THE CONTEMPORARY BASSOONIST: MUSIC FOR INTERACTIVE ELECTROACOUSTICS AND BASSOON

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As the bassoon has evolved over time, the music written for the instrument has evolved around it, and was many times the catalyst for its evolution. Bassoon music of the seventeenth through early twentieth centuries has defined much of the curricula for bassoon studies, and has established how we consider and experience the bassoon. We experience, write, and consume music in vastly different ways than just a generation ago. Humans use technology for the most basic of tasks. Composers are using the technology of our generation to compose music that is a reflection of our time. This is a significant aspect of art music today, and bassoonists are barely participating in the creation of this new repertoire. Performance practice often considers only the musical score; interactive electronic music regularly goes beyond that. The combination of technological challenges and inexperience can make approaching electroacoustic music a daunting and inaccessible type of music for bassoonists. These issues require a different language to the performance practice: one that addresses music, amplification, computer software, hardware, the collaboration between performer and technology, and often the performer and composer. The author discusses problems that performers face when rehearsing and performing interactive electroacoustic works for bassoon, and offers some solutions.

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INTRODUCTION

The bassoon has a long history and tradition, but is a product of evolution and innovation. From the very moment the first instrument maker bent the first pommer into a dulcian in the 1400s, the bassoon has never stopped changing. The bassoon became more flexible, and more able to meet the demands of performers and composers alike throughout the centuries. The instrument gained keys, and the bore became longer and wider. The walls of the bassoon were thinned for resonance, and the bocal became longer to meet the demands of both the high and low registers. The bassoon even developed into two distinct lineages of the same instrument, known as the German and French schools. Bassoonists and instrument makers are constantly fine-tuning the instrument to make a more efficient and consistent machine.

As the bassoon has evolved over time, the music written for the instrument has evolved around it, and was many times the catalyst for its evolution. Bassoon music of the seventeenth through early twentieth centuries has defined much of the curricula for bassoon studies, and has established how we consider and experience the bassoon. All of this, of course, was in the context of the way humans have created and experienced western music as a whole.

We experience, write, and consume music in vastly different ways than just a generation ago. Humans use technology for the most basic of tasks. Composers are using the technology of our generation to compose music that is

a reflection of our time. This is a significant aspect of art music today, and bassoonists are barely participating in the creation of this new repertoire.

I personally became interested in this medium through free improvisation, and began seeking ways to enhance and add to my improvisation pallet of sounds and skills. After meeting and studying with Elizabeth McNutt, I realized electroacoustic music could add an entire set of sounds that I could be utilizing. I wondered how many interesting works there were for bassoon and interactive electronics, and how to begin playing them. After searching for such information, I realized there were few resources and less music than I had originally thought. While there are many articles and dissertations written on electroacoustic music composed for the flute or piano, etc., hardly anything has been written about bassoon and electronic works; bassoon and interactive electronics is rarely mentioned in the literature. After speaking with many of my fellow students and colleagues, I realized that much of this music is unknown to bassoonists, and can seem intimidating or crude. I later asked composer Benjamin Shirey to write a solo work for bassoon and interactive electronics after working together on a project. He wrote *Sand Daemon*, a work I will discuss later in this dissertation.

This dissertation will focus on works containing interactive media. Robert Rowe defines interactive music as, "[…] those [systems] whose behavior changes in response to musical input. Such responsiveness allows these systems to participate in live performances, of both notated and improvised

music."[1] Interactivity can be a nebulous concept to many composers and performers. The word can be overused to refer to music that is hardly interactive at all, though many composers think of interactivity in various degrees. This project will examine four pieces in various gradations and categories of interactivity, comparing the works to each other, and discussing interactivity as a genre moving into the future.

The first chapter of this dissertation will contain a brief history of electronic music for bassoon. Most of the music written for bassoon and electronics (fixed and interactive) has been written in the last thirty years. Considering the most often played works for bassoon were written over two-hundred years ago. Even the majority of most commonly played twentieth century works were written before the fall of the Berlin Wall. This is a large gap in what we consider "contemporary" music for bassoon. When half the composers considered "contemporary" are deceased, when do we stop using the word "contemporary" to describe the literature?

Performance practice often considers only the musical score; interactive electronic music regularly goes beyond that. The combination of technological challenges and inexperience can make approaching electroacoustic music a daunting and inaccessible type of music for performers. These issues require a different language to the performance practice: one that addresses music, amplification, computer software, hardware, the collaboration between performer and technology, and often the performer and composer.

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[1] Robert Rowe, *Interactive Music Systems: Machine Listening and Composing*. (Cambridge, MA: The MIT Press,1993), 1

The second chapter will discuss problems that performers face when rehearsing and performing these works, and offers some solutions. Four prominent and accomplished bassoonists in this field were interviewed: Rebekah Heller[2], Brad Balliett, Dana Jessen, and Katherine Young. Each performer was sent a questionnaire via email, allowing each one ample time to contemplate the questions. These performers give their own opinions on music, rehearsal, and equipment for interactive electroacoustic music.

The third chapter will offer an analysis and guide of each of the four pieces covered in this dissertation: *On speaking a hundred names* by Nathan Davis, *Sand Daemon,* by Benjamin Shirey, *Ripped-up Maps* by Andrew May, and *Obsessed Again,* by Keith Hamel. These works contain many of the elements that any bassoonist would encounter when seeking works for bassoon and live electronics. These composers were also interviewed about their music and thoughts on interactive electronics, providing additional perspectives. The viewpoints of these composers give a unique view of collaboration in this repertoire. Most works written for bassoon and interactive electronics are the result of collaboration between a performer and composer.

[2] Note: Heller's interview is a transcript from a live interview with the author

2 ELECTROACOUSTIC MUSIC CONSIDERATIONS

2.1 A Brief History of Music for Bassoon and Electroacoustics

Much of the earliest music technology was born in Europe after World War II. Magnecord, Mining, and Manufacture (or 3M as the company is known) had invented magnetic tape in the 1930s, and by 1949, many companies were using commercial tape machines. France established its first modern electronic studio in 1951 with the *Groupe de Recherche de Musique Concrète* and an array of tape recorders. Many European composers began their electronic careers here, including Pierre Boulez, Karlheinz Stockhausen, and Olivier Messiaen.

The 1950s were a time of large-scale experimentation and invention in computing systems. In 1955, after a report by the Rockefeller Foundation on experimental music, the Columbia University Electronic Studio was founded in the rooms of a former insane asylum.[3] Though not the first synthesizer, the RCA Mark I & Mark II represents a turning point in music and computers, and were operated by entering paper with a binary sequencer that looked a bit like a pianola roll. After significant involvement by Milton Babbitt (a professor at Princeton), the studio became the Columbia-Princeton Electronic Music Center, and installed the RCA Mark II computer in 1959. The center produced its first concerts in 1961.[4]

The first works for the bassoon and electroacoustics were written in the early 1970s. *Aria No.* 4 was written by Elliot Schwartz in 1972, and might be the

[3] Joel Chadabe, *Electric Sound: The Past and Promise of Electronic Music* (Prentice Hall: Upper Saddle River, NJ.,1997), 45
[4] Chadabe, *Electric Sound,* 47

earliest work for solo bassoon and tape. Miklos Maros wrote *Manipulations No. 1* for bassoon and Svenson-Box in 1976. Maros's piece may be the earliest piece for bassoon and interactive electronics.

> When Miklós began working at EMS, the big hybrid synthesizer [the Svenson-Box]—one of the first of its kind in the world—was still under construction, and the only available instrument was the Sound workshop, a classic analog studio and the place where almost all of the early electroacoustic works in Sweden were composed. When the computerized studio opened in 1973, Miklós composed his work Movements, one of the very first compositions completed there.[5]

Paul-Heinz Dittrich wrote *the-m-for bassoon and live electronics, after an epigram by e.e. Cummings* in 1982-83. This work was part of a collection of contemporary works for bassoon compiled in 1986 by Dieter Hahnchen, bassoonist in the Berlin Wind Quintet. Much of the technology of the time was limited to, "Tape delay systems, ring modulators, contact microphones, and modules for effects such as tremolo, reverberation, and phasing [which] were all employed together with acoustic instruments during this period."[6] The piece originally uses a sequencer and synthesizer, feeding into a mixer, which is then fed into a ring modulator operating at 240 Hz. This, along with a delay and a set of repetition sequences feeding into four different speakers (two in front, and two behind), makes up the electronics portion of the piece. Each individual component had its own separate device that creates these effects. Now, of course, most of these effects can be implemented by interactive software such

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[5] "Fylkingen Records," Accessed Feb 21, 2016, http://www.fylkingen.se/node/900.

[6] Rachel Yoder, "Performance Practice of Interactive Music for Clarinet and Computer with an Examination of Five Works by American Composers", (DMA, diss. University of North Texas, 2010), 5

as Max/MSP or SuperCollider. “Originally, the live-electronic of ‘the-m’ was realized by Eckart Rodger with tape recorders (as delay systems) and analogue synthesizers.”[7] Dieter Hahnchen performed *the-m* in 2011,[8] with the electronics part programmed by Andre Bartetzki.

The 1980s saw a surge in music for interactive electronics. *Alba,* by Richard Barrett is probably one of the most historically significant works of that decade. Barrett is a new complexity composer, who is still very active in the experimental music scene, and participates in the contemporary improvisation duo FURT. Barrett asks for contact microphones amplification and loudspeaker system, and digital signal processor with silent switch-pedal. The bassoonist controls electronic equipment during performance.[9] This piece is the third in a series of works entitled *Fictions. Alba* is currently listed as “under revision” on Barrett’s website.[10] The piece utilizes technology that is obsolete, which now renders the piece unplayable. Many “bassoon and electronic” works are simply pieces with amplified bassoon. Karlheinz Stockhausen wrote a piece for bassoon and amplification, simply named *Fagott,* in 1995.

Some of the most complex music for bassoon and electronics comes from the *Institut de Recherche et Coordination Acoustique/Musique* (IRCAM). IRCAM has contributed significantly to the repertoire for bassoon and electronics, both

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[7] Andre Bartetzki, Accessed February 13th, 2016, http://www.bartetzki.de/en/index.html.
[8] Randspiele Neue Musik in der St. Annen Kirche Zepernick, Accessed February 13th, 2016, http://www.randspiele.de/?m=2011.
[9] National Library of Australia Accessed December 3, 2015, http://trove.nla.gov.au/work/22991093?selectedversion=NBD24539877.
[10] Richard Barrett, Accessed November 7, 2015, http://richardbarrettmusic.com/scores1soloduo.html.

fixed and interactive. Established in 1977 by founder Pierre Boulez, IRCAM has served as a place of experimentation and invention for electroacoustic music. Pierre Boulez's *Dialogue de l'ombre double version pour basson et électronique* was originally written for clarinet in 1985, but was rewritten in 1995 for Pascal Gallois. In this piece, the instrumentalist becomes his or her own "shadow," as half the piece is prerecorded, and is replayed in the middle of the work.[11]

In Appendix B, I have made a comprehensive (yet ever growing) list of works for bassoon, involving both fixed media and interactive electronics. I hope this list will serve bassoonists on a path to curiosity and discovery of this music.

2.2 Thoughts on Interactivity

In Robert Rowe's book, *Interactive Music Systems: Machine Listening and Composing,* Rowe divides interactive music into three "dimensions" that are then divided into further classifications.[12]

The first dimension classifies score-driven systems and performance-driven systems. While score-driven systems use a score or fragments of a score to track the performer, a performance-driven system has no stored representation of the music. The next distinction classifies "response methods" as transformative, generative, or sequenced. Any one of these, or all of these classifications can take place in a single composition. Transformative systems take existing material and apply new sounds to it, while generative systems

[11] IRCAM, Accessed February 11, 2016, http://brahms.ircam.fr/works/work/6963/#program.
[12] Robert Rowe, *Interactive Music Systems: Machine Listening and Composing* (Cambridge, MA: The MIT Press, 1993), 6-8.

create complete musical output from the stored fragmentary material. Sequencing takes prerecorded material and uses it in response to real-time input. Sequencing can vary from performance to performance.

Finally, Rowe distinguishes between an instrument-based program and a player-based program. The instrument-based program will act as an extended instrument, taking performance indications, analyzing them, and creating elaborate output. The player-based program will try to create an artificial musician. This output would produce more of a duet-like piece, where both the human and the artificial intelligence would have personalities all their own.

Rowe created this classification system to give performers and composers a way to discuss their music. Each piece in the subsequent chapters will be given a Rowe classification.

Winkler defines a performer's participation in interactive music: "[…] by the amount of freedom they have to produce significant results in the computer's response."[13] Winkler makes the case that interactive music should be considered the same class as chamber music, wherein the computer and performer act together in different models of interaction, like chamber music, an orchestra (with a conductor), or jazz combo. It is important to note that the author also mentions gestures as part of interaction. Winkler tells us that key pressure, foot pedals, or computer mouse movements all serve as interaction. This is an important distinction when looking at fixed media works with foot pedals or a technician. Nathan Davis's *On speaking a hundred names,* has a fixed media version of the

[13] Todd Winkler, *Composing Interactive Music: Techniques and Ideas Using Max* (Cambridge, MA: MIT Press, 1998), 4.

work discussed later in this dissertation. Because the performer still uses a foot pedal to activate the cues in the fixed media, under Winkler's definition, one could argue that the piece is still interactive. Some scholars would argue the exact opposite: if the computer is not actively interpreting a signal and playback, it is not interactive.

