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UNIVERSITY OF CALIFORNIA,
IRVINE

Capturing the Buzuq's Sonic Landscape: An Expedition Through Synthesis Processes from
Soundboard to Digital Music Interface

DISSERTATION

submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in Integrated Composition, Improvisation, and Technology

by

Jiryis Ballan

Dissertation Committee:
Professor Mari Kimura, Chair
Professor Michael Dessen
Professor Amy Bauer
Assistant Professor Rajna Swaminathan
Associate Professor Jesse Colin Jackson

2024

DEDICATION

To

my beloved Mother and Father, who gifted me the *buzuq*. And to the mysterious figure whose
craftsmanship brought the *buzuq* into existence.

To heartfelt gratitude to every music teacher who has guided me along the way.

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ACKNOWLEDGMENTS

With deep appreciation, I extend my heartfelt gratitude to my advisor, Professor Mari Kimura, whose expertise, unwavering patience, and steadfast encouragement have been the foundation of my PhD journey. I also wish to express my sincere thanks to my committee members—Professor Michael Dessen, Professor Amy Bauer, Professor Rajna Krishnan Swaminathan, and Professor Jessi Jackson—for their invaluable guidance and support.

Additionally, I am deeply grateful to the faculty of the Department of Music at the University of California, Irvine, as well as the ICIT faculty and community. A special recognition goes to Dr. Stephan Hammel for his exceptional support throughout this journey. I also wish to extend my gratitude to my fellow musicians and PhD students in the ICIT program.

The completion of this dissertation was made possible through the generous support of the UCI Department of Music, the Medici Circle Scholarship, and the Graduate Dean's Scholarship

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ABSTRACT

Capturing the Buzuq's Sonic Landscape: An Expedition Through the Synthesis Processes from
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University of California, Irvine, 2024

Professor Mari Kimura, Chair

This dissertation offers an in-depth exploration of integrating technology to innovate the practice of the buzuq, an Arabic and Kurdish musical instrument, explicitly focusing on sound transformation. The study emphasizes interactive music-making and sound sculpting, aiming to enhance techniques and expressions in both composition and performance. The primary objective is to investigate novel sounds and timbres produced through unconventional gestures on the buzuq, facilitated by piezo amplification technology. This research has evolved into a systematic approach that involves sampling the buzuq's latent sounds, applying digital manipulation, and integrating these elements across diverse contexts, including creating a virtual orchestra. The research culminates in exploring approaches to designing digital music interfaces, which resulted in incorporating the MUGIC® motion sensors into digital music interfaces. By expanding the materiality of electroacoustic composition centered around the buzuq, this study broadens the repertoire of techniques and performance contexts available to buzuq players.

Introduction

This dissertation examines the integration of technology into the practice of the Arabic musical instrument, the buzuq, with a particular focus on sound transformation and processing. The study explores the incorporation of motion sensors while emphasizing the preservation of the buzuq's traditional construction and distinctive acoustic characteristics.

The research involves capturing latent, previously unknown sounds from the instrument's soundboard, discovered through improvisation and deep listening. It further incorporates a motion sensor as a digital music interface system. This investigation explores both conventional and unconventional gestures with the buzuq to uncover new sound possibilities and delve into the compositional practice of working with the medium of sonic art.

This dissertation offers a critical examination of how we can reconceptualize the evolution of instrumental practices—specifically for marginalized folk music instruments—through the integration of technology. It focuses on preserving the instrument's historical construction and unique sound while transforming our relationship with it and altering traditional methods of listening and practice. These approaches led to the creation of tools for developing new music improvisation practices with a sample-based digital instrument and a new, individualized compositional approach using materials from the buzuq's spherical body.

The objective is to expand the repertoire of performance gestures by examining different approaches to constructing systems or methods for a sample-based virtual digital *buzuq*. Furthermore, this dissertation serves as a case study on how technology, focusing on gestures, creates new spaces and practices for folk instruments and their players. It also addresses the benefits and challenges these methods can bring to composer-performers.

This practice-centered artistic analysis aims to elucidate how transforming the *buzuq*'s sound and my musical practice can contribute to integrating marginalized Arabic musical instruments into contemporary art forms and interactive music-making. The guiding questions of this dissertation are: How can composer-performer-technologists utilize modern digital tools to explore new avenues for virtual and digital music instruments created from folk instrument traditions? How can integrating technology and developing a digital music interface for the *buzuq* transform its sound and performance practices while preserving its historical construction and unique sonic qualities? Therefore, what are this process's cultural, historical, and sonic implications? Additionally, this research seeks to explore the methods, techniques, and strategies employed in integrating a motion sensor into *buzuq* performances. This investigation places particular emphasis on the aspects of indeterminacy and agency within musical pieces, examining how these factors influence performative gestures and the interaction between the motion sensor and the *buzuq*.

This dissertation consists of both creative work and a research-based written thesis. The creative works evolved over several phases. The initial phase of the research focused on the *buzuq*'s latent sounds, treating each documented sound file as a multilayered object, akin to an archaeological site. This approach led to the development of a creative method for 'excavating' the multiple layers of these latent sounds. Altering of the *buzuq*'s latent sounds revealed additional sonic information that became a key tool for composing *musique concrète* and later as a bank of sound to be triggered in an interactive music context with sample-based digital interface. During this process, creative ethical and aesthetic concerns emerged.

These concerns pertain to the sampling processes of the *buzuq*'s latent sounds, particularly those arising from unconventional performance techniques. My ethical

considerations centered on the potential risk of compromising the instrument's tonal integrity and diminishing its inherent mystique. Aesthetic concerns also played a crucial role in the sound manipulation processes, including how I would present the sounds to the audience and the possible loss of sonic nuances during digital manipulation. These dilemmas and concerns substantially influenced the design of the digital music instrument system and the integration of latent sounds into my compositions and performances.

The ethical concerns stemming from my work in documenting the buzuq's latent sounds are multifaceted. Firstly, there is the issue of the extent to which I could push the acoustic boundaries of the buzuq through unconventional techniques, such as retuning the instrument or drumming on it, without compromising its quality. These actions raise questions about the potential damage to the instrument and the ethical implications of altering its traditional sound production methods. Secondly, the implications of these processes extend to modifying my relationship with the instrument and altering my perception of it following such experimentation.

Subsequently, my ethical concerns also encompass the digital modifications applied to the documented sounds during the classification and compositional processes. This includes considering how these changes might affect the authenticity and integrity of the original acoustic sounds and the ethical responsibilities associated with presenting these modified sounds in my work. However, over time, the ethical considerations regarding the digital modification of the sound were gradually minimized.

The first chapter provides an in-depth exploration of scholarly writings on sound art and the evolution of toolkits utilized by composer-performers and technologists, with a focus on techniques and expressions. This interdisciplinary discourse with scholars and artists

encompasses endeavors involving sound, timbre, and digital interfaces. Their overarching objective is to investigate, sample, and digitally manipulate original sonic materials derived from non-Western musical instruments and produced by unconventional instrumental gestures.

The second chapter presents case studies of composer-performers who use non-Western musical instruments and have adopted unorthodox approaches to expanding their instrument's expressive capabilities through technology. It also explores the contributions of Arab performers who, influenced by Arabic music and its cultural sounds, have integrated these elements into global musical practices using technology.

The third chapter presents my compositional works utilizing the buzuq's latent sounds, ranging from dance music influenced by *musique concrète* to the construction of a digital music interface. It provides a detailed examination of the incorporation of MUGIC® sensors and analyzes its impact on compositional processes in crafting pieces for solo buzuq, *buzuq* with ensemble, and intermedia compositions. This chapter also explores how the motion sensors have facilitated the expansion of performance gestures, enhancing expressive capabilities during performances, and the implications of incorporating motion sensors in my compositional and performance processes.

This dissertation aspires to significantly contribute to the academic discourse on integrating traditional musical instruments into contemporary digital practices. By bridging the buzuq's rich historical legacy with advanced technological tools, this study aims to preserve the instrument's cultural significance and expand the possibilities of its sonic and performative capabilities. Through this investigation, the research highlights the critical importance of ethical considerations in digital modification, the potential for fostering new forms of artistic expression, and the pivotal role of technology in shaping the evolving landscape of global music traditions.

Chapter 1. Literature Review

To contextualize my project, this chapter explores three interconnected themes within the interdisciplinary landscape that shape my practical research.

The first theme engages with scholarly discourse on sonic art, particularly focusing on the "sound object" concept in electroacoustic composition, which reflects a significant aspect of my creative work. The second theme examines approaches to designing virtual music interfaces, specifically addressing gesture recognition and motion sensors.

The third theme investigates writings on intersectionality and the use of non-Western instruments in contemporary digital and electronic music. This theme emphasizes the contributions of artists and composers by reviewing scholarly writings and ethnographic studies that explore the integration of non-Western musical instruments into the digital realm. In essence, it focuses on the artistic contributions of composers and performers who skillfully blend traditional instruments and sounds through innovative sampling processes within contemporary music¹.

Sonic Art

The literature on sonic art and sound objects is extensive, with its foundations laid by Pierre Schaeffer. As Brian Kane demonstrates in his 2019 chapter, "The Fluctuating Sound Object," from the book *Sound Object*, Schaeffer's framework defines the sound object as a distinct and

¹ This review intentionally avoids focusing on the discourses of cultural appropriation and Orientalism, which dominate much of the existing academic literature on this topic, out of respect for the diverse cultural influences in music.

recognizable sonic component isolated from its source and treated as a standalone entity.² This separation allows for manipulating and altering the sound independently of its original context. Schaeffer's focus on the sound object shifted from traditional musical elements, such as melody and harmony, towards the intrinsic characteristics of individual sounds.

