Re-engaging the Body and Gesture in Musical Live Coding

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ABSTRACT

At first glance, the practice of musical live coding seems distanced from the gestures and sense of embodiment common in musical performance, electronic or otherwise. This workshop seeks to explore the extent to which this assertion is justified, to re-examine notions of gesture and embodiment in musical live coding performance, to consider historical approaches for integrating musical programming and gesture, and to look to the future for new ways of fusing the two. The workshop will consist firstly of a critical discussion of these issues and related literature. This will be followed by applied practical experiments involving ideas generated during these discussions. The workshop will conclude with a recapitulation and examination of these experiments in the context of previous research and proposed future directions.

Author Keywords

Live coding, gesture, embodiment, musical instruments

CCS Concepts

•**Applied computing** → **Sound and music computing;** *Performing arts;* •**Human-centered computing** → User interface design;

1. INTRODUCTION AND MOTIVATION

The success of the live coding movement has drawn attention to an apparent tension between electronic music performance, performative embodiment, and musical gesture. Computer programming, conventionally carried out in comfortable and relatively isolated environs, may seem a strange activity to perform on stage in a musical performance. Furthermore, the gestures and physical activities present in many forms of musical performance are typically absent from live coding performance, or, at least, are not requisite to the actual production of music.

This workshop seeks to probe this apparent tension, firstly questioning whether it really exists at all. Many efforts evident in the literature and in practice have connected live coding to more clearly embodied creative practices, such as performance of gestural electronic musical instruments, acoustic instrumental performance, dance, and puppetry. However, interaction with the coding medium itself—typically a set of text buffers—is most often conducted using a keyboard and mouse, affording limited capabilities for musical gesture. Of critical import to this workshop is to consider how gesture and embodiment figure into the process of programming itself in live coding performance.

Secondly, this workshop seeks to re-examine existing definitions and conceptions of musical gesture and embodiment with specific attention to musical live coding performance. Literature on gesture in electronic music is often focused on digital musical instruments. Is live coding readily viewed through this lens, or are additional considerations necessary? Similarly, the literature surrounding live coding discusses many individual instances of gesture and embodiment in relation to live coding, but to date lacks a general treatment of these concerns.

Considering historical approaches, participants will discuss and propose new methods for expanding the role of gesture in live coding music, or extensions to existing systems for doing so. A lab session will be devoted to rapidly prototyping these ideas. Finally, participants will present their prototypes alongside their underlying motiviations and discuss future directions for live coding research and practice.

2. BACKGROUND

As surveyed in [13], evidence of tension between live coding and gesture can be seen across the literature related to the former, given many efforts to complement live coding with more typically embodied creative practices. Collins describes a number of instances of "bodily explicit live coding," including his own explorations of live coding and dance and live coding of an acoustic improvisation ensemble [3]. Stowell and McLean state that "[a] live coder, like any improvising performer, is under pressure to do something interesting in the moment," and that a programmer's use of abstraction and scheduling "can lead to a lack of immediacy in how the performer's actions relate to the music" [16]. These concerns motivated their commingling of live coding with "open gesture-based expression," including collaborations with vocalists, thrash guitarists, drummers, banjo players, and beatboxing. Baalman notes "the physical interaction of our body [...] with the machine" as the primary instance of embodiment in live coding, in addition to the development of muscle memory of commonly-typed programming language syntaxes [2]. Magnusson describes a live coder as "primarily a composer, writing a score for the computer to perform" [10], distancing the gestures of typing musical code from the actual production of sound.

Much as been written regarding the relationship of gesture, embodiment, and electronic music [12, 5], though little if any specific treatment of live coding is offered in the literature. A survey of definitions of musical gesture by Jensenius et al. broadly defines gesture as a "bridge between movement and meaning" [7]. At least one notion of gesture in

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a computing system rejects the activities associated with typing on a keyboard [9], though most seem to admit any physical action linked to a musical result.

3. QUESTIONS AND CHALLENGES

This workshop aims to confront a number of questions and challenges in existing thought and practical efforts surrounding live coding and gesture, detailed in this section. The workshop will approach these issues both through discussion and through prototyping of practical systems.

3.1 Algorithm and Gesture

Typically, any musical action effected in a live coding performance must be formulated as a series of instructions for the computer to enact that action, i.e. an algorithm. Consider a musical action such as fading down the volume of a sound source. To code this, a programmer must decide if they want a linear or exponential fade out or something else entirely, and how long in duration the fade out should span. In some cases, the mathematical formula for the type of fade out over the specified duration must be encoded into an algorithm, if such an algorithm is not built in to e.g. a system library of the language. This analytical approach affords a great deal of flexibility in specifying the exact parameters and timing of the fade out, although this precision may not be necessary or even desirable in the context of a musical performance. This process transpires entirely before any of the resulting sound has actually been effected, and, once initiated, a musical action encoded in this way might not be easily canceled or modified. Overall, for some musical actions, the advantages of devising an expressive algorithm many not justify the effort required, especially in a performance scenario. Furthermore, the length of this feedback cycle—formation of a musical idea, devising the corresponding algorithm, evaluating the computer's result, and repeat—may impede the exploration of diverse musical ideas, an integral component of many creative practices [11].