3 ISSUES AND SOLUTIONS FOR THE BASSOONIST

Many questions arise when considering interactive music. As performers, we must ask ourselves: why is this music not being played as often as it could, or should be? The first problem is exposure, as many bassoonists are not introduced to this music by a professor. For most students, their professor is the chief resource of music and the works they should be studying. Many of these professors have professional orchestral backgrounds, and do not have the time or the desire to devote to learning this music. The learning curve can be steep, and if one is not familiar with the hardware or software, it can make even the boldest of musicians uncomfortable.

This music can also be intimidating. The music itself can be of the level of the most difficult contemporary solo literature, and listening to or watching some performances can scare musicians away. Dana Jessen, performing *cornerghostaxis #1* for bassoon and motion-enabled live electronics by Gerriet Sharma, may not only sound unusual, but may look bizarre. In the performance[14], the Motion Enabled Live Electronic device, or MELE, is attached to an extending limb, or in this case, the bassoon bell. Jessen is controlling not the sound, but the timing of the piece. She is essentially conducting her own

[14] Dana Jessen, "*cornerghostaxis #1 for bassoon and motion-enabled live electronics* by Gerriet Sharma" (2009). Youtube video, 7:10. Posted June 23, 2011. Accessed January 29, 2016, https://www.youtube.com/watch?v=_Av6uCnIyM8,

chamber music companion.[15] The issue of coordination immediately comes to mind when viewing some of these videos; many bassoonists spend decades learning to coordinate their hands and bodies to one of the most complicated wind instruments ever made. The prospect of managing the MELE, along with learning a work the performer may play only once, would make some performers less than enthusiastic about the endeavor.

Fixed media works can seem to be a logical gateway into this music, but such works are problematic. As Elizabeth McNutt points out in her article, "For the player, performing with fixed accompaniment is like working with the worst human accompanist imaginable: inconsiderate, inflexible, unresponsive and utterly deaf."[16] There are, however, some well-written works for bassoon in the fixed media genre, and this music can help a performer become more familiar with the hardware, including pedals and amplification.

Xenia Pestova defines the difference between Interactive music and fixed music deftly:

> It is important to note that live electronics differ from fixed media by giving the composer and the performer an opportunity to escape the potential rigidity of strict synchronization, and to have the electronic as well as instrumental parts of the piece sound different in every performance.[17]

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[15] Gerhard Eckel, David Pirro, Gerriet K. Sharma, "Motion Enabled Live Electronics" (paper presented at the Sound and Music Computing Conference 2009, Porto, Portugal). http://iem.kug.ac.at/fileadmin/media/iem/projects/2009/motion.pdf

[16] Elizabeth McNutt, "Performing Electroacoustic Music: A Wider View of Interactivity," *Organised Sound* 8 (January 2003): 299.

[17] Xenia Pestova, "Models of Interaction in Works for Piano and Live Electronics" (DMA diss., McGill University, 2008), 2

While each piece has significant merits, one can understand why many bassoonists shy away from these works.

3.1 Rehearsal

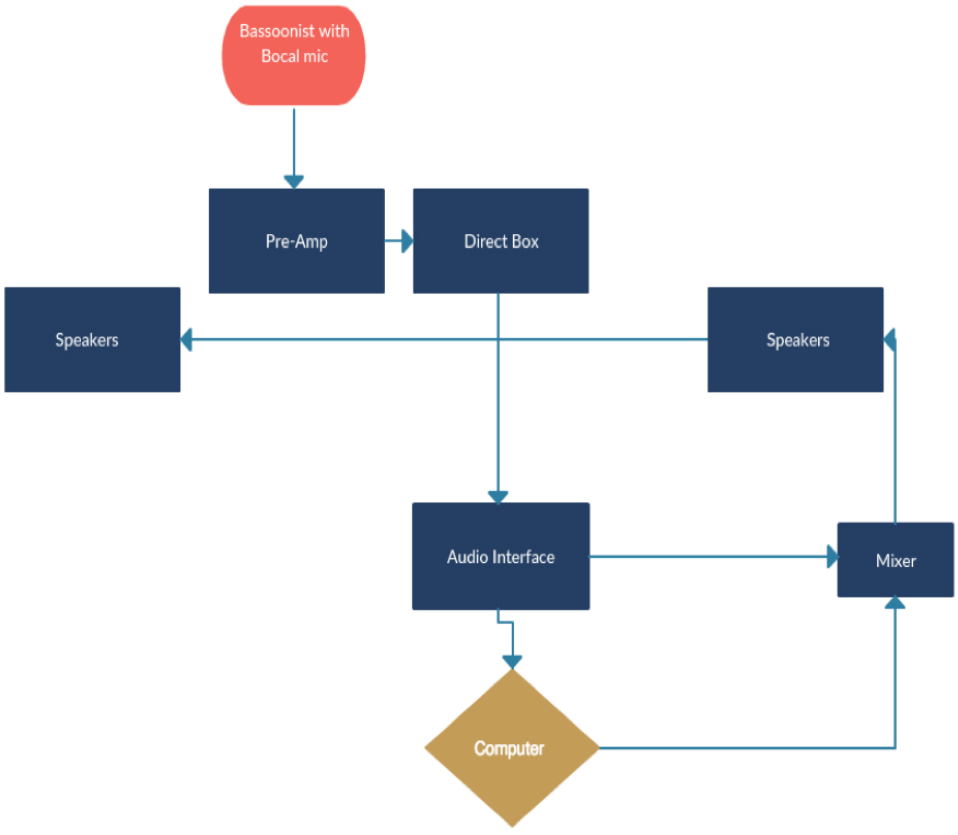
Many bassoonists do not know what to expect when beginning to rehearse these works, or how to go about rehearsing them. This technology is not new, but it is continually changing and evolving. A performer must know what is making their side of the stage work, so that when something goes wrong, the bassoonist can know whether or not they are the cause of any problems. The relationship of performer and technician is very similar to that of reed and instrument: the instrument could be perfectly fine, but the reed could be awful; conversely, the reed may be just fine, but the instrument could be leaking. The performer needs to know that they are not making the mistake that causes the rehearsal to go badly. Knowing where your preamp hooks into the direct box, and what channel your pedals are supposed to be on can save valuable time at setup.

At a performance recently, my amplification was not registering in the computer. While the problem turned out to be minor, it had taken the technician and I an extra three minutes to check all the cords and devices. While we had plenty of set up time, sometimes a hall will only afford you ten minutes of set up time for a thirty-minute concert.

Knowing what your set up looks like is important. Typically, the bassoonist's bocal pickup would go straight to the preamp, usually attached to

the performer to aid in movement. This connects to a direct box, or direct interface, which is there to minimize distortion, and carry the signal farther. The audio interface converts the analog sound of the bassoon into digital, so that the computer can read and sample it. All audio interface boxes have at least two inputs and 2 outputs. The audio interface is connected directly to the computer, which then processes the performer's sound through Max (or a software of the composer's choosing). These signals are then sent into the mixer, and direct the sounds out to the speakers. This is the most basic of setups (See figure 1). A number of works require more than two speakers. Some performers might be hesitant to perform certain scores, if the venue they are playing in does not have a four-six speaker sound system. kjsdkjhfoiho

Figure 1: Setup for bassoonist with bocal microphone



3.2 Technology

As a performer, it is not necessary to know how to design patches, or write code. For the performing artist, Max or other interactive software is a means to an end. Lack of familiarity with Max/MSP or other similar software is another reason performers may choose to avoid interactive electroacoustic music. As Rachel Yoder explains,

> In interactive music, the notated score often only tells part of the story; the rest of the "score" is often hidden inside of Max patches and lines of code. The program for a given piece may be incomprehensible to a performer unfamiliar with the inner workings of the software—or it may even be incomprehensible to everyone but the composer.[18]

Max/MSP is a graphical data flow programming language created by Cycling '74, based on software originally written by Miller S. Puckette. This program was developed into its commercial version in 1990 at IRCAM, and it has become a widely used code-writing platform for composers and visual artists. Max/MSP is more user-friendly than text based programing languages like Java, but requires years of study and practice to become proficient. Performers usually do not take the time or have the resources to acquire these skills. While one does not have to be an expert in coding for Max/MSP, performers may benefit from a basic understanding of patchers (a set of visual objects) and familiarity with different functions, basic terminology, and troubleshooting techniques. In an interview with Dana Jessen she states:

> I have a solid understanding of Max/MSP- I wouldn't consider myself an expert but I do have enough grasp of the program to feel comfortable performing with Max patches. I have created Max patches in the past for

[18] Yoder, "Performance Practice of Interactive Music for Clarinet and Computer with an Examination of Five Works by American Composers," 23

> some of my own pieces. Creating your own work gives you an even better understanding of the software that can't be learned by just playing the bassoon part. In addition to Max/MSP, I've used QLab often in the past.[19]

Even if a performer is only able to test the patch adequately as the directions from the composer state, the performer is better off than if he/she had no experience with patches. Many composers also use PureData (Pd), which is the open source version of Max/MSP. If performers do not know the Max/MSP language very well, they will find Pd even more difficult to maneuver. The language is very much like Max, as both programs share the same developer, Miller Puckette, but many of the terms are changed to protect Cycling '74's copyrighted material.

Other software formats composers use are CSound, or SoundCollider, text-based formats that are developed by the Massachusetts Institute of Technology. "Native Instrument's Kontakt and MOTU's MachFive are examples of the first category [synthesizers modeled on MIDI gear]….These programs…could be described as software imitations of hardware samplers."[20] Concerned with the longevity of their piece, a composer will take special care to make sure that their patch is performer-friendly. Usually with a few clicks of a mouse, one can start up a well-built patch. Because Max/MSP is so able to do so many things, and each patch is individualized, every patch will look different from another, especially from composer to composer. Wendy Grew also interviewed composers about their expectations from musicians: "most of the

[19] Dana Jessen, Interviewed by Jolene Masone. Written interview, November 13, 2015

[20] "Cycling '74," Accessed October 19, 2015, https://cycling74.com/support/faq_max4/#1.

time, composers take special measures when programming to ensure that the visual impact for the oboist is user-friendly when the program is opened. Composers are aware that if the program is not user-friendly, an oboist will not proceed further."[21] The programs can be challenging at times, but with the help of a technician or a friendly composer, much confusion and consternation can be avoided.

The solution to many of the problems with technology is simply practicing with the technology. "I encourage musicians to practice setting up all of the technology as they practice so that they don't run into issues during performance."[22] Practicing with the systems in front of you is very important. Being able to see the system performing its job is like rehearsing with another person in a chamber music setting. If you can see the system working, you can know better when it is not working, and are able to trouble-shoot issues with the composer or technician before the performance. Nathan Davis said this about performers:

> Some performers don't realize how much they must practice with the electronics and get to know them – or think that they can just learn their part and means they have learned the piece. A piece with live electronics should be chamber music. This never comes up with those who commission my pieces, but it sometimes does as the pieces go out into the world.[23]

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[21] Wendy Grew, "A Guide To Electro-Acoustic Performance for the Acoustic" Oboist" (DMA diss., University of Memphis, 2014), 42
[22] Jessen Interview
[23] Nathan Davis, Interviewed by Jolene Masone. Written interview, October 10, 2015

3.3 Collaboration

When asked what kind of misconceptions most bassoonists have about this music, Ben Shirey stated: “Probably the misconception that electronics are glitchy… In truth, it’s not the electronics; it’s the composers, which I hate to admit. We are not (for the most part) electrical engineers or software engineers. Our specialty is music, not electronics. We are explorers in a new medium; which means that sometimes we are going to get it wrong a few times before we get it right.”[24]

As with an acoustic composition, the composer is putting in immense time and effort, however, in an electronic work, the stakes are even higher. The occasional wrong note, or a non-idiomatic passage can easily be changed or passed off as artistic license, whereas a faulty patch can take hours to fix, and can cast the composer in a poor light. Blaming only the composer is not recommended. In one instance, I asked the composer to email me the file of the composition’s patch. When I opened it on my computer, the patch did not run at all, and was missing components. When we opened up the composer’s patch on another computer, it was still missing components of the patch, but not the same components I was missing! This can be frustrating, but can be resolved. Like an instrument breaking, or a reed splitting, we cannot always anticipate when either our instrument or our reed ceases to operate properly

The composer also needs to understand what the instrument and the

[24] Benjamin Shirey. Interviewed by Jolene Masone. Written interview, October 25, 2015

performer can do. Performers should be able to explore and explain many of the effects and sounds the bassoon can make. Davis said this about the bassoon, after borrowing a bassoon from a student, “the bassoon cleans up well to play in the orchestra, but its natural tendencies are much less polite and much more interesting.”[25] From thumping on the opening of the bocal with the tongue, or blowing into the open keys, bassoonists have a range of effects that are available to the instrument. Whether the performer and the composer want to explore any range of effects is up to them as a team, but a performer should be able to at least explain ranges of the instrument, and musical desires. Rebekah Heller stated in her interview:

> My biggest priority is erasing the fear and trepidation around the bassoon, because a composer isn’t going to write for it. That’s totally fine. It’s not a thing you are born knowing. I sort of want to erase that fear, and keep a really, really open line of communication so that they can come to me and say “Hey, create this multiphonic,” or, “is this tremolo possible?” or “What does this weird air sound, sound like?” And they know that I will send them a sound file, an email, or a text within 10 hours, at any given time. To me, that is the ideal relationship, so they will write something that makes sense to me, and is as much about our shared visions as it is about the composer’s alone. [26]

Katherine Young also said:

> More often I am on the composer side of this dynamic these days, so I will answer from that perspective. An ideal composer/performer collaboration is mutually open, flexible, and committed. It is also important for me to

[25] Davis, Interview
[26] Rebekah Heller, interviewed by Jolene Masone. Phone interview, February 15, 2016

> have time together to develop materials that work well for both, and mean something to both the composer and the performer.[27]

Keeping the lines of communication open for collaboration is incredibly important for both the performer and composer. Much of a new work hinges on removing any preconceived notions about the bassoon's capabilities, and inventing a new creative space for the composer.