Schaeffer, a pioneer in sound studies and *musique concrète*, introduced the notion of the sound object. Kane emphasizes that Schaeffer investigates sound objects with time, considering them as fragments that transcend the materiality of the composer in the compositional process. Furthermore, Kane delves into the term "sound object" by offering perspectives on sonic materiality in relation to Schaeffer's concepts. He explores these ideas through the viewpoints of other composers, sound artists, and critics such as Pierre Boulez, Christoph Cox, Francisco López, and R. Murray Schafer. Schafer, for example, critiques Schaeffer's characterization of sound objects by favoring an interpretation of sound as an event rather than a physical entity. According to Kane, Schaeffer's critique is that this perspective inadequately addresses the sonic ontology that perceives sound as a tangible object.³

Technological advancements of latent sounds in the *buzuq* and digitally archived data have primarily facilitated the potential of exploring them through digital manipulation, revealing new layers of sonic material. In this creative practice, I aim to initiate an inquiry into the discourse on the organizational characteristics of sound within sound objects. Additionally, this inquiry delves into how to classify the latent sounds of the *buzuq*, questioning whether they should be regarded as inherent acoustic attributes or classified as new digital sounds. This examination of the definition of *buzuq's* latent sound stems from their documentation and use

² Brian Kane, "The Fluctuating Sound Object," in *Sound Objects*, ed. James A. Steintrager and Rey Chow (Duke University Press, 2019), 53-70.

³ *Ibid.*, 62-63.

within computer-mediated contexts, and I need to delineate the boundaries between the *buzuq's* organic and digital sounds. Aden Evens addresses pertinent questions about the definition of digital sound in his study 'What Would Be a Digital Sound?' He defines *digital sound* as a numeric code stored in computer files that lacks natural sounds' temporal, spatial, and structural characteristics, emphasizing the abstract nature of stored sound.⁴ Further, Evens adopts the term "stratum" from geology as a metaphor to describe sound objects and differs in his analysis between the characters and the behavior of natural to digital sound.⁵

Following Evens' approach, this research initially adopts the term 'stratum' from archaeology to describe the organizational characteristics, structure, and multidirectional movement inherent in the *buzuq's* sonic qualities. This term depicts the *buzuq's* natural and digitally stored sounds as multilayered objects analogous to archaeological sites. The concept of 'stratum' effectively captures the temporal evolution of sound events over time, encompassing their natural production and subsequent digital storage.

Digital manipulation plays a crucial role in revealing additional layers of sonic information, influencing frequencies across the spectrum and various forms of string reverberations; this approach not only allows for diverse interpretations of the temporal dimensions to lose their organic qualities and become numerical sequences, detached from the instrument's physical essence, as Evens has noted. This transformation—starting from the moment of production, through storage, and into a new identity—renders these sounds digital artifacts.⁶

⁴ A. Evens, "What Would be a Digital Sound?" in *The Routledge Companion to Sounding Art*, ed. Marcel Cobussen, Vincent Meelberg, and Barry Truax, 1st ed. (Routledge, 2017), 401.

⁵ *Ibid.*, 402-403.

⁶ *Ibid.*, 403-404.

While Evens conceptualizes stored sounds primarily as data structures focusing on the structural aspects of sound, my perspective diverges. I view a substantial portion of latent sounds as complex, multilayered objects that embody rich sonic information. Unlike Evans's perspective, I do not view latent sounds in their raw state merely as digital constructs. Instead, I consider them integral to the sonic identity of the *buzuq*, reflecting its unique acoustic properties and historical significance. However, I argue that heavily processed sounds should be conceptualized as distinct objects, separate from the *buzuq*'s intrinsic sonic identity. These transformed sounds do not simply extend the instrument's inherent qualities but represent a new transformation that symbolizes phenomena or sounds beyond the *buzuq*'s sonic identity. This viewpoint allows for reimagining the *buzuq*'s sound, positioning it within a broader interpretative framework that transcends its traditional acoustic boundaries and presents a unique musical and sonic language in my creative practice.

On sound transformation and musical language in electroacoustic compositions, Denis Smalley explored sound transformation as a concept for understanding its role in contemporary electroacoustic composition, as discussed in his article "Defining Transformation." Smalley emphasizes how technology profoundly influences sound transformation by integrating instrumental sound manipulation driven by physical gestures. He categorizes sound transformations into several types, including continuous, unitary, noncontiguous, proximate, simultaneous, revelatory, and crossing transformations.⁷

These categories are organized based on their temporal connections, illustrating the diverse ways sound can evolve within a composition, where composers can develop a personal, individual musical language.⁸

⁷ Denis Smalley, "Defining Transformations," *Journal of New Music Research* 22, no. 4 (1993): 279–300.

⁸ *Ibid.*, 279-80.

Smalley (1993) identifies two principal approaches to sound transformation: first, in instrumentally-based music, gestural transformation is tied to specific physical-musical gestures in creating new sound. He introduces the concept of "instigated transformation," which complements active gesture and leads to innovative sonic outcomes that transcend an instrument's inherent identity. Smalley then goes on to describe the subsequent transformation of texture and spectral shapes of stored sounds through technology.⁹

These approaches align with my creative work on sound transformation in the discovery of the *buzuq*'s latent sounds and in sound transformation in recent compositional works. Furthermore, Smalley underscores the importance of evaluating how these transformations affect the intrinsic physical characteristics of the gestures, whether passive or active.¹⁰

Exploring what has been mentioned above in greater depth, Smalley examines how technology empowers composers to manipulate sound and gestures, a concept he refers to as the "possibility of grammar."¹¹ This concept is pivotal for organizing material through sound and gesture manipulation, enabling composers to realize otherwise challenging musical ideas through traditional notation.

Gestures are central to Smalley's discourse on sound exploration and transformation. He associates gestures with the musician's physical body, considering it part of the instrument.¹² Smalley's discussion parallels *musique concrète*, resonating with my approach to sound sculpturing and computer music. He delves into ambiguity, a concept that aligns with themes of chance in composing with digital tools—an integral part of my compositional practice. I focus on producing, sculpting, and transforming the latent sounds of the *buzuq* into new sonic identities.

⁹ Ibid., 281-82.

¹⁰ Ibid., 293-94.

¹¹ Ibid., 297.

¹² Ibid., 294.

This process illustrates my sound classification method, emphasizing that categorization relies not just on techniques and gestures but on the new intrinsic character of sounds. The transformation of the *buzuq*'s familiar and latent sounds through digital manipulation transcends mere historical narrative, embodying a symbolic resonance beyond its traditional existence. My research aligns closely with Smalley's foundational principles, especially the notion of "possibility grammar." This alignment is evident in sampling the *buzuq* and composing and designing sound in a digital workstation, which generates additional materials for my compositions.

In his exploration of the nature of sonic space, Trevor Wishart presents two studies, notably "*On Sonic Art*" and a specific study case for composers in "Sonic Composition in 'Tongues of Fire'". In Wishart's study he articulates his creative perspectives on sound manipulation through digital processing. He focuses on themes such as forming structure through sound organization, sound complexity, and the multidimensionality of sound objects. Wishart elucidates how composers can approach these aspects as compositional materials, with a specific emphasis in his chapter "The Nature of Sonic Space", where he discusses the possibilities of navigating sonic spaces. He highlights the structural aspects of timbre-space, asserting that this new compositional approach provides composers with extensive tools for navigating and exploring sonic materiality with the assistance of computers.¹³ This approach to composition contrasts with traditional Western methods from the first half of the twentieth century.

His examination in "Sonic Composition in 'Tongues of Fire'" provides an in-depth analysis of the transformative processes applied to sound within the composition. Wishart's study offers valuable insights into the structuring of musical phrases and the conceptualization of sonic

¹³ Trevor Wishart and Simon Emmerson, "The Nature of Sonic Space," in *On Sonic Art* (Harwood Academic Publishers, 1996): 73.

events.¹⁴ This detailed analysis aligns with my own compositional methods, particularly in my approach to computer-based music production. Wishart's discussion of the perception of sonic space and the formation of musical structure mirrors my efforts to investigate and articulate these aspects in my creative work. His work supports and enriches my understanding of these fundamental concepts:

"My composition *Tongues of Fire* [1994] musical work created for recorded medium using the computer. It relies on the computer's signal processing power to metamorphoses one kind of sound materials into another, thereby making audible connections between different kinds of sounds enabling a musical structure to be developed in the sonic domain."¹⁵

Exploring sound as an element in electroacoustic composition entails experimenting with audio manipulation, including techniques like delay and reverb, to uncover sub-materials. Daniel Siepmann's study "A Slight Delay: Agency and Improvisation in the Ambient Sound World" aligns this compositional approach with improvisation, stressing the influence of jazz improvisation on composers who employ audio manipulation in delay systems.¹⁶ This technique not only shapes ambient music experiences but also embraces the inherent unpredictability of the creative process.

On the topic of sound materiality and its relation to gestures—since the majority of my focus is on the representation of the *buzuq*'s new sounds—my work in composing with these materials is centered on highlighting the gestures that assist in producing these sounds, both in compositional works and in the classification library. Edson Zanpronha's literature review explores musical gestures in contemporary music. It also explores their intricate relationship with sound and meaning. The author extensively investigates different facets of this topic, such as

¹⁴ Trevor Wishart, "Sonic Composition in 'Tongues of Fire,'" *Computer Music Journal* 24, no. 2 (2000): 22–30.

¹⁵ *Ibid.*, 22.

