrix-ian. I was smitten. When I moved back to the Bay Area to go to San Francisco Conservatory I was able to get a FRAP after seeing Herbert Diamant play bassoon with a FRAP with the art-rock band CARTOON in San Francisco. The interest I always had was a combination of the beautiful tone, range and sonic possibilities of bassoon when combined with amplification. I was also very stubborn on making playing electric bassoon my life's calling.

Do you have a favorite memory of performing with the electro-acoustic bassoon?
There are so many-it is what I primarily do. I am actually glad to play normal acoustic bassoon too but I've had so many moments that are mind-blowing. Here's a few:
#1: Playing for 10,000 people at an arena somewhere in the Midwest with Bela Fleck and the Flecktones-and playing the Beacon Theater in NYC. In fact-that whole 2000 tour with Bela touring OUTBOUND (which won a Grammy). It was ridiculous. When one plays an electric bassoon funk solo with Victor Wooten accompanying you and people are raising their lighters in the audience (normal rock concert stuff)-it really stands out. #2: Playing Cirque Du Soleil's ZED in Tokyo was also amazing. What a show-I wish more Americans could have seen this. Again-either of these would not be possible without the setup I was using. #3: There are many great memories of playing with bands on the road and at home where the music was just incredible-recently playing at Subculture with 2 other great jazz bassoonists Michael Rabinowitz and Alexandre Silverio was a great moment.

Electro-Acoustic Equipment:

What specific equipment do you currently use? I.E. Brands and models of microphone/pickup, amplifiers, effect pedals, software.

Oh my god I will try to make this simple. I've used so much equipment over the years. Right now I use the Trent Jacobs Little Jake pickup and not the FRAP as my FRAPs are both obsolete and starting to decay. The FRAPs probably sounded 'better' for some uses in the past but I don't use them now as they are starting to decay-they are both very old. The Little Jake is used with a LL Baggs small preamp with treble and bass attenuation-and I put that through an Avalon U5 preamp. I use as my primary processing gear the TC Helicon Voice Live 2-and I use a MXR Bass Envelope Filter. For looping I use the Boomerang III. I have used in the past Ableton Live to play through as well as Logic 9 on my MacBook. I prefer going through the house PA and using a monitor wedge rather than bring an amp-but sometimes an amp is easier to control. I have a MACKIE SM450 powered wedge with a 10 and a horn. I had a great amp called an ULTRASOUND that I wish I could get fixed as it sounded great. I have in the past used Roland Jazz Chorus amps, Marshall, Line 6 gear such as the M13 and DL4. The one thing I really want to start using is an actual microphone for the bassoon as I want to incorporate the normal sound of the bassoon more. That is my fall 2014 project.

How did you arrive at your decision to use this particular equipment?
Through what happens on gigs in terms of sonic quality. I try to learn from what I've heard of live performances. And I don't always want to carry a huge piece of gear-the smaller the better. I've been doing this for very long.

How is your equipment set up for use? I.E. Levels of volume, proximity of microphone, pedal setup.
The Little Jake pickup comes with a LL Baggs preamp-I set the treble at about 4 and the bass at about 1 and the trim pretty low. This way I don't over saturate the node of the bassoon sound at about 440. I don't like to be too turned up at the preamp stage as I would rather turn it up on the preamp (Avalon U5) and/or my processing unit and front of house. That way the tone stays better and less distorted. Believe it or not-I'm trying for the best acoustic tone I can get out of the pickup. Sometimes I use a volume pedal but one has to be careful to get a good one that does not suck all the tone out of your horn. They can do bad things to your tone.

Have you experimented with other equipment, and were there any benefits or drawbacks?
I've experimented with a lot of equipment. When I was in the Paul Dresher Ensemble I had a more elaborate setup using a Mackie mixer to discreetly mix each effect with it's own EQ and balance-much more like a recording studio. My primary experimentation nowadays is with software-based stuff such as Logic, Ableton Live, Reason.

In regards to equipment, what issues have been faced? What challenges have you had to overcome? How did you overcome these concerns?
I am always trying to find the happy place with equipment. I would say that being too bassy or muddy is always a big concern as often people who mix me think that the bassoon has a boatload of low end sonically and therefore they want to keep a lot of bass in the sound. That's not how bassoon works! The low end on a bassoon is very subtle. One of the biggest issues I've had is not with a general audience but with other bassoonists-and I can somewhat understand. For years I've fit into ensembles with the sound I get-I play stylistically somewhat like a sax/keyboard/guitar player. Often bassoon is not the first instrument that comes into people's heads when they hear me. And whatever sounds I've gotten have been what other bands and

leaders have wanted in their ensembles. They go on what they hear as it stylistically fits into the style of music I may be called to do. Personally I am very excited that the sound of the acoustic bassoon is going to become more popular in groups that play improvised-based or groove-oriented music. I was signed to a Japanese record label where they tried on purpose to equalize me like a sax player-they were afraid to have me sound like a bassoon player as that sound did not fit the style of music I was recording. Or so they felt. This was in the mid 1990s. Over time-I have made more recordings such as VOODOO SUITE, DAVKA LIVE and FROLIC IN THE LAND OF PLENTY (and to some extent POLARIS with OoN) that feature a more acoustic sound. Still I deal with engineers who want to 'brighten' my sound for the purpose of being more 'sparkly' for the point of the recording. Who's right at this point? What's good for the music? Personally I really miss playing with the band DAVKA because there was NO electronics!

