MadLib: Developing performative skills with live electronics through educational compositions

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ABSTRACT

The proliferation of the visual programming language Max has yielded a number of educational resources for those looking to use the language. Max course curricula often revolve around projects in composition or sound design, but rarely focus on developing the skills that a performer would need to perform with a Max patch. This study explores the musical output and educational potential of the composition MadLib (2021) by Louis Pino, for solo performer and Max patch. MadLib is specifically designed to engage fundamental skills to help performers think about the application of technological concepts from an artistic, rather than a task-oriented, perspective.

This paper incorporates the work into a creative, experiential study involving eight participants from the Technology and Performance Integration Research (TaPIR) Lab at the University of Toronto. Participants performed and recorded their own interpretations of MadLib, participated in interviews, and completed surveys describing their preparation process and learning outcomes.

Most participants described positive learning outcomes from this experience, indicating that projects such as MadLib could be beneficial for those looking to develop performative skills with Max. Further performer-oriented educational resources for Max could help to both encourage performances of new works and further disseminate existing works for live electronics.

1. INTRODUCTION

Max is a well-established programming language and interface, adopted internationally by composers to create electroacoustic music [1]. Max courses offered at universities often adopt a compositional, project-based approach, asking students to build material in creative and unique ways. Although these projects normally focus on outcomes related to composition or sound design, the practice of live performance with interactive electronics generally is less explored. In these curricula, performers do not get the opportunity to develop and integrate the concepts required to musically interact with the technology they are building.

This paper presents a study of the musical and educational potential of *MadLib* (2021), a new concert piece for solo performer and Max patch[1]. *MadLib* engages the performer's Max skills and creativity by requiring them to "play" with the patch using a wide variety of objects[2], workflows, and methods considered fundamental to understanding the Max language.

Playful practice-based learning has been proven to be an effective method of learning new interfaces for musical expression, also resulting in more interesting and unique final products [2]. At ICMC 2021, Andrea Bareggi and Simonetta Sargenti presented a paper examining two short instrumental pieces with live electronics as potential educational tools by "reconsider[ing] the electroacoustic music teaching process in relation to modern pedagogical approaches, more practical and student centered (learning by practice)" [3]. Several elements of *MadLib* can be—or in some cases must be—chosen and/or adjusted by the performer in the process of creating their interpretation of the piece. Here, we use the term "interpretation" to encompass both the player's individual live performance of the work as well as all of the preparatory decisions made ahead of time when preparing the patch and the piece.

Learning to perform with Max also requires students to develop troubleshooting skills that will naturally arise with nearly every patch. Consider, for example, uploading and playing audio files in a Max patch. All-too-often, files played from a directory fail to play after uploading: users familiar with how Max interacts with files will be able to identify and solve the issue much more quickly than those without this experience. Similarly, with pitch tracking, it is critical to be able to understand the process of how Max objects–such as the fiddle~ external object [4]–identify pitches so that issues can be identified and addressed. A

[1] Programs written in Max are referred to as patches. The user interface where a Max program is written and interacted with can also be referred to as the patch.

[2] An object is a pre-built module that performs a specific task or function. Objects are the building blocks of Max patches.

performer using Max patches with these features must be able to troubleshoot them in dynamic and stressful settings such as rehearsals and concerts. Beyond troubleshooting, increased interaction with complex patches can familiarize the performer to various audio processing techniques and different methods of transitioning within a patch.

Oliver Hancock advocates for an approach to learning visual programming languages centered on interactivity and creative experimentation [5]. In order to test the efficacy of *MadLib* as a potential platform for constructionist learning, this study below follows eight participants with varying degrees of experience with Max as they learned and performed the piece for the first time. The aim of this study is to determine the extent to which a composition like *MadLib* can be an effective practice-based supplement for learning Max. By asking multiple people to perform the same work, we were able to observe how different performers navigate the patch, and in the process, learn the semantics of Max and general concepts related to performing with live electronics.

2. ORIGIN AND CONCEPT

Percussionist Jonny Smith commissioned Louis Pino to compose *MadLib* in order to practice performing with live electronics while also gaining a better understanding of Max. The concept was to create a piece that gives the performer creative agency and allows for a wide array of musical outcomes through patch customization, sample selection, and open instrumentation.