¹⁶ Daniel Siepmann, "A Slight Delay: Agency and Improvisation in the Ambient Sound World," *Perspectives of New Music* 48, no. 1 (2010): 173–99.

compositional choices and the incorporation of significations through gestures. Zanpronha's exploration involves an analysis of transcultural significations inherent in gestures while specifically discussing electroacoustic music performance.¹⁷ Jianing Zheng, Nick Bryan-Kinns, and Andrew P. McPherson address one design factor of digital music instruments in their ethnographic work: the use of deformable materials.¹⁸ This facilitates the exploration of materiality through a material probe approach.

Their findings indicate that material properties influenced participants' design thinking and that a significant link existed between touch and imagined sound creation.

Gestures and Digital Interface

This section examines diverse perspectives from recent studies on the intricate interaction between technical and performance strategies in designing music interfaces within the digital music environment and instrumental development. The exploration encompasses essential components such as music interface control, aesthetics, and gestures, primarily focusing on case studies involving motion sensor-based interfaces. Additionally, a key emphasis in this section is the exploration of ambiguity in performance using digital interfaces, particularly within the realm of improvisation.

To address the critical question of the human performer's agency within digital music interfaces, John Robert Ferguson's work in "Imagined Agency: Technology, Unpredictability,

¹⁷ Edson Zampronha, "Gesture In Contemporary Music On The Edge Between Sound Materiality And Signification," *TRANS-Revista Transcultural de Música* 9 (artículo 17), 2005.

¹⁸ J. Zheng, A. McPherson, and N. Bryan-Kinns, "When Materials Meet Sound: Discovering the Meaning of Deformable Materials in Musical Interaction," in *Proceedings of the 2023 ACM Designing Interactive Systems Conference*, 312–325.

and Ambiguity" provides significant insights.¹⁹ Ferguson builds upon N. Katherine Hayles' seminal work, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999), which interrogates the extent to which musicians perform with technology versus technology performing the musician and explores related concerns. Hayles' study interrogates the extent to which musicians perform with technology versus technology performing the musician, and Ferguson extends this inquiry.²⁰ Ferguson (2013) emphasizes the inherent unpredictability and ambiguity in performance contexts involving computer interfaces. He suggests that the constructive aspect of these elements arises from the dynamic interaction of interdependent and ambiguous components within technologically mediated music-making methods. Ferguson terms this phenomenon "imagined agency," identifying it as a critical and beneficial feature of computer-based musical interfaces.²¹

Ferguson's work addresses an important aspect of performing with technology: the ambiguity introduced by mapping systems in preprogrammed patches, which incorporate embedded randomness and, thus, unpredictability. This unpredictability, or 'chance,' plays a crucial role in shaping real-time improvisation and overall performance dynamics, as I have experienced in experimenting with various approaches to constructing virtual interfaces. Moreover, Ferguson supports his analysis of technological improvisation with examples from his electric guitar practice.²²

A key aspect emphasized by Ferguson resonates with my practical research approach and curiosity regarding the sonic domain of my instrument and any technological tools employed

¹⁹ Ferguson, John Robert. "Imagined Agency: Technology, Unpredictability, and Ambiguity." *Contemporary Music Review* 32, no. 2-3 (2013): 135-149.

²⁰ Hayles, N. Katherine. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: University of Chicago Press, 1999. Quoted in Sher Doruff, *Collaborative Culture*. Rotterdam: V2_Publishing/NAi Publishers, 2003, 71.

²¹ Ferguson, "Imagined Agency", 135-149.

²² *Ibid.*, 136, 146.

with it: the propensity to navigate both intentional and accidental activities contributing to the functionality of performance with technology. Ferguson uses Simon Emmerson's concept of "field space" to elucidate how performers establish contextual relationships within the space connecting the agent, the instrument, and the resulting sonic output from the speakers.²³ A particularly compelling statement from Ferguson, with which I agree, concerns the notion of control in mediating through interface design. Ferguson argues, "I consider 'effort' and 'struggle' to be vital markers of authenticity in technologically mediated music-making."²⁴

By integrating Ferguson's insights and reflecting on my practical experiences, I have come to appreciate the profound impact of ambiguity and unpredictability in digital music interfaces, acknowledging them as essential components of authentic and dynamic music performance.

Following Ferguson, one can utilize familiar tools to mediate between technology and instruments during performance, contributing to aspects of shaping the sonic experience and the level of control and agency. The study "Designing Interactive Musical Interfaces" by Dan Overholt offers a comprehensive exploration of motion sensor interface development, emphasizing critical considerations such as control mechanisms, sonic effects, and data mapping. Overholt's study holds significance as it sheds light on the role of musical instruments in shaping our musical experiences, similar to how language influences thought processes. Additionally, it emphasizes the influence of technology on instruments, highlighting the tendency to rely excessively on familiar tools, particularly in contemporary interactive musical interface design. It

²³ Ibid., 136.

²⁴ Ibid., 145.

also underscores the crucial role of the performer in shaping the sonic experience, empowering them to take control and make their mark in the digital music performance environment.²⁵

Both Ferguson and Overholt share a common focus on engaging with sonic experiences; however, they differ significantly in their methods and approaches to technology. Ferguson emphasizes sonic sensor motion, which influences performance development through personal experience with hardware and prepared electric guitar. In contrast, Overholt concentrates on signal processes and synthesis in digital environments, utilizing software such as Max/MS.

Rimoldi and Manzolli explore new approaches for digital music interfaces, incorporating a more dynamic and interactive relationship and promoting bilateral exchanges between the performer and the instrument.²⁶ This source is relevant to my practice since I reimagine the role and the sound of the *buzuq*. In coming to terms with the role of the *buzuq* in contemporary art music, I explore different methods of using computer-based virtual instruments while expanding the affordances of the instrument.

Through innovative approaches using conventional and unconventional gestures (similar to those I employ with the motion sensor), tuning, and sampling methods with amplifications, I aim to achieve my vision of integrating the virtual *buzuq* with the motion sensor. This integration will grant me greater control over the sonic outcome of the virtual instrument while preserving its unique cultural identity.

I acknowledge Andersen and Gibson's examination of the technological considerations associated with crafting new instruments for new music creation.²⁷ While their study does not

²⁵ Dan Overholt, "The Musical Interface Technology Design Space," *Organised Sound* 14, no. 2 (2009): 217–226.

²⁶ Gabriel Rimoldi and Jónatas Manzolli, "Enactive Framework for Design of Digital Music Interfaces," in *Proceedings of the 2nd International Conference on New Music Concepts-ICNMC* (2016).

²⁷ Kristina Andersen and Dan Gibson, "The Instrument as the Source of New in New Music," *Design Issues* 33, no. 3 (2017): 37–55.

explicitly delve into motion-based music interfaces, it addresses performance techniques with a focus on gestures. Their argument contributes to the discourse on instrumental modifications that aid performers in developing their virtuosity and enhancing the performer's "[...] personal mental images of the music that could be produced."²⁸

One noteworthy observation by Gibson pertains to a visual perspective on the cultural attributes of musical instruments, explicitly addressing the instruments' imagery as a cultural object.²⁹ In their case study, the cello serves as the experimental subject. Anderson and Gibson's study is pertinent to the initial stages of my research. The objective of my research is to re-conceptualize the sound and the role of the *buzuq* and my performance by integrating motion sensors, aiming to explore novel sonic possibilities while enhancing my virtuosity through new gestures in technological means. Importantly, I undertake this endeavor not to alter the *buzuq*'s cultural image and associated attributes. Insights derived from this research have informed my approach to integrating acoustic instruments as primary tools for manipulating existing sounds and triggering new ones within the framework of virtual music interfaces. The discourse outlines a thorough methodological framework for harmonizing electronic processing techniques with acoustic instruments, with specific attention directed towards the cello. It accentuates the significance of comprehending both the instrument's physical and sonic characteristics, ensuring that the audience feels informed and knowledgeable about the process.

²⁸ Ibid., 37.

²⁹ Ibid., 37.

Integration of non-Western musical instruments

This section explores scholarly discourse on the integration of non-Western musical instruments into the realms of art, music, and technology. To contextualize my project, engaging with literature addressing the incorporation of non-Western sounds and musical instruments within the framework of Western art music is crucial. Following this, I will examine writings by artists, particularly in relation to technological advancements and global sound, where instrumentalists have expanded the potential of their instruments and their cultural musical heritage. However, this literature highlights a facet that requires critical engagement and creative dialogue, as my practice may expose inherent limitations within existing scholarship.

In his 2020 article, "Non-Western Musical Instruments and Contemporary Composition," Luigi Antonio Irlandini explores the implications of integrating non-Western instruments into contemporary music, emphasizing the expansion of the "instrumentarium" and the evolving roles of composers. Irlandini highlights the potential for composer-performers to develop culturally sensitive approaches to non-Western musical instruments. A central inquiry in his work is the strategic utilization of non-Western instruments within the new music framework. Irlandini examines this integration through the lens of compositions from the twentieth and twenty-first centuries, introducing the concept of "World New Music" to underscore its global significance in contemporary art composition. He argues that contemporary art music compositions should be termed "World New Music" rather than exclusively European phenomena, reflecting the global nature of new music.³⁰ This perspective encourages us to be

³⁰ Luigi Antonio Irlandini, "Non-Western Musical Instruments and Contemporary Composition," *Gaudeamus MuziekWeek* (2020):.

more inclusive and open-minded, recognizing the contributions of composers with Western music education, regardless of their cultural or ethnic backgrounds or the locations of their musical training.

Consequently, Irlandini suggests that composers of contemporary art music be referred to as "World Composers." This global perspective ensures that all composers, regardless of their background, feel included and part of a larger community.

