TOWARDS THE BEAT OF A DIFFERENT DRUMMER: A JOURNEY INTO THE LOSS OF FIDELITY IN DRUMS AND ELECTRONICS

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ABSTRACT

In this paper, the author describes his explorations and experiments in turning an acoustic drum-set into an expressive tool for electroacoustic improvisation. This is primarily achieved through the addition of DIY and lo-fi electronics, as well as DIY acoustic and electroacoustic instruments to the drum-set. The author details how he began building and modifying instruments and goes into detail on the conception and execution of some of his most recent creations, where alternative interfaces for electronics are explored. Additionally he provides insight into his own methods for the practical integration of a large range of sound objects and instruments into his improvisation. The author concludes with his plans for future instruments and explorations predominately dealing with Arduinos and Apple iOS devices.

1. INTRODUCTION

In 2003 I began performing on what would eventually become the Drums+Electronics setup I use today. At the time, it was made up of a fairly standard 4-piece acoustic drum-set surrounded by miscellaneous bits of percussion. What set it apart, and set my journey on its path, was what sat on the stand to the right of my drum throne. It did not have a name yet, but what it did have were eighteen strings, three guitar pickups, and an output jack, all crudely attached to a few pieces of plywood. I eventually named it the Specto-Situationalist (see Figure 1) and to this day it is an integral part of my instrument. The significance of its addition to the drum-set was lost on me at the time, but now, eight years and countless additions later, I can recognize it as being the beginning of my journey.

2. DISCOVERING ELECTRONICS

My first exposure to the world of instrument making and modification came in the form of Circuit-Bending[1]. I happened upon a book entitled *Gravikords, Whirlies & Pyrophones* [1] which contains selections from the, then defunct, *Experimental Musical Instruments Journal*[2]. In that book there was a chapter on circuit-bending that really excited me. I had always wanted to learn more about electronics, and circuit-bending offered an approachable entry point into the subject. Listening to examples of circuit-bending, where the nostalgic sounds of electronic toys shattered into the fragmented and chaotic sounds of the future, resonated deeply with me. I immediately opened the Casio keyboard that had been gathering dust in my closet and started probing away. The results were very disappointing at first, as the only thing I could get the keyboard to do, through short-circuiting, was crash.

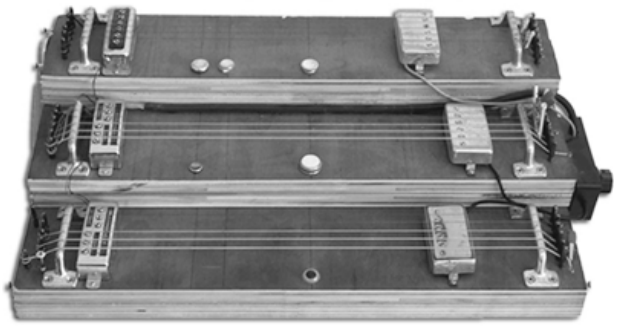

Figure 1. The Specto-Situationalist in its current form with an additional three guitar pickups and a knob to blend between the sets of pickups. The dots along the body mark where harmonic nodes of the strings can be found. (Photo © Rodrigo Constanzo)

Even though that initial experiment ended poorly, it got me thinking about electronics in a way I hadn't before, as something tangible and tinkerable. Since I was also a guitar player, I purchased a book on DIY guitar pedals that also covered rudimentary electronics [2]. In an effort to improve my knowledge and understanding, I started building some of the simpler circuits in the book. Eventually I worked my way back to toys and, with my improving skills in electronics, was able to successfully modify several toys, including the circuit-bending staples Speak & Spell talking game, Casio SK series of portable keyboard samplers as well as some interesting toy drum machines (see Figure 2).

[1] Circuit-Bending is the practice of creatively short-circuiting a battery-powered electronic device in order to generate sounds and functionality that the device was not designed for and is generally not capable of.

[2] *Experimental Musical Instruments Journal* has since proven to be an endless source of inspiration and resources for all of my instrument builds through the years.

At the time, in 1998, novice circuit-benders didn't have the resources they do today.[3] The downside to this was that finding which toys "bent" well, this is to say, produced interesting sounds when short-circuited, was difficult. The upside was that every single toy had the potential to be an amazing instrument. This really set the tone for all of my instrument building in the future, in that everything was pregnant with potential and anything was possible through experimenting. Even though it would be another five years before I would start using circuit-bent instruments and acoustic drums together, I did begin performing and improvising with these modified and DIY electronic instruments in other settings.