3.4 Amplification

Amplification of the bassoon will always be challenging due to its length and uneven resonances. Our choices are to use external microphones, or an internal "pickup" microphone. The Little Jake, which is a condenser microphone, mounted in a hole in the bocal. This microphone is simple and easy to use, but has to be connected through a pre-amp. The disadvantage of this pickup is that is that it requires a hole drilled into a bocal, which can seem extreme or intimidating. The bassoon can also sound unnatural, and synthesized, which is not always desirable, but is an aesthetic option we have.

> […]The pickup is designed specifically to interface with guitar equipment. If you're in a theater situation you'll at least need a direct box of some kind, don't plug directly into the mixer. Have the sound engineer interface with you in the same way he would interface with an acoustic/electric guitar. Ideally you should plug into an acoustic guitar amp or keyboard amp, and take the direct out of the amp into the house sound system. That's how I get the best results.[28]

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[27] Katherine Young, interviewed by Jolene Masone. Written interview, March 1, 2016.

[28] "Trent Jacobs," Accessed November 28, 2015, http://tjbassoon.com/little-jake/.

In Ben Shirey's *Sand Daemon,* we decided together that the slightly harsher sound created by the bocal pickup was actually more in keeping with the aesthetic of the piece. Certain special effects, not necessarily amplified by external microphones, may be created using the bocal pickup. However, these sounds may not be what the performer intends to be audible. While one bassoonist may want the audience to hear condensation in the bocal as a distortion effect, another bassoonist may not want that sound to be audible, or the removal of the condensation (however distasteful that may be). McNutt states "Performers spend their lives cultivating a gorgeous projecting tone, and are understandably dismayed when the microphone indiscriminately projects 'private' and normally inaudible sounds such as breathing, rushing air, bow noise, throat sounds and finger noises."[29] The bocal pick-up can project many of these sounds, including singing into the bocal.

While sounding more natural, multiple external microphones can create feedback, and hinder movement when performing. Some bassoonists prefer to use two microphones, one at the bell and one above the right hand. This arrangement amplifies many of the tones and resonances more evenly than with just one microphone. Bassoonists Jeffrey Lyman and Martin Kuuskmann use lapel microphones, otherwise known as lavaliers.[30] Lapel microphones include a transmitter that is attached to the performer. This device comes with a long cord that is attached to the audio interface. The microphone allows freedom of

[29] McNutt, "Performing Electroacoustic Music," 298
[30] Bradley Behr, "The Electroacoustic Bassoon: An Exploration of a Modern Use for the Traditional Instrument" (DMA diss., Florida State University, 2014),16.

movement while performing, with a more natural sound. However, this setup does not always pick up air sounds coming through the instrument, or instrumental key clicks called for in the score. Personally, I find compromise in this area to be the best recourse. Using a lapel microphone along with the Little Jake gives the performer more options and effects to utilize. Brad Behr has a different opinion about combined amplification:

> 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 the need for up to three separate cables to be attached to the bassoon may make this option unrealistic for most performers. [31]

I personally disagree with this assessment. While using three different microphones would indeed result in three cables going into the audio interface (and three cables weighing down the performer), two stand microphones or two lavalier microphones would hardly be that much different, and would require the same amount of processing as one Little Jake microphone and one lavalier microphone, or any combination thereof. It is only a matter of how many inputs exist on the audio interface.

The bassoonist then has to decide whether to sit or stand while performing. The additional presence of pedals and microphones will influence your decision. If you are shorter, like me, running a footswitch pedal with a heel-toe motion can be difficult while sitting down. My ankle simply is not long enough to make the movement easily. Meanwhile, managing 4 pedals in a square while standing up is challenging. The bassoonists must practice this skill, much like

[31] Behr, “The Electroacoustic Bassoon,” 20.

practicing a difficult passage in a concerto. In Davis's work, *On speaking a hundred names,* the bassoonist is not only required to operate two pedals, but to move to a vocal microphone and use a cell phone. This makes sitting a nuisance, if not impossible.

4 WORKS FOR BASSOON AND INTERACTIVE ELECTRONICS

There are many more works written for bassoon and fixed media, otherwise known as tape/CD/playback (Mp3) or sound file. There are also works for bassoon that fit in the electronic genre, including pieces involving electronic hardware, such as amplification, whammy pedals, or distortion stomp boxes. While all are considered to be under the large umbrella of electronic music, most of this music consists of simple manipulation or accompaniment, whereas in interactive electronics, the computer must interact with the musician and the sound created by the live acoustical input.

4.1 *Ripped Up Maps*, Andrew May 1998 (revised 2011)

Ripped-Up Maps comes with an extensive set of instructions. The work is a text-based piece for solo instrument and computer where the computer effectively becomes a partner in your improvising duo. The performer can record up to twenty tracks, each seven seconds long, that the computer will then take and reprocess. This gives the performer some autonomy over what the computer samples. The performer must give the computer enough samples for the manipulation to make effects. May describes how the four “states” of his piece progress: “The computer transitions between four “states” of behavior, in each of which it behaves quite differently. You guide it from state to state by the way you

play."[32] Each state is signaled by the timing of sounds and the grouping of pitches the performer choses to make. The performer also has ultimate control over whether the computer permanently stays in one specific state, moves on to the next state, or ends the piece. These decisions represent a certain amount of autonomy on the part of the performer. The performer for all intents and purposes becomes a co-composer, making decisions about what the computer can use to contribute to the piece. May also adds: "Remember that you can influence the computer, but beyond using the pedal to lock, jump, or stop the patch, you cannot control it. Some trial and error in rehearsal will show you how the computer responds to you, and what kinds of musical ideas, shapes, and samples work best in this piece."[33]

May gives specific instructions for set up on acoustic instruments vs. electronic instruments. If a bassoonist choses to use directional microphones, the performer can use one or two, but that must be a decision made with the help of the technician. Then the performer and technology specialist would have to decide on a set-up that also coincides with the directions of the composer. If a bassoonist decides to use a bassoon pickup, this results in turning the bassoon into an electronic instrument with acoustic input. The audio settings, according to May, are different when using an acoustic instrument, like a bassoon with a microphone. These settings may not be satisfactory to the performer. May also prepares for this contingency saying, "If an acoustic instrument is used, leave the "FEEDBACK" fader all the way down. If an electric instrument is used, consider

[32] Andrew May. *Ripped-Up Maps,* 1992, Rev. 2007
[33] May, *Ripped-Up Maps*

raising it; it will send the computer's output back in to the tracking engine to simulate the somewhat unpredictable results of the computer 'hearing' and responding to itself."[34] May also puts "wet" and "dry" settings in the patch to make sure that the performer and technician can determine how the instrument will sound when fed through the computer.

Improvisation is key to the performance of this piece. Without a thorough understanding of one's instrument and the bassoon's timbral options (bisbigliando, multiphonics, microtones, etc.), this piece could be intimidating for a novice. However, one could also consider these options liberating. All the bassoonists I interviewed recommended practicing and participating in improvisation in general.

With only the electronics to enhance playing, a performer could explore their instrument in a prescribed setting. May has the performer sample up to 20 different short tracks to feed to the computer. The computer then takes those samples, feeds them through the patch, and sends them back to the performer in a manipulated form. The performer not only has a certain level of autonomy with the decision of where the computer decides to stay, but what the computer has to work with. The computer can still make "decisions" on it's own, but will use pieces of tracks made by the instrumentalist. Rachel Yoder gives a succinct explanation on interactive improvisation. "Interactive music offers a new 'meta-level' for composition, in which the composer can create an environment or

[34] May, *Ripped-Up Maps*

structure for the computer and the human improviser. This method leaves the performer with a great deal of freedom, but also responsibility for the end result."

Obviously, the ultimate result of this piece is the appearance of complete improvisation by the performer. However, bassoonists can chose to make decisions beforehand that will influence the computer and the overall structure of the work. For example, I discovered that the computer did not respond well to my loud passages, and would not snap into the "fourth state," unless I played very loudly. This was both a result of my microphone options at the time, as well as the patch. Instead of trying to play extremely loud for a large portion of the work, I left the "fourth state" for the apex of the piece, knowing that if I did specific things into the microphones, the computer would activate that state. I built some of the 20 short tracks around that apex, creating a semi-gestalt for myself while working within the parameters of the composition. Making those choices, while still leaving room for in-the-moment improvisation creates a more cohesive work for the listener, yet is the result of free improvisation. In this way, a performer becomes a part of the composition process.

Using Rowe's definition of interactivity[35], it would be fair to say that May's piece is entirely interactive; while listening to the performer the computer is still acting of its highly structured accord. In terms of Rowe's classifications, May's

[35] "…those [systems] whose behavior changes in response to musical input. Such responsiveness allows these systems to participate in live performances, of both notated and improvised music" Rowe, *Interactive Music Systems*

piece would be considered a performance-driven, generative, player-based program.

4.2 *Obsessed Again…*, Keith Hamel 1992, revised 2014

Because of the work's history, the piece is significant to any performer seeking these works. In 1992, the technology we now have did not exist; thus some of the electroacoustic music written before 2000 is no longer playable because the technology required is no longer available. Some works are lost completely as composers die before being able to essentially re-compose a piece with the new technologies. As a result, various projects have been founded to preserve and revise these works in order to make them viable for performance again. *Obsessed Again…* is one of these works.

> The interactive elements in the work were realized by using the Max music software environment along with a commercial Proteus 1 synthesizer and an IVL pitch-to-MIDI converter. Because of obsolescence, the work has not been performed for several years. The computer files required to perform *Obsessed Again...* are incompatible with current operating systems and the hardware previously used is aging. As a result, the composer is currently composing a second version of this work so it can once again be performed.[36]

Obsessed Again… is the only piece covered in this paper with score following (also known as pitch tracking or score orientation) and one of the only works for bassoon with pitch tracking. Because of the acoustics of the bassoon, pitch following is much more difficult. Resonances occur over various parts of the instrument, and because the bassoon is too long to amplify with just one

[36] Melissa Adams and Tracey Krause, "Case Study 13: Obsessed Again..." International Research on Permanent Authentic Records in Electronic Systems, January, 2006, rev. August 2006. 1, Accessed January 29, 2016, http://www.interpares.org/display_file.cfm?doc=ip2_cs13_diplomatic_analysis.pdf

microphone, score following software can drop the pitch or become confused, and may become stuck or stop working altogether. Wendy Grew also describes this phenomenon with the oboe:

> Programs involving score reading or score orientation which are listening for specific notes to be played by the oboist in order, the trigger [for] the computer's response can be faulty. Things such as coughing, trills, instrumental harmonic overtones, wrong notes, and loud noises are among the things that could cause the computer to either trigger early or not at all. McNutt equates this to an accompanist who stops playing because the oboist hit a wrong note.[37] This could possibly be more prevalent with pieces involving double reeds than other instruments, due to the changes in tone, timbre, and articulation, which occur between different reeds.[38]

The work also comes with an extensive technical rider that may make a novice performer think twice before attempting it, though the patch itself is quite user-friendly. The piece requires two applications running concurrently (preferably on the same computer), to make the effects work along with the pitch tracking. Keith Hamel explains in the instructions to the score, "In the revised version it uses Max/MSP for all pitch tracking and sound generation and NoteAbility Pro (my music notation program) to control sections, turning on effects and the live video processing."[39]

The work contains some free multiphonics, where the fundamental is given, but no fingering instructions or suggestions. The composer is assuming

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[37] Grew, "A Guide To Electro-Acoustic Performance for the Acoustic" Oboist," citing Elizabeth McNutt, pg. 43

[38] Grew, "A Guide To Electro-Acoustic Performance for the Acoustic" Oboist,"43

[39] Keith Hamel, interviewed by Jolene Masone. Written Interview, October 11, 2015

that the performer will have some knowledge of how multiphonics work, or have a resource on hand (Figure 2 and 3).

The first multiphonic fundamental given is a C#2. Leslie Ross[40] has various suggestions on fingerings based on the C#2, which, considering the way in which the performer is expected to slide from the C#2 into a multiphonic, is probably what the composer desires. The performer could even decide to simply bite the reed, and produce a multiphonic. Though that is not suggested in this case, as shifting from a biting embouchure into a normal embouchure to play the sextuplet directly after the multiphonic is difficult, and a slight change of fingering might be a more prudent choice. The composer also uses the instruction "alternate fingering" on top of many of the notated stems without note-heads. This is a timbral effect where the performer uses different fingerings to produce the same pitch with different timbres.