The piece is named after and inspired by the word game, Mad Libs, in which the reader is prompted to provide words that fit certain categories (nouns, verbs, colors, etc.) in a given order [6]. These words subsequently fill the blanks of a prewritten story, usually resulting in a comedic outcome. Similarly, in *MadLib,* the performer must record or import their own samples to be inserted into the patch while also deciding certain parameters for how these samples will be manipulated to construct the electronic accompaniment.

MadLib was premiered on April 29, 2022 at The Space Between Conference at McMaster University in Hamilton, Ontario, Canada. Smith and Pino performed their own versions of the piece back-to-back to demonstrate how personal customization results in unique performances.

Figure 1. Smith and Pino at their respective setups during the premiere of *MadLib.*

3. THE PIECE

MadLib was specifically designed to aid in the performer's practical learning of skills related to performing with Max patches and live electronics in general. The following description of the piece and the preparations one must make to perform it is meant to highlight the specific ways in which *MadLib* can be a useful educational tool.

MadLib gives the performer a chance to interact directly with the Max patching environment through a selection of musical features including granular synthesis[3] and looping control[4], as well as organizational methods such as file directories, signal flow, and in-patch data management. The piece intentionally employs standard electroacoustic techniques and Max-specific language (e.g., objects, messages, digital signal processing) covered in various Max course syllabi in order to introduce concepts and techniques generally considered to be fundamental to understanding Max [7] [8] [9]. Furthermore, the piece allows for the performer to practice interacting with standard live electronic processes such as pitch and amplitude tracking, live looping, and live audio processing (i.e., delay, modulation, live sampling, and pitch shifting).

Figure 2 shows the main interface of the *MadLib* patch. The performer is encouraged to explore the given possibilities and, if desired, use their own code to augment the patch.

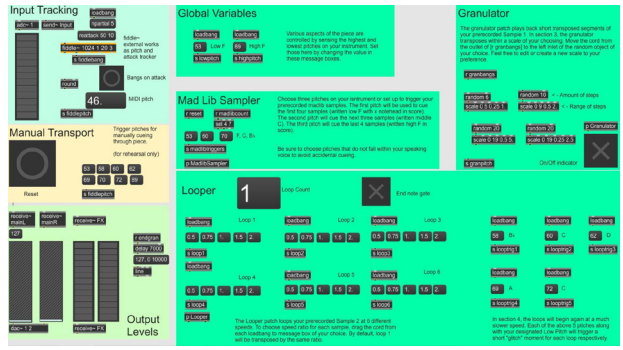

Figure 2. Screenshot of the main window within the *MadLib* Max patch.

3 An audio synthesis technique where a sound is cut into very short pieces (typically 5-100 milliseconds) and reconstituted based on various parameters into a longer piece of audio or continuous stream of sound.

4 The performer is able to preset the speed and pitch of a variety of sample loops used throughout the piece.

3.1 Preparation

The performer may choose any instrument or a collection of instruments for their performance of the piece. In order to accommodate the use of both traditionally pitched (e.g., piano, flute) and unpitched instruments (e.g., drum set, found sounds, non-western tuned instruments), the score is provided in both conventional and relative pitch notation (Figure3).

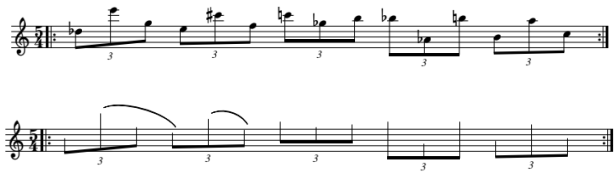

Figure 3. Excerpt of *MadLib* in conventional notation for pitched instruments (top) and relative pitch (bottom) notation for unpitched instruments.

They must also adjust certain pitch tracking values in the patch based on their instrument choice. The player sets two main cue pitches, the highest and lowest in their instrument range, along with five other arbitrary cue pitches that control various aspects of the electronics including moving between sections and triggering samples.

Furthermore, the performer must also source thirteen audio samples, as there are no default samples or pre-recorded materials included with the piece. Eleven samples are meant to be short, punctuative sounds that are played without alteration. The other two are longer samples of recorded music that are processed by the patch to generate much of the electronic material present throughout the work. In addition, an optional area of the patch allows the performer to select and customize a number of live audio effects:

- *Delay*: records sound and plays it back after a period of time
- *Pitch-shifted delay*: records sound and plays back a pitch-shifted version after a period of time
- *Amplitude modulator*: alters the volume of a sound by using another sound wave as a control signal
- *Harmonizer*: shifts the pitch of incoming sound by four different values
- *Reverse sampler*: records sound and plays it back in reverse at varying speeds and lengths

The performer also has access to a variety of low-frequency oscillators (LFOs), which allow the player to assign fluctuating streams of values to any parameter of the auxiliary effects. Using the "pattr" object, a common Max object that manages multiple parameters of a patch, the performer can choose to use certain effects in one section of the piece and forgo them in another. Understanding and controlling these mechanisms, which are embedded in many Max compositions, enhances the performer's ability to effectively present other composers' live electroacoustic music.

