

**Expressive Engines:
Musical Technologies from Automata to Robots**

Richard H. Shindell Choral Hall
Mason Gross School of the Arts
Rutgers, The State University of New Jersey
Monday, February 15, 2016

Schedule:

8:45 a.m. Opening remarks

9:00–10:00 a.m. Session 1: Aesthetics and Performance in the Early Modern Era and Today

Music's Technophilic Technophobia
Emily Dolan (Harvard University)

Built to Perform: Design Principles and Performance Practices for Musical Robots
Troy Rogers (Expressive Machines Musical Instruments)



10:00–10:15 a.m. Coffee break



10:15–11:45 a.m. Session 2: Automation, Expression, and Music at the Crossroads

Perspectives on Expressivity in Robotic Music
Steven Kemper (Mason Gross School of the Arts, Rutgers University)

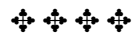
“It would be without error”: Automation as Expression in Engramelle's *Tonotechnie*
(1775)

Rebecca Cypess (Mason Gross School of the Arts, Rutgers University)

What if Orfeo Was an Automaton?
Bonnie Gordon (University of Virginia)



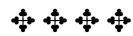
12:00–1:30 p.m. Break



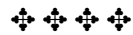
1:30–2:30 p.m. Session 3: Interactivity and the Self in Musical Robotics

Composing Perception in Interactive Musical Machines
Scott Barton (Worcester Polytechnic Institute)

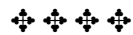
Composing Machine: The Triadex Muse
Thomas Patteson (Curtis Institute of Music)



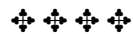
2:30–2:45 p.m. Coffee break



2:45–3:30 p.m. Roundtable discussion by all conference participants



7:30 p.m. Concert
Nicholas Music Center

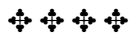


Abstracts

Music's Technophilic Technophobia

Emily Dolan (Harvard University)

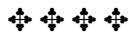
Music has a complicated relationship with the technologies that enable its production. At once technophilic and technophobic, musical practice gobbles up, resists, flaunts, and hides its complex instrumentarium. This reflects the variegated nature of instruments themselves: they are agents of chaos and order, harmony and noise. Technology organizes and controls music, while, at the same time, music makes sense of and defines the boundaries of technology. This talk reflects focuses on the changing attitudes towards techno-musical innovation and novelty in the late eighteenth and early nineteenth centuries. Exploring the shifting understanding of the fundamental purpose and the significance of musical instruments—and their relationship to history—allows us to access the different regimes of instrumentality at work in musical culture.



Built to Perform: Design Principles and Performance Practices for Musical Robots

Troy Rogers (Expressive Machines Musical Instruments)

Over the course of the past 25 years of its development, the field of musical robotics has rapidly expanded to encompass a dizzying plurality of motivations, conceptions, realizations, and utilizations of robots that make music. In this survey of approaches to musical robot design, various examples of robotic musical instruments, robot musicians, interactive kinetic sound sculpture, audio animatronics, and performance enhancing prosthetics will be examined and analyzed with the intent to identify and contemplate established and emerging traits of contemporary robotic performance practice.

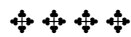


Perspectives on Expressivity in Robotic Music

Steven Kemper (Mason Gross School of the Arts, Rutgers University)

Designers of robotic musical instruments typically describe musical expressivity in terms of the number and resolution of sound control parameters their instruments possess. Framing the expressive potential of robotic instruments in this way stems from discussions of gestural control of sensor-based, digital musical instruments (DMIs) that equate expressivity with timbral and dynamic nuance. Discussing expressivity of DMIs in terms of the potential for timbral and dynamic expression addresses the central question of how these instruments mediate human

performance. Since by definition robotic instruments do not require human performers, their ability to be musically expressive depends not only on their capacity for timbral nuance, but also on questions such as timing, the relationship between action and sound, expressivity in robotic composition, and capabilities of artificial systems to express musical meaning. To address these issues, this paper will situate robotic music within contemporary understandings of musical expressivity through a discussion of classical definitions of music and meaning, taking into account reactions to musical automata in the eighteenth and nineteenth centuries, psychology, gesture, and affective computing. It will describe how these aspects of expressivity are applicable to musical robots, and how robotic instruments are capable of their own “mechatronic” expressivity.



“It would be without error”:

Automation as Expression in Engramelle’s *Tonotechnie* (1775)

Rebecca Cypess (Mason Gross School of the Arts, Rutgers University)

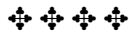
In 1775, Marie-Dominique-Joseph Engramelle published a treatise explaining his technique of punching cylinders for use in automated keyboard instruments. As long as the cylinders were perfectly shaped and the technology applied correctly, and as long as the artisan responsible for punching the cylinder knew how to interpret musical notation with *goût* (taste), Engramelle’s method would “transmit [musical works] for posterity in all of their purity”—that is, as the composer intended them. Indeed, Engramelle ridiculed performers with bad taste, who “disfigured” the works of great composers of the past, such as Lully, Rameau, and Couperin. Valorizing his automated technology, he asked, “would it not be better to hear the same thing many times, if it were good, than to have the ears perpetually tormented by a mediocre organist?”

