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Creating MIDI Instruments for use in Theatre Sound Design

Abstract:

A sound designer's job is to craft an aural landscape that feels organic to the world of the production. There are many different tactics and avenues to explore while doing this, but one way to encourage this effect is to create show specific MIDI instruments. This paper explores the process of making these instruments and examines three productions that I have designed as case studies for possible applications. While these instruments are not applicable to all productions, creating them can provide improvements in collaboration, improvisation, and performance.

1. Introduction

What originally drew me to the concept of creating custom-designed MIDI instruments for theatre was working as a consultant for local music artists. Their show needs often differ greatly from that of a theatrical piece. These artists need to control music in a nonlinear way that allows and encourages improvisation. In doing so, they treat their software as another instrument. In theater, we tend to create content that is presented the same way each night. While this an entirely valid way of designing for linear productions, the process of creating custom MIDI instruments adds a higher level of flexibility to a theatrical production/event's aural landscape.

2. MIDI Terminology

To engage with this paper, it is important to have a basic understanding of what MIDI is and what it can do. MIDI stands for Musical Instrument Digital Interface. It is a digital message that once sent, gets translated, and then used as a value to control something. It can be used to

control faders on digital boards, play notes from a Mainstage patch, or have synthesizers keep time with each other, among other things. To expand this idea even further, you can have the acoustic notes played by a guitar converted into a MIDI message, and then, with the proper piece of software, use that MIDI message to control the delay time of a group of singers. With that in mind, when this paper refers to "creating MIDI instruments" it is shorthand for designing an audio system controlled via MIDI that is sent by a physical user interface.

3. The Impetus

Generally, the instrument creation process begins with an idea or goal: an actor-controlled effects processor, an audience-controlled instrument, A1-controlled semi-randomized spatialization, etc. With goals like this in mind, the designer builds an instrument by considering the following: software, physical interface, spatialization/reinforcement, and troubleshooting and refinement. The designer then continues to edit instrument functionality throughout the rest of the rehearsal process until satisfied.

4. Software

Possible software choices are Max/MSP, Pure Data, and Ableton Live. Each program has its advantages and disadvantages. Max/MSP and Pure Data are both visual programming languages. Max/MSP has a thriving community of users and is actively being developed by Cycling '74 at a high level. On the other hand, Pure Data is a free program, so the barrier of entry is lower. Each allows the user to create "patches" that can act as custom made control interfaces, effects, measurement systems, synthesizers, or a combination thereof. While they both offer a level of flexibility and precision to the instrument creation process, they are in many cases not time efficient. The visual programming language can at times be dense and difficult for

people who are unfamiliar. A designer can combat this with adequate study, combining

previously created patches, and prototyping well before rehearsals.

The software I utilize most often is Ableton Live. It allows the user to quickly access live

effect processing, click tracks, and control surfaces. It has a built-in sample playback engine and

allows for the user to MIDI map[1] quickly. It is generally less flexible than the other two pieces of

software; however, because it has built-in Max/MSP integration, stemming from the 2009

addition of Max for Live, it can house Max/MSP patches and be used as a way to create a more

user-friendly Graphical User Interface (GUI) for said patches.

5. Physical Interface

The next consideration when choosing/creating a piece of gear is asking how you want

the software on your computer to be affected. Some important questions to be answered include:

1. What aspects of the aural landscape do you need to dynamically control?

2. Are there any acoustic sources patched into your system? (Microphones, guitar

   pickups, analog synths, etc.)

3. What do you want to physically manipulate to control audio? (Knobs, faders,

   trackpad, guitar strings, piano keys, etc.)

4. How musically literate is the operator of the instrument?

5. How technically literate is the operator of the instrument?

6. What is the production budget?

Armed with this knowledge, the designer can now choose equipment to control their

system. Later in this paper I will elaborate on my use of MIDI-enhanced systems later in the

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1 Receiving MIDI messages from a physical interface and assigning to specific parts of software.

Case Studies section but two quick examples include *Feed*, where the actors interacted with a DJ-style Fader board and three microphones. Throughout *Bricolage*, I used a 49 key MIDI keyboard. Another example of this, not taken from my work, is the work of electronic music artist Imogen Heap. She decided that she wanted to manipulate her voice by moving her hand, so to do this she created a glove that controls a Max/MSP patch with MIDI messages.[2]

6. Reinforcement & Spatialization

An important consideration while creating a MIDI instrument is deciding how to propagate its audio output to an audience. Most often these MIDI instruments are auxiliary systems, so some sort of sound card/audio interface is required. Depending on the interface, this can cause a serious limitation regarding spatialization control. As a general rule, the greater the number of outputs, the more control you have over how the instrument spatializes within a space. While this is something to consider, often you do not need high-level spatialization control. If a designer is making an FX processor for a single actor's voice, then there is only a need for a mono signal to pass through the auxiliary MIDI instrument system.