3.2 Form

MadLib has three main sections. The performer navigates the sections at their own pace using pitch and amplitude tracking provided by the fiddle~ external object.

In the first section, cued by the performer's first note, the patch loops a sample and gradually adds five more layers when triggered by designated cue pitches in the score. The performer chooses the speed of all six sample loops which determine the tempo and rhythmic framework for this section. The patch then listens for 5 seconds of silence, after which, any note played will cue the next section.

The middle section is a musical Mad Libs story. The performer speaks a text which is notated along with the music, while crucial words of the text are replaced by the performer's eleven short samples that are triggered by playing cue pitches. The performer also makes use of a granular synthesizer by cueing short bits of a sample with each note they play, resulting in a constant drone. After all of the short samples are played, slower versions of the loops from the first section are brought back one by one.

The last section is improvisatory, asking the performer to freely play in loose rhythmic conjunction with the slowed loops. The performer triggers cue pitches to briefly alter the speed of each loop, resulting in new composite rhythms with each speed change. After one minute in this section, the performer can choose when to end the piece by playing the highest pitch on their instrument.

4. OUR STUDY

The goal of the study is to test the effectiveness of *MadLib* as an opportunity for performers to develop skills and learn concepts about live electronics and Max and to observe the diversity of performance outcomes possible from the piece. In this creative, experiential study, eight participants were coached on and given resources to prepare performances of *MadLib*. There are two levels of preparation involved in learning *MadLib*: musical (i.e., playing the notation and improvising) and technical (i.e., patch customization). The majority of the participants spent most of their time modifying and customizing the patch. Therefore, the discussion below will describe the procedures that aided the participants in working with the patch and that most significantly affected the final results of the project.

The study involved eight research assistants, including seven graduate students and one recent graduate, with an average of sixteen years of musical training. There were seven percussionists and one accordion player, most of whom cited proficiency in other instruments: piano (3), woodwind (1), guitar (1), and brass (1). The participants demonstrated a wide range of experience working with Max and performing with live electronics (Table 1). All the participants are advanced performers with a high level of proficiency on their instruments.

Participant	Years of Max experience	Formal Max class completion	Frequency of performance with electronics
P1	0	Currently enrolled	Not often
P2	2	Currently enrolled	Not often
P3	0	No	Sometimes
P4	3	Yes	Often
P5	2	Yes	Often
P6	1	Currently enrolled	Often
P7	4	Yes	Often
P8	2	Yes	All the time

Table 1. Table showing participants' experience with Max and performance with live electronics.

This study, facilitated by TaPIR Lab, ran from October 4 to November 6, 2022. It consisted of the following steps:

1) An introductory workshop explaining the technical requirements for performing the piece, consisting of step-by-step instructions on how to customize the patch and prepare the work for performance.

2) Individual tutorials and independent experimentation with the piece between October 5 and November 4. Some participants who had very little to no experience felt more comfortable having the composer present as they recorded their samples and made their edits. For the participants who were already more comfortable with Max, these tutorials were a chance to go over their edits and gain a more thorough understanding of how the patch operates on a detailed level.

3) Final recorded performance and interview. Performers completed questionnaires before their recording sessions in order to collect background data on the participants' prior experience with live electronics. Immediately after recording, they were interviewed about their experiences of learning and preparing the piece.

Overall, including setup and troubleshooting, this process took approximately one hour per participant. The written questionnaire, video recordings of performances, and audio recordings of interviews were kept for later review by the authors.

5. PERFORMANCES

A diversity of interpretations and distinct performances resulted from this workshop. Table 2 shows participants' interpretive decisions regarding instrument selection, sample selection, and further auxiliary processing used in their preparation of the patch. The heterogeneity of these decisions, in addition to variation in each participant's musical interpretation, resulted in performances that sounded almost like different pieces of music entirely. Participants tended to stick to a particular theme for their *MadLib* sample selection, with some recording or designing their own sounds but the majority of participants sourcing audio clips from sources on the Internet.

