

Choreographing Sound: Co-creating Music and Movement through Touch with the Magical Musical Mat

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ABSTRACT

This paper presents insights and findings from an experimental dance workshop conducted with the Magical Musical Mat (MMM), an interactive instrument that amplifies physical touch with sound. The workshop, held as part of the exploratory phase for a larger performance project, aimed to explore the creative possibilities of the MMM in the context of dance performance. The workshop brought together two dancers versed in contact improvisation to collaboratively experiment with the MMM as both a musical instrument and a choreographic tool. The workshop highlighted the MMM's potential to facilitate expressive interactions between dancers, revealing possibilities for collaborative creativity in interdisciplinary contexts.

Author Keywords

NIME, DMI, interactive dance

CCS Concepts

• Applied computing → Sound and music computing; Performing arts;

1. INTRODUCTION

Digital Musical Instruments (DMIs) are often used to facilitate collaborative creative expression for broad audiences, and much attention has been given to the design of systems for this purpose. Many new musical instruments created for novices focus on creating playful, social interactions rather than on musical output [12]. Such instruments often transfer some musical agency from the participants to a computer. In these systems, limiting the participants' musical control lowers barriers to participating in collective experiences [2]. Two aspects of control in DMIs influence user experience: instrument efficiency and control intimacy. Instrument efficiency refers to the ease of transferring input gestures to outputs [10]. Control intimacy describes the extent to which subtle variations in input gesture express notable changes in sound outputs.

Often, restricting control means that users quickly hit the upper limits of creative expression for a given DMI. High skill ceilings are a desirable characteristic of DMIs, and the tradeoff between control and skill ceiling is a key design consideration in the development of DMIs [15]. We find that introducing professional dancers (who are novices in music-making) to an existing DMI, the Magical Musical Mat¹ (MMM), serves to raise its skill ceiling since the dancers bring a high degree of skill and experience in body expression to their interactions on the MMM. The system's low latency and sensitivity contribute to a high degree of efficiency when interacting with the MMM. Furthermore, the dancers have a large amount of control over their movement expression, granting them more control intimacy with the MMM.

The MMM is a DMI for collaborative music-making that translates interpersonal touch interaction into musical sounds. It was designed with accessibility in mind, in a process that centered non-speaking autistic children [5]. It went through multiple design cycles that considered the MMM's layout, materiality, and technical constraints. Later iterations were evaluated through Integrated Play Groups at an autism clinic. Acknowledging that spoken word is inaccessible to some students, the creators of the MMM were interested in uplifting diverse interaction modalities to give participants equal access to expression through interaction. See [4] for more discussion of the MMM's design process.

The MMM is made up of two conductive mats. When two participants stand on each mat and make contact with each other, the changes in contact resistance between their bodies are processed to generate sounds. The original MMM design utilized the Bare Conductive Touchboard's built-in MIDI synthesizer, and it operated in several different modes. A variety of modes were created to explore the range of interactions that the MMM could facilitate. These included mappings from resistance to pitches played on a MIDI piano and a mode where each new touch interaction triggered a percussive sound.

This work represents the first time the MMM's capabilities have been explored in the context of dance performance. The MMM naturally lends itself well to contact improvisation, an improvisatory dance practice where dance partners move together in contact. Contact improvisation calls for a "focus on relational aspects of movement" [7]. Practitioners communicate information about their movement to their partners through touch [13]. The MMM can serve to enrich touch interaction between dance partners, which extends their somatic awareness. This kind of added sensory information in multimodal systems can help dancers break out of habitual movement patterns, allowing for greater creative freedom [9].

Digital Dance and Music Instruments (DDMIs) facilitate

¹<https://www.magicalmusicalmat.com/>



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or augment dance performance [14]. Then often use muscle sensors, inertial sensors [11], and/or motion-tracking technology [9, 6] to capture body movements that are then mapped to sounds. While many DDMIs emphasize partnership between dancers and musicians [8, 1], few DDMIs focus on the unique considerations of partnered dance. One notable example is Interactive Tango Milonga (ITM), an interactive dance system built around Argentine tango and social dance [3]. ITM serves to foster intimacy and connection between dancers. As the dancers learn the mappings between their movement and sound outcomes, they develop a more acute perception of their partner’s movements. ITM uses sound and movement to facilitate connection and communication between dance partners.