7. Troubleshooting/Refinement

The process of troubleshooting and refining the instrument in rehearsals is dependent on who the operator of the MIDI instrument is. To make a general outline, there are two different strategies. If the designer or a dedicated audio engineer is going to be the operator of the instrument than the process allows for more flexibility throughout rehearsals. Perhaps running multiple Max patches simultaneously, switching in-between a few Ableton Live session views, or a combination thereof. Having an audio professional as the operator allows the designer to

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2 Imogen Heap's glove can be found [here](.).

have the ability to quickly iterate possible programming variants in response to the onstage action. On the other hand, if someone unfamiliar with playback technology is the operator of the instrument then a less fluid method should be employed. Within the first few rehearsals the operator should be using a viable MIDI instrument. Then the designer observes, takes notes, and makes changes in between rehearsals. They should continue refining the instrument while making the act of interfacing with the instrument as comfortable as possible for the actor throughout the process.

One the largest concerns in the process of creating the instrument throughout rehearsals should be the repeatability of the performance. Using one of these in tandem with a live performance allows for improvisation and randomization but these aspects should always remain in the parameters that the designer specifies.

II. Case Studies

In this section, three projects will be discussed in which MIDI instruments were utilized during their process.

8a. Improvisational Sound Design/Composition in *Slow No Wake*

In early 2018, I was a contributing artist in the event entitled *Bricolage* put on by the art company Maelstrom Collaborative Arts in Cleveland, Ohio. In it, as the contributing artists were paired together at random, I was paired with the analog projection artist Nathan Melarangro. We decided that we wanted to improvise in front of our audience live each night in a piece that we entitled *Slow No Wake*. To do this, I created an Ableton-based live composition tool that allowed me to create live sound design and music that matched his improvised visuals.

8b. The System

The system for this piece was as follows: Focusrite Clarett 4pre Audio Interface,

Macbook Pro, Oxygen 49 (MIDI keyboard), and four EV ZLX-15P Loudspeakers

8c. Programming

One of my favorite sound design gestures is pitch shift automation on ambient sounds

such as rain, wind, beach ambience, traffic, etc. With Ableton, you can accomplish pitch-shifting

effects by MIDI mapping parameters to knobs or faders. In this specific case, mapping the

transposition of a sound file onto a knob of the Oxygen 49 let me control in real-time how the

piece unfolded. I continued mapping parameters onto my MIDI keyboard until I had a suite of

verb, delay, pitch, and dry/wet controls mapped to the various knobs of the Oxygen 49. During

the piece I also played various synth patches on the keys of the MIDI keyboard. The five drum

pads on top allowed me to switch between these synth patches.

For the performance, I created a ten-minute track inside of the arrangement view. While

this view is used mostly for linear content, in this case, I used it to give my composition a loose

structure. Then I used the MIDI controller to adjust parameters of the samples live. For example,

the piece opens up with rain samples, but because I had mapped the transposition of the rain to a

dial on my controller, I could transpose the rain sample in response to the content Nathan

provided. This process continued as more audio content was delivered by the arrangement view

player. The keyboard portion of the controller I left entirely to my "in the moment" discretion.

8d. Effect on Collaboration

During the piece, the audience was asked to watch us collaborate in real-time with each

other. Creating in this style let us change our performance dependent on the nightly atmosphere.

Knowing that we both had a high level of freedom in our respective practices encouraged us to delve into different artistic directions.

9a. Interdisciplinary Collaboration: *Ironbound*

Effective collaboration between disciplines is key to the theatrical art form. Interestingly enough, in theater, every other designer works in a different world. Costume designers, scenic designers, and lighting designers all work strictly in a visual environment. The sound designer is left almost entirely to their own devices. Our true collaborators are the actors' voices and the occasional music director/composer. In this career path, one often finds themselves as the lone defender of the aural realm in a room.

In this particular instance, I decided to create a way for a director and me to sit in a room together and create soundscapes unencumbered by each other's past musical or audio training/experience. This production was entitled *Ironbound,* directed by Emily Moler, and was presented at UCSD. To do this, I created a custom instrument to aid in discussing sound and music similar to the one in *Slow No Wake*, but with some important differences. The instrument could not be a piano, if it were then the director might feel as though she had to perform despite limited music training; it needed to have simple FX/volume control, and it needed to allow the user to easily switch between sounds quickly.