The auxiliary effects tended to be either used individually per section or built up cumulatively throughout the piece, with many participants favoring the pitch-shifted feedback delay and the LFO. Given that participants were generally inexperienced with electronics, it was surprising that four out of the eight participants chose to experiment with these effects, as they were among the more complicated options for processing. We could infer that participants gravitated towards these specific effects because they offered the most immediate and drastic impact to the overall sound, motivating the performers to continue their experimentation and play, regardless of their technical facility.

Participant	Instrument	Mad Lib samples	Auxiliary effects used
P1	Vibraphone	Cantonese speaking clips	Pitch-shifted feedback delay, LFO
P2	Metal pipes and wood planks	Custom-made synthesized sounds	Feedback delay, pitch-shifted feedback delay, modulator
P3	voice	effects	Modulator
P4	Accordion	Various bird calls	Pitch-shifted feedback delay, harmonizer, reverse sampler
P5	Melodica	Vocal samples	None
P6	Vibraphone	Recorded tabla sounds	Pitch-shifted feedback delay, harmonizer, LFO
P7	Almglocken, gong and triangle	Ice and water sounds	Pitch-shifted feedback delay, modulator, reverse sampling, LFO
P8	Glockenspiel	Custom-made synthesized sounds	Pitch-shifted feedback delay, LFO

Table 2. Table showing participants' interpretive decisions.

Regarding instrumentation, the majority of participants chose pitched instruments; the three participants that chose un-pitched instruments were required to find creative solutions in order to set cue pitches. Participants 2 and 7 found specific instruments to act as cue pitches that seemed to work well with the pitch-tracking software, and Participant 3 sang pre-established high and low notes with their voice in order to trigger the cues. Each one of the participants described a process of trying out different combinations of things, listening to the results, and then going back to the patch to make alterations.

Not only did the participants produce vastly different musical results, but many stated that they had more ideas for what they would change if they ever performed the piece again. The comments below, from the participants' post-study interviews, indicate how the process of learning and preparing *MadLib* caused them to think critically about how they could engage with the electronics to create desired results:

- "If I were to perform it again I would probably go in and make my own user interface so I can get more information out of the patch by just looking over at my computer during performance." (Participant 8)
- "I would like to play around with the live effects a little bit more so that it doesn't sound so drastic but so that they feel unified through the whole thing." (Participant 2)
- "One thing I would do differently would be to refine the volume of the samples. That was one thing I noticed because one of the clips I got was a lot quieter and I felt like it might have gotten buried." (Participant 5)

These comments and the overall positive experiences of the study participants substantiate the idea that customizable repertoire such as *MadLib* can be a fulfilling

creative outlet for performers that engages their imaginations and helps them to develop their skills with live electronics.

6. DISCUSSION

When discussing her view on why musicians are often hesitant to perform with unfamiliar technology, Elizabeth McNutt stated that "much of the schism that holds performers at bay may be repaired by simpler means: dialogue between composers and performers, education of performers in working with technology, and comprehension of performer's needs and expectations among composers" [10]. The learning experiences described by the participants of this study indicate that *MadLib* can be an effective tool to help bridge the schism described by McNutt because it addresses the specific needs of performers and allows them to engage directly with the technical aspects of the piece.

In the post-study interviews, the participants described learning about: A) troubleshooting problems when performing with a Max patch and live electronics in general (Participants 4, 6, 7, and 8), B) the fiddle~ object, how it interacts with live sound and tracks pitches (Participants 1, 2, and 5), and C) the possibilities of using live effects in Max such as delay, pitch-shifted delay, harmonizer, modulator, and reverse sampler (Participants 2, 3, 6, and 7). These are all transferable skills for performers who want to learn to play a variety of repertoire with Max and/or live electronics.

One of the most important phases of the study, especially for those with the least Max experience, was the workshops and one-on-one meetings led by the composer. Several of the performers mentioned that, while they had some degree of anxiety about preparing the piece, after meeting with Pino and being able to ask questions, their fears were alleviated. The comments listed below reinforce the need for quality instruction and interaction with a knowledgeable practitioner in order for this type of educational endeavor to be successful.

- "We had two workshops with Pino. That was really helpful, especially the second one, actually, because it really went into every detail of what I can customize and I did some of it. Then I looked at the playing part before I dove into the Max." (Participant 6)
- "Once I met with Pino… he explained to me what the different trigger points were. Once that was done, I was able to understand and figure out the rest." (Participant 2)

Although some of the study participants seemed initially intimidated by the *MadLib* patch, all were successful in presenting their own performances of the piece by the end of the study. With a sufficient amount of instruction and guidance, even novice Max users learned to play this piece, suggesting that *MadLib* could be a useful addition to a Max course where the student also receives direction from an instructor.