Irlandini elaborates that the term "World Composer" refers to: "someone who writes art music and was educated and trained in the Western art music tradition, irrespective of where this took place or where the person comes from".³¹ From his perspective, labeling non-European composers as Western composers may cause discomfort. This insight should make us more empathetic and considerate in our use of labels.

He defines 'global sounds' as musical elements that transcend cultural and geographical boundaries, reflecting the diverse influences and perspectives of the contemporary art music community. I agree with Irlandini's redefinition, recognizing that contemporary art music can incorporate various cultural elements, resulting in a rich, global soundscape. Irlandini raises ethical concerns about the level of competency composers should possess when exploring new sounds through unfamiliar, often non-Western, musical instruments or those outside their cultural domain. He critiques the unconventional approach in which composers assume the role of performer, drawing inspiration and compositional material from instruments with which they are not fully acquainted.³² While I understand Irlandini's emphasis on the need for competency and cultural sensitivity, I find myself disagreeing with his critique. I believe that, in some cases,

³¹ Ibid., 4.

³² Ibid., 35.

composers can produce innovative and valuable musical expressions even without full proficiency in the instruments they explore.

Irlandini further discusses the evolving dynamics within electroacoustic compositions, focusing on the relationship between composer-performers and instruments and the broader integration of technology. This discourse highlights the increasing experimentation and the engagement composer-performers have with non-Western instruments becoming more direct—using their unique sonic capabilities as a tool in composition in contemporary western art music, specifically in electroacoustic compositions. This resonates with my perspective as I address the tension between Arabic musical instruments and Western new art music.

Although the ethics of borrowing musical instruments and the issues of cultural appropriation are significant, this research intentionally refrains from addressing these ethical questions. Instead, it posits that providing composers and instrumentalists with opportunities to experiment with non-Western musical instruments is essential. Such experimentation can lead to the discovery of new sounds and roles in intercultural and experimental music. The focus of this dissertation is specifically on Arabic musical instruments. Nevertheless, in alignment with Irlandini's recommendation:

“The composer/performer path might be a privileged position for the successful employment of non-Western musical instruments. This practice is "experimental " because it is an artistic research based on the experience of the praxis with these instruments. It is by means of experimentation with the instrument that the research advances to its results; the more uniquely the music depends on the practical experience with the instrument, the more experimental the music.”³³

My primary interest lies in integrating Arabic musical instruments into both new art music and vernacular music through unconventional means. This interest stems from my role as a composer within the global community of new art music. My artistic research aims not only to bring new

³³ Ibid., 35.

representation to the buzuq but also to foster a novel relationship between my composition, instrumental practice, and improvisation.

My research examines my artistic practice and contemporary art music through an internationalist lens. I view my creative practice as both a cultural and political dialogue, in addition to its artistic dimension. However, I diverge from the notion that composers must possess full competency in other instruments, such as non-Western ones, to effectively engage with them. Instead, my objective is to foster experimentation with non-Western musical instruments, including those proficient in Arabic music.

This exploration holds the potential to unveil novel sounds or layers previously undiscovered by Arabic music instrumentalists or to approach them in innovative ways that pave new pathways for the instrument. This perspective primarily pertains to experimental art music. My research aims to elucidate new sonic profiles of Arabic musical instruments.

I propose a novel strategy for incorporating Arabic musical instruments into contemporary art music compositions. This strategy involves exploring new sounds that Arabic instruments can offer and establishing a new language for improvisation with these instruments or other non-Western musical instruments. In this case, I propose that the "new language for improvisation" represents a personal set of techniques and approaches designed to enable spontaneous musical expression with non-Western instruments.

This individualistic strategy expands the sonic possibilities of these instruments within my own creative practice. While tailored to my specific artistic exploration, it also offers potential pathways for broader experimentation in the field, providing new perspectives for composers and performers interested in integrating non-Western instruments into their improvisational practices. The approach integrates technology as a tool to expand the sonic

capabilities of the instrument—in this case, the *buzuq*—while preserving its visual and structural integrity. This innovative strategy is designed to inspire and intrigue, opening up new possibilities for integrating non-Western musical instruments into contemporary art music.

This method fosters discourse with prevailing transcultural music traditions and engages with historical methodologies within experimental music. By situating Arabic musical instruments within this context, the strategy contributes to a broader dialogue on the intersection of traditional and experimental practices in contemporary music.

Budhaditya Chattopadhyay's book, "*Sound Practices in the Global South*", stands out as one of the most unique ethnographic studies focusing on international composers and sound artists.³⁴ In the next chapter, I analyze the work of some of the interviewees from this book and engage in conversation with their ideas. Among those particularly relevant to this review are the works of Khyam Alami, Abdellah M. Hassak, and Sharief Sehnoui. Alami and M. Hassak have actively explored the possibilities of deconstructing elements of Arabic music, including its instruments, and defamiliarizing their cultural references. As for Sehnoui, he delves into the art of sampling by decontextualizing sounds from existing Arabic music materials, placing them into new contexts and forms.

These artists have specifically focused on aspects such as tuning systems and have integrated their practice and interest in Arabic music instruments into the digital music performance realm. using software and electronic music equipment to expand their performance possibilities, blurring the lines between traditional and electronic music. This practice relates directly to my own approach and research objective in sampling the *buzuq* and deconstructing its unique tuning. Yet most of these artists have focused on deconstructing existing Arabic music

³⁴ Budhaditya Chattopadhyay, *Sound Practices in the Global South: Co-Listening to Resounding Plurilogues*, 1st ed. (Cham: Springer International Publishing, 2022).

repertoires within the realm of digital performance. I am looking at extending the *buzuq*'s identity. However, these artists craft their performances at the crossroads of popular and art music within the digital domain, a context akin to DJing, albeit with some incorporating acoustic instruments, as is the case with Sehnoui.

Examining the extraction of traditional-ethnic sounds from their cultural milieu, Heidi Chan-undertake an ethnographic inquiry delving into the adaptation and assimilation of sampling.³⁵ Their study specifically targets the practice of sampling "ethnic" musical instruments, with a notable emphasis on Chinese instruments. These investigations contribute to a global discourse on sampling non-Western instruments, employing cultural musical elements and situating them within novel contexts.

Furthermore, this study primarily relies on the writings of artists and composers, as well as interviews, with a particular focus on international performers and composers who integrate non-Western instruments and sounds into their musical practice. This emphasis is particularly evident within the domains of electroacoustic compositions and digital methods. In the final subsection addressing non-Western sounds, my resources will prioritize artists' writings such as program notes, academic articles, and interviews due to the lack of scholarly literature on their musical practices.

The Indonesian ensemble Uwalmassa serves as an example of employing unconventional techniques to create innovative sounds. Uwalmassa has shared their experiences in sampling and deconstructing Gamelan music, performing in a hybrid setting that incorporates a sample-based instrument. In an interview published on the official Ableton Live website, Uwalmassa explained

³⁵ Heidi Chan, "GarageBand's Chinese Instruments – An Overview and Discussion of a Virtual 'Ethnic' Instrument," *The Canadian Music Educator* 62, no. 3 (2021): 12–19.

one of their methods, which utilizes digital software, specifically Ableton Live³⁶. Their exploration of sampling and digital sound manipulation of Indonesian musical instruments aligns closely with my work involving *buzuq* samples.

More on non-Western music instruments, Miya Masaoka describes her work in sampling the Koto in her project “Laser Koto”. Masaoka combines the acoustic Koto and sample-based virtual interface in her live performances. Stacey Sewell’s discussion of Masaoka’s technical work in the piece ‘*Making My Skin Crawl*’ provides insights into the technical aspects of virtual and augmented instruments.³⁷ Masaoka employs a sensor system to trigger her samples. Her initial experiment involved a physical MIDI pedal interface triggering a bank of Koto sounds, which later developed into a laser sensor. I resonate with Masaoka’s approach given the shared emphasis on the human body and its connection to the instrument as a wellspring of expressive gestures. Furthermore, Masaoka’s exploration of the laser Koto aligns closely with my interest in practicing the *buzuq* and finding new sound materials. Masaoka’s work is a compelling model for developing a virtual music interface that seamlessly integrates with the original instrument and its sonic identity rather than supplanting it.

Instruments, as a reflection of regional cultural identity, are a focal point in synthesis and sound processing of Arabic music instruments and elements from Arab music cultures.

³⁶ Nyshkka Chandran, “Uwalmassa: Gamelan Deconstructed,” *Ableton.com*, September 10th, 2019, <https://www.ableton.com/en/blog/uwalmassa-gamelan-deconstructed/>

³⁷ Stacey Sewell, “Making My Skin Crawl: Representations and Mediations of the Body in Miya Masaoka’s Ritual, Interspecies Collaboration with Giant Madagascar Hissing Cockroaches” *Radical Musicology* 4 (2009).

Conclusion

The above expounds upon the three primary areas of relevance to my practical research endeavors. The first section of the literature review examined pertinent scholarly articles on sonic arts, focusing on using sounds as compositional materials and engaging in discourse surrounding the concept of 'sound object,' which refers to a sound that is perceived as a distinct entity, separate from its source. Much of my work, preceding and concurrent with my exploration of performance techniques and gestures utilizing motion sensors, has been dedicated to the sonic arts, delving deeply into compiling a comprehensive sound bank comprising latent sounds.

The second section explored various methodologies for constructing digital music interfaces, with an emphasis on motion and gestural-based sensor interfaces. In this section, I made an effort to identify both similarities and differences between my own practice utilizing motion sensors and that of other composers-performers and technologists. It was a reassuring experience to find commonalities, including the expansion of instrument capabilities, instrumental virtuosity, and considerations of ambiguity and sonic control in gestural expression, alongside the shared utilization of computational software such as MAX/MSP. Conversely, I note dissimilarities, particularly regarding the predominant focus of other studies on real-time sound synthesis rather than sample-based interfaces, as well as differences in the specific tools employed.