9b. The System

The system for this collaboration was as follows: Behringer X32 (digital audio mixing console), APC 20, Macbook Pro, five JBL studio monitors, and one JBL studio subwoofer (low frequency speaker).

9c. Programming

To create the collaborative environment I wanted, I set up the Akai APC20 as the main MIDI device. This seemed optimal because it only has buttons, knobs, and faders. There is no inkling of a traditional musical instrument.

Fig. 2 Akai APC 20

In each of the columns of buttons were a different suite of sound files. The faders controlled the volume of each of the categories of loop-able samples, and the knob controlled a reverb send. I then put together a custom suite of sounds for each scene in the play as separate Ableton Live sessions.

9d. The Collaborative Process

After the Ableton programming and system design, I invited Emily Moler, the director of the piece, into the studio to play the new instrument and create gestures based on scenes alongside me. I introduced her to the APC 20 as a "custom-designed soundscape instrument" and then began editing the soundscape live together in the studio. The simplicity of cycling through

sounds allowed her to quickly make creative decisions without having to learn about things such as loop points or clip gain.

The beauty of this process is that it feels tactile and musical even for people with no musical training. It is easy to select a sound from a category and then adjust volume, pan, and reverb to taste. I let the director use the hardware while I offered comments and suggestions. This way, we put together a variety of different sounding scenes that were story-driven and satisfied both of our artistic visions. It also invited the director to be an active participant in the sound design alongside me. Due to the addition of the MIDI instrument we both left feeling better about the project, the soundscapes, and the production than we would have if I had sent ambient sound and music samples via a cloud service.

10a. Live FX Processing/Sound Effect Playback in *Feed*

The last piece examined in this paper is a piece entitled *Feed* that I had the pleasure of designing at the Cleveland Playhouse. The large technical challenge in this piece is that the script is split into two halves. One half is in a typical script format and the other half is running a constant monologue of commercials that underscores the entire show. For this production, we decided that we wanted to do these monologues live. To aid in doing this, I created a custom Ableton based vocal effect setup that allowed for user-controlled effects to be added onto the voices of the actors. This process gave the performer's more of a sense of ownership over their commercials, and, because of this, the commercials felt much more organic than if the underscoring was played through QLab and the A1 controlled the vocal effects at the board.

10b. The System

The system for this collaboration was as follows: Yamaha CL5, Behringer Uphoria 404, three SM58s, Akai APC 20, Macbook Pro, and a variety of theatrical speakers. The actors portraying the Feed were hidden behind a drum shield where they affected their own voices: pitch bending, adding delay/reverb/chorus effects, and adding in DJ-style sound effects. We then sent them out of an audio interface and into the house CL5. The A1 then mixed this signal throughout the show.

10c. Ableton Programming

Each of the three SM58s were routed into Ableton separately. These digital signals were then internally routed into one dry return track at full volume. They used an Akai APC 20 as a control surface where they sent that signal to various FX sends. These actors also had control over a number of DJ-style commercial sound effects and musical underscoring.[3]

10d. Rehearsal Process/Instrument Refining

Luckily, I was brought into this process fairly early on. I quickly realized the A1 would not have the technical experience to mix the two shows simultaneously (the commercial underscore and the traditional script). Before the actors started rehearsal, I had a viable Ableton Live based vocal processing system running smoothly, and on the first day of rehearsal I had the pleasure of introducing it to the actors. They were very enthusiastic having never experienced vocal effects and playback that they themselves controlled.

Throughout the rehearsal process the actors each played with the instrument. They noted which of the vocal effects they liked on their voice for specific moments and which underscoring

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[3] The rehearsal Ableton Live file can be found [here](#).

sound effects they wanted to select. I took their notes and edited VFX and music selections for them in rehearsal. Through this process the actors felt ownership over the instrument, having made suggestions as to how it worked and sounded. We created the MIDI instrument for the show together, and, because of this, when technical rehearsal arrived I had the joy of focusing on underscoring, ambience design, and area mic-ing.

Fig. 3 Feed Rehearsal Setup

12. Conclusion

Sound design for theater is a profession based around answering a production's audio questions, and, because of this, every so often a designer finds themselves asked a particularly complex one. My hope is that by presenting the process of making show specific MIDI instruments designers can use this as a solution to some of their own questions.

For the designers who are not programming inclined, the best way to try creating a MIDI instrument would be to start with Ableton Live. From there, MIDI-map sample parameters to a controller and try to use it to underscore and enhance live performance. After getting accustomed

to that process, they can begin exploring other pieces of supplementary software: Max/MSP, Pure Data, Spat~, OSCulator, Live Professor, Clyphx. It is an exciting time to be a sound designer as these new tools are being developed faster and faster.