The hands-on experimentation and creative exploration required to prepare and perform *MadLib* were the main reasons that the participants of this study were able to develop and solidify their Max skills. There has been a wide range of published studies that advocate for this as a useful educational approach to music technology (e.g., Tomás, 2020; McPherson et al., 2016; Hancock, 2014) [2] [11] [5]. Hancock in particular advocates for constructivism/constructionism or learning through play: "Constructivism asserts that knowledge and understanding are constructed by learners. This is seen as an active process, distinct from models of passive reception associated with traditional instructionist methods…. Constructionism adds the notion that learning is aided by the manipulation of some tangible (not necessarily physical) object, possibly shared with other learners." [5]

Because the performer engages directly with the patch and electronic hardware by recording samples, establishing cue pitches and loop speeds, and setting levels for sound effects, it draws them into the process of exploration and experimentation. The requirement for the performer to venture below the surface level of the patch and engage with sub-patches and other features allows them to learn how to troubleshoot issues with the patch when they arise. Moreover, it provides an opportunity to apply one's skills with Max in a creative and personalized way. By providing a framework for the exploration of musical ideas, which is relatively user-friendly but also affords the user the artistic agency to make changes to and/or add to the existing framework, *MadLib* facilitates a form of constructivist learning that can complement other avenues for learning how to use Max software.

7. CONCLUSION

At ICMC 2016, Pete Furniss and Richard Dudas called for "the creation of a body of musical works that are technically straightforward enough to serve as an introduction to live electronic performance for musicians who might otherwise be daunted by the demands of the existing repertoire" [12]. This study demonstrates that, with some mentorship and oversight, *MadLib* can provide an effective and creative learning experience for both relative novices and more experienced performers working with Max. In their post-study interview, various participants expressed that their applied knowledge of Max and comfort level with the program increased through the experience of learning *MadLib*. More than just learning about various capabilities of the program, however, many of the participants stated that they gained "conceptual Max skills" or "inspiration about how to use Max" from learning and performing the piece. This higher-level thinking is a critical step towards regularly incorporating live electronics into one's artistic practice.

By examining the learned outcomes from the study participants and analyzing the aspects of interpreting and performing *MadLib* that facilitated that learning, this study demonstrates that creative interactivity with a pre-built patch can be a significant aid towards developing performance skills with Max. This kind of invited alteration of a patch can also produce highly individualized musical results that reflect the artistic choices and

personality of the performer, far beyond what typical pre-composed material would allow.

Although *MadLib* is a concert piece, it can be thought of as an étude as it fosters the development of techniques relating to performance with live electronics [13]. *MadLib* covers a variety of concepts in Max, but the idea of performative Max études could be implemented on a smaller, more segmented scale. These etudes could then be used as a means to practice isolated live electronic performance techniques (e.g., pitch tracking, MIDI mapping, and amplitude reactivity). In *Making Music With Sounds,* Landy states "[t]here is an assumption regarding sound synthesis, namely, that the maker of such sounds is aware of what (s)he is doing. The need for detailed knowledge is in dire contrast to today's society in which instant gratification or at least understanding is almost assumed" [14]. The ability to "play" with performative, purposely customizable Max patches gives the learner the opportunity to explore the applied outcome of a particular concept in a top-down perspective (that is, with a fully-formed patch, rather than beginning with a blank canvas) that can inspire deeper and more diverse learning outcomes.

The syllabus for Oberlin Conservatory's Tech 170, an introductory electroacoustic performance course taught by Dr. Aurie Hsu, concludes with a call to "[c]ultivate a performance practice that integrates your personal style with a proficiency in electroacoustic performance techniques...and [to] have a heightened awareness of how musical elements function together in practice and performance" [7]. For many performers hoping to program works with Max patches, there is a general threshold after which works become too complicated to perform without direct, in-person involvement of the composer.

If implemented widely, however, further educational resources focused on familiarizing performers with the Max language could raise this overall threshold for complexity in contemporary works for live electronics resulting in the increased presence and dissemination of existing works. Just as instrumentalists need some time in the practice room and on stage to hone their abilities, those who want to perform with Max need a creative space and performance goal in order to practice and develop those skills.

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