Are there any equipment issues that, in their application to the bassoon itself, would make one apprehensive to install?
I would never, ever drill into the wood of an instrument. You don't have to-so I would say there's nothing I'm apprehensive about doing. If you have a good bocal-you will sound better-even when you use an electric pickup such as a Little Jake.

Is there an effective way to begin experimenting with the electro-acoustic bassoon without purchasing the usual equipment?
The easiest way is to have Garageband on a Mac computer and use the microphone of the Mac to record yourself and then process it with the effects they have in Garage band. Of course I think Logic is much, much, much better for this.

In electro-acoustic bassoon performance, are there reed issues that differ from traditional acoustic performance?
Not for me.

Has electric bassoon playing influenced your acoustic bassoon performance?
It's possible it has-I try not to drift away on acoustic playing as that is where it all starts. It's sometimes easy to get carried away playing with gear and tones when you have all those 'toys' at your disposal. So it takes good old fashioned discipline to stay centered-as always.

Performance Aspects:

Of the electro-acoustic compositions you have performed, what are your favorite pieces, and why?
First I'm mentioning pieces that were written for me. I thought Steve Mackey's "RAVENSHEAD" opera (performed by the Paul Dresher Ensemble in New York and on tour in 1998-2001) was an amazing incredible tour de force. I really enjoyed that. I also enjoyed performing Daniel Baldwin's THE DARK SIDE double electric bassoon concerto with Richard Ramey at the IDRS in New York this year. Can't wait to play that again.
There are so many but I always liked "Inner Openings" that I wrote for my first album THE LAST ROMANTICS. It's out of print of course but one might be able to find it somewhere. RITE OF SCORPIO is a great electric bassoon solo from VOODOO SUITE and SUBTLE DEMONS from FROLIC IN THE LAND OF PLENTY is another favorite.

What were the issues faced in performance preparation for the electro-acoustic works, and how did you resolve them?
My primary vehicle for playing electro-acoustic classical compositions was with the Paul Dresher Ensemble. The biggest issue with a group like this is the huge amount of time spent detailing the mix of a live performance. Not only must the front of house be mixed-the monitors have to be mixed so everyone hears everything they need to hear. When you play with a bunch of samplers, synths, electric drums, processed violin, mallet instruments-it's easy to miss a sound here or there. The palette is ridiculously wide.

Change, and the Future in the Electro-Acoustic Bassoon Medium:

Do you see the medium changing? Would you like to see a change?
I am thrilled that there is a medium in the first place. I am thrilled to see other bassoon players in bands and playing jazz, rock, funk, big band, electronic classical and folk styles. What I see as the change is that there are more people out there doing it and there is more media of these performances that influence other bassoonists. The best thing I can think of is for there to be positions than require electric bassoon playing. There usually aren't jobs in the union paper that say 'electric bassoon player audition' or 'electric bassoon player needed-inquire'. As time goes on this may change-I know when I was at ZED I thought about leaving. Cirque sent out audition notices in case I didn't renew my contract. I think that was one of the only times there has been an audition for an electric bassoon job. What I would like to see is a great microphone that can be used in conjunction with the electric pickup. Something that gets a great bassoon sound from one position on the instrument-not 3 different microphones.
Another huge thing is that musically (not electric or acoustic)-bassoonists can always learn new musical things such as how to swing, how to groove in non-classical music, and how to improvise. This is neither electric nor acoustic-it is regardless of that.

In your opinion, does electro-acoustic bassoon performance affect the future of traditional bassoon performance?
I only think it augments it. Traditional bassoon performance is based off of orchestral playing. That is never going to go away no matter what people say about the future of the orchestral medium. Thank god. But in addition to playing Haydn, Mozart, Brahms, Mahler, Stravinsky there will be new music written for smaller ensembles that features a degree of electronics. That degree is adjustable depending on the player, the composer and what is intended with each composition. Music is music no matter how you slice it. Tools are just that-tools in order to coax expression and feelings out.

Composition:

Have you composed music for electro-acoustic bassoon?
Yes

What were the specific issues faced, in relation to the bassoon, while composing, and how did you resolve them?
Until recently I primarily wrote for myself so I knew what I was up against. The biggest issue is the microphone that captures acoustic sound. In the studio it is possible to do so much that is

really hard to do live. Especially in rock based music where drums are 50% of the mix-this can work great in a studio but live is it totally different. Also-when you distort a bassoon sound like a lead guitar-it's very hard to get the level just right. It's either too soft and you can't hear anything or too loud and there's nothing but electric bassoon in the room. I would say that rock music when you distort the bassoon sound (which sounds GREAT by the way) is the hardest to play live.