Figure 2. Circuit-Bent Yamaha DD-7 drum machine with drone, glitch, and filtering based bends. (Photo © Rodrigo Constanzo)

3. SAMPLE TRIGGER PAD

After the Specto-Situationalist, the next significant addition to the drum-set was a Roland sampler made specifically for use with drumsticks. It was completely self-contained and allowed samples to be loaded via memory card. The intended purpose of the sampler was to trigger percussion and electronic drum sounds, but with its long sample time and configurable polyphonic playback, it was ideal for playing back all manner of samples.

At the time I was aesthetically and philosophically interested in plagiarism and Plunderphonics[4], so the sampler was a perfect vehicle for these kinds of explorations. I created banks of patches filled with plagiarised samples I could recontextualize in a performance setting [4], and used the sampler in this way for many years. Currently, the sampler is mainly used to create instrument-like patches that I can play with by striking the sample pads. Examples of this are samples of looped church organ clusters, or individual hits from a modified drum machine.

[3] The inventor of Circuit-Bending, Quabais Reed Ghazala, has since published a book on the subject of Circuit-Bending [3] and there are a number of webpages, forums, and mailing lists devoted to the subject.

[4] Plunderphonics refers to the use of existing audio recordings to create a new composition where no attempt is made to disguise the fact that the material has been plagiarized.

The sampler was the first addition to the drum-set that really extended the sound canvas available to me while playing. One could argue that the Specto-Situationalist already did this, but acoustic drum-set and strings amplified by guitar pickups are very much part of the same sound world. If the Specto-Situationalist made the drums a hyper-instrument, by extending the sounds of the original instrument, the sampler made it a meta-instrument, by bringing in sounds beyond that world [5].

4. ACOUSTIC EXPLORATIONS

After the addition of the electronic instruments I began experimenting with DIY acoustic instruments. I was very much inspired by Harry Partch and how he built his own instruments in order to create a new music unique to those instruments [6]. This approach was intrinsically more interesting to me than that of the Baschet brothers, who created their own instruments only to use them in classical music [7].

The most significant instrument I made at this time was a hand-hammered cymbal (See Figure 3). I had read an article by cymbal-maker and sculptor Steve Hubback [8] where he spoke about using stainless steel to make cymbals. Stainless steel, unlike the more commonly used bronze alloys, could be cold hammered, that is to say, that you could just hammer the cymbal without needing to heat it in a forge before hammering [9].

Figure 3. A hand-hammered cymbal made out of 316L grade stainless steel. (Photo © Rodrigo Constanzo)

The prospect of making my own cymbal was very exciting as there was a "pushing from both sides" approach that I had adopted in evolving my drum-set. The more electronics I added to the drum-set, the more the acoustic drum-set changed to match it. By this point my drum-set had dropped down to a 3-piece drum-set with only a ride cymbal and hi-hat as the cymbals. With making my own cymbal I tried to make the acoustic elements that remained as unique and interesting as possible, while still retaining "drum-set" functionality[5].

[5] This process has continued by adopting small and customized drums to make up the standard portion of the drum-set.

Other acoustic explorations came in the forms of small and modular components that could be added or removed as needed. These include cast iron cooking pot lids, a trimmed and bent cymbal bell, and more recently a string with hooks on each end, which can be quickly mounted on a drum with a violin bridge, making the head of the drum a resonator, similar to a banjo.

In addition to expanding the sounds of the drum-set, these smaller instruments fundamentally changed how I functioned as a performer at the drum-set. Rather than being a fixed instrument, the drums became an increasingly dynamic performance space, where instruments laid at my feet, and the drums themselves served as resonant tables.

5. TOYS AND SELF-AMPLIFIED INSTRUMENTS

The successful introduction of small acoustic instruments led me to a significant realization. All of the Circuit-Bent and DIY electronic instruments I had been creating and performing with over the years could be integrated into the setup in much the same way. Due to the difficulties involved with amplifying dozens of tiny instruments, I had never considered using all of my self-amplified instruments, but if I used them as I did the small acoustic instruments, they added a new and exciting dimension to the setup.