In Engramelle’s method, the communication of musical expression and meaning was the domain of the composer on one side and the person who punched the cylinder on the other; he deemed performers unreliable and blamed them for ruining works of art. In elevating his own artisanship and denigrating the artisanship of performers, Engramelle added a new layer of complexity to a long tradition within French philosophy, extending from Descartes to Diderot, which viewed artisanal performance as subject to error, and celebrated instead the automated machinery invented and set into motion by the theorist–practitioner. Consideration of Engramelle’s treatise within this context helps to shed light on the role of music and musical machines for understandings of automation and human expression in the age of Enlightenment.



What if Orfeo Was an Automaton?
Bonnie Gordon (University of Virginia)

In 1616 Monteverdi famously explained to his recalcitrant librettist Alessandro Striggio that he could not write words for winds. Orpheus moved listeners “because he was a man.” What if Monteverdi was wrong? What if Orpheus, the mythical and the operatic, effects musical magic because he is either an automaton or a robot, depending on the century in which listeners hear his accompanied song? I begin with this bit of historical whimsy to push against the presentism of modern robotics, and to push against the modern contrast between expressivity and the idea of a machine. I suggest that the notion of things not human as heartless and brainless is a post-Enlightenment concept. I focus on the castrato in seventeenth century Italy as a vocal organ that resonates with automated hydraulic musical machines.



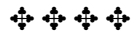
Composing Machine: The Triadex Muse
Thomas Patteson (Curtis Institute of Music)

In 1972, MIT professors Edward Fredkin and Marvin Minsky, under the auspices of the newly founded Triadex corporation, invented a device called the Muse. A futuristic wedge of metal bedecked with buttons, sliders, and lights, the Muse was a “computer musical synthesizer” that generated sequences of tones by means of a digitally implemented logic system known as a feedback shift register. By adjusting the settings on the instrument’s front panel, the user changed the patterns of tones produced by the instrument, from short repetitive patterns to dizzying cascades that seemed never to return to their source.

Viewed in the context of twentieth century technoculture, the Muse presents a bizarre synthesis of consumerism and creativity, passive entertainment and engaged artistry. On the one hand, its inventors promised that it would “[make] composing and playing music almost as easy as adjusting your television set.” On the other hand, however, the device was framed in unmistakably modernist language that emphasized exploration and originality: “The Muse *starts* where all the music that has ever been composed leaves off. The Muse is for tomorrow’s music. Music that has never been heard before . . . until you.”

From a broader historical perspective, the Muse belongs to a long tradition of combinatorial thinking in music that dates back to the seventeenth century, if not earlier. Whether embodied in a physical machine, a formula, or something in between, this approach begins by defining composition in terms of a finite number of elements (most often, the notes of a scale) and systematically permutes them according to certain rules. Such approaches could be found in cultural contexts both esoteric and everyday, from the speculative musicology of the Baroque era to vernacular algorithmic practices such as change ringing.

In this paper, I examine the Muse, seeking to understand its complex internal workings, its role in the technological and aesthetic discourses of the late twentieth century, and its deeper context in the history of systematic approaches to musical composition.



Composing Perception in Interactive Musical Machines
Scott Barton (Worcester Polytechnic Institute)

Interactive systems typically comprise an input stage(s) and a processing stage(s) that results in a particular output. In the input stage, a complex stream of information is segmented into distinct entities that are subsequently categorized and identified. These entities become the building blocks that are used in the interpretation and generation of complex communications. They are combined, separated, accented, subordinated and ordered to form larger groupings. In music, this process yields organizations such as rhythms, melodies and phrases. Structural information, such as meter and form, can then be extracted from the organization and qualities of these groupings. We can define these activities that purport to decode a communication or expression made by an external source (s) as perceptual. How interactive systems respond is the responsibility of a processing stage(s). Typically, this activity occurs after some “understanding” of the perceived input information is reached (though this doesn’t have to be the case). In designing this processing stage(s), one is confronted with a number of questions. When will the system respond? Are responses imitative, complementary or novel? What degree of the input is reflected? What elements are considered structural and what elements are considered illustrative?

These questions are familiar to the composer and improviser. As the programmer connects these generative questions to those asked by the artist, she puts the weight of creativity

on the processing stage.[1] One assuming this perspective typically seeks a perceptual system that yields human-familiar entities that are easily manipulated to form responses. In this paper, I propose there is also creative potential in the design and modification of machines' perceptual systems. Machines are not bound by human capabilities, and in fact, it is often the case that the information most easily extracted through mechanical means doesn't align particularly neatly with human tendencies. Emphasizing and manipulating the parameters of idiomatic machine perception offers an additional way to generate musical interactions. The parameters of the machine perceptual system - amplitude thresholds, averaging periods, length of short-term memory, acceptable ranges for rhythmic intervals - become composable. The extent to which information perceived is activated in awareness is also variable, depending on predefined knowledge and aesthetic preferences. Such an approach shifts the weight of creativity from processing to perception, which presents a variety of compelling possibilities in regard to both expression and interaction. This paper will explore some of these possibilities both in theory and in practice, the latter illustrated through the implementation of these ideas in software developed by the author that allows human musicians to improvise with robotic ones.

[1] The similarity of these approaches supports the idea that interactive systems are compositions, even if they enable machines to function autonomously.