Did being familiar with the instrument's capabilities help or hinder your compositional process?
Yes it helped.

Words of Wisdom:

What suggestions would you give to a bassoonist who wanted to begin experimenting with electro-acoustic bassoon performance?
I would suggest that it takes a bit of a small budget to try. First you need a pickup like the Little Jake. Then you need cables, an amp like a keyboard amp that is full range. Don't use a Fender Twin Reverb guitar amp. There are inexpensive stomp pedals all over the internet or at Guitar Center that you can experiment with. That's how I would start the pure electronic side of electric bassoon playing. Musically I would think it would be more important to start playing with musicians that play jazz, pop, funk, rock, folk music. Get out of the page and learn to hear melodies that you can play back by ear. Find a pianist and start playing 12 bar blues and experiment with soloing. There are methods for this-there's a whole world out there of jazz and jazz improvisation that you can start to implement. And have fun and take your time!

APPENDIX C

SURVEY RESPONSE: JEFF LYMAN

General Overview:

How have you used electro-acoustic bassoon in your career?
I've played pieces that have attracted my attention for a variety of reasons.

When and why did you decide to experiment with electro-acoustic bassoon? What began your interest in this medium?
In high school I first heard the music of Mario Davidovsky and looked forward to playing similar music for bassoon, but at that time I did not know of any such works. I believe it was years before I got the chance to actually play a work composed specifically for bassoon and electronics.

Do you have a favorite memory of performing with the electro-acoustic bassoon?
I enjoyed playing and recording Filippo Zapponi's *Hypérion-Éos*, a uniquely interesting take on the genre by a very fine Italian composer working in eastern France.

Electro-Acoustic Equipment:

What specific equipment do you currently use? I.E. Brands and models of microphone/pickup, amplifiers, effect pedals, software.
For simple amplification I use two lavalier type microphones that I wear in pockets or on my belt, and I attach one with a rubber band near the bell and the other I clip to my lapel or to my shirt. This set up generally gives the engineer a good spectrum of the bassoon sound to put through the mixing board. If I need the sound to be processed via the use of a pickup, I use the S-29 bocal pickup available from Forrests Music, and this is attached to a Püchner bocal that I had modified for this pickup.

How did you arrive at your decision to use this particular equipment?
Trial and error, as well as advice from colleagues.

How is your equipment set up for use? I.E. Levels of volume, proximity of microphone, pedal setup.
It depends on the piece, the venue, etc.

Have you experimented with other equipment, and were there any benefits or drawbacks?
I have used all sorts of interactive and non-interactive software and playback formats. When they work, they work, when they don't, it's frustrating. I would say the same thing about live colleagues.

In regards to equipment, what issues have been faced?
What challenges have you had to overcome? How did you overcome these concerns? As I've stated before in other similar studies, the greatest issue in this genre is the obsession with the

new. As soon as one piece of equipment, one software program or one device is invented, someone else tries to outdo that with another new toy. Consequently the genre seems to favor the seduction of new tech over composition itself, and hence I find most works to be ephemeral and uninteresting from a composition standard, regardless of how unique the electronic sounds might be.

Are there any equipment issues that, in their application to the bassoon itself, would make one apprehensive to install?
Drilling anything causes apprehension.

Is there an effective way to begin experimenting with the electro-acoustic bassoon without purchasing the usual equipment?
In this day and age, everyone has the tech they need on their phone or their laptop, so there is nothing stopping anyone.

In electro-acoustic bassoon performance, are there reed issues that differ from traditional acoustic performance? Not in my experience.

Has electric bassoon playing influenced your acoustic bassoon performance?
It has sometimes made it louder.

Performance Aspects:

Of the electro-acoustic compositions you have performed, what are your favorite pieces, and why?
The aforementioned *Hypérion-Éos* by Filippo Zapponi is one work I enjoy as a composition, plain and simple. The composer has integrated the live bassoon and the prepared electronics in such a way as to feature the best aspects of both. It is a work that uses the bassoon in both traditional and innovative ways, and the tricky but vital coordination between the electronics and the bassoon is assured through the use of a click track. The super-slow tempo of the final coda, for instance, would be nearly impossible to assure in a live performance without the click, and so the subtle connections between the solo part and the electronics is assured without it being distracting to the listener. On top of all of this, Zapponi has written a bassoon part that wails, sings, flies and soars. It's one of the only works for bassoon and electronics I've ever played that is truly satisfying to me as a musician and that I would listen to simply as an enjoyable work of music, not as some show piece or as some demonstration of a particular software program or device.

What were the issues faced in performance preparation for the electro-acoustic works, and how did you resolve them?
Coordination: closely follow the score or the click. Balance: leave it to the tech assistants.

Change, and the Future in the Electro-Acoustic Bassoon Medium:

Do you see the medium changing? Would you like to see a change?
See my reply about the obsession with the new above.