My practical research within the contemporary domain has allowed me to observe the pivotal roles of agency, ambiguity, and indeterminacy in utilizing virtual music instruments. These factors influence the creative process and the resulting musical expressions, encompassing tools such as motion sensor interfaces and interactions facilitated by computer-based systems.

Through this analysis, it became evident that the existing literature predominantly concentrates on sonic art and conceptualizing sound as an object and compositional material.

The third section delves into non-Western musical elements, integrating academic scholars' viewpoints and valuable insights from artists' writings and ethnographic studies. Furthermore, this section presents case studies focusing on the discourse surrounding non-Western music instruments within the digital domain. These case studies offer specific examples of composers-performers who have ventured into the digital realm by adopting innovative approaches to their instruments, highlighting instances where they have expanded both the cultural and technical capacities of their instruments, with particular emphasis on Arabic music instruments, which aligns closely with my research focus.

The scarcity of available academic literature limits the examination of these composers. However, I advocate for the creative exploration of non-Western and Arabic instruments, believing such endeavors can yield enriching and novel musical expressions. The potential of these instruments to inspire and enrich the field of contemporary Western art music is immense. Accordingly, this literature review includes a scholarly discussion on integrating non-Western instruments and sounds within the context of contemporary Western art music.

Chapter 2.

Exploring Unconventional Gestures, Technology, and Sound Synthesis: Study Cases.

This chapter examines the intricate processes by which composer-performers skillfully incorporate unconventional musical approaches regarding their respective musical heritages and non-Western instruments. By emphasizing unorthodox performance gestures and integrating technology with sound synthesis, it explores how these artists aim to honor traditional source material while simultaneously creating new performance practices and sonic possibilities. This approach highlights the coexistence of innovation and tradition, contributing to the evolution of instruments and fostering a dynamic integration between non-Western folk music and contemporary Western art music.

The presentation of case studies on Sharief Sehnaoui (Lebanon), M. Hassak (Morocco), Khyam Allami (Iraq-UK), Miya Masaoka, and the Uwalmasa Collective (Indonesia) plays a central role in my creative research and practice. These studies are particularly relevant in relation to how I have transformed the sound and performance practice of the *buzuq* by integrating sound synthesis technology and designing a digital interface.

I analyze the design of digital music interfaces, highlighting sample-based interfaces influenced by the varied sounds and instruments of non-Western musical traditions. I initiate dialogue with artists who explore their instruments as repositories of innovative compositional elements and performance techniques and who explore different approaches to leveraging technology. These creative endeavors specifically highlight the integration of non-Western musical instruments into contemporary technological contexts.

An unifying theme among these artists is their collective interest in exploring novel instrumental timbres and sound qualities, which are foundational elements in integrating technology into their creative processes. Notably, this discussion encompasses musicians from the Arab world whose musical works extend the boundaries of non-Western music instruments, particularly focusing on Arabic music instruments and avant-garde approaches to Arabic music.

The subsequent chapter meticulously analyzes noteworthy works and unconventional approaches to non-Western music instruments by artists such as Miya Masoka, the Uwalmasa collective, Khyam Allami, and others. The chapter thoroughly investigates the motivations driving the expansion of instrument capabilities through focusing on the instrument's sonic capabilities, addressing both cultural, stylistic and practical considerations. It aims to illuminate the transformative impact of digital technologies on musical practices, integrating traditional-folk and contemporary art music realms.

By closely examining the creative sampling process, the chapter contends that working with sonic art transcends mere appropriation, serving as a dynamic catalyst for innovative performance practices and fostering novel relationships with both acoustic and digital instruments.

Arabic Music Instruments and Unconventional Approaches to Sound

My examination of the sound artists considered delves into the commonalities and divergences apparent in their musical compositions, as well as their individual approaches to music and cultural backgrounds. Although initially not directly involved in Arabic music, I later encountered it through various means and to varying extents, and it ultimately became a wellspring for our creative endeavors. The three artists I am highlighting—Sharief Sehnaoui (Lebanon), M. Hassak (Morocco), and Khyam Allami (Iraq-UK)—originated from three distinct geographical locations in the Arab world, sharing similarities in their musical education backgrounds.

The first artist discussed is Sharief Sehnaoui, a Lebanese sound artist and guitarist, whose focus lies primarily in the realm of experimental music, and avant-garde music, particularly in acoustic and electric guitar performances. Sehnaoui's distinctive approach involves exploring extended and prepared techniques for the guitars, often collaborating with musicians well-versed in the *maqam*-based music and free jazz improvisers. While he does not delve into digital music performance or virtual interfaces, his work reflects a global music influence, enriching his musical vocabulary in his performances which focus on timbre and sonic outcome.

Sehnaoui's emphasis on sound art involves intentionally disconnecting his creative pursuits from cultural origins, using extended guitar techniques to unearth new sonic possibilities. Parallel to this, my musical practice with the *buzuq* shares a common ground with Sehnaoui, as we both delve deeply into understanding our respective instruments and unlocking unfamiliar sonic dimensions within them. Despite the diverse musical influences shaping our work, a key distinction lies in my conscious grounding of sounds in their cultural origins, particularly in the realm of Arabic folk music from Lebanon.

In my exploration of microtonality, I incorporate elements deeply rooted in Arabic music modes, adding Arabic music rhythms for contextual depth. Unlike Sehnaoui, who radically modifies the guitar through prepared techniques, I maintain the authentic design of the *buzuq*, considering it not just an instrument but a cultural icon in Arabic music. Preserving its acoustic sound becomes paramount, symbolizing a specific geographical region within Mediterranean music culture.

Microtonality, woven into a specific Arabic context, serves as a focal point, combining experimental exploration for new music textures and forms, with a dedication to cultural authenticity. My compositional drive is propelled by the concept of imitation and the cultural connotations embedded in these sounds, strategically creating compositions with latent sounds that transport both the listener and myself into a space of ambiguity.

This strategic maneuver aims to disengage not only from my cultural identity but also from the cultural identity of the instrument itself, enabling artistic exploration beyond traditional confines. Sehnaoui shares a similar trajectory in his guitar performance, associating himself with free jazz improvisation and employing prepared guitar techniques to reach additional sounds.

While Sehnaoui cites maqam-based music as a late inspiration, its direct influence may not be evident in his music materials. However, his noteworthy collaboration with musicians in the context of the festival he founded, “Irtijal” (meaning improvisation) in Lebanon, underscores his pioneering role in breaking the tension around Arabic music instruments. This initiative expands the platform for musicians to experiment with Sehnaoui's innovative sounds, creating a dynamic space for sonic expression within the realm of *maqam*-based music and free improvisation.

Aligned with Shenaoui's methodological framework, I have encountered a significant instance while exploring avant-garde approaches applied to Arabic musical instruments. This example involves a rare solo composition titled "ZIRA " for the *qanun*, created by Auge Abou Zeed from Syria. Encountering Abou Zeed's composition was particularly impactful, as it resonated with the concept of deconstructing the dichotomy between Arabic musical instruments and contemporary art music. Notably, this piece not only offers a comprehensive exploration of the qanun but also demonstrates meticulous attention to new ways of notation to the qanun instrument.

M. Hassak, a sound artist, electronic music performer, and technologist from Morocco, specializes in sampling folk Moroccan music and incorporating sounds from Arabic classical and folk music recordings within Moroccan culture. Bridging the gap between popular and art music-making, Hassak's compositions are deeply rooted in digital programming, utilizing IT coding for interactive music performance. Employing tools like sampling, he crafts sonic tapestries that blend retro-futuristic and psychedelic elements, creating immersive social environments.

Within the realm of electronic music, M. Hassak seamlessly integrates city sounds into contemporary intermedia composition. Employing soundscape and electronic sounds as mediums for cultural exchange, his sampling involves auditory archive materials, including soundscape, city noises, and folk instruments from Morocco. Notable among his works is 'A Symphony Of Cities' (2018), where he combines sampled materials with notated scores in an innovative sound installation. The work of M. Hassak goes beyond a specific music genre, his musical practice combines complexity of sounds that are taken from his surrounding culture. My comment on this, that usually Arab musicians find a way to communicate with larger musical communities through sound art, including soundscape compositions.

In contrast, my exploration of M. Hassak's musical journey extends beyond the digital landscape, delving into the shared realm of sound archiving. In my creative process, I occasionally prefer the term "archiving" over the conventional "sampling" when extracting latent sounds from the *buzuq*; *it does* archive musical and-non musical sounds captured by the *piezo* microphones. This distinction highlights a unique perspective, transforming the act into a deliberate and artistic preservation of sound, documenting the instrument's story and history. Looking at the artistic approach of music making in some recent pieces that I have composed since the discovery of the *latent sounds* included soundscape materials I have archived in recent years.

I integrate these soundscape recordings with the latent sounds of the *buzuq* into my compositions, particularly in dance works and spatial sound compositions. Drawing from environments that significantly influence my musical perspective, including the resonances of protests and the dynamic ambiance of collective improvisations within multicultural ensemble rehearsals, enriches my sonic palette. This approach differs from my digital music composition, which predominantly engages with the sonic domain. In contrast, M. Hassak's trajectory is focused on fostering cultural exchange, navigating realms with a deep interest in the materiality of sound—a profoundly personal avenue for articulating his voice within the contemporary art sphere.