[40] "Leslie Ross," Accessed November 16, 2015, http://leslieross.net/multiphonics.html

Figure 2: Multiphonic notated, *Obsessed Again,* Keith Hemel, Cue 1, Page 1

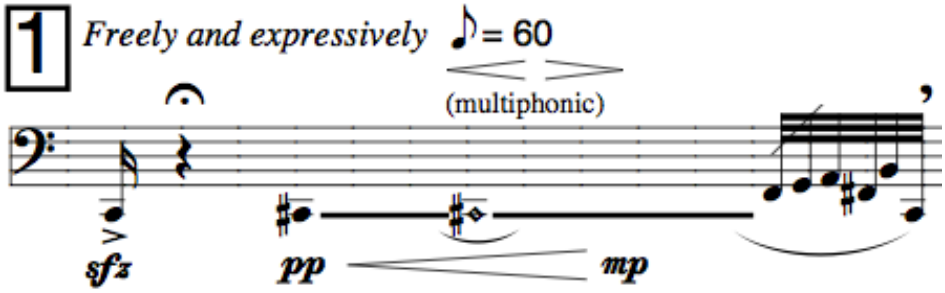


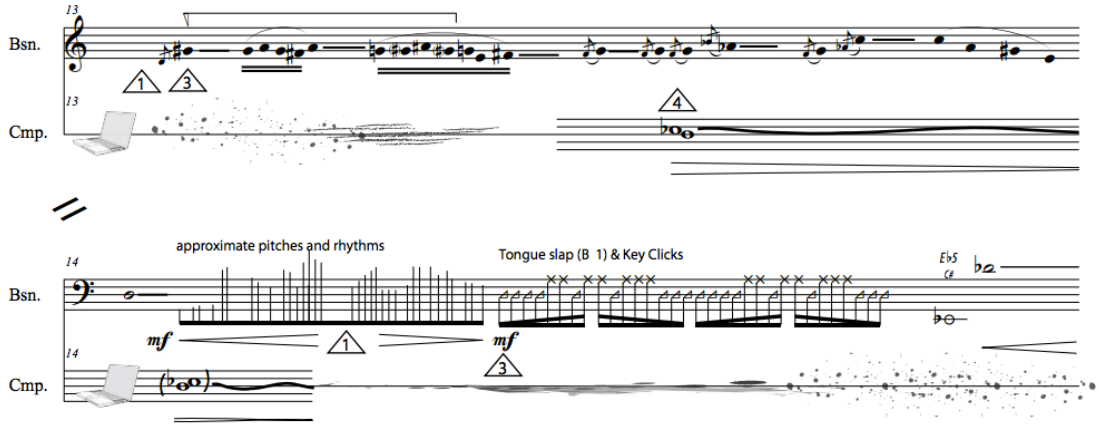
Figure 3: Suggested Multiphonic fingerings for figure 2

This piece is certainly difficult. The quick note-to-note dynamic changes, along with flutter tongue, timbral alternate fingerings, immediate changes in tempo, and live audio input can make this piece challenging in many aspects. The effects are a beautiful addition to the bassoon sound though, and the difficulty of the piece does not out-weigh the significance of the piece, or the chamber music aspect. The piece fits into its classification as a score driven, sequencing, instrument based composition, which is perhaps less interactive than May's work.

4.3 *Sand Daemon*, Benjamin Shirey, 2014

I premiered *Sand Daemon* in 2014, after working with the composer for several months on another project. Shirey and I spent several hours in the lab recording and sampling sounds from the bassoon and my voice for the effects for this work. This type of close work is important for an effective collaboration. Shirey and I had a strong working relationship, and he already knew quite a few of the things I knew how to do, as well as my aesthetic interests. *Sand Daemon* is difficult, but the use of technology for the performer is well explained, and the extended techniques are spelled out simply. The piece also contains some aleatoric elements, and portions of the music are proportional notation. As you will see in Figure 4, Shirey's piece also shows what is expected from the computer in graphic notation.

Figure 4: *Sand Daemon,* Benjamin Shirey, Staves 13-14, Page 5



Almost all elements in Shirey's piece are represented here. Reading from left to right by system: Proportional notation, pedal cues (large triangles with numbers), improvisational movement in stave 14, along with tongue slaps and key clicks (notated with triangles and X's respectively), and at the end of staff 14, a multiphonic represented with the Leslie Ross notation system.

This piece uses a 4-channel midi pedal (indicated by numbers inside triangles), with each pedal controlling a different cue to the computer. The cues in different combinations create different effects. This type of pedal can create problems for the performer. For example, it was sometimes difficult to stand while playing, as I often had to hit multiple pedal buttons in succession, balancing on one foot for a whole measure while reading music and balancing a bassoon on the other hip. The pedals were in a foursquare pattern, and the pedal was particular to the piece (as provided by the composer). Working towards a different set of pedals may also be a solution, such as pedals in a straight line, or a set of pedals closer to the ground. Learning to play at the same time as pushing the button is also important. Some of the effects from the patch record the playing of the performer. If a performer leaves a lag between pushing the pedal and playing, the computer will record that moment of silence, creating an awkward rest in the music.

During the collaborative process, the composer also fine-tuned the work, which meant that the effects fluctuated slightly over the weeks it took to practice it. Shirey made new places for the pedals to be cued, and created fresh effects for the computer; not only did I have to make sure my memory of the pedals was well rehearsed, but I also had to make changes to the way I heard and understood the effects. At times, the performer may have to make quick decisions about where to place their feet and bodies, to make changes to the music. Making alterations to a work is always expected in collaboration, regardless of the chosen medium.

This work also asks for a bassoon pickup like the Little Jake. A microphone could be used, but could create feedback issues with the delay effects, depending on what kind of hall you are in. As I said in Chapter 2, Shirey and I made the decision together that the Little Jake fit the aesthetics of the piece better, as an "electronic" sound was more desirable for the piece. Though Shirey's work may seem less interactive than others in this survey, a case may be made for the interaction that happens beforehand, in the studio. Xenia Pestova states,

> In addition to live transformations, composers also have the option to include offline transformations, or electronic transformations made in the studio. The performer is then able to synchronize, communicate and interact with the computer by triggering with an external hardware device such as a MIDI pedal[…][41]

Shirey's piece is a performance-based system, with transformative elements. Because of the foot pedal, the system is a player-based program, where the system seems to have a mind of its own. The system is mostly unaffected by my playing, but is reacting to the cues from the pedal.

4.4 *On speaking a hundred names*, Nathan Davis 2010

Davis's work is difficult, but incredibly rich in bassoon sound and nuance. The composer specifies that the bassoon be amplified with two microphones, which are mixed and sent to the computer. One microphone is placed over the right hand fingers, and the other over the bell. The work also includes the use of an optional vocal microphone, which will be discussed later. The composer has

[41] Pestova, "Models of Interaction in Works for Piano and Live Electronics", 3

eleven different phases (cues) of processing running in Max/MSP. Each can be triggered by the performer pushing a foot pedal or optionally operated by a technician following a score. Having a technician run the cues can be helpful to someone playing the piece for the first time. Very much like playing with an accompanist, one expects that the technician is able to follow along. If the performer is traveling with the piece and does not know the technician in the booth, or is performing in a venue not traditionally used for classical performance, it would be hard to presume that the sound technician is able to read music. This real possibility could hinder the entire performance. Therefore, using the foot pedal certainly adds a sense of autonomy to the performance.

The patch contains eleven cues, one for each rehearsal letter in the piece. The volume pedal (or expression pedal) is where things can become tricky for a performer without the aid of a technician.

> The volume pedal can be either analog or midi by selecting one or the other in the application. For midi, no additional audio i/o [input/output] is needed. For analog, it is necessary to connect output 6 from the interface to the pedal input and the pedal output to the interface input 6 in order to convert the pedal to midi information.[42]

This refers to the patch that the composer is using in the software. If the performer is not using a technician, this could be confusing for some performers if they are not familiar with the program. It is simply a few clicks of a mouse, but for someone not familiar with Max/MSP, this could be intimidating. The volume pedal opens a new level of processing in the patch, but is only employed in certain places throughout the score (usually low notes), which are clearly

[42] Nathan Davis, *On speaking a hundred names.* New York, 2010

marked. The durations of pitches for the volume pedal are relatively short, and could make playing in time difficult, as the performer has to push the expression pedal all the way forward (toe down) to turn on, and all the way back (heel down) to turn off the patch,

The performer can make a choice whether to be processed live, or to play with the fixed recorded files of Rebekah Heller, the bassoonist for which the piece was written. Playing with the fixed recorded files does not eliminate the need for a pedal to cue sound files, but does eliminate the volume pedal. The cue pedal can be any form of cue pedal or keyboard sustain pedal; this pedal signals the computer to cue each track in the fixed media sound files.

Essentially, when playing with the pre-recorded sound files provided, the piece becomes a fixed media work, wherein Ms. Heller is your accompanist/partner. The performer must even credit Heller's playing in the program as if she were a live duet partner. This means that the bassoonist must blend his/her sound with the recorded sounds of Heller. Unlike a live duet partner, the recorded sound has no regards for blending with the live performer. This means that aesthetic choices made by Heller are artistic choices that the performer must take into consideration. However, when the bassoonist is performing with live electronics, one can make those aesthetic decisions for oneself.

The easiest electronic element to use in any of the pieces could be the most difficult to execute. The piece requires the use of a mobile phone for the last cue of the piece, where the performer records him/herself on the phone's

recording mechanism. The bassoonist then plays the recording back into the vocal microphone (mentioned earlier), while the performer moves their mouth into different vowel shapes around the speaker from the phone. Loud, open earbuds would be best, so that the performer can place the speaker directly into the front of the mouth cavity. The bassoonist also has to get quite close to the vocal microphone for the effect to function properly.

I practiced through the end of the piece several times, trying to find a place to record myself with a cellular phone. Because there was not a place in the music to reach over, and push the record button, I emailed the composer about this in November of 2015, and he replied:

> In the original routing of the piece, a loop is automatically recorded at the start of letter I (as part of cue 10), then played back through a channel routed to an earbud on stage on cue 11…. As I have written and developed this piece (and my other electroacoustic pieces), I have learned to find multiple solutions and have become somewhat more practical!"[43]

In his newest edition of the work, the mobile phone is no longer needed, as the effect has been written into the patch. An additional advantage to playing these works is that that the composer is often alive and able to answer questions, providing a resource for the performer to seek better ways of playing their works.

Davis gives no instruction for the fingerings desired in the score besides what looks like a chord progression symbol beneath the music. This refers to the Leslie Ross multiphonic fingering system.[44] If a performer were not familiar with this fingering system, they would be lost. Davis does give a directive for the

[43] Nathan Davis, email correspondence, November 5, 2015
[44] "Leslie Ross," http://leslieross.net/multiphonics.html

numbers above the music. These are for timbral fingerings. Timbral fingerings, if left up to the performer, can be picked out by trial and error. They are simply fingerings that change the sound of the pitch, without changing the actual pitch. Figure 4 shows that the composer wants three slightly altered versions of G#4. In Figure 5, I begin the pitches with the actual fingering for G#4.

Davis's piece is a performer-driven work that utilizes transformative and generative properties. The work is an instrument-based work, and even the event at the end of the piece (with the amplified earbud) is an extension of the instrument and as a result, the performer

Figure 5: *On speaking a hundred names, Nathan Davis, page 1, stave 3*

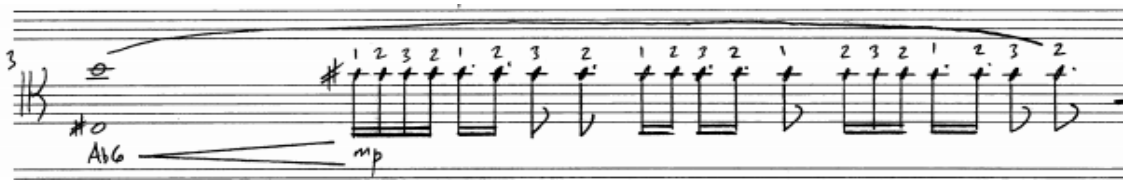
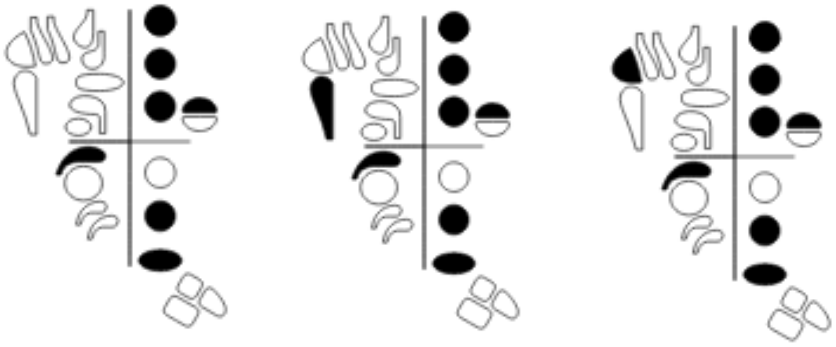


Figure 6: The "Ab6" below the multiphonic refers to the Leslie Ross fingering system, which is the fingering below

Figure 7: Fingering options for alternate fingerings



Fingering for “1” “2” “3”

5 CONCLUSION

Works for bassoon and interactive electroacoustic music provide an opportunity for bassoonists to collaborate with new and interesting composers to create music and sounds that are completely new to the repertoire, to the bassoon, and to an audience. This music is a relatively new addition to the large body of Western music. Technology continues to evolve, and composers are coming up with new ways to use and expand the way in which we use that technology. Composers are hopeful that performers will push the technology into new realms of interactivity and art. When asked what he sees for the future of this genre, Nathan Davis wrote,

> I hope that it goes in a direction that makes the technology invisible to the performance, insofar as the performer may be free to simply play music and interact with the sound they hear without having to overcome the significant learning curve of learning software, etc. Many composers and performers are working toward this point, both from their own directions.[45]

Benjamin Shirey wrote, "I believe that interactive music will continue to grow and flourish as long as composers and performers can continue to build good collaborative and continuing relationships."[46]

Interactive electronic music may be considered chamber music on many levels. From the collaboration between composer and performer in the sound lab, to performer and computer in the concert hall, interactive music is all about relationships. Indeed, all music is about relationships. Composers and

[45] Davis, Interview.
[46] Shirey, Interview.

performers are looking forward to the future of interactive music and all the curiosity and creativity the human element can bring to it.

APPENDIX A

TERMS AND DEFINITION

- Audio Interface: A piece of hardware that expands and improves the sonic capabilities of a computer. Some audio interfaces give you the ability to connect professional microphones, instruments and other kinds of signals to a computer, and output a variety of signals as well.