In your opinion, does electro-acoustic bassoon performance affect the future of traditional bassoon performance?
It could, if more people would explore it and make it less of an oddity.

Composition:

Have you composed music for electro-acoustic bassoon?
No

What were the specific issues faced, in relation to the bassoon, while composing, and how did you resolve them?

Did being familiar with the instrument's capabilities help or hinder your compositional process?

Words of Wisdom:

What suggestions would you give to a bassoonist who wanted to begin experimenting with electro-acoustic bassoon performance?
Treat it like any other genre and play well.

APPENDIX D

SURVEY RESPONSE: JIM RODGERS

General Overview:

How have you used electro-acoustic bassoon in your career?
I have used electro-acoustic bassoon for community center demonstrations, pre-concert lobby performances, recitals, IDRS conferences, fundraisers, museum events, for recruitment, and with the PSO.

When and why did you decide to experiment with electro-acoustic bassoon? What began your interest in this medium?
I began experimenting in the summer of 2004. I first became aware of the possibilities while performing a concerto at an outdoor concert and realized the potential of amplification. This idea blossomed into using effects and looping in addition to amplification.

Do you have a favorite memory of performing with the electro-acoustic bassoon?
There are many good memories, but my favorite happened at a run-out concert with the PSO, conducted by Marvin Hamlisch. The PSO was performing a pops concert called "Broadway Rocks", which called for electric bass. Our electric bass player got a flat tire on the way to the concert and, with no time to find a replacement, I decided to approach Marvin and tell him that I was able to "plug in" my bassoon to the bass amp. I ended up playing the electric bass part for the entire concert on my electric bassoon. Marvin gave me a solo bow and later told PSO administrators that I "saved the show".

Electro-Acoustic Equipment:

What specific equipment do you currently use? I.E. Brands and models of microphone/pickup, amplifiers, effect pedals, software.
My bocal mic and pickup are from Forrests Music. I have several Boss effects pedals: Phaser, Digital Delay, Harmonist, Tera Echo. My looper is a Boss RC 20XL. By Digitech: a Bass Multi-effects processor and a Whammy pedal. My wireless setup is by Line 6 and I use a Roland keyboard amplifier.

How did you arrive at your decision to use this particular equipment?
The Forrests microphone and pickup worked the best for what I wanted to do with the electronics. I found the Roland amp to be the best for the range and sounds I wanted to use, since keyboard amps handle everything a full-range synthesizer can produce. After trying many different pedals, the Boss and Digitech choices were the best for my objectives and the most user-friendly. I would always test any new pedal across the entire bassoon range and with different dynamics and attacks, to see how the pedals reacted, given the sensitive nature of the bocal pickup. My looper gives me the most flexibility without any extra frills, allowing me to focus on the loops and layers.

How is your equipment set up for use? I.E. Levels of volume, proximity of microphone, pedal setup.
The microphone is attached directly to the bocal and is quite sensitive. This means that levels in the pedals, and the amp, are not terribly high. I use the wireless for freedom of movement and have the pedals arranged at my feet. Usually the cable runs right to left, beginning with the Whammy and always ending with the looper before going to the amp.

Have you experimented with other equipment, and were there any benefits or drawbacks?
I am always experimenting and trying new gear. Most other pedals are too sensitive or produce sounds that are incompatible with my setup, or sounds I'm not interested in. Boss pedals seem to work best for me as well as my original Digitech multi-effect pedal, which can be programmed to accommodate the sensitivities and "spikes" that the microphone/pickup can produce. Rarely are there drawbacks to experimenting and always benefits, if nothing else to validate my current choices.

In regards to equipment, what issues have been faced? What challenges have you had to overcome? How did you overcome these concerns?
Mostly the challenges have been related to the bocal mic sensitivity, finding gear that will not "spike" or distort, and the learning curve for the gear itself. Since I was not trying to reproduce an actual bassoon sound, timbre issues were not as challenging. Learning to use the gear, a skill not generally part of a bassoon performance degree, was a huge challenge, but a welcome one. Using my feet to work the pedals was something I had never needed to do before and the coordination required was more than I could have imagined. I had to seek out individuals outside of the orchestral world to teach me about the gear. Fortunately there were several such individuals who were very helpful.

Are there any equipment issues that, in their application to the bassoon itself, would make one apprehensive to install?
The bocal microphone pickup required a hole to be drilled into the bocal and a pickup soft-soldered onto it. This was a bit of a leap of faith, especially since I had this done to a very good Heckel bocal. Other than that, there is no modifications that need to be made to the bassoon itself.

Is there an effective way to begin experimenting with the electro-acoustic bassoon without purchasing the usual equipment?
If you can borrow a modified bocal, and some simple gear (amp, cables, effects, looper) this will give you an idea if this sort of thing is good for you. Try to get together with an expert, so that you understand how to use the gear and recognize its limitations. Always have a good ground for the amp.