This included many of my circuit-bent instruments as well as a few touch-based instruments designed by Peter Blasser [10]. One of these, the Fyrall (See Figure 4), is a noise generator, which is played by touching several dozen brass rods protruding from the surface of the instrument. I found touch to be an ideal interface when dealing with a hybrid instrument such as mine. The immediacy and subtlety it provided became a significant part of my improvisation and future instrument designs.

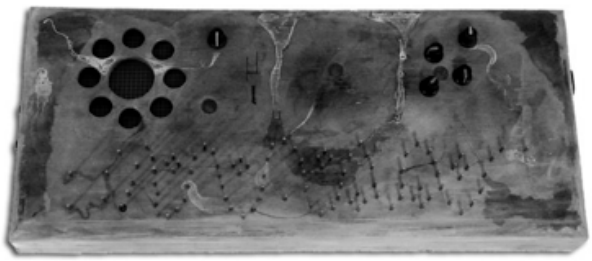

Figure 4. Fyrall, a touch-based synthesizer designed by Peter Blasser. (Photo © Rodrigo Constanzo)

The small, and directional nature of the speakers built into these small instruments adds an interesting element of spatialization to the setup, by localizing their sounds to the to the drum-set itself, as opposed to the amplifier and/or PA system. This also serves to make the electronic sounds more organic, and 'acoustic' sounding by being relatively quiet and originating from an acoustic source[6], similar to the trombone-propelled electronics of Nic Collins [11].

Around this time was also when I began using a melodica as part of the setup. Since I had played piano nearly all of my life, I was very comfortable with improvising with a keyboard-based instrument. This was a noteworthy addition, in that my setup now included elements from every traditional instrument I played, namely drums, guitar and finally piano.

6. ELECTRONIC ADAPTATIONS

A byproduct of having a modular set of instruments is that moving from one to another can take some time both mentally and physically. To resolve this problem I began integrating the interface of electronic instruments directly into the acoustic drum-set. This section will go into detail on how I adapted some of my electronic instruments in this way.

6.1. Sidrassi-Tom

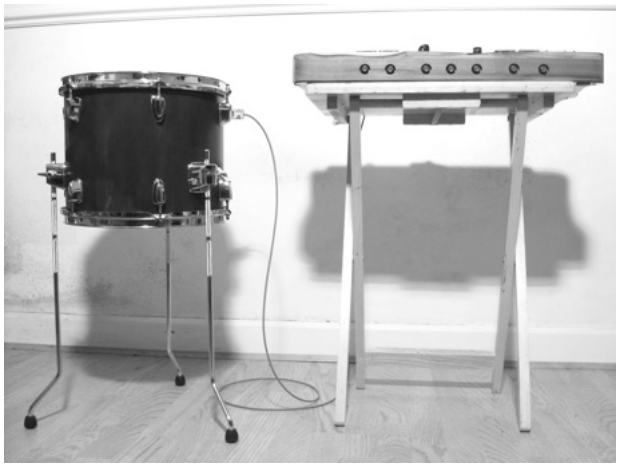

Figure 5. Sidrassi-Tom, a floor tom adapted to controlled the Sidrassi Organ. (Photo © Rodrigo Constanzo)

The Sidrassi Organ[7] is an instrument I had been performing with regularly when I did more "table top" oriented performances. It's an incredibly dynamic and expressive instrument that I wanted to find a way to incorporate into my drums setup. Since it is played by pressing aluminum bars that had pressure sensitive piezo-electric discs under them, I thought to try placing those piezos elsewhere. After a few experiments I decided that the floor tom was the most practical location for them. The 12" drumhead is large enough

[6] In order to further explore this idea I am currently experimenting with using transducers attached to the heads of the drums so that the electronic sounds would literally originate from the acoustic drums by vibrating the heads of the drums like speaker cones.