- Bisbigliando: a tremolo produced by alternating timbral fingerings of the same pitch in rapid succession.

- Delay: An effect that records a piece or all of the audio, and holds it for a specific moment in time for playback.

- Direct Box: Often referred to as “DI” boxes. This stands for “Direct Injection” as their main purpose is to convert unbalanced and/or high impedance instrument signals into a format suitable for direct connection to a mixing console's mic input - without the use of a microphone.

- Iteration: An effect that creates a repeating of the audio sampled, sometimes referred to as an echo.

- Lapel/Lavalier Microphone: A condenser microphone that is small enough to attach to the performer or speaker’s clothing.

- Little Jake Mic: Invented by bassoonist Trent Jacobs. A condenser microphone that only works when placed very close to the sound source, making it necessary to drill a mount into the bocal of a bassoon.

- Max/MSP: A graphical data flow programming language by cycling74.com and based on software originally written by Miller S. Puckette. This program was developed into its commercial version in 1990 at IRCAM, and it has become a widely used code-writing platform for composers and visual artists. Max/MSP is more user-friendly than text based programming languages like Java

- Mixer: An electronic device that takes multiple signals (camera, microphones, etc) and combines and directs those signals out to other specific devices (individual speakers, projectors, etc.).

- Multiphonic: An extended technique wherein a monophonic instrument produces multiple sounds, or chords, at the same time.

- Patch: Max programs, made by arranging and connecting objects within a patcher, or visual canvas.

- Pedals: Various trigger inducing hardware that cue the computer to perform various tasks.

- Pre-amp: A preamplifier prepares a low frequency signal for further amplification, and cleans up the distortion.

- Ring Modulator: A type of effect that takes a frequency signal, and a frequency inside that signal, and combines the signals to create both the sum and difference of those signals, playing at the same time. This is called a ring, for the shape the diodes created when the signal was in analog.

- SuperCollider: SuperCollider is a programming language for real time audio synthesis and algorithmic composition. (defined by http://supercollider.github.io/)

APPENDIX B

LIST OF PIECES FOR BASSOON/CONTRABASSOON AND ELECTRONICS

Composer	Title	Year	Live	Fixed	Equipment needed	Publisher
Diemente, Edward	For Lady Day	1972		X	Tape	Seesaw Music
Schwartz, Elliot	Aria	1972		X	Tape	
Fongaard, Bjorn	Concerto for bassoon and tape, op. 131	1976		X		
Maros, Miklos	Manipulation I	1976	X			Deutscher Verlag fur Musik Leipzig
Mellnäs, Arne	Soliloquium IV	1976	X			Deutscher Verlag fur Musik Leipzig
Allgood, William	Pentacycle	1979		X	4-channel Tape	Dulcian Music
Dittrich, Paul-Heinz	the-m	1982/ 1983	X		Ring Modulator/ Sequencer/ Delay	VEB Deutscher Verlag fur Musik, Leipzig, 1986
Sharman, Rodney	Towards White	1982	X		Delay	Composer
Heininen, Paavo	Gymel, op. 39	1984		X	Tape	
Korte, Karl	Demiola	1984		X	Tape/CD	Seesaw Music
Boulez, Pierre	Dialogue de l'ombre double	1985/ 1996	X			Composer
Franzen, Olav	From the Junction Point	1985		X		
Burns, Michael	Swamp Song	1986		X	Tape/CD	Potenza Music
Miller, Elma	Syneidesis IV	1987		X		
Patachich, Ivan	Fagotto Digitale	1988	X			
Chamberlain, Donald	Beck and Call	1990		X		Jomar Press
Sonstevold, Knut	Chewing Bassoon Burger	1990	X			Composer
Hamel, Keith	Obsessed Again…	1992	X		Max, Other	Canadian Music Centre
Leach, Mary Jane	Feu de Joie	1992		X	Tape	Composer

Azguime, Miguel	Du Néant Qui Le Croit	1994	X		Max/MSP	CIIMP
Stockhausen, Karlheinz	Fagott	1996	X		Projector	Stockhausen Verlag
Campana, José-Luis	D'un geste apprivoisé	1997		X		Composer
Fritts, Lawrence	Pre-Images	2000		X	Tape	Composer
Felice, Frank	...and so the hole was dug	2001		X	mp3	www.frank-felice.com
Sigal, Rodrigo	Twilight	2001		X		
Bedrossian, Franck	Transmission	2002	X			Billaudot
Dempster, Thomas	Glass Ghosts	2002		X	Mp3	Composer
Neuwirth, Olga	Torsion	2003		X		Boosey & Hawkes
Cannon, Joanne	Speak	2004	X		Max	www.bentleather.com
Meredith, Ann	Axeman	2004		X	Amplification	June Emmerson
Shapiro, Alex	Deep	2004		X	mp3	www.alexshapiro.org
Davis, D. Edward	Reflexion	2005		X	CD/Portable CD player	composer
Hudry, David	Impromptu pour un monodrame	2007	X			United Music Publishers
Miljkovic, Katarina	Drop	2007	X		Max/MSP	
Rivas, Roque	Conical Intersect	2007		X		Composer
Spangler, Erik	A firefly in the belly	2007				Composer
Lane, Peter Van Zandt	Manteia	2008-2014	X	X	Max	www.petervanzandtlane.com
Correia, Hugo	Solo Soundscapes 1	~2009	X		Linux, Pure Data	Composer
Lavista, Mario	Plegarias	2009		X	mp3	Composer
Keller, Stefan	Stuck	2009	X			Composer

da Ponte, Angela	Reflex II	2009	X	X	Max/MSP	Scherzo Editions
Sharma, Gerriet K.	cornerghostaxis #1	2009	X		MELE, tracking target	Composer
Zapponi, Filippo	Hypérion-Éos	2009	X		Max/MSP, Iana and CataRT	Composer
Carl, Robert	Brown Velvet	2010	X			Composer
Davis, Nathan	On speaking a hundred names	2010	X		Max	Composer
Hovatter, Kyle	Mist	2011		X	Mp3	Imagine Music
Hutchinson, Simon	Doppelganger	2011		X	Mp3	Composer
Hartman, Hannah	Central Heating	2014	X		Max, objects	Composer
Hovatter, Kyle	En Los Bosques	2012		X	Mp3	Imagine Music
Kahn, Frederic	Unendlichkeit	2012	X	X	Max	Unpublished
Steiger, Rand	Concatenation	2012	X		Max	Composer
Kirchoff, Keith	Crook'd	2013	X		Max	Composer
Pritsker, Gene	Electrically Tragic	2013	X		Max	Composer
Dempster, Thomas	ahalugisdi unole (to quiet the wind)	2014		X	Click Track, Mp3	Composer
Pluta, Sam	Points Against Fields	2014		X	Mp3	Composer
Shirey, Benjamin	Sand Daemon	2014	X		Max	Composer
Forston, K.L.	Crack the Needle	2015		X	Mp3	Composer
Matthusen, Paula	of an implacable subtraction	2015		X	Mp3	Composer
Oliviera, Joao Pedro	Heavy Metals	2015		X	6 speakers	Composer
Bruckmann, Kyle	Cadenza & Degradations	2016	X		Max	Composer
Cost, Deborah	I and the electrician	?		X	2 channel amp	
Sumarokov, Victor	Partita, op. 7	?		X	Tape	

APPENDIX C

INTERVIEWS WITH PERFORMERS

Dear Performer,

Thank you for participating in this questionnaire about interactive electronic music for bassoon. Your responses will create a resource of information that will help both composers and performers of this music, and hopefully create more numerous and balanced works for the bassoon and electronics.

I will take your responses and form conclusions on how electronic music for bassoon should be collaborated, practiced, and performed. To define interactive music, "Interactive computer music systems are those whose behaviour changes in response to musical input. Such responsiveness allows these systems to participate in live performances, of both notated and improvised music"[47]

We will be discussing all electronic music written for the bassoon, but with a special emphasis on music written for the interactive genre. Where it is appropriate, please reference specific pieces, composers, or interactive systems. If a particular question does not apply to you, or if you do not wish to answer, feel free to respond with "not applicable". Please allow about 1 hour to complete the questions. Your time is immensely appreciated, and I hope that this research project will bring new performers and composers to the genre.

[47] Rowe, R. 1993 *Interactive Music Systems: Machine Listening and Composing*. Cambridge, MA: The MIT Press

Dana Jessen

General:

1. How did you first become involved with interactive electroacoustic music?

   I first became involved in electroacoustic music as a bassoon student in college. I was really interested in contemporary music and as I explored the repertoire, and began collaborating with composers, it was a natural entryway to electronic music. I also attended a handful of electroacoustic concerts featuring other instruments that peaked my interest in electroacoustic composers and artists.

2. How has interactive music influenced your professional life?

   Most of the pieces that I commission for bassoon include electronics, whether they are fixed or interactive. I'm currently touring a full program of bassoon + electronics pieces by composers Sam Pluta, Paula Matthusen, Peter V. Swendsen and Kyle Bruckmann. I recently recorded an album of this music that will be released later this spring. I also played for many years in a duo for bassoon, saxophone, and electronics, often times with video. The duo performed throughout the U.S. and Europe, collaborating with electroacoustic composers. Much of my professional identity as a bassoonist involves electroacoustic music.

3. What do you think are the greatest challenges for bassoonists who are interested in performing interactive electroacoustic works?

   For bassoonists just starting to play with electronics, it's really about learning the (electronic) instrument. Each interface and electronic processing is like a new instrument that you have to learn how to play with. I think this is often overlooked. I encourage bassoonists to have a proactive approach- have a full understanding of what the electronics are doing, how they sound, how they react or influence what you are playing. Once instrumentalists truly know the electronic component, the music and performance really becomes more compelling and engaging. Bassoonists also have to consider the gear that is required for electroacoustic performances. If they plan to run electronics themselves, having a strong understanding of the gear and software is essential.

4. What are the differences in performing music for bassoon and tape vs. bassoon and interactive technology? Is there a major difference between performing and practicing electroacoustic music vs. acoustic music?

   Bassoon and tape pieces can be more forgiving than bassoon and interactive technology. For that reason, knowing the system and processing is really important. There is a lot more that could go wrong in a performance involving interactive technology. I've seen concerts where the musician had to cancel a piece because the system was not working and they couldn't quickly fix the problem. I encourage musicians to practice setting up all of the technology as they practice so that they don't run into issues during performance. There aren't major differences between performing/practicing electroacoustic music vs acoustic music, though often the notation can be different.

5. To aid in a compilation of works for electroacoustic music and bassoon, what are some of the pieces you recommend? Are there any you would include specifically in a curriculum for young adult students?

   Northern Circles for bassoon, saxophone, electronics and video by Peter V. Swendsen
   (he has both an interactive electronic version and a fixed electronic version)

   of an implacable subtraction for bassoon and electronics by Paula Matthusen
   (bassoon + fixed electronics)

   Dorian Reeds by Terry Riley arranged for bassoon and electronics by Dana Jessen
   (bassoon + interactive electronics)

   For young adult students, I would recommend starting with bassoon and fixed electronics pieces. There are several pieces in existence for bassoon and fixed electronics. One nice piece is "Feu de Joie" by Mary Jane Leach. The fixed electronic part is pre-recorded bassoon tracks, so not very electronic-sounding, but a good introduction for someone expressing interest.

6. How might you recommend a student begin studying this music?

   Students should begin studying the music just like any new or contemporary piece. Study the score, learn the electronics and how the bassoon part fits

with the electronics. I also encourage students to attend performances of electroacoustic music to become familiar with the genre. I strongly recommend taking a music technology class or electroacoustic music class if they are offered at their institution.

7. What do you most enjoy about performing pieces for bassoon and electroacoustics?

   I love the sound of the bassoon in an electronic environment. The bassoon lends itself so well to electronics- the natural timbre of the instrument and extended techniques – there are so many sound worlds that the bassoon can create that have an electronic quality. I also think that electroacoustic pieces allow room for sonic exploration and variety that can't be captured in other genres.

8. What do you see for the future of this genre?

   I think many more bassoonists are starting to play with electronics, so I have high hopes for the future of this genre. Many prominent new music ensembles both in the U.S. and in Europe are programming works with electronics as well.

Equipment:

1. Are you familiar with any of the software composers use, or do you rely on sound technicians or others to help? Does this influence your choice of works?

   I have a solid understanding of Max/MSP- I wouldn't consider myself an expert but I do have enough grasp of the program to feel comfortable performing with Max patches. I have created Max patches in the past for some of my own pieces. Creating your own work gives you an even better understanding of the software that can't be learned by just playing the bassoon part. In addition to Max/MSP, I've used QLab often in the past.

   When I'm playing solo, it is always ideal to have a sound technician to help during sound-checks and performance. It is nearly impossible to properly check the balance of electronics and bassoon by yourself. When I do travel

with a sound technician, it eases a lot of pressure and allows me to really focus on the music itself.

2. Does the type of piece (interactive vs. fixed) effect your choice of amplification? If so, explain.

   I often like to add a little bassoon/amplification to the mix in fixed pieces so that there is a fluidity of combined sound. Otherwise the venue acoustics and speaker systems will help inform how much or little amplification is used.

3. What hardware and equipment do you use for interactive or fixed electroacoustic music?

   I use an AMT mic (applied microphone technology) for my bassoon. At the moment I use an Audiobox interface but have also used the motu ultralite with great success in the past. I highly recommend the AMT mic- it is an excellent microphone that clips-on to the instrument. I much prefer the clip-on mics to pick-ups because it maintains the natural tone/sound of the bassoon. I also sometimes use a footpedal- mine is a Griffin Technology footpedal, very basic but easy to use and setup.