In electro-acoustic bassoon performance, are there reed issues that differ from traditional acoustic performance?
I've found that the reed can be lighter and easier to play, since any real dynamic issues are controlled by the gear. I do recommend that the reed not be too "spitty" since this is picked up very clearly by the bocal microphone. Every now and then I've performed without the gear and

then "plugged in". This requires a special reed, one that sounds good, free of "spit" and is free & easy to play when the gear is used.

Has electric bassoon playing influenced your acoustic bassoon performance?
Definitely! I now think of almost all of the solo pieces I play in terms of their potential in the electric-acoustic medium, as well as songs and brief classical pieces being ripe for solo looping arrangements and performances. Also, when using the looper, every loop must be very well in time and very well in tune. Working with the looper has sharpened both my rhythm and intonation skills considerably. When using the harmony pedals, I get to apply, on the spot, some useful theory skills as well.

Performance Aspects:

Of the electro-acoustic compositions you have performed, what are your favorite pieces, and why?
I am very fond of my version of the Pachelbel Canon, since this was the first piece I worked out using the looper. I am also very fond of my Bolero, since it gets the widest range of reactions. My composition, The Flea, is dear to me since it represents a synthesis of many aspects of my life and profession. My cover version of Angela Sheik's Morning Apology will always be treasured because of my collaboration with an amazing artist and one of the world's best loopers.

What were the issues faced in performance preparation for the electro-acoustic works, and how did you resolve them?
Most issues have to do with setup and energy sources. I always have a battery-powered option, in case there is no wall plug nearby. Sometimes there is not enough time for an adequate sound check, so I'll make it part of the performance if this happens. Making sure I have backup gear (cables, replacement microphone) is a must because you just never know when these things will give out. Most important for me is to know the music very well. Since I'm dealing with gear, the music needs to be very well prepared so that I can focus more on the gear.

Change, and the Future in the Electro-Acoustic Bassoon Medium:

Do you see the medium changing? Would you like to see a change?
I think the medium itself represents change and it is always evolving. There isn't really a "standard" for this yet. I feel like we are all creating our own way, our own path, experimenting in our own ways with experiences shared amongst each other. The idea of the gear unites us, but its applications are all unique among us. I would love to see more bassoonists doing this so, yes, I would like to see a change. I would like to see more of us adding this to the traditional approach.

In your opinion, does electro-acoustic bassoon performance affect the future of traditional bassoon performance?
Yes, for reasons stated above. Also, I think that when more composers write more pieces for this medium, it will necessitate a familiarity with the medium and the gear. I have used my electric

bassoon (unintentionally) for recruitment. These new students are expecting to, one day, be electric bassoon players.

Composition:

Have you composed music for electro-acoustic bassoon?
Yes

What were the specific issues faced, in relation to the bassoon, while composing, and how did you resolve them?
My compositions involve using loops and this presents interesting challenges. The loops must be in tune and in time. This was a skill that was difficult to coordinate with the feet, as well as recognizing the limits of the looper itself and working within them. Understanding polyphony and knowing how dense a series of layers can be is very important when using the looper and the effects. Some effects lend themselves better to multiple loops and others don't. Improvisation is also very important, as well as a knowledge of the effects and how to implement them during improvisational performance. Trial and error was the best way to see what worked best in this regard.

Did being familiar with the instrument's capabilities help or hinder your compositional process?
It definitely helps to know what the bassoon can (and can't) do. It also helps to know what the gear can (and can't) do. With the gear there is a lot of sound and range opportunity that can augment the bassoon, expanding its potential in every direction. The bassoon's technical limits are still there however, but I'm always working on this.

Words of Wisdom:

What suggestions would you give to a bassoonist who wanted to begin experimenting with electro-acoustic bassoon performance?
I would say first and foremost: know your instrument. Be the best bassoonist you can be so that you can implement these skills in an electric environment. Think very outside the box and take as much opportunity to try as many things as you can with regards to the gear. Don't be afraid to seek the advice of people who have done this before. Learn from their success and from their mistakes. Stay open to performing music outside of your traditional training, and to working with non-classical musicians. This can be very rewarding on many levels. Above all - have fun!

APPENDIX E

LIST OF EQUIPMENT REFERENCED

Bocal Mounted Microphones (Pickups)
Little Jake: 17, 19, 20, 51
Telex S-29: 19, 20, 25
Barcus-Berry: 19, 30

Impedance Buffers (Preamps)
Gigpro- L.R. Baggs Preamp: 20
Avalon U5: 20

Wireless Transmitters
Line 6 Wireless Transmitter: 25

Processing Units
TC Helicon VoiceLive-2 (Vocal Effect Unit): 24
Digitech Bass Multi-Effects Processor: 25

Phase Loopers
Boomerang III phase sampler pedal: 24
Boss RC 20XL: 25
Ableton Live (Computer-Based): 24.
Logic 9 (Computer-Based): 24

Pedal-Based Effects
MXR Bass Envelop Filter: 24
Boss-Phaser, Digital Delay, Harmonist, Echo: 25

Amplifiers
Roland Keyboard Amplifier: 21, 25
Mackie SM450 Head-Unit powering 10” wedge with horn: 21

APPENDIX F

LIST OF COMPOSITIONS REFERENCED

Paul-Heinz Dettrich- *Kammermusic I.* (1970)
Instrumentation: flute, oboe, clarinet, bassoon, piano, and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

Edward Diemente- *For Lady Day: a trio for one player*. (1972)
Instrumentation: Solo instrument pre-records and layers two accompanying lines then performs the melody live with pre-recorded track.
Electric Equipment: Recording equipment for initial recording and layering.
Playback equipment for pre-recorded track.