Khyam Allami, an Iraqi-British composer and oud player based in England, is widely acknowledged as a versatile multi-instrumentalist specializing in the digital realm of music composition, particularly focusing on fundamental aspects of Arabic music. There is a notable parallel between Allami's work and my own creative pursuits: both of us have translated the foundations of Arabic music into the digital domain, although Allami's approach differs in that

he did not sample his *oud* for a sample library. Instead, he developed two computer-based equal-temperament virtual interfaces called Leimma and Apotome. These interfaces generate MIDI samples or manipulate real-time input from instruments, representing the Arabic music scale system and other non-Western modes.

The significance of Allami's work extends beyond musical expression, delving into a broader ideological framework challenging post-colonial and orientalist constructs related to the assimilation and appropriation of non-Western musical elements by non-Western audiences and musicians through technology. His interfaces, Apotome and Leimma, aim to awaken a deeper understanding of music and highlight its historical and colonialist origins, which, as Allami emphasized in an interview, are often overlooked in discussions on music technology. As Allam described in an interview:

It actually highlights the problems with equal temperament and allows people to explore others. So both Apotome and Liemma fall into the same category here. They definitely are an attempt to awaken such an understanding of music and also to highlight the fact that what we think of as music today—this fundamental element of music—stems from a supremacist and a colonialist place. I don't think that this has been really discussed at all when it comes to music technology these days³⁸.

Both Khyam Allami and I ventured into the digital realm of music by incorporating Arabic musical instruments and tuning systems, particularly focusing on string and plucked instruments. While our approaches share a common foundation, distinctions arise in the design and functionality of our respective interfaces. I generate sounds directly from the acoustic *buzuq* instrument without artificial elements, whereas Allami's interface includes artificial sound components. During my research on Arabic music instruments in the contemporary art music scene I have encountered more names of composers and technologists who also stretched the

³⁸ Ibid., 159.

boundaries of the sonic capabilities of Arabic music instruments, as shown above in one of the examples in the piece *ZIRA For Solo qanun* by Auge Abou Zeed.

Furthermore, my virtual interface is personalized, intimately connected to my practice as an improviser with the acoustic *buzuq*. While adaptable for use by other *buzuq* and *oud* players, it requires musicians to utilize their own sample sets, tailoring the interface to individual preferences and requirements. These differences highlight the individualized nature of our approaches to digital musical exploration within the context of Arabic instruments and tuning systems.

A notable observation is the undeniable influence of Arabic musical elements and broader cultural foundations on our artistic practices. Whether serving as a wellspring of inspiration or integral material for our creative processes, Arabic music plays a pivotal role in contemporary and experimental musical conversations. Significantly, my creative research, running parallel to that of the three sound artists, delves deeply into facets of our individual Arab cultural and musical heritages, as well as our relationships with our musical instruments.

Our collaborative effort centers around engaging with a wider musical community, aiming to amplify the impacts of Arabic music and innovatively manipulate sounds in the process.

The narrative of this chapter seeks to clarify the nuanced interplay between these artists' distinctive approaches and the cultural resonances that shape their sonic work in experimental music and the digital realm.

In conclusion, the artists discussed in this examination share commonalities in their engagement with sound, characterized by a penchant for experimentation and manipulation. Their creative endeavors traverse diverse terrains, incorporating elements from Arabic music culture and global sound. While they explore the boundaries between art and popular music, each

artist has a unique approach, contributing to a broader discourse on Arab music artists. Notably, despite the shared Western musical education background, my research, involving sampling and documenting marginalized folk Arabic music instruments like the buzuq, presents a distinct contribution not replicated in the works of the artists under consideration.

Additionally, these artists have yet to propose methods for extending the capabilities of their instruments into virtual music interfaces and broader digital music environments, which aligns with the unique focus of my research. Expanding on this topic, I delve into how these case studies inform my aesthetic by highlighting the contributions of Arab music performers and composers, which serve as a foundation for the questions explored in my own work.

A Case Study of Miya Masaoka's Laser Koto: Exploring of Gesture and Sound Synthesis

When examining the integration of non-Western traditional folk musical instruments as the basis for sample-based music interfaces and unconventional gestures, the case study of the composer-performer Miya Masaoka emerges as particularly relevant and closely aligned with the thematic focus of my research. I primarily attribute this alignment to the notable parallels in our respective methodologies. While my research primarily investigates unconventional gestural expressions in performance, Masaoka's endeavors embody analogous thematic motifs and methodological approaches, particularly her 'Laser Koto' project. My dialogue with Miya Masaoka provided an insightful journey into the intricate nuances of her artistic vision, particularly concerning the Koto and its timbre. I had a conversation with Masaoka on January 21, 2024; this conversation took place via Zoom. In my interview with Miya Masaoka, I inquired about her interest in sound

as a material entity, mainly how she views it extending beyond its traditional association with specific musical instruments.

In her exploration of additional sonic layers of the *koto*, Miya Masaoka embarked on a comprehensive project aimed at developing a sound library that captures the intricate timbral variations of the instrument. This endeavor was significantly influenced by her residency at the Center for New Music and Audio Technologies (CNMAT) at the University of California, Berkeley. The project was conceived in response to the limitations of digital pitch shifting, which often fails to capture the unique timbral qualities of each pitch on the *koto*, resulting from its distinct wood and structural characteristics.

Masaoka's approach began with recording fundamental pitches of the *koto*, emphasizing the capture of acoustic pitches rather than relying on digital manipulation. She meticulously recorded various dynamic levels, from pianissimo (*p*) to forte (*f*), and varied gain levels to account for the subtle timbral changes across different pitches and dynamics. This methodical process involved unconventional techniques such as bowing, which, although atypical for the *koto*, allowed her to achieve a diversity of timbres. Additionally, she employed string bending to explore micro-tonalities and recorded a comprehensive set of harmonics, resulting in approximately 900 samples.

As Masaoka narrated, the initial stages of documenting the *koto*'s sound were first to create a sound library. This process was a labor-intensive project that required daily recording sessions with an audio engineer at CNMAT over several weeks. Masaoka is committed to capturing the *koto*'s authentic tonal and timbral qualities, timbres, and registers while accommodating techniques such as pizzicato and tremolo. Addressing potential concerns about the impact of the sampling process of the *koto*, Masaoka acknowledged the psychological

challenges associated with altering her relationship with the instrument. She was sensitive to the possibility of stripping the *koto* of its inherent mystery through the exhaustive sampling process. She aimed to develop a controlled method of digital interface that allowed her to access the desired pitches in her live performances with the acoustic *koto*. Despite these concerns, Masaoka's dedication to creating a detailed and nuanced sound library reflects her commitment to expanding the sonic possibilities of the *koto* and integrating these elements into her broader artistic practice.

The integration of technology in the realm of acoustic instrumentation facilitates a novel and invigorating engagement with traditional instruments that has not been explored in new mediums. This interplay fosters a renewed perspective on acoustic instruments string plucked instruments in experimental music. There are considerations that arise in the extent of manipulation applied to raw audio samples—specifically, the degree of filtering or sound alteration employed. This stage presents not only technical challenges but also significant ethical and aesthetic dilemmas. The balance between preserving original sonic information and the artistic augmentation of this information could be crucial, as it affects both the integrity and the creative potential of the auditory experience. Instrumentalists are training their ears and brains to accept new sounds as additions and extensions of their traditional acoustic instruments.

This acceptance can be a deliberate choice for instrumentalists who seek to expand the sonic profile of their instruments, along with the techniques and gestures they have mastered. However, in Masaoka's experience, she successfully integrated the virtual and acoustic *koto* in her performances, achieving a balance that preserved the construction and visual appearance of the *koto* while expanding its sonic possibilities. The challenges were more related to the reaction of her mentor and how she would be perceived in the musical community of *koto* players.

Masaoka: “I had a lot of breaking point with one of my teachers because I began to improvise on the instrument and I began to do lots of concert and this specific teacher did not like that, and at one points she said: “every time you going to have a concert you need to have my permission.” which was ridiculous and she said: “if you continue to keep doing it by yourself I will take away your koto performance certificate.” (Masaoka, January 1/21/2024).

JB: *I agree with you, there is something in integrating technology that brings us back to our acoustic instrument in a new and fresh mind. I am curious — how much did you interfere with the raw samples, in other words how much did you apply filters or sound manipulation on them? I found it myself a challenging stage, not technically but ethically and aesthetically, how much sonic information we lose or we gain in this stage.*

MM: For me the bank of the *koto* was the pure sounds and if I wanted to do audio processes I did it later, and if I did not like these processes later, I could go back to the original material and do it again. I did so much work with these samples and there are a lot of possibilities, I think there is a taste of a sound processes that comes and goes every decade in contemporary electronic music, and the change goes fast.”

Masaoka reflects on her extensive engagement with these samples and notes the evolution in audience perceptions and preferences at various stages outside the traditional confines of contemporary and electroacoustic music. This evolution reveals how each generation inherently develops its taste and preferences, a phenomenon she considers natural, like the evolution of instruments that result from experimentations conducted by composer-performers.

Masaoka also offered a contrasting perspective, suggesting that one's primary aim should be self-satisfaction rather than striving to cater to Western audience institutions. She emphasized the necessity of aligning one's musical endeavors with personal tastes and motivations to sustain a lifelong commitment to music, irrespective of external factors such as record labels or concert series. Further, Masaoka distanced herself from any political agenda, framing change and evolution as inherent aspects of music and technology. She emphasized the inevitability of change

in musical practices and technological advancements, viewing adaptation and evolution as natural processes rather than conflicts.