Scores:

1. How clear are the scores you have played from? Are there any issues that come up when faced with an electroacoustic score? What is the difference between interactive vs. fixed? Electroacoustic vs. acoustic?

   Most of the scores are very clear for me but perhaps would not be clear to other bassoonists. The pieces that I commission are very collaborative and are a result of conversations, workshopping, and experimentation; after which there may or may not be a clearly notated score. I haven't had many issues of notation on pieces that I didn't commission, or at least issues that couldn't be resolved through a quick email to the composer. Many composers of electronic music use time-based notation, so knowing when or whether to use a stopwatch often comes up. Most composers now include a key or directions on their patch to clarify any notation or software specifications.

2. How much information do you require from a score, or you think should be in a score? Do you prefer to write in cues, or have them already there for you?

This question really depends on the piece, the performer and the nature of the collaboration with the composer. Much of my work involves improvisation so I personally don't require a huge amount of information on a score. In fact, one of the pieces that I just commissioned by Peter Swendsen doesn't even have a score yet and I've already performed it several times. Sometimes it is nice to have cues, but I also value the ability to fully understand the electronic part.

3. What kind of notation do you prefer from a score (Graphic, Text, notated, none, other)?

   Again, it depends on the collaboration and nature of the piece. Much of the music that I perform is a combination of notated, graphic and text-based scoring.

Preparation and performance

1. Can you describe your practicing to performing process? What challenges do you come up against when working through a piece for interactive music?

   I have a pair of speakers in my practice studio so practicing with electronics is fairly common for me. I often record myself as I practice so that I can listen back and get a full picture of how the piece is coming along. Much of what I've learned also comes with performing, which I consider part of the progression of a piece.

2. Which things do you like to control from the stage?

   If I have a sound technician whom I trust, I prefer to control the starts of pieces and cues within the work (if applicable).

3. Do you make any changes to your sound to play interactive works?

   No.

4. Has improvisation become part of your performance practice? If so, do you practice improvisation outside of electronic works?

The answer to this question could be a whole thesis on it's own. Yes, improvisation is a major part of my identity and I take improvisation very seriously. I'm always improvising because it is part of who I am as an artist.

5. Do you think students should practice improvisation?

Yes, if they want to improvise.

Collaboration:

1. Describe an ideal composer/performer collaboration. Is there anything you specifically ask from each composer you have worked with?

Ideally both performer and composer should have a solid understanding of each other's work prior to a collaboration. My ideal collaboration is to work with a composer or artist at an artist residency, where we can have time to experiment and explore possibilities. One of my favorite collaborations happened in this way- I spent a week at the CMMAS institute in Mexico with Paula Matthusen where we worked for a full week. During the week we improvised, tested new ideas, recorded ourselves, and presented a concert at the end. In my most recent program of pieces, I asked each composer to write a piece that reflects my work as an improviser. That could mean leaving room for improvisation within a piece, or including specific techniques that I use as an improviser.

2. How important is it to you to know how the computer and other equipment is working?

I think it is very important, especially if I don't have a sound technician with me. It also helps me practice.

Is there anything else you would like to add?

Brad Balliett

General:

1. How did you first become involved with interactive electroacoustic music?

   I became interested in electroacoustic music by listening to Stockhausen when I lived in Houston as a temporary 2nd bassoonist for the Houston Symphony. I wanted to find a way to interact with electronics. I began with simple sound processing through a guitar board for a performance of Tierkreis, with a simple microphone set-up. When I moved to New York, I got a slightly more sophisticated set-up, including a bocal with a hole for a pick-up, and began working with Ableton Live as well. Most of my work with electronics now is in ensembles. This is much simpler because there is often a conductor.

2. How has interactive music influenced your professional life?

   For a number of years I tried to incorporate live processing of the bassoon sound in a variety of situations. Since that time I've been less involved with live electronics in my own compositions, but the knowledge of how to make it 'work' still comes in handy frequently, since i spend a great deal of my time playing new music. Perhaps the greatest impact is that I try to produce 'electronics' sound acoustically in my own compositions -- in this way, it has helped me push to find a greater range of sounds on the bassoon.

3. What do you think are the greatest challenges for bassoonists who are Interested in performing interactive electroacoustic works?

   Finding a comfortable set-up is probably the greatest challenge. Of course, the greatest challenge is always to do something inherently interesting with the electronics, instead of having it merely obscure the natural sound of the instrument. But this is true of any instrument.

4. What are the differences in performing music for bassoon and tape vs. bassoon and interactive technology? Is there a major difference between performing and practicing electroacoustic music vs. acoustic music?

   The differences between tape and electronics are very evident. Tape is a fixed media; the challenge is simple ensemble. The performer should have much greater control with live electronics, although working with a talented engineer is often essential, so this becomes an act of chamber music as well.

   I don't perform with electronics frequently enough to have it feel as comfortable as acoustic music. Electronics introduces a new and often

unpredictable element to performance.

5. To aid in a compilation of works for electroacoustic music and bassoon, what are some of the pieces you recommend? Are there any you would include specifically in a curriculum for young adult students?

   Bora Yoon has just completed a piece for a recent concert I gave with Metropolis Ensemble. The bassoon part is the solo part to the Mozart Bassoon Concerto; the electronics part (which includes both a tape element and a live processing element) is entirely new. I think it will be a valuable and fascinating piece for students and professionals, especially since the solo part is a piece with which most bassoonists are familiar. The piece was just premiered in October, and should be available in about a year.

6. How might you recommend a student begin studying this music?

   If a student has access to equipment or can afford it, the best method is individual creative experimentation. Working with an experienced performer is also essential.

7. What do you most enjoy about performing pieces for bassoon and electroacoustics?

   I like having the capacity to perform a solo piece that includes more than just the solo bassoon sound. Having a portable set-up that can create fascinating, moving sounds is the best part for me.

8. What do you see for the future of this genre?

   The sky's the limit!

Equipment:

1. Are you familiar with any of the software composers use, or do you rely on sound technicians or others to help? Does this influence your choice of works?

   I use a very simple set-up when I live process sound; I also use Ableton Live from time to time. I have been more interested in acoustic music recently, so I haven't been seeking new electro-acoustic pieces. I imagine that when I

revive a strong interest in performing this music, i will need to become conversant with MAX MSP.

2. Does the type of piece (interactive vs. fixed) effect your choice of amplification? If so, explain.

   It is much easier to use external mics for a fixed media piece. Any live processing is best done with a bocal pick-up. Of course one must use what is available and most appropriate for performance.

3. What hardware and equipment do you use for interactive or fixed electroacoustic music?

   I use the Fox bocal pickup. I've often used simple guitar boards. I usually collaborate with the engineer for a performance, since they often have a more sophisticated set-up than I do.

Scores:

1. How clear are the scores you have played from? Are there any issues that come up when faced with an electroacoustic score? What is the difference between interactive vs. fixed? Electroacoustic vs. acoustic?

   The clearer the score, the better! I've seen a wide variety. The best is with a cue line that shows what should be heard, if it is a fixed media piece. An interactive piece should just have extremely clear instructions.

2. How much information do you require from a score, or you think should be in a score? Do you prefer to write in cues, or have them already there for you?

   I find cues to be more essential in electroacoustic music than acoustic music, although not in a conducted ensemble.

3. What kind of notation do you prefer from a score (Graphic, Text, notated, none, other)?

   Whatever will make it most clear. A good composer will have a good sense of what the musician needs to see.

Preparation and performance:

1. Can you describe your practicing to performing process? What challenges do you come up against when working through a piece for interactive music?

   If I'm playing a fixed media piece, I will listen to the tape part, and then just practice with the tape as many times as necessary, writing in as many cues as are needed. I'll use both headphones and speakers in this phase. One challenge is negotiating playback -- in performance, to hear the part, one needs a monitor or headphones.

2. Which things do you like to control from the stage?

   Whatever is necessary.

3. Do you make any changes to your sound to play interactive works?

   Not particularly -- although if the part is laden with extended techniques, I often use a Legere synthetic reed.

4. Has improvisation become part of your performance practice? If so, do you practice improvisation outside of electronic works?

   I enjoy practicing improvisation; this is useful because much new music, electroacoustic or otherwise, incorporates improvisation.

5. Do you think students should practice improvisation?

   Yes, of course. Students should also compose, produce concerts, and learn other instruments. This is just called being a complete musician!

Collaboration:

1. Describe an ideal composer/performer collaboration. Is there anything you specifically ask from each composer you have worked with?

   The bassoon, in particular, has so many special sounds and unique challenges that would not be apparent to a composer simply from an orchestration textbook, that I always encourage composers with whom I work

to sit down with me for several hours to explore all of the possibilities. This is especially true for multiphonics!

2. How important is it to you to know how the computer and other equipment is working?

   It is critical! Unless someone else is in charge of the sound. Then I leave it up to that person.

Is there anything else you would like to add?

Thanks for assembling this info! Send me a copy of the results!

Rebekah Heller

(Note: Heller's interview is a transcript from a recorded interview with the author)

General:

1. How did you first become involved with interactive electroacoustic music?

   Most of it stems from my involvement in ICE. ICE has been working with composers doing works with electronics for several years. I think my first piece ever…My first piece, was in 2008 or 2009. I think that was my first real window into that world.

2. How has interactive music influenced your professional life?

   I think, done well, it shouldn't just be an experience for the performer or the composer. I think the most important thing for me and for us as a group is to work with people we trust, so that the person who is doing your electronics and running your sound is a member of the band. Someone as involved in the process of creating the pieces and creating the concert experience as whoever is on stage making music. So that is a really important part of our process, and not seeing them as separate things, but being wholly interactive from day one. From starting to work with the composer the moment you get the score. I think even with pieces without electronics, every piece is very personal and very different, so it's hard to make general statements about how they've changed me. But it's always really exciting to hear yourself amplified through processing, or working with a tape part, it's fun to play louder. It's fun to play in an immersive environment, so performance-wise, there's a bit of a different element to it, but it does depend on the piece.

6. What do you think are the greatest challenges for bassoonists who are interested in performing interactive electroacoustic works?

   Finding someone you trust to be your partner in the sound world. So it's someone you trust running the electronics, running the sound, creating that environment for you. Because you can't be playing the bassoon on stage and know exactly what it sounds like in the seats. Whether it's a tiny theater that seats 50 people or it's a hall that seats 2000 people. You need to be with someone who understands the way that you like to sound amplified, and the way that you like to be balanced with the tape or the electronic part. It's really, really important. I think it's the most important part of playing music with

electronics. A) Finding someone that you trust to work with, and B) having ears in the hall, because you can't be two places at once. So the most important part is to hear properly and to convey the heart of the music. You need partners in that.

7. What are the differences in performing music for bassoon and tape vs. bassoon and interactive technology? Is there a major difference between performing and practicing electroacoustic music vs. acoustic music?

   A tape is going to be the same every time. You know the tape. The tape does X, Y, and Z, and then 1,2,and 3, and it never changes. You need to learn how to interact with that, and keep your part exciting while working with this fixed entity. Live Electronics is different every time. It's like making music acoustically, with a chamber music partner, but you are your own chamber music partner. Usually live, in the moment, live electronics are triggered by what you, as the soloist, are doing on stage. That's kind of fun to play around with. You can, for a lot of programs […] you can sort of get to know how it reacts to you, and play around with that so you can become your own chamber music partner, which can be really fun and cool. I think that's how it relates to playing chamber music acoustically. You need to listen as much as you are playing. It's interactive and you need to use your ears as if you are playing a duet.

   I think some of the nuts and bolts can be different, but it's not different in the sense that you need to immerse yourself in the score, you need to learn the notes. There's a process. The process is slightly different but the outcome is the same, and the number of hours aren't any different (that's completely dependent upon the work). There can be that are very challenging, converting from a practice room to a room with speakers and a click track. I think you need to be even more prepared.

8. To aid in a compilation of works for electroacoustic music and bassoon, what are some of the pieces you recommend? Are there any you would include specifically in a curriculum for young adult students?

   There's not really a canon like there is for other instruments. While I'm happy to give recommendations, I want to encourage young bassoonists to make their own. If you are in school, meet composers in your school, and ask them to write pieces for you and with you. Do your part to expand this micro-repertoire into something really substantial and we will all thank you for it.

There are a lot of great pieces. On my first solo album, which is called On speaking a hundred names, is Nathan Davis's piece of the same name. It started out as a live electronic patch, and it can still be performed that way, but to make it easier for people to perform the piece remotely and away from Nathan, we made a tape part. It's much easier to play now. It's a great piece, it's not super hard technically, and you can hear it for free on my website, spotify, or itunes.

6. How might you recommend a student begin studying this music?

   The same way you begin studying anything else. Just start.

7. What do you most enjoy about performing pieces for bassoon and electroacoustics?

   It depends on the piece. I don't think we can say in this day and age and where we are in music that "this is acoustic music," and "this is what electronic music is." Music is music, and every piece is wildly different. I approach them by who they are by, or what the sound world is, or where I need to go, but I don't necessarily approach them terribly differently.

8. What do you see for the future of this genre?

   I don't know! I'm excited to see what it morphs into. Again, music is music and there is endless creativity. The composers of today, and especially the ones I work with often-it's exciting to see what they come up with. The most creative situations are when we are challenging each other, as performers and composers. The most exciting is when you are in a room together creating this piece with each other. There are no limits!

Equipment:

1. Are you familiar with any of the software composers use, or do you rely on sound technicians or others to help? Does this influence your choice of works?

   I am vaguely familiar. Sometimes I do run electronics or tape parts from my laptop on stage. Sometimes I am very involved in that, and sometimes, I am

very spoiled, as ICE is lucky enough to have an electronics engineer with us. When we're on tour he is with us.