In this paper, we discuss expanding the MMM’s scope to encompass additional forms of collaborative creative expression. Specifically, we reimagine the MMM as a platform for contact improvisation. We seek to answer the following questions:

- How can DMIs be utilized in broader interdisciplinary creative contexts, and what are the implications of such collaborations?
- What aspects of interactive systems like the MMM influence the process of collaborative music-making and movement exploration?

2. DESIGN OVERVIEW

The MMM operates in several different “palettes” or modes that define different touch-to-sound mappings. For the performance context, we adapted the MMM to run on an Arduino Leonardo and act as a MIDI controller, sending MIDI messages over USB to a laptop. Sounds are generated with Ableton Live and Max/MSP. The audio was played over an external speaker. For the workshop, the MMM’s conductive surfaces were made of two yoga mats with strips of foil (Figure 1).



Figure 1: Dancers using the MMM.

In developing sound design for performance with the MMM, we wanted to create a diverse array of sonic palettes suitable for a dance performance to seed the dancers’ experimentation. Prior work with the MMM has shown that each different palette inspires different movement vocabularies [5].

We used many of the MMM’s original MIDI mappings and further processed them in Ableton. Examples of these included mappings from contact resistance to:

- Chromatic pitches
- Chord tones that change over time
- Trills or sustained notes based on length of contact

Leading up to the workshop, we tested different Spitfire Audio instruments and MIDI plugins like arpeggiators and snap-to-scale settings. We also introduced new sonic material including field recordings, poetry narrations, and pop songs and played them unprocessed or as source material for MIDI granulators. Ultimately, we aimed to create palettes that were evocative and engaging for both the dancers and an audience.

3. METHODS

3.1 Participant Background

Two professional dancers experienced in contact improvisation, Laura and Rafael, were invited to a three-day workshop hosted by the authors to explore the MMM in the context of dance performance. Laura was a female dancer and choreographer based in the United States with training in contemporary dance and hip-hop. Rafael was a male dancer and choreographer based in Italy with training in contemporary dance. Laura and Rafael were both in the age range of twenty to twenty-nine years, and they self-identified as non-musicians.

3.2 Workshop Structure

The workshop was the first of a series of workshops planned to lead toward a staged dance performance centering the MMM. It was the dancers’ first time interacting with the MMM, and their first time dancing with one another. We also invited a cinematographer to videotape the interactions and document the experience.

We introduced each new palette to the dancers without explanation. Instead, we let them learn about each palette experientially. The workshop was otherwise collaborative, as the authors and the dancers jointly which palettes to work with and how to modify them. At the end of the workshop we conducted a semi-structured interview with both dancers. We asked questions about their expectations, motivations, and partner dynamics. We conducted thematic analysis on the transcripts, with a focus on identifying mechanisms that activated or sustained creativity. We also reviewed the workshop footage and conducted thematic analysis to distill the major categories of interaction the dancers engaged in. The analysis results have been curated into a set of studies that we introduce in a short film that documents the workshop². Table 1 offers examples of the factors that contributed to creative, varied movement activity during the workshop.

4. RESULTS

4.1 Creative Mechanisms

It was creatively generative for participants to think about approaching the MMM as a site for play. During the interview, Laura expressed that a sense of playfulness empowered her to explore different qualities of touch gesture on the mats, like tapping and brushing, beyond those often used in contact improvisation.

The dancers’ experimentation process involved coming up with improvisation tasks that constrained various aspects of movement and interaction. Some examples of improvisation tasks are included in Table 1.

At the end of the workshop, Rafael reported feeling more like a composer than a dancer at many points, as he created

²https://www.youtube.com/watch?v=JB_NbmG0oBM

Table 1: Examples of creatively generative factors and selected quotes from semi-structured interview