JB: As a composer with a multifaceted interest in diverse forms of musical expression, how do you navigate disengagement from extensive projects such as the laser koto or the sampling endeavor? At what juncture do you recognize the necessity to disengage from these projects or from the instrument itself?

MM: This project was decades ago, and I know what do you mean to get tired of your instrument or the sound you work with, so I think it is natural to have mixed feelings and to go to different parts of the research and learning something else or to go to different instrument that is similar, I for example get a lot of inspiration from improvising on other instruments when I was playing *koto* all the time that was a new world that open up to me, and also the combination of instrument and new sounds, from a composer perspective this combination brings complexity to the audience and the listener so rather to be a solo instrumentalist there is a possibility of taking yourself from to explore the realm of performance to create new ways of generating sounds, rhythms, and textures, and to develop compositions beyond your identity as a performer. As a composer I always wanted interaction with other instruments and other people. It is all important for you as a composer, you create a new identity.”

Throughout the interview Miya Masaoka reflected on the cyclical relationship between sound, its physical properties, and compositional practice. She emphasized the vibratory impact of sound on the body and how this perception influences her creative decisions as a composer. For instance, when selecting instruments, she considers their ability to produce specific sonic qualities, such as choosing a bass for lower frequencies or a piccolo for airy, high-pitched tones. According to Masaoka, sound serves as the raw material that is constantly shaped and manipulated, whether through traditional or electronic means. Sound composition, for her, is not merely about sound as an object but also about its experience within different temporal frameworks. Moreover, she highlights the importance of exploring new instruments, noting how

learning other instruments—such as her early experience with classical piano—shaped her understanding and provided fresh perspectives on her primary instrument. This process allows her to engage with sound and pitch in novel ways, although she acknowledges that not all performer-composers follow this path, with some remaining content with their primary instrument. For her, the continual exploration of how sound is produced and perceived enriches her overall approach to music-making.

Miya Masaoka reflects on the natural process of creative disengagement and re-engagement in the context of compositional and instrumental practice, in shifting focus from one instrument or project (e.g., the koto) to other traditional Japanese and Chinese instruments. This process of disengagement and re-engagement enables Masaoka to explore new sonic possibilities, rhythms, and textures, transcending the limitations of her identity as a koto player. Her work emphasizes the historical and cultural connections between Japanese and Chinese music traditions, integrating these influences into her contemporary practices of improvisation, composition, and technological experimentation. Technology, for Masaoka, is not merely a tool for exploring new sounds and materiality but also serves as a statement of musical evolution, reflecting and responding to the dynamic realities of the contemporary world.

On her digital interface Masaoka's initial experimentation commenced in the early 1990s, wherein her virtual interface incorporated a physical MIDI pedal interface to trigger a bank of *koto* samples. This interface subsequently evolved to incorporate a laser sensor. Within Masaoka's musical domain, sampling transcends its peripheral status to become a central and integral element. In her compositions utilizing sampling, Miya orchestrates a dynamic interplay between structural elements and sonic progression over time. This encapsulates a fundamental principle she fervently upholds in her musical pursuits—the pursuit of sonic development

satisfaction. Additionally, her exploration extends beyond the confines of the *koto*, reflecting a broader interest in gestural expression.

Masaoka's contemplation of the interface arises not merely from a technical standpoint but is deeply rooted in a personal narrative, one of the inspirations for Masaoka to translate sounds into data, and data into sounds came inspiration data representing the pattern of heartbeats. In this poignant moment, data emanating from the body resonated with her as a wave of sound, transforming the seemingly mundane into an object imbued with sonic significance.

Presented at the Redcat Theater in Los Angeles in 2006, *Things in an Open Field* stands as another compelling creation by Masaoka for Laser Koto and electronics. Departing from traditional norms, Masaoka deliberately reduces her engagement with the acoustic *koto* in this piece. Instead, she delves into a rich exploration of various bodily gestures, weaving the metaphorical strings of the laser *koto*. This performance incorporates manipulated *koto* samples from the laptop and embraces the inclusion of environmental sounds. This marks a distinctive facet of Masaoka's solo repertoire. By skillfully integrating manipulated *koto* samples from her laptop and incorporating ambient environmental sounds, she carves out an artistic space that sets her work apart. A noteworthy example of her inventive approach is found in 'A Crack in Your Thoughts' (2012), a solo piece showcased at the Walker Art Center Gallery in Minneapolis³⁹. Here, Masaoka not only utilizes *koto* and laser *koto* but also uses a variety of musical and nonmusical objects as sound sources. The interplay involves both direct and laser-beam-aided interactions. Going beyond the expansion of gestures with the laser *koto* and the sample library, Masaoka delves into the creation of a sonic landscape enriched by additional environmental sounds. As articulated in her interview with the New Music USA organization, her focus extends beyond

³⁹ Miya Masaoka, *A Crack in Your Thoughts*, performance at the Walker Art Center Gallery, Minneapolis, 2012. Accessed online, <http://miyamasoka.com/work/2012/a-crack-in-your-thoughts/>.

mere musical exploration; she strives to craft sounds that accurately mirror the reality she lives in⁴⁰. Miya's discourse on instrument evolution is of particular significance. In it, she explores the experience of employing extended and unconventional gestures facilitated by digital interfaces. Through this exploration, she manifests continuity and the evolution of her music and her instrument. Masaoka perceives her projects as avenues for the development of the *koto* in terms of its physical construction and the expression of the sounds it produces. She underscores that her interest extends beyond the *koto* itself to instruments from Japanese and Chinese cultures that are linked to the evolution of the *koto*. I concur with this perspective, as evidenced in my own research on the *buzuq*.

Masaoka's vision of instrument development aligns with my approach, which diverges from recent advancements such as the creation of the electric *buzuq*. Instead, I aim to preserve the instrument's traditional shape, sound, and construction. Through the incorporation of digital instruments and sound banks of latent sounds, I seek to ethically propel the evolution of the *buzuq* into new realms of performance.

⁴⁰ Miya Masaoka, "Miya Masaoka: Integrating the Body, Gesture, and Sound," *NewMusicBox*, published August 23, 2022, <https://newmusicusa.org/nmbx/miya-masaoka/>.

A Case Study within the Uwalmassa Collective (Indonesia)

The Indonesian ensemble Uwalmassa comprises three musicians from Indonesia: Harsya Wahono, Randy Pradipta, and Pujangga Rahseta. This collective demonstrates a notable proficiency in applying unconventional methodologies to traditional Indonesian musical instruments and in deconstructing Gamelan music through digital interfaces and live sound manipulation. Their creative endeavors involve utilizing a bank of samples, with a focus on extracting the timbral qualities of Indonesian musical instruments such as metal and wooden percussion instruments, bamboo flutes, and stringed instruments. Through the artful manipulation of these elements in experimental music, Uwalmassa are pioneers of an innovative approach to bringing non-Western music instruments into the digital realm of sample-based digital instruments, while focusing on timbre and gesture, as the case of Miya Masoaka.

Based on insights gathered from a series of interviews and an analysis of their compositions, it becomes evident that the Uwalmassa Collective's primary objective is to cultivate innovative sonic expressions rooted in their cultural heritage and to express the ongoing musical transformation of Gamelan music. The primary written resource available on Uwalmassa is an interview featured on the official website of Ableton Live, reflecting their predominant utilization of Ableton Live in their endeavors with digital music interfaces.

A noteworthy composition in their repertoire is the debut album 'Malar,' wherein Uwalmassa deftly incorporates a diverse array of acoustic and synthetic samples. The resulting musical tapestry is mysterious and ambiguous, offering a subtle nod to Gamelan traditions while seamlessly integrating industrial sounds. When experiencing Uwalmassa's live performances, a

key facet of their musical interface becomes apparent: a computer-based digital interface with Indonesian percussion instruments.

The collective navigates this interface primarily through popular digital workstations, notably Ableton Live in conjunction with a MIDI keyboard, all while seamlessly integrating traditional Indonesian percussion instruments into their sonic palette. Within the realm of transcultural music creation, one of the solo performances by Wahono, a member of Uwalmassa, showcases a distinctive musical performance ‘Apotome Artists Takeover’ at the CTM Festival in 2022⁴¹. His solo act revolves around a generative microtonal music environment, where he skillfully employs the Apotome digital interface (crafted by the sound artist Khyam Allami). This interface dynamically generates microtonalities in real-time from an instrument input. Wahono in this show manipulates live sounds that he extracts from a snare drum, and an assorted collection of samples of Indonesian music instruments.

The performance by Wahono, representing the enigmatic essence of Uwalmassa's music, intricately blends elements of contemporary electroacoustic music with vernacular Indonesian musical traditions. Through adept manipulation of wind and reed samples inspired by instruments such as the *serunai*, *saluang*, and *slompret*, Wahono crafts a sonic tapestry that evokes a mysterious atmosphere while incorporating electronic rhythmic patterns reminiscent of Indonesian music. This synthesis of genres and influences underscores the creative practice of the Uwalmassa Collective, positioning their performance within the realm of electro dance music, as exemplified by the study case of M. Hassak.

⁴¹ Wahono’s performance: *Apotome Artists Takeover* by the Uwalmassa collective at CTM Festival, 2022. Accessed online, <https://www.youtube.com/watch?v=1cWBLS7qZDo&t=63s>.

Through the Nusasonic project in Jogjakarta, Indonesia, Uwalmassa presented a collective thirteen-minute performance⁴². The trio positioned themselves on stage, with two members playing Indonesian percussion instruments, including the Khendang or Gendang, while the third generated sounds from a laptop. Their stage presence resembled that of a DJ, albeit with Indonesian percussion instruments.