[7] The Sidrassi Organ is an electronic instrument that is played by pressing or tapping pressure sensitive bars on its face. Each bar produces pitch that can be modulated by touching or interconnecting 42 brass rods on the face of the instrument. <http://www.ciat-lonbarde.net>

where I could press each piezo individually, and it was also soft enough to allow for subtle movements. There is a matter of durability to consider when working with delicate piezo discs. I found that by placing the piezos on the underneath of the drumhead, near the edge of the drum, they were out of the way enough to survive for a long time. I still have to periodically replace the piezos with new ones as they eventually sustain some damage, through striking the drumhead with sticks, which severely limits their dynamic range.[8]

The Sidrassi-Tom (See Figure 5) has proved to be a very effective alternative controller for Sidrassi Organ. Since the Sidrassi is primarily designed to sense slow finger presses, striking the head of the floor tom in the regular way does not trigger the instrument. Because of this, I can have the Sidrassi's volume up the whole time I am playing. Not having to manually raise the volume of the instrument when I want to use it allows me to very easy and efficiently play the instrument without having to switch physical and mental "gears", which is often a problem when switching between instruments.

6.2. Electric Whisks

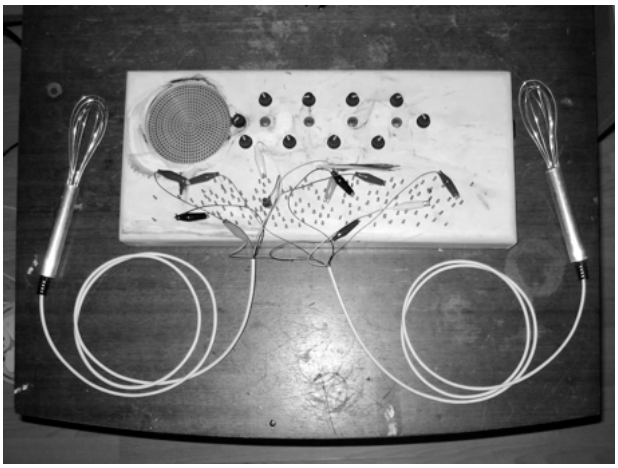

Figure 6. Electric Whisks, a set of DIY whisks where each prong is electronically isolated, connected to the Fourses, a touch-based synthesizer designed by Peter Blasser. (Photo © Rodrigo Constanzo)

The Electric Whisks (See Figure 6) are another exploration into alternative interfaces for electronics. The idea was to create a set of whisks where each prong was electronically isolated so that when using the whisks like a drumstick, pressure and vibration would make pseudo-random connections between the prongs. This would allow a single movement/strike to generate an acoustic sound, as well as an electronic one. They can also be used to slowly press and scrape a drumhead much like drum brushes, to create an evolving series of connections. Finally, they can be physically grabbed along the prongs so that varying pressure and skin contact can create variable resistance between each prong. Essentially, the whisks function like a dynamic patch bay, making and breaking electrical connections.

I fabricated the prongs of the whisks out of flexible, silver-coated wire from a hobby shop as I could easily solder to them without special equipment. The handle is made out of round and hollow aluminum, as it is lightweight and inexpensive. The most difficult part to fabricate was what would physically hold, and isolate, the prongs from each other inside the handle. After some testing I found that a thick wooden art brush ideal, since wood was easy to work with and did not conduct electricity. I wanted the whisks be open ended, in that I can connect them to any of the touch-based instruments I was using. To do this I ran wires from the prongs through the handle of the whisks, which terminated in alligator clips, so they could be easily attached to any instrument I wanted to control.

The whisks have proven to be incredibly dynamic controllers that, depending on the instrument they are controlling, can cover a huge range of sonic possibilities. One of the more interesting aspects of the whisks is that the relationship between the acoustic and electronic sounds they control is not necessarily linear. For example, I can play quiet and constant acoustic sounds while simultaneously producing intermittent and loud electronic ones.

6.3. The Party Bus

Figure 7. The Party Bus, an 8-bit sampler and DIY mixer housed in a small plastic enclosure. (Photo © Rodrigo Constanzo)

After incorporating the Sidrassi-Tom into my setup, I now had three distinct instruments that needed amplification. The amplifier I was using at the time only had two inputs, which were already in use by the Specto-Situationalist and the sampler. I was hesitant to incorporate a mixer to my setup as the added complications of wiring and powering the mixer outweighed the benefit of having an additional input.

[8] I am currently investigating the use of flexible piezo film instead of the standard ceramic disc piezos in order to increase the durability of the dynamic range of the instrument. Piezo film does not produce as high an output as piezso discs so I will have to use larger piezo films to produce the same amount of current. This will have the negative effect of dampening the acoustic drum. Whether the trade-off in acoustic sound for electronic durability is worth it is yet to be seen.