Factor	Examples	Dancer Quotes
Choreographer as composer	<ul style="list-style-type: none"> • One dancer “played” the MMM alone while the other danced outside the mats • The dancers remixed a recording of a poem through contact on the MMM, adding their own pauses and emphasis 	<p>L: “I got to a place where it was more like composing the world, and that included both dance and music”</p> <p>R: “I’m composing music for her, she’s moving in a certain way. Let’s try to repeat the sound or let’s try to make a rhythm. Let’s see if she follows”</p>
Playfulness	<ul style="list-style-type: none"> • The dancers engaged in a thumb war together • The dancers feigned being shocked when staticky sounds played 	<p>L: “[playfulness was] super present. . . it factored into how I was approaching it, just more freedom to explore different qualities”</p>
Finding origins of movement	<ul style="list-style-type: none"> • One dancer positioned the other’s limbs by touching her joints • The dancers moved their bodies away from each point of contact 	<p>R: “it really puts you in the place where you don’t look for movement, you just look for the thing that generates movement [...] like I do this movement because I press her”</p>
Partnering	<ul style="list-style-type: none"> • The dancers mirrored each other’s movements • The dancers closed their eyes and communicated through touch and sound 	<p>R: “The partnering experience, it also puts you in the place of how much am I doing? [...] How much should I be there or not? Or maybe how much I should not think anymore and just go?”</p> <p>L: “It was really beautiful to have the mat because it brought it back to that [...] human relationship. [...] Rather than, okay, we’re going to do this specific lift.”</p>

rhythms or drew out sound he found especially interesting on the mats. Eventually, Laura and Rafael found that the MMM would also function if just one person on the mats bridged them making skin contact with both of them. From this realization, a new interaction mode emerged, as one dancer acted as composer/musician on the mats and the other danced in response to the sounds generated outside the mats.

4.2 Sonic Exploration

The dancers’ behavior was also heavily influenced by the sonic material we presented to them. Sounds like drum kit samples resulted in percussive movements, such as tapping noses together. One of the palettes used slowly-evolving organ sounds in a looping chord progression that started and stopped as the dancers touched and let go. This inspired slow and drawn-out movements, with little break in contact to avoid pausing the chord progression.

We developed a palette that turned the mats into an on/off switch, pausing and resuming playback of a recorded sample. We recorded Laura and Rafael reciting a poem together, and used it as material for the new palette. When Laura and Rafael tried out this palette, they reacted to the poem’s content, for example lying down on their respective mats after a line about sleep. Afterward, they reported being frustrated by the lack of immediacy in sound production with this mode; when the natural pauses in speech ran counter to their previously established expectations about the cause-and-effect relationship between touch and sound.

4.3 Affordances of Touch-Based Interaction

The MMM is distinct from many DDIMs in that sound is borne out of touch rather than movement. Rafael expressed that this changed his improvisatory process from looking for movement to looking for the source of movement, which is often contact and pressure, since these aspects of dance were reinforced by the MMM’s sounds.

This was especially evident in the dancers’ experimentation with an electricity-inspired palette. In this palette, the sounds with a short speech sample run through a granulator. The result was a staticky sound that suggested the energy of an electrical shock. When exploring this palette, the dancers established an improvisation task where they moved fluidly in their own space and feigned being electrocuted when they happened to touch. This task established an explicit cause-and-effect relationship between action and resulting movement, which built up a strong sense of anticipation leading up to each touch event.

5. DISCUSSION

As we worked toward a broader vision for the MMM, we found that bringing the DMI into an interdisciplinary context broadened its possibilities for creative expression. Exploring the dancers’ creative processes bettered our understanding of how the MMM can effectively be used as a performance tool. Organizing movement experiments around improvisation tasks clarified the effects of various constraints on the performance experience.

The dancers were also in unfamiliar territory as they shared the role of musician/composer. This meant they approached movement-making in new, expansive ways. The unique affordances of the MMM as a touch-based instrument enable dancers to cultivate a deeper awareness of their physicality in relationship to one another. It was important

to create conditions that fostered connection between the dancers, and amplifying touch in a contact improvisation setting helped in this respect.

Unfamiliarity was an important factor in creative exploration during the workshop. Allowing the dancers to explore the MMM without much guidance while interacting with each new palette allowed for sustained engagement as the dancers experimented with gesture. Establishing playfulness as a guiding principle during the workshop had the same effect, as it empowered the dancers to freely experiment with diverse qualities of movement.

6. CONCLUSION

Exploring the MMM in the realm of partnered dance and collaborative music-making provides valuable insights into the interdisciplinary creative expression. Through a three-day experimental workshop with professional dancers experienced in contact improvisation, we witnessed the potential of the MMM as both a musical instrument and a choreographic tool. Participants' reactions and feedback highlighted the significance of open-ended exploration and playful experimentation in unlocking the creative potential of the MMM within the context of dance performance.

7. ETHICAL STANDARDS

All workshop participants participated voluntarily. They all gave verbal, informed consent for the use and representation of all audio and video recordings.

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