2. Does the type of piece (interactive vs. fixed) effect your choice of amplification? If so, explain.

   It depends on what kind of tape and what kind of electronics. If there's a part of the piece that is spectral, or really low and overblown multiphonics in the lowest register, I will definitely make sure to have a bell mic, because I want to make sure to get some of those amazing partials amplified. But it I won't hate the way that sounds amplified. I really like to focus on different parts of the bassoon. It's very tricky, as I'm sure you know. The bassoon is a very imperfect thing. The sound goes every which way. Especially if you are playing in a smaller hall, I like not to be super amplified to where it sounds super fake, but again, it all depends on what the piece requires

3. What hardware and equipment do you use for interactive or fixed electroacoustic music?

   I don't own any microphones. ICE owns microphones, and generally use nice condenser mic[rophone]s, around the area where the long and the boot joints are attached. I usually just use just on condenser mic[rophone]. I am highly simplified. I used to use three microphones and it just got really annoying and I decided it sounded just as good. Sometimes I use a lav[alier] mic[rophone] on my lapel, and that's it. If I'm just using effects and not a lot of applications. If I just want reverb or a ring modulator I want just a lav[alier] mic[rophone].

Scores:

1. How clear are the scores you have played from? Are there any issues that come up when faced with an electroacoustic score? What is the difference between interactive vs. fixed? Electroacoustic vs. acoustic?

   There's not any difference in most of the scores. Whether it is electronic or acoustic. I haven't found a real difference in the scores. I use an ipad to read scores, but that's about it.

2. How much information do you require from a score, or you think should be in a score? Do you prefer to write in cues, or have them already there for you?

Totally depends on the piece. Depends on how busy the score is already, and how complicated the piece is. That's something I usually work out with the composer as we are writing a piece together. She or he will ask me about that pretty early on, and while they are sending early versions of scores. Best-case scenario, you have control over that from the very beginning. I like there to be enough information to know what is happening, but not too much. Generally I will write my own cues for what is happening in the tape part. It's generally clearer for myself to write my own chicken scratches, than for something to be notated. Too much information can be deceiving and hard for your brain, for me.

3. What kind of notation do you prefer from a score (Graphic, Text, notated, none, other)?

   Depends on the piece, again. There's no way to plug it into an equation.

Preparation and performance:

1. Can you describe your practicing to performing process? What challenges do you come up against when working through a piece for interactive music?

   This goes back to earlier. The biggest challenge is the way that you sound alone in a room with iPad headphones or whatever you are using, to a stage with speakers and a sound system. That can be really disorienting, for sure.

2. Which things do you like to control from the stage?

   I can't control levels in the house, or my volume, or my level of reverb. It depends on the piece. If it's a tape, I use a pedal, or a computer and start myself. I think generally, those things are controlled at the board.

3. Do you make any changes to your sound to play interactive works?

   Just reverb.

4. Has improvisation become part of your performance practice? If so, do you practice improvisation outside of electronic works?

Totally. Improvisation wasn't something I was trained in, like many classical musicians. I only started dabbling in when I started playing with ICE. I started dabbling more seriously for the last 5 or 6 years. It's something that I do regularly now, and very much enjoy it. I now play shows that are completely improvised often.

5. Do you think students should practice improvisation?

   Absolutely! Yes!

Collaboration:

1. Describe an ideal composer/performer collaboration. Is there anything you specifically ask from each composer you have worked with?

   The ideal relationship is one that starts from day one. From the idea of the piece, that you develop together, or at least in close conversation with the composer, so that there's never a period of time where the composer goes away and then comes back and hands you a full piece, and you are like "What is this?" There's constant communication about ideas, about length, about scale, or about execution…notation. So that that line of communication is open. Every composer I work with, young, old, in school, every one has a line of open communication with me. My biggest priority is erasing the fear and trepidation around the bassoon, because a composer isn't going to write for it. That's totally fine. It's not a thing you are born knowing. I sort of want to erase that fear, and keep a really, really open line of communication so that they can come to me and say "Hey, create this multiphonic," or, "is this tremolo possible?" or "What does this weird air sound, sound like?" And they know that I will send them a sound file, and email, or a text within 10 hours, at any given time. To me, that is the ideal relationship, so they will write something that makes sense to me, and is as much about our shared visions as it is about the composer's alone.

2. How important is it to you to know how the computer and other equipment is working?

   Sometimes that's really important. If I'm working with my team, at ICE, it's not as important. If I know I can trust the people running it, as long as it works,

and as long as I can hear in my head phones and the monitor. So it's not always 100% important.

Is there anything else you would like to add?

Katherine Young

General:

1. How did you first become involved with interactive electroacoustic music?

   I began working with electronics playing in rock / pop bands and then incorporated the electronics into my work as an improviser on the bassoon.

2. How has interactive music influenced your professional life?

   My work with amplifying and processing my bassoon through effects pedals has deeply influenced my creative / professional work: It is definitional for my vocabulary as an improviser, and it has impacted the way I compose for other instruments. I almost always incorporate some kind of amplification or electronics into my music today.

3. What do you think are the greatest challenges for bassoonists who are interested in performing interactive electroacoustic works?

   The greatest challenge seems to me to lack of preexisting models -- at least that was the case when I began 10 or so years ago. Now there are lots more people performing and composing for the bassoon with electronics. Another challenge continues to be how tricky the bassoon's sound is to accurately capture for amplification and processing. The technology has greatly improved, but continues to have limitations: usually sound quality is sacrificed for stability / strength of signal.

4. What are the differences in performing music for bassoon and tape vs. bassoon and interactive technology? Is there a major difference between performing and practicing electroacoustic music vs. acoustic music?

   The greatest difference lies in the technical knowledge required to perform acoustic vs. bassoon+tape vs. bassoon+more interactive electronics. Musically, you still have to think about sound and phrasing and conveying your intentions to the audience.

5. To aid in a compilation of works for electroacoustic music and bassoon, what are some of the pieces you recommend? Are there any you would include specifically in a curriculum for young adult students?

Central Heating for bassoon and amplified objects by Hanna Hartman.

6. How might you recommend a student begin studying this music?

   Familiarizing yourself with the instrumental techniques and the technological requirements. Then, it's crucial to have time to work with the electronics. The electronics should not be a last-minute addition, but rather an integral part of the interpretation of the piece.

7. What do you most enjoy about performing pieces for bassoon and electroacoustics?

   The way the electronics expand and modify the vocabulary and expressive scope of the bassoon.

8. What do you see for the future of this genre?

   With curious performers, the genre will continue to grow. Composers and audiences are ready!

Equipment:

1. Are you familiar with any of the software composers use, or do you rely on sound technicians or others to help? Does this influence your choice of works?

   I am familiar. I often run my own electronics, but depending on the complexity of the set up, working with an electronicist can also be helpful.

2. Does the type of piece (interactive vs. fixed) effect your choice of amplification? If so, explain.

   I generally employ a little bit of amplification any time there are electronics so that the instrument's sound can blend with the electronics in the speakers. It depends on the room and the piece, however.

3. What hardware and equipment do you use for interactive or fixed electroacoustic music?

Ableton Live/Max for Live, ProTools, Adobe Audition.

Scores:

1. How clear are the scores you have played from? Are there any issues that come up when faced with an electroacoustic score? What is the difference between interactive vs. fixed? Electroacoustic vs. acoustic?

   This varies widely.
2. How much information do you require from a score, or you think should be in a score? Do you prefer to write in cues, or have them already there for you?

   No scores are perfect for everyone. I prefer information to be clear in the performance notes, and then to add in a lot of my own cues.

3. What kind of notation do you prefer from a score (Graphic, Text, notated, none, other)?

   I like a mixture of graphic, notated, and text - it really depends on what the musical priorities are.

Preparation and performance:

1. Can you describe your practicing to performing process? What challenges do you come up against when working through a piece for interactive music?

   One of the biggest difficulties is carving out time to rehearse in the space with the electronics. This is logistically difficult, but can make a huge difference.

2. Which things do you like to control from the stage?

   I like to control as much as possible from stage, with someone in back of house doing subtle level adjustments. It's crucial to be able to hear yourself well on stage.

3. Do you make any changes to your sound to play interactive works?

4. Has improvisation become part of your performance practice? If so, do you practice improvisation outside of electronic works?

Improvisation is very much a part of my practice, and yes I do practice improvisation acoustically as well as electro-acoustically.

5. Do you think students should practice improvisation?

   Absolutely!

Collaboration:

1. Describe an ideal composer/performer collaboration. Is there anything you specifically ask from each composer you have worked with?

   More often I am on the composer side of this dynamic these days, so I will answer from that perspective. An ideal composer/performer collaboration is mutually open, flexible, and committed. It is also important for me to have time together to develop materials that work well for both and mean something to both the composer and the performer.

2. How important is it to you to know how the computer and other equipment is working?

   The more you know, the better. Having trusted expert collaborators is also important. But knowing how things work will empower you to really "own" the piece and bring your own musicality to it.

Is there anything else you would like to add?

APPENDIX D

INTERVIEWS WITH COMPOSERS

Dear Composer,

Thank you for participating in this questionnaire about interactive electronic music for bassoon. Your responses will create a resource of information that will help both composers and performers of this music, and hopefully create more numerous and balanced works for the bassoon and interactive electronics.

I will take your responses and form conclusions on how electronic music for bassoon should be collaborated, practiced, and performed. To define interactive music, "Interactive computer music systems are those whose behaviour changes in response to musical input. Such responsiveness allows these systems to participate in live performances, of both notated and improvised music"[48]

We will be discussing all electronic music written for the bassoon, but with a special emphasis on music written for the interactive genre. Where it is appropriate, please reference specific pieces, composers, or interactive systems. If a particular question does not apply to you, or if you do not wish to answer, feel free to respond with "not applicable". Please allow about 1 hour to complete the questions. Your time is immensely appreciated, and I hope that this research project will bring new performers and composers to the genre.

[48] Rowe, R. 1993 *Interactive Music Systems: Machine Listening and Composing*. Cambridge, MA: The MIT Press

Andrew May

General:

1. Why did you write a piece for open instrumentation? Had you ever written for open instrumentation before?

   I was inspired to leave the instrumentation open in part because of the model of George Lewis's Voyager, which is an earlier free improvisation environment that can be played by any instrument; and in part because the computer's behaviors are all derived from the live sound, so any instrument should work equally well (though when I first adapted the work for a double bass player, I had to make sure the computer tracked low notes properly!).

2. I am compiling a list of works for bassoon and electronics. Have you written other solo works for bassoon (or Contrabassoon) and live electronics? If so, list them, please.

   There are no other works for bassoon and electronics in my repertoire – but we could talk about fixing this.

3. Had you ever written an interactive electronics work before?

   I had written The Twittering Machine for flute and computer in 1995 before I wrote the first version of this piece in 1996. By the time I finished the latest version of the piece in 2011 I had written quite a lot of interactive computer music.

4. Do you think there's a difference writing for the bassoon over other instruments?

   The bassoon's distinct timbres within different registers, its tremendous range and agility, its unusual "idiomatic" fingerings, its tremendous potential for an unique set of multiphonics, its incredible range of articulations, and its particular repertoire and history set the bassoon apart from other instruments. It is always amazing to me to see how music notation flattens out and generalizes a very small set of dimensions of the physical act of playing any instrument – how, I wonder, can it be that a cello line and a bassoon line can look the same when the physical behaviors they invoke are so different?

5. What do you think are the biggest misconceptions performers have for this genre?

   If you mean instrument and electronics, I would say the biggest misconceptions are (1) that it is important or even necessary to make direct

(or processed) use of live sound, (2) that it's possible to make interesting chamber music with a computer without programming some sort of model of musical signification into it, (3) that either clock time or metric time might constitute a sufficient model of musical time in performance, and (4) that "control" of the computer's behavior is a desirable goal – personally, I am much more interested in "influence."

6. What would you like to covey to bassoonists looking at pieces in this genre?

   The best is yet to be: collaborate to create the repertoire you want to play.

7. Do you think that "interactivity" is an over-used term in electronic works? Explain.

   99% of so-called "interactive" pieces aren't. They use real-time generation of audio, perhaps, but they don't create a closed loop of communication between performer and machine in which both add meanings to the conversation that are shaped by context or past content. Even the most primitive video games are far more interactive than the majority of "interactive" music.

8. Where do you see the future of this genre going?

   I see a period of retreat in the culture right now – witnessed by the number of pieces using click tracks, for instance. I don't know where the future will take us, but I believe forward progress it will require a careful look at how performers think and act on stage. The fact is, programming is not easy, and most musicians are not well-suited to it; and collaborative teams are difficult to form in a resource-poor context. It should not be assumed that any composer or performer who installs Max on his computer can create interesting interactive music!

Collaboration:

1. Was this a commissioned work?

   Ripped-Up Maps emerged as an experiment in which I was both the guinea pig and the lab tech. It has evolved through various collaborations, and thanks to the magic of performance rights distribution for concert music it has earned me some money, but there was no commission.

2. How did you and the collaborative artist figure out what would be in the work? Did you work with the collaborative artist at all? Was the performing artist a part of the process?

I alternated personalities/roles as I developed the piece, the patch, and the performance. When I worked with other musicians, they contributed insights about the interaction, the sound, the dynamics, the user interface, and so forth, many of which affected later revisions. Clarinetist Pete Furniss is now actively editing the patch for his own use, though I haven't seen his latest version.

3. Had you ever worked with this person previously?

   n/a

4. Please describe your ideal composer/performer collaboration. Is there anything you specifically ask from every performer?

   I have a questionnaire that I share with most performers I'm writing for, mainly to make sure that I write a piece they will want to keep performing, but also because I find performers' goals and ideas to be valuable compositional determinants.