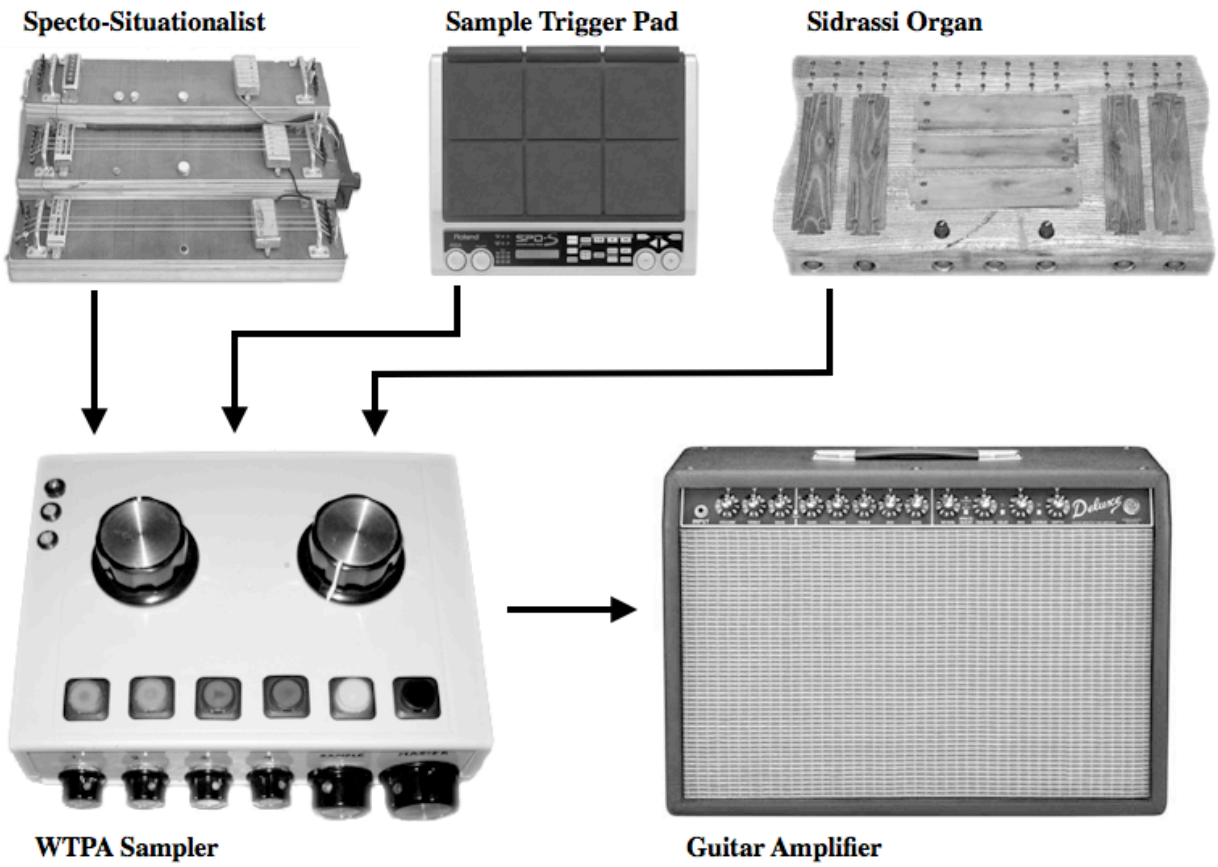

Figure 8. Drums+Electronics amplified electronics audio routing.

Around that time I had purchased a WTPA sampler[9], which I was looking for a way to incorporate, and decided to kill two birds with one build.

The Party Bus (See Figure 7) was conceived to be the central hub of my setup. It contained a simple, DIY 4-to-1 mixer, which merged all of my amplified instruments into a single mono channel and routed them into the WTPA sampler where they could be sampled and manipulated in real-time (See Figure 8). I built both the mixer and WTPA sampler circuits into a small plastic enclosure that I could easily mount on top of my bass drum, directly below the sampler, and within easy reach of both of my hands.