Elliot Schwartz- *Aria no. 4*. (1972)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

Bjørn Fongaard- *Concerto for Bassoon and Tape, Op. 131 no. 10.* (1976)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

Arne Mellnäs- *Solioquim IV*. (1976)
Instrumentation:Solo bassoon with optional electronic tape.
Electric Equipment: Playback equipment for pre-recorded track (if used).

Karl Korte- *Demoila*. (Date Not Specified)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

Michael Burns- *Swamp Song.* (1986)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

François Bousch- *Espace-Temps*. (1988)
Instrumentation: Solo bassoon and live electronics.
Electric Equipment: Playback equipment for amplification of live electronics.

Donald Chamberlain- *Beck and Call.* (1990)
Instrumentation: Amplified solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track. Some method for the amplification of the bassoon.

Knut Sönstevold- *Chewing Bassoon Burger*. (1990)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

Pierre Boulez- *Dialogue de L'Ombre Double*. (1995)
Transcription by composer, originally for clarinet and electronics. (1985)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track.

Michael Rothkopf- *At a Crossroads for bassoon and computer*. (2007)
Instrumentation: Solo Bassoon and live electronics.
Electric Equipment: Computer with "Max/MSP" and amplification of computer sounds.

David Hurdy- *Impromptu pour un Monodrame*. (2007)
Instrumentation: Solo Bassoon and live electronics
Electric Equipment: Computer with "Max/MSP" and amplification of computer sounds.

Mark Engebertson- *Contramax*. (2008)
Instrumentation: Solo Contrabassoon and live electronics.
Electric Equipment: Computer with "Max/MSP" and amplification of computer sounds.

Filippo Zapponi- *Hypérion-Éos*. (2011)
Instrumentation: Solo bassoon and pre-recorded track.
Electric Equipment: Playback equipment for pre-recorded track. In ear click track.

Filipe Pérez Santiago- *Ifitra*. (2012)
Instrumentation: Bassoon quintet and electronics.
Electric Equipment: Playback equipment for electronics.

APPENDIX G

GLOSSARY OF TERMS

Audio Signal Processing
Intentional alteration of electronic audio signal by an audio effect (effects unit). May be in either analog or digital format.

Bocal Mounted Microphone (Bocal Pickup)
A small microphone that is attached directly into the bocal through a drilled and threaded (or soldered) adapter. The most common brands currently used are the Little Jake and Telex S-29.

Chorus Effect
Produces slight variations in timbre and pitch by adding a slight delay and simulated vibrato to part of the input signal, while leaving the rest of the signal unaltered.

Compressor Effect
Makes loud sounds quieter and quiet sounds louder by dampening the beginning of a note and amplifying its sustain.

Computer-Based Effect
Digitally produced audio effect by a computer, rather than a pedal. Max/MSP systems fall into this category as well.

Delay, Echo and Reverb Effects
Produce an echo effect by adding a duplicated signal to the original signal at a slight time-delay. May be a single echo (Slap or Slapback) or multiple echos. Reverb effects produce a large number of echoes of the original signal that gradually decay

Distortion, Fuzz and Overdrive Effects
Reshapes the audio signal's wave form by clipping the top and bottom of the wave and adds harmonics to the signal as well.

Dynamic Effects
Modifies the volume of an instrument by increasing or decreasing the amplitude of the audio signal. Volume pedals, compressors, and noise gates fall into this category.

Envelope Filter (Envelope Follower)
Activates an effect once a designated volume is reached.

Equalizer
A set of filters that boost or weaken specific frequency regions to provide targeted control over the frequency spectrum.

Feedback
Effect produced when the amplified sound is picked up by a microphone and played back through an amplifier, thus creating a "feedback loop."

Filter Effects
Alters the frequency content of the signal by amplifying or weakening specific frequencies.

Flanging Effect
Creates a variably delayed version of the audio signal in addition to the original signal. This simulates a studio effect produced by periodically slowing one of two synchronized tapes by pressing the edge (flange) of its reel.

Gain
An increase in the audio signal, originally achieved by increasing the power supply, currently achieved through digitally altering the signal.

Impedance Buffer (Preamp)
A signal amplifier that prepares a small electric signal for further amplification/processing.

Harmonizing Effects
A type of pitch shifting effect that combines the original pitch with one or more pitches altered at a designated level (octave, fourth, fifth, etc…).

Max/Max Signal Processing
A visual computer programming language for music and multimedia. May be programmed to react to sounds from a performer by producing an audio response within a pre-determined set of parameters.