If in this example the sound source's volume is mapped to a typical gestural control such as a fader or knob, the process is somewhat different. As a performer adjusts the volume using the gestural control, they are able to quickly hear the audible result of their action, and continue or modify the overall gesture as desired. The translation of musical intent to audible result is a dynamic feedback loop between physical action and sonic effect.

This is not an absolute dichotomy: algorithms might be rapidly enacted within a performance in a gestural manner and gesture can be used to carry out algorithmic processes. Some systems, such as Field, Max, and Auraglyph, merge gestural control within a programming language to varying degrees. Perhaps it is simply a given of live coding performance that creative control be ceded to algorithms that we might not entirely understand. We are interested in exploring further methods in which these two methods of musical activity might be integrated in complement with one another.

3.2 Re-examining Text-based Coding Media

Text is arguably the preeminent medium for humans to create programming code, and its wide interoperability and simplicity make it a convenient means for doing so. However, the entry of linear streams of plain text by standard keyboard leaves comparatively little room for the use of gestural tools and techniques common in other forms of electronic music performance. This workshop seeks to contemplate musical programming systems that have distanced themselves from plain text, which might then present interesting opportunities for gestural interaction.

Graphical programming languages for music, such as Max, Pure Data, or Reaktor, are well known in the electronic music community, though find comparatively little use in live coding circles. Field, Processing's "Tweak Mode," and Codea are text-based programming systems that additionally enable gestural manipulation of syntax elements directly inline with text code. In Auraglyph, developed by the first author, coding structures are sketched rather than typed, and further manipulated by touch gestures [14]. These systems begin to resonate with Victor's principle of enhancing the connection of a programmer with the program they have created; an ultimate consequence of this principle is the dispensing of the traditional write-compile-run cycle in exchange for a more immediate and reactive computing medium [18]. Fusing these ideas with the concepts of dynamic [8] and tangible [6] media, Victor's Dynamicland realizes computing processes in the form of physical objects that are digitally tracked and projected onto as an individual interacts with them in the real world.[1]

Other researchers have employed very different approaches to the apparent gestural limitations of text programming. The Stenophone, developed by the second author, is a chorded keyboard with gestural control of its individual keys, used as an interface for musical live coding [1]. The CodeKlavier uses a musical keyboard as an interface for both direct sound production and entry of textual code into a live coding environment [17]. The aforementioned systems are presented here as considerations for further discussion within the workshop.

3.3 Thinking Outside the Laptop

Other approaches to thinking about embodiment and live coding have sought intersections between live coding and other, more typically embodied creative practices. Collins provides antecedents such as the rule-based systems of John Cage and Merce Cunningham in dance practice, João Fiadeiro's employment of real-time composition, and Michael Klien and Nick Mortimore's live direction of dancers via a software interface [3]. Collins' own work includes a collaboration with Matthew Yee-King to perform live-coded algorithmic dance routines, among other live coding practices engaging the body. Sicchio has explored the space of live coding and dance extensively; within a framework of "Hacking Choreography," her dance works have used a score modified in real-time by its performer, allowed dance scores to be created by an audience and performed in real-time, and employed a feedback loop between the score, the dancer, and live-coded sound [15]. Similar to common musical practice in live coding, Sicchio projected the code of her choreographed performances, making the process visible to the audience; however, the crucial difference is that these algorithmic processes were ultimately interpreted by human dancers rather than by machine musicians. Jensenius et al. make a fundamental distinction between "the gestures of those that produce the sounds (the musicians), and the gestures of those that perceive the sounds (the listeners or dancers)" [7]; this contrast is readily apparent in algorave performance, in which live coding is explicitly oriented to the production of music for audience dancing [4]. A symposium dedicated to live coding and the body was recently held, covering live coding in relationship to painting, choreography, puppetry, mobile devices, and other embodied forms of expression.[2]

4. WORKSHOP INFORMATION

[1] `https://dynamicland.org`

[2] `http://www.livecodenetwork.org/body`

4.1 Goals

The goal of this workshop is to explore the multifaceted relationships between live coding, gesture, and embodiment in musical performance. In particular, we seek to critically assess the current state of affairs as pertains to live coding and gesturality, and further propose and evaluate new ideas for synthesizing the two. We will offer an opportunity for participants to compare experiences, reflect on their own work, and discuss ways to impart gestural and embodied interactions in musical live coding.