The WTPA sampler, in addition to having the standard features found on most samplers and real-time loopers such as record, overdub, one-shot, and reverse playback can do lo-fi bit-crushing, sample slicing and reshuffling, sample startpoint/endpoint/window editing, and other esoteric processing due to its software based control system[10]. Its efficient interface consists of only six buttons and two knobs, making it perfectly suited for this kind of use, where I could quickly reach over with one hand and capture and/or manipulate anything running through it. This added an extra layer to what I could do with my amplified electronics in terms of processing and, more importantly, added the dimension of live sampling.

7. PUTTING IT ALL TOGETHER

One of the most important factors in the evolution of my instrument and playing is that I do not consider myself a drummer. My musical background is primarily that of a classical pianist and composer, which allows me to view the Drums+Electronics instrument in a different manner. Even when I play a standard drum-set in a conventional context I try to think compositionally, instead of the more "groove" or "backbeat" oriented role expected of the instrument. This approach becomes amplified when improvising. At the same time, my background gives me the discipline needed to improve my playing and instrument as well as the virtuosity needed to articulate ideas in the context of improvisation [12].

The way I've developed my setup (See Figure 9) lends itself very well to tangent-like improvisation. That is to say, each individual instrument has a sound world and language associated with it, so that when improvising, I make decisions to explore and navigate between these sound worlds. When performing a solo improvisation, I usually play short and disconnected sections where I explore these worlds and how they connect to each other. Texture and density also play an important role,

[9] The WTPA Sampler is an 8-bit, software controlled, circuit-bendable (by design) sampler and looper designed by Todd Bailey. <http:www.narrat1ve.com>

[10] The WTPA sampler has features that are only accessibly through MIDI control, unlike how I have set mine up, such as introducing sample jitter errors.

due to the drone-like nature of many of the electronic instruments.

Figure 9. The current Drums+Electronics setup photographed just before a recording session. (Photo © Rodrigo Constanzo)

My overall sound and approach is decidedly lo-fi. There is something about dirty and imperfect sounds that appeal to me. This has informed nearly all of my instrument making, composition, and improvisation. I share John Richard's digital "allergy" in that I primarily use what he calls "dirty electronics", but for me this is not a reactionary decision, it is an aesthetic one [13]. I purposely look for unique, esoteric sounds and instruments, as well as different ways of playing them in order to have an ownership of my sound. Sometimes this leads me, full circle, into cutting edge technology like the iPad. For me, the loss of fidelity has more to do with fingerprint and ownership of sound, than it does with a tendency towards analog electronics.

All of my amplified electronics go into a small tube-powered guitar amplifier, which sits on the floor close to the drum-set. I found that even though this type of amplifier is generally not used for electronic instruments, due to its poor frequency response and monaural nature, it is ideal for my setup. Guitar amplifiers tend to have a very pronounced mid-range with limited bass and treble response which fits perfectly "inside" the frequency range of an acoustic drum-set, which generally has the opposite frequency contour from the low-pitched drums and high-pitched cymbals. I have done performances in the past where all of the electronics go directly into a high quality, full-range PA system and the results are terrible. The highs and lows become muddled and the spatial image is disjointed with the electronic and acoustic instruments coming from a different place.

8. THE FUTURE

My current experiments and interests are primarily dealing with software and embedded systems. The advent of powerful and self-standing computers in the form of Arduinos and Apple iOS devices offers a world of possibilities previously only available through large, complicated, and expensive systems. Since I have very little background in coding, other than some relatively basic Max/MSP patching[11], it was not an obvious direction for me, but the flexibility and power afforded by these systems is worth investigating.

I first began experimenting with the Arduino platform in order to build embedded systems into my instruments. Inspired by the instruments of Godfried-Willem Raes [14], I wanted to create hybrid instruments that go one step further than my adapted electronics by having intelligent systems built into them. The first instrument I conceived was one where my bass drum would be fitted an Arduino-based system that could sense what was being played on the drum-set through contact microphones and intelligently produce accompaniment based on what it heard, by striking the inside of the drum. In effect creating a lo-fi artificial intelligence performer and instrument hybrid.