5. What level of knowledge do you think performers need to execute works in this genre.

   There's room for a lot of variation here. Everyone starts somewhere, after all! Mostly you need a certain kind of attitude: one of patient seeking, persistent (and non-superstitious) problem-solving, and open-minded delight. The rest will come with practice.

The Work:

1. What kinds of processes did you go through to develop the work?

   I worked for hours and hours at all times of day and night alternating between playing, coding, and meditating, trying to create an environment that I found consistently surprising, and yet surprisingly consistent.

2. What software did you use for this work?

   SGI Max, a transitional phase between IRCAM's Max/FTS and the more recent environments Pure Data and Max/MSP. SGI Max doesn't exist any more, as far as I know; I ported it to Max/MSP in 2001 and made the last major update to the piece in 2011. The current version of the patch is tested through Max7.

3. Do you prefer running the program specs (or having a technician), or is there a specific set up for a no-technician rehearsal/performance?

The patch is designed to be "point-and-shoot" – other than audio input from the performer and pedal controllers operated by the performer, the computer should not need any additional operator. However, it's always nice to have *someone else wire things up and test them so that you can concentrate on important things like reeds, repertoire, and resting before the show*.

Anything else you would like to add?

Thank you for including my piece in this project!

Cheers,

Andrew

Benjamin Shirey

General:

1. Why did you write a piece for bassoon? Had you ever written for bassoon before?

   I wrote Sand Daemon specifically for Jolene Masone. After collaborating with her on a previously work, another collaboration made perfect sense.

2. I am compiling a list of works for bassoon and electronics. Have you written other solo works for bassoon (or Contrabassoon) and live electronics? If so, list them, please.

   No, this is the first solo piece for bassoon and live electronics that I have ever composed.

3. Had you ever written an interactive electronics work before?

   Yes, electronic music is my specialty.

4. Do you think there's a difference writing for the bassoon over other instruments?

   I believe that every instrument has intrinsically its own set of advantages when approaching solo composition. That being said, the bassoon has specific advantages that are of interest to the electronic composer. One of these advantages is its rich timbre. This rich timbre is characterized by a particularly strong formant with its peak in the 440-500 Hz range[49]. The bassoon's unique tone color combined with its similarity to vocal range provides an extensive pallet for the electronic composer.

   There are also many extended techniques that a bassoon can offer such as multi-phonics that further extend this pallet.

5. What do you think are the biggest misconceptions performers have for this genre?

   Probably the misconception that electronics are glitchy… In truth, it's not the electronics; it's the composers, which I hate to admit. We are not (for the most part) electrical engineers or software engineers. Our specialty is music, not electronics. We are explorers in a new medium; which means that sometimes we are going to get it wrong a few times before we get it right.

[49] Backus, John, The Acoustical Foundations of Music, 2nd Ed, W W Norton, New York, 1977, Ch 6, Table I.

6. What would you like to covey to bassoonists looking at pieces in this genre?

   Don't be afraid to commission a new work. It's a fairly new genre and there are not a lot of pieces for bassoon and live electronics out there.

7. Do you think that "interactivity" is an over-used term in electronic works? Explain.

   Possibly. I also think there are also three different types of interactivity in electronic music each with different implications.

   1. *A performer interacting with a computer (the performer having some control over the computers choices).*

   2. *A computer + computer operator interacting with a performer*

   3. *Performer interacting with an artificial intelligence (AI) (performer having little or no control over the choices the computer makes)*

8. Where do you see the future of this genre going?

   I believe that interactive music will continue to grow and flourish as long as composers and performers can continue to build good collaborative and continuing relationships

Collaboration:

1. Was this a commissioned work?

   Yes

2. How did you and the collaborative artist figure out what would be in the work? Did you work with the collaborative artist at all? Was the performing artist a part of the process?

   Yes the performing artist was part of the process and actually helped inform me to unique abilities, techniques, and limitations with the instrument. Together we explored several different techniques, tones, and timbres for possible inclusion into the piece.

3. Had you ever worked with this person previously?

   Yes Jolene and I had worked together within a collaborative group on a previous multi-media piece

4. Please describe your ideal composer/performer collaboration. Is there anything you specifically ask from every performer?

   I prefer to work with performers that are open to elements of aleatoricism or improvisation within a piece. I believe that a good performer knows much more about their instrument that any composer (unless the composer is very proficient in that specific instrument). By allowing for some elements of aleatoricism within a work, the composer enables the performer to bring into the piece their innate musical understanding and intimate knowledge of the instrument. These are things that separate human performers form AI performers. However, many performers are not open or comfortable with aleatoricism.

5. What level of knowledge do you think bassoonists need to execute works in this genre.

   I believe performers of this genre should have a basic understanding of audio technology including understanding basic terminology like:

   a. *TRS*
   b. *XLR*
   c. *Input/output*
   d. *Mixer*
   e. *Feedback*
   f. *Channel*
   g. *Gain*

   This list is not necessarily a comprehensive list. However, understanding terms like these can greatly enhance the communication between composers and performers.

The Work:

1. What kinds of processes did you go through to develop the work?

   My typical compositional process for this genre of music consists of these steps:

   a. *Research*
   b. *Develop software*
   c. *Write primary musical ideas*
   d. *Test software*
   e. *Select Hardware (if applicable)*
   f. *Compose score*
   g. *Tweak software to piece specifics*

h. *Finalize score*

2. What software did you use for this work?

   MaxMSP

3. Do you prefer running the program specs (or having a technician), or is there a specific set up for a no-technician rehearsal/performance?

   The piece could be run without a technician. However, I prefer to run the program specs myself.

Anything else you would like to add?

A special thanks to Jolene Masone for commissioning Sand Daemon and for being such a great collaborator.

Nathan Davis

General:

1. Why did you write a piece for bassoon? Had you ever written for bassoon before?

   Rebekah Heller asked me to write a piece for her. We play together in the International Contemporary Ensemble, so I knew her and her playing very well.

2. I am compiling a list of works for bassoon and electronics. Have you written other solo works for bassoon (or Contrabassoon) and live electronics? If so, list them, please.

   "On speaking a hundred names" is my first, and so far only.

3. Had you ever written an interactive electronics work before?

   Yes – I have a series of works for solo instrument and live electronics.

4. Do you think there's a difference writing for the bassoon over other instruments?

   Absolutely. The bassoon cleans up well to play in the orchestra, but its natural tendencies are much less polite and much more interesting.

   I borrowed a bassoon from one of Rebekah's students and I worked with it for a few weeks. I was struck by how easy it is to play multiphonics, and hard it was to produce only one note at a time. That became a central idea of the piece.

   Another inspiration from the instrument is the fact that there are many fingerings with the same fundamental but vastly different overtone structures.

5. What do you think are the biggest misconceptions performers have for this genre?

   Some performers don't realize how much they must practice with the electronics and get to know them – or think that they can just learn their part and means they have learned the piece. A piece with live electronics should be chamber music. This never comes up with those who commission my pieces, but it sometimes does as the pieces go out into the world.

6. What would you like to covey to bassoonists looking at pieces in this genre? *Commission more pieces!*

7. Do you think that “interactivity” is an over-used term in electronic works? Explain.

   Perhaps just misused – interactivity doesn't only mean using sensors and live triggering – it also means to interact with electronic media through listening, as you would with other live musicians.

8. Where do you see the future of this genre going?

   I hope that it goes in a direction that makes the technology invisible to the performance, insofar as the performer may be free to simply play music and interact with the sound they hear without having to overcome the significant learning curve of learning software, etc. Many composers and performers are working toward this point, both from their own directions.

Collaboration:

1. Was this a commissioned work?

2. How did you and the collaborative artist figure out what would be in the work? Did you work with the collaborative artist at all? Was the performing artist a part of the process?

3. Had you ever worked with this person previously?

   Yes, see above

4. Please describe your ideal composer/performer collaboration. Is there anything you specifically ask from every performer?

   Besides the musicianship I look for in any performer, I request a curiosity about sound and a willingness to interact with the object-ness of their instruments and any hardware involved with the electronics.

5. What level of knowledge do you think bassoonists need to execute works in this genre.

   Ideally they would just need open ears. In reality, any performer of electroacoustic music needs to be willing and able to get their hands quite dirty with the gear – software and hardware – because it is their collaborator and partner in their sound and the success of the performance. They need to know how to fix technical problems themselves before going into a soundcheck. Many times I've seen a small problem completely take over a

dress rehearsal because the performer doesn't know the many variables at play in getting sound in an out of a new system.

The Work:

1. What kinds of processes did you go through to develop the work?

   I worked with a bassoon, and with a bassoonist, separately and in combination

2. What software did you use for this work?

   MaxMSP, using mostly granulating delays with some pitch shifting, spectral exaggeration, and spatialization.

3. Do you prefer running the program specs (or having a technician), or is there a specific set up for a no-technician rehearsal/performance?

   I always design my software to be able to be run by a performer who knows the parameters well and can take a house engineer through the steps for a successful soundcheck without them having to follow score or know MaxMSP.

   For years I have toured solo programs that use live processing throughout and don't need an engineer at all.

Anything else you would like to add?

Interactive music is finally crossing a threshold from primarily showcasing the advances in technology necessary to make such a thing possible and towards realizing the promise of simply making chamber music with electronics. That is what interests me. Also of primary interest is the organic integration of interface with the physicality of playing

Keith Hamel

General:

1. Why did you write a piece for bassoon? Had you ever written for bassoon before?

   I wrote the work Obsessed Again at the request of a bassoonist Jesse Read who had recently joined the UBC School of Music where I work. Jesse had commissioned other works for bassoon solo, but was particularly interested in having me write a piece for bassoon and interactive electronics using Max. Obsessed Again was written in 1992. I had not written for bassoon solo before but I had included bassoons in large ensemble works (orchestra, wind ensemble) before. The work was revised in 2008 and an interactive video was added to the piece.

2. I am compiling a list of works for bassoon and electronics. Have you written other solo works for bassoon (or Contrabassoon) and live electronics? If so, list them, please.

   No – this is the only work I have written for bassoon and live electronics.

3. Had you ever written an interactive electronics work before?

   Yes, I had previously written works for saxophone and interactive electronics, midi piano and interactive electronics, as well as works for instruments and fixed electronics.
   .

4. Do you think there's a difference writing for the bassoon over other instruments?

   All instruments are different and have their advantages and disadvantages. The bassoon as the advantage of producing a wide range of colours across the different registers and of having many multiphonics available. However, of all the instruments I have worked with, the bassoon was probably the most difficult instrument in terms of microphone placement and consistency of sound pickup and each time this work has been performed that has been the most difficult part of creating the interactive environment – the sound comes out of the instrument in many different places and so it is necessary to have several mics in order to get all registers adequately.

5. What do you think are the biggest misconceptions performers have for this genre?

I don't really know, but I think that upper winds and string players are generally more interested in playing works that are adventurous and explore contemporary techniques. I don't know if this says something about the kind of personalities that choose bassoon or not. In chamber situations the bassoon often has a supporting role – maybe bassoon players are not as inclined to be in the spotlight. Obsessed Again has been played less often than any of my other interactive works.

6. What would you like to covey to bassoonists looking at pieces in this genre?

   Performers should probably expand out of their comfort zones more often.

7. Do you think that "interactivity" is an over-used term in electronic works? Explain.

   Perhaps the term is overused – since sometimes there isn't really a lot of interactivity between instrument and computer. However, it is the agreed upon term for works where the electronics are responsive to the performance.

8. Where do you see the future of this genre going?

   In the future there will certainly be an increase in the number and complexity of interactive works for all instruments and familiarity with interactivity will be important for the development of performers.

Collaboration:

1. Was this a commissioned work?

   Yes, it was a commissioned work – Jesse Read was the commissioner.

2. How did you and the collaborative artist figure out what would be in the work? Did you work with the collaborative artist at all? Was the performing artist a part of the process?

   I got together with the performing artists to learn more about the instrument and to see what extended techniques were possible. The performer had no involvement in the composition per se. I don't think that is a role that performers should take on.

3. Had you ever worked with this person previously?

No, I had not worked with him previously.

4. Please describe your ideal composer/performer collaboration. Is there anything you specifically ask from every performer?

   I like to work with a performer to get to know the instrument and their particular skill set better. However, pieces are not written for one performer so I wouldn't write a work that relied on a special technique that would not be expected of all performers of contemporary music on that instrument. Most of the interactions with performers are focused on techniques and notation. I think the arrangement I normally have is an ideal one.
   .

5. What level of knowledge do you think bassoonists need to execute works in this genre.

   They need a high performance level, familiarity with electroacoustic music and a strong sensitivity to timbre and timbral control.

The Work:

1. What kinds of processes did you go through to develop the work?

   The work was written for specific hardware devices that became obsolete quite quickly so it was re-written as a hardware independent program. I composed the piece with simulations of the bassoon and was able to approximate the acoustic result until the composition was completed and could be rehearsed.

2. What software did you use for this work?

   Originally, the software was Max, with an IVL pitchrider for pitch detection and a proteus 2 synthesizer for the sound generation. In the revised version it uses MaxMSP for all pitchtracking and sound generation and NoteAbility Pro (my music notation program) to control sections, turning on effects and the live video processing.

3. Do you prefer running the program specs (or having a technician), or is there a specific set up for a no-technician rehearsal/performance?

   The piece requires that someone run the software on the computer – this can be me or another technician. It is possible to run the piece without a technician during rehearsal because the performer can run NoteAbilityPro and that will control all the preset and processing changings in the piece. However, it would be a good idea to use a technician for the performance.

With some pieces I have used automated score following but I haven't done that with this piece and given the difficulties of pitch tracking bassoon I probably wouldn't risk doing it.

Is there anything you would like to add?

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