4.2 Participants

The workshop will be free and open to any interested parties (subject to the usual NIME registration policies). We expect that some participants will have experience in live coding or gestural interaction of some form (whether with a musical instrument or not), though no specific technical expertise is required. We would also welcome participants with experience in practices with a predominant focus on embodiment such as dance, and researchers and designers working with gesture.

No submission or pre-registration beyond the usual NIME registration will be required to attend. Nonetheless, we will publish information on the workshop online in the months before the conference and circulate a call for participation, where interested participants will be encouraged to consider a particular live coding and embodiment-related issue they might like to discuss at the workshop.

Participants should bring to the workshop a laptop, which will be used during the hands-on activity for background research and rapid prototyping activities. The organizers will provide additional materials for the design exercise.

4.3 Workshop Schedule

This is a half-day workshop that will divide into three parts of approximately one hour each. The central activity of the workshop will be a design exercise centered around gestural live coding systems, framed on either side by discussion and evaluation.

4.3.1 Introduction and Discussion

In the first 20 minutes, the organisers will briefly introduce the subject of embodiment as it relates to live coding, situating it within historical context and examples from the literature and their own work. This presentation will conclude with a series of open questions about the nature of embodiment and gesture in live coding, motivated by the discussion included here. The next 40 minutes will feature open discussion of these questions, inviting personal perspectives from the participants. In this short time, we do not expect to reach firm conclusions, but we will record notes for later review and exploration.

4.3.2 Activity

Participants will form small groups to further explore these ideas. After responding to a series of written prompts from the organizers, the groups will develop and discuss an original proposal for bringing together gesture and live coding, or for extending an existing mechanism for doing so. They will then sketch this idea in either digital or physical form, at their option. This could include a quick sketch in Processing or Photoshop, or a paper cutout, cardboard construction, or diagram. The goal is not to produce any sort of operational tool but to have a quick mockup illustrating the idea for incorporating gesture into live coding. (Sketches of existing systems will be provided by the organizers to serve as examples.)

4.3.3 Evaluation and Review

In the final section of the workshop, participants will present their responses to the prompts and their idea for extending gesture into live coding of music. Participants will keep a sheet of paper on which they take notes about their thoughts with each one. A general discussion will then compare the qualities of each proposal. From this, we will seek to draw conclusions about the workshop participants' collective perspectives on gesture, embodiment, and musical live coding. Considerations for future development of the ideas presented and their dissemination in research literature will also be discussed.

4.3.4 After the Workshop

Shortly afterwards, documentation of the workshop and a summarization of the proceedings will be publicly disseminated via the Embodied Live Coding mailing list[3] and the webpage for this workshop:
`https://embodiedlivecoding.github.io/nime2018-workshop/`.

5. FURTHER INFORMATION

5.1 Materials Brought by Organisers

We will bring the following to the workshop:

- Paper and cardboard
- Permanent marker pens
- Tape and scissors

5.2 Requirements of the Space

The workshop should ideally be held in a room large enough to accommodate around four or five groups of four people each. We ask for the following from the NIME workshop venue:

- One table (ca. 1x2 meters) for each team.
- A pair of speakers for listening to existing work in this area.
- A video projector for the beginning presentation.

5.3 Biographies

Spencer Salazar is a computer musician and researcher currently serving as Special Faculty in the School of Music at California Institute of the Arts. His research, teaching, and practice is focused on interactive computer systems for musical performance, mobile music software, music programming languages, and digital music ensembles. Previously he pursued his doctoral studies at Stanford CCRMA, where he developed his dissertation research on Auraglyph, a modular sketch-based programming system for computer music, and was a co-director of the Stanford Laptop Orchestra. He is also a lead developer for the ChucK music programming language. In the past he has prototyped consumer electronics for Microsoft and architected large-scale social music interactions for Smule, an iPhone application developer, including the popular Ocarina and I Am T-Pain apps. He received a Doctor of Philosophy degree in Computer-based Music Theory and Acoustics from Stanford University in 2017.

Jack Armitage is a musician, designer and technologist, and is currently a PhD student within the Augmented Instruments Lab in the Centre for Digital Music at Queen

[3]Hosted here: `https://groups.google.com/forum/#!forum/embodied-live-coding`

Mary University of London. His research is focused on developing tools and methods that support live craft process in digital musical instrument design. There he is also part of Bela, the open source maker platform for ultra-low latency audio and sensor processing. In 2017 he was a Visiting Scholar at the Georgia Institute of Technology Center for Music Technology. In the last year has given instrument design and live coding lectures and workshops in London, Edinburgh, New York, Atlanta, Pittsburgh and Morelia Mexico. He has performed as a live coder in prestigious clubs such as Heaven London, Berghain Berlin and Create Hollywood Blvd. He has a BSc in Music, Multimedia and Electronics, and before joining Queen Mary he was a research engineer at ROLI.

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