Being able to control physical things through software also allowed me to investigate real-time performance applications of sounds and instruments I could only work with in the studio, due to their unstable nature. In the past I had worked with skipping CDs, where I filled a CD with multiple recordings of a Bach prelude to then improvise along to the skipping and glitchly playback. I experimented with different CD players and CD "preparations" similar to those of Yasunao Tone [15] and although the results were excellent, they were also inconsistent, which is not ideal in a performance setting. With an Arduino using a similar "listen and respond" system mentioned above controlling a CD player modified to skip on command [16] I could create an intelligent, hardware, real-time granulizer.

In addition to creating Arduino-based systems from the ground up, I have started incorporating iOS devices, namely the iPhone and iPad, into my setup. Although I've owned an iPhone for years, the software available for the platform was very limited and disappointing. The most intriguing of these is Concat, a real-time concatenative synthesis application written by Nick Collins[12]. Controlling complex electronic sounds organically, through the familiar interface of playing drums, similarly to how PA Tremblay uses his electric bass to control his laptop, [17] is a very welcome addition to my laptop-free setup. The introduction of the iPad, with its more powerful processor and large multi-touch screen, will undoubtedly give way to increasingly complex instruments and application for the iOS platform.

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[11] Most of my Max/MSP patching was geared towards creating a sample and playback instrument which would intelligently accompany me as an improviser, similar to what I am currently trying to accomplish with the embedded systems mentioned in this section.

[12] Nick Collins has created some very interesting iOS applications ranging from stochastic and concatenative synthesis to live coding, to an adaptation of his Supercollider breakbeat slicing library BBCut. <http://www.informatics.sussex.ac.uk/users/nc81/iphone.htm>

As made evident throughout this article, this instrument is an ever-changing one. I am constantly exploring new instrument ideas and performance approaches, all the while keeping the setup relatively small. There is an evolution taking place where things that do not function or get used get replaced by things that are new in an effort to develop as best as possible. After years of thinking that the instrument was finally "done", only to be struck by a new idea, I have come to the realization that the instrument is actually a process. It is a development that mirrors my improvisation and music. In a way, the instrument is my metaphor.

9. REFERENCES

[1] Hopkin, B. *Gravikors, Whirlies & Pyrophones*, Ellipsis Arts, 2006.

[2] Anderton, C. *Electronic Projects for Musicians*, Music Sales America, 1992.

[3] Ghazala, Q. R. *Circuit-Bending: Building Your Own Alien Instruments*, Wiley, 2005.

[4] Oswald, J. "The Plunderphonic, or, Audio Piracy as Compositional Prerogative", *Wired Society Electro-Acoustic Conference*, Toronto, Canada, 1985.

[5] Bongers, B. "Electronic Musical Instruments: Experiences of a New Luthier", *Leonardo Music Journal*, XVII (2007), 9-16.

[6] Partch, H. *Genesis of a Music*, Da Capo Press, 1974.

[7] Baschet, F. *Les Sculptures Sonores*, Soundworld, 1999.

[8] Bettine, M. "Percussion Today: The Percussion Odyssey of Steve Hubback – Dreaming up Wondrous Sounds", *Modern Drummer*, XXIX (2005), 108-109, 111, 113.

[9] Hubback, S. *Fire And Steel*, Soundworld, 2005.

[10] Blasser, P. "Pretty Paper Rolls", *Leonardo Music Journal*, XVII (2007), 25-28.

[11] Collins, N. "Low Brass: The Evolution of Trombone-Propelled Electronics", *Leonardo Music Journal*, I (1991), 41-44.

[12] Bailey, D. *Improvisation: It's Nature And Practice In Music*, Da Capo Press, 1993.

[13] Richards, J. "Getting the Hands Dirty", *Leonardo Music Journal*, XVIII (2008), 25-31.

[14] Raes, G. "A Personal story of Music and Technologies", Web Publication (Accessed on 27 December 2010). <http://www.logosfoundation.org/g_texts/ibart-leonardo.html>

[15] Kelly, C. *Cracked Media*, MIT Press, 2009.

[16] Collins, N. "Hacking the CD Player", Web Publication (Accessed on 27 December 2010). <http://www.nicolascollins.com/texts/cdhacking.pdf>

[17] Tremblay, P.A. and Schwarz, D. "Surfing the Waves: Live Audio Mosaicing of an Electric Bass Performance as Corpus Browsing Interface", *Proceedings of the 2010 Conference of New Interfaces for Musical Expression*, NIME10 (2010), 447-450.