Multi-Effects Processing Unit
A single devise that contains many different electronic effects for signal processing.

Phase Looper or Looping Effect
A pedal or computer-based effect that allows the performer to record and store numerous phrases that can then be played back verbatim.

Phasing Effect
Creates a slight rippling effect by amplifying some aspects of a signal, while lessening others. Phasers split an audio signal in two and alters the phase of one portion.

Pitch Shifting Effect
Raises or lowers each pitch played by a pre-set interval. Most often used for octave shifts.

Ring-Modulation Effect
Produces a reverberating metallic sound by mixing the audio signal with another sound wave generated by an oscillator. The original sound wave is replaced by higher and lower harmonic pitches.

APPENDIX H

USE OF HUMAN SUBJECTS IN RESEARCH: APPROVAL MEMORANDUM

The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM (for change in research protocol)

Date: 8/13/2014

To: Bradley Behr

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research (Approval for Change in Protocol)
Project entitled: The Electro-Acoustic Bassoon: an Exploration of the Non-Traditional use of a Traditional Instrument

The form that you submitted to this office in regard to the requested change/amendment to your research protocol for the above-referenced project has been reviewed and approved.

If the project has not been completed by 7/30/2015, you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Jeffrey Keesecker, Advisor
HSC No. 2014.13474

APPENDIX I

SAMPLE INFORMED CONSENT LETTER

Dear Participant:

You are being invited to participate in a research study about the electro-acoustic bassoon. This research is being conducted by Bradley S. Behr, Doctor of Music candidate at Florida State University.

Your participation in voluntary, and there will be no penalty for nonparticipation. Your answers given in this survey will ensure accuracy of information the treatise. Bradley Behr, Jeff Keesecker (supervising professor), Deborah Bish and Eric Ohlsson (doctoral committee members), will be the only persons with access to your interview until the treatise is defended. Public confidentiality will be kept until the defense. All of your contributions will be attributed to you, and you will be cited by name.

Your participation will involve an electronic interview survey. No probing personal information will be asked. The total time commitment is approximately 2-3 hours, and will take place through email communication.

By signing below, you indicate your consent to participate in this study and that you are over the age of 18.

Although there may be no direct benefit to you, the possible benefit of your participation might involve a greater understanding of the use of the electro-acoustic bassoon.
If you have any questions concerning this research study or your participation in the study, please e-mail me. You may also contact Mr. Jeff Keesecker

Sincerely,
Bradley S. Behr

Name: _____

Signature _____ (Date) _____

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633 or you may access their website at http://www.fsu.research.edu.

REFERENCES

Bassingthwaighte, Sarah Louise. "Electroacoustic Music for the Flute." *www.subliminal.org.* n.d. http://www.subliminal.org/flute/dissertation/TOC.html (accessed September 19, 2014).

Bousch, Francois. "Espace-temps : pour basson, dispositif et bande magnetique." Paris: Salabert, 1988.

Bullock, Jamie, Lamberto Coccioli, James Dooley, and Tychonas Micchailidis. "Live Electronics in Practice: Approaches to training professional performers." *Organised Sound* 18, no. Special Issue 02 (Best Practices in the Pedagogy of Electroacoustic Music and its Technology (2013): 170-177.

Burns, Michael. Interview by Author. *Electronic Survey* (September 27, 2014).

—. *Michael Burns, bassoon.* 2009. http://www.michaelburnsbassoon.com/Bio_Resume/Bio_Resume.html (accessed August 21, 2014).

Busoni, Ferruccio. "Sketch of a New Esthetic of Music." In *Source Readings in Music History*, by Oliver Strunk, edited by Leo Treitler, 1321-1328. New York, New York: W.W. Norton & Company, Inc, 1998.

Campbell, Murray, and Clive A. Greated. "Electro-Acoustic Instruments." In *The Musicians' Guide to Acoustics*, 498-524. Oxford: Oxford University Press, 2001.

Couprie, Pierre. *Electro Acoustic Music Studies Network.* n.d. http://www.ems-network.org/ (accessed August 19, 2014).

Cycling '74. *FAQ: Max 4.* n.d. http://cycling74.com/support/faq_max4/ (accessed October 2, 2014).

Diemente, Edward. "For Lady Day : a trio for one plyer." New York, New York: Seesaw Music, 1972.

Dunn, David. "A History of Electronic Music Pioneers." *Pioneers of Electronic Art.* Linz, 1992.

Ears: ElectroAcoustic Resource Site. n.d. http://www.ears.dmu.ac.uk/ (accessed August 19, 2014).

Emmerson, Simon and Smalley, Denis. "Electro-acoustic music." *Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/08695 (accessed August 19, 2014).

Erato, David M. "Interview with Jazz Bassoonist Paul Hanson." *www.daviderato.com.* January 18, 2010. http://www.daviderato.com/blog/2010/1/18/interview-with-jazz-bassoonist-paul-hanson.html (accessed August 8, 2014).

Hanson, Paul. Interview by Author. *Electronic Survey* (August 20, 2014).

—. "I'm an Improviser." *The Double Reed* 23, no. 3 (2000): 89-92.

Hanson, Paul. "My Life as a Bassoonist and Improviser." *The Double Reed* 28, no. 3 (2005): 97-106.

—. *Paul Hanson Music.* n.d. http://paulhansonmusic.com/ (accessed August 21, 2014).

Hunter, Dave. *Guitar Effects Pedals the Practial Handbook.* San Francisco, California: Backbeat Books, 2004.

Jacobs, Trent Jared. *Elements of Jazz in Bassoon Solo Repertoire.* DMA Dissertation, Urbana, Illinois: University of Illinois at Urbana-Champaign, 2010.

—. *Trent Jacobs, bassoonist.* n.d. http://tjbassoon.com/ (accessed August 21, 2014).

Klimko, Ronald. "Bassoon Music Reviews." *The Double Reed* Vol. 23, no. 2 (2000): 24.

Lyman, Jeffrey. Interview by Author. *Electronic Survey* (August 24, 2014).

—. *The University of Michigan Bassoon Studio.* n.d. http://www-personal.umich.edu/~jlym/Welcome.html (accessed August 21, 2014).

—. *The University of Michigan Bassoon Studio.* n.d. http://www-personal.umich.edu/~jlym/pages/new_bsn_cd.html (accessed September 27, 2014).

McNutt, Elizabeth. "Performing electroacoustic music: a wider view of interactivity." *Organised Sound* 8, no. 03 (December 2003): 297-304.

Morrill, Dexter. "Loudspeakers and Performers: Some Problems and Proposals." *Computer Music Journal* (The MIT Press) Vol. 5, no. 4 (Winter, 1981): 25-29.

Mumma, Gordon, et al. "Recording." *The New Grove Dictionary of Jazz, 2nd ed.. Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/J371600 (accessed September 20, 2014).

New Interfaces for Musical Expression. n.d. http://www.nime.org/ (accessed August 19, 2014).

Pittsburgh Symphony Orchestra. *James Rodgers, Principal Contrabassoon.* 2014. https://www.pittsburghsymphony.org/pso_home/biographies/musicians/rodgers-james (accessed August 21, 2014).

Rabinowitz, Michael. "Bassoon Amplification in Jazz and Popular Music." In *A Bundle of Joy. A Practical Handbook for the Bassoon*, by Maarten Vonk, 109-110. Nederland: FagotAtelier Maarten Vonk, 2007.

Reese, David, Lynne Gross, and Brian Gross. *Audio Production Worktext: Concepts, Techniques, and Equipment.* Waltham, Massachusetts: Focal Press, 2009.

Rodgers, Jim. Interview by by Author. *Electronic Survey* (October 1, 2014).

Romine, Ryan D. "ElectroBassoonica." *The Double Reed* Vol. 36, no. 1 (2013): 97-113.

Russcol, Herbert. *The Liberation of Sound: An Introduction to Electronic Music.* Englewood Cliffs, New Jersey: Prentice Hall, 1972.

Russolo, Luigi. "The Art of Noises." In *Source Readings in Music History*, by Oliver Strunk, edited by Leo Treitler, 1329-1334. New York, New York: W.W. Norton & Company, Inc, 1998.

The Paul Dresher Ensemble. n.d. http://www.dresherensemble.org/about/index.html (accessed September 7, 2014).

The Society for Electro-Acoustic Music in the United States. n.d. http://www.seamusonline.org/about.html (accessed August 19, 2014).

Watterhouse, William. "Bassoon." *Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/02276 (accessed September 20, 2014).

Wells, David Atkinson. *A History and Discography of the Bassoon in Jazz.* DMA Dissertation, Madison Wisconsin: University of Wisconsin-Madison, 2010.

Zahler, Noel B. "Davidovsky, Mario." *Grove Music Online. Oxford Music Online.* n.d. http://www.oxfordmusiconline.com.proxy.lib.fsu.edu/subscriber/article/grove/music/07281 (accessed September 4, 2014).

BIOGRAPHICAL SKETCH

Brad Behr is currently the Adjunct Professor of Bassoon at the University of North Florida, a freelance musician, and professional reed maker. He holds a B.S. in Music Education from Indiana University of Pennsylvania, as well as a Master of Music, and Doctor of Music in Bassoon Performance from Florida State University. He has studied bassoon with Jason Worzbyt of Indiana University of Pennsylvania, Jim Rodgers of the Pittsburgh Symphony and Jeff Keesecker of Florida State University.

In summers, Brad has served as bassoon coordinator for FSU's Summer Double Reed Camp, bassoon instructor for the Golden Isles Youth Orchestra Camp, and as an instructor at UNF's Summer Music Camp. An active performer, Brad has appeared with numerous ensembles across Pennsylvania and the southeastern United States. Currently, he is the principal contrabassoon and utility bassoonist for the Tallahassee Symphony Orchestra, and frequently performs with the Jacksonville and Hilton Head Symphony Orchestras.