Typical of their recordings, the performance began with synthetic noises, accompanied by clear rhythmic patterns on the acoustic percussion instruments. These repetitive motifs formed cyclical patterns that developed throughout the piece, eventually transitioning into distinct rhythmic patterns reminiscent of Gamelan music. These patterns were accompanied by soundscapes and singing voices recordings.

The climax of the performance featured complex interlocking rhythmic layers, combining electronic and synthetic sounds with a prominent presence of Gendang⁴³. The overall sonic and rhythmic texture resembled dance club music. The intersectionality between contemporary art music and vernacular music is evident in the cases of Hassak and Uwalmassa, like the study case of M. Hassak. Both artists navigate the cultural landscape of electronic dance music, resonating with a particular demographic of young listeners.

Further, in my analysis, I have discerned shared characteristics between the Uwalmassa collective and Masaoka. Both artists extend the sonic expression of their respective instruments beyond their traditional confines. Despite this expansion, they steadfastly uphold the historical and cultural integrity of their instruments while simultaneously pushing the boundaries of their sonic capabilities. Although both case studies exhibit a common emphasis on timbral

⁴² Uwalmassa collective performance at Nusasonic Yogyakarta Festival, Eloprogo Art House, Central Java, Indonesia, 2018, accessed online, <https://www.youtube.com/watch?v=hBwWjAsUpec>.

⁴³ A pitched percussion instrument commonly found in a gamelan ensemble in Indonesia.

exploration, the Uwalmassa collective's approach transcends mere timbre manipulation. Their focus extends to the rhythmic propulsion inherent in Indonesian traditional music, as evidenced by their manipulation and expressive rendition of percussive elements. This nuanced approach underscores their dedication to capturing the essence of Indonesian musical traditions.

Furthermore, the Uwalmassa collective's emphasis on the concept of change and evolution within their culture's music and instruments is noteworthy. This aspect is elucidated in their interview featured on Ableton Live's official website, where they articulate their commitment to both preserving and innovating upon their cultural heritage through music.

Chapter 3.

The latent sound, from the soundboard to a digital music interface.

Introduction

This chapter delineates the creative and research processes involved in various stages and compositional mediums, starting with the initial exploration of the instrument's latent sonic profiles enhanced by amplification. The newly discovered sonic profiles of the buzuq were systematically categorized and classified into a sound bank library. These profiles have been integrated into two primary types of electroacoustic composition and performance. The first involves the creation of a virtual orchestra utilizing the buzuq's latent sounds, digitally manipulated according to the principles of *musique concrète* for soundtracks, dance compositions, and fixed media works. The second focuses on interactive composition and performance using a motion sensor interface.

The chapter provides a detailed thematic and chronological account of the work with the buzuq's latent sounds. It explores how these sounds and their digital manipulation, a process demanding dedication and thoroughness, actively structure my recent compositions. This has led to the development of a virtual orchestra and compositions for dance pieces. Furthermore, the chapter presents parallel work on the development of a sample-based digital music interface.

The section on the digital music interface presents the design process in chronological order, concluding with the integration of the acoustic buzuq and the MUGIC® motion sensor as a digital music interface. It emphasizes gestures and motion sensors as key tools for interface design. Throughout the primary sections on virtual orchestra compositions and the construction of digital music interfaces, a critical consideration is the role of indeterminacy and chance in

both compositional practice and research. These elements significantly influence concepts of improvisation, composition, and creative decision-making.

The thesis includes two main sections: high compositions of dance and ensemble pieces for the virtual orchestra, and four pieces featuring digital music interfaces. The dance and ensemble pieces for the virtual orchestra are:

- "Breaking Barriers" (2022), a dance piece
- "Fixed Dabke" (2024), a composed-improvisation fixed media piece
- "Luminescent Mote" (2003), a composed-improvisation fixed media piece

The four compositions utilizing the MUGIC® motion sensor are:

- "Drawing with the Latent Sounds" (2023)
- "The Buzuq Riot" (2024)
- "Bhallelak" (2024)

Definition of the Latent Sounds

It is essential to define and describe latent sounds and the methods and conditions that assist in discovering them. Latent sounds comprise a collection of sonic materials that differ from the traditional, familiar sound of the *buzuq*. These sounds remain hidden within the *buzuq*'s soundboard and spherical body, only revealed through specific techniques. Discovering these latent sounds clarifies the compositional and research goals of this chapter.

The application of amplification to the instrument, utilizing a piezo microphone, has directed my focus toward investigating the diverse sonic outcomes achievable through physical interaction with the *buzuq*. This technological intervention not only facilitates the cultivation of a novel mode of auditory perception but also fosters a more profound sense of intimacy with the instrument. The piezo microphone captures both musical and nonmusical sounds, documenting the intimate relationship with the instrument. Consequently, any sonic materials recorded have the potential for musical expression in future compositions.

The necessity of monitoring the *buzuq*'s sound output through headphones heightened my awareness of the expansive sonic landscape extending beyond the superficial realm of the soundboard. This realization underscored the *buzuq*'s spherical body as a conduit for transmitting nuanced auditory information that is preserved through headphones, and capable of being captured through piezo microphone technology and potentially archived for compositional endeavors. The interplay between the ambiguity and familiarity of these sounds plays a pivotal role in my creative process, motivating ongoing experimentation in sampling and subsequent composition. Recently, my relationship with these latent sounds in the context of constructing digital music interface has evolved.

The buzuq's latent sounds exhibit distinct timbral variations, significantly expanding its sonic landscape through unique vibrations influenced by air pressure, unconventional string manipulation, and percussive gestures. These variations encompass musical resonances, including harmonics and various spectral shapes, timbral variation. Additionally, sound sculpting through manipulation has yielded a collection of latent sounds with sharper, more powerful, and occasionally harsher qualities compared to the conventional buzuq sound. Despite these differences, all latent sounds share a common characteristic: they reflect unique string vibrations inherent to the instrument.

Sampling/recording techniques

The exploration of new musical materials and gestures in my composition and improvisation motivated the development of an initial sampling technique. The sampling technique involves expelling air from the lungs to create air pressure that interacts with the buzuq's strings, producing a drone sound characterized by fluctuating high and low frequencies depending on the direction of the airflow.

I recorded sound samples resulting from various unconventional gestures and techniques, encompassing different pitches, timbres, and tuning systems with varying gain levels. This decision aimed to capture diverse intensity levels and timbres for each technique. Each track was categorized within the digital workstation using the software Reaper, based on techniques and tuning, and the data was stored in a library of raw materials. This process, initiated in Winter 2022, now comprises approximately four hundred varied raw material samples, including samples of the three main performance techniques and secondary improvisatory performance

technique resulting from spontaneous interaction and experimentation with the *buzuq* between each track.

This spontaneous and unprepared method resulted in the first collection of latent sounds, revealing unexpected sonic characteristics similar to those achieved with a violin bow. However, the resulting sound possesses a more subdued quality across a broad spectrum of frequencies and harmonics. These unconventional techniques uncover complex harmonic layers and are termed "latent sounds" due to their elusive nature; without amplification, these sounds pose challenges for detection, recognition, and archival processes.

The second category entails capturing a distinctive spectral shape of sound motion produced by rebounding one of the *buzuq*'s strings, primarily from the bass string. The third category features the production of harmonic sounds achieved by plucking the strings at the instrument's edges. Finally, the timbre of the wood is captured by drumming on the *buzuq*'s body. While these constitute the primary categories, exploring the *buzuq* through unconventional playing techniques opens up additional avenues.

The approach undertaken in this endeavor involves documenting numerous pitches and timbres resulting from the three specific techniques recorded at various gain levels, and different types of strings and tension levels. My primary focus has been on the exploration of diverse tunings of the *buzuq*, a stringed instrument characterized by its composition of three double strings tuned to C, G, and C respectively, each set possessing distinct frequency levels. In creating a drone sound, which I term as (air sound), I focus on the creation and documentation of the results of sounds based on different tuning systems.

The compositional vision and strategy are to collect different and discordant homophonic textures from the *buzuq*. There are two main timbre qualities within the drone sound, which I

classified into two categories: "low resolution" and "high resolution" air sound. In the low-resolution, I follow the method of sampling the vibrations of the string in the standard tuning of the buzuq of a perfect fifth and a perfect fourth, for example, C, G, C, the set of strings (taking into account that the buzuq has double strings) is tuned to the same pitch while taking into account the minimal different frequencies due to the level of the gauge of each string. I expand this method by altering the tuning of the strings to different notes while maintaining the interval relationship of a ninth chord to document a variety of tonal outcomes.

Conversely, the high-resolution sampling I use to follow the frequencies of each string as I alter their tuning concentrates on microtonality. Each of the six strings is tuned differently from one another, albeit with minimal deviations. The precise measurements are denoted in cents or by closed position, i.e., positioning my fingers on frets that indicate quarter tones on the *buzuq*.

This phase delved deeper into the realm of microtonality and maqam-based tuning systems, thereby enabling experimentation with homogenic textures imbued with microtonal nuances. It is noteworthy that these strategies predominantly targeted two specific techniques: firstly, what I refer to as "the air sound," resulting from the application of exhaled air pressure onto the instrument, as mentioned previously; secondly, chords produced by fretting the strings, specifically along the neck of the instrument rather than over the sound hole, yielding unique and uncommon timbres.

This systematic process was meticulously documented and classified according to its suitability for compositional purposes. The experimentation with tuning unfolded across two distinct phases: firstly, the adjustment of the instrument's overall tuning, involving either raising or lowering it while maintaining consistent intervals of fifths and fourths; secondly, the

exploration of micro-tuning, wherein each of the six strings is tuned differently, with precise measurements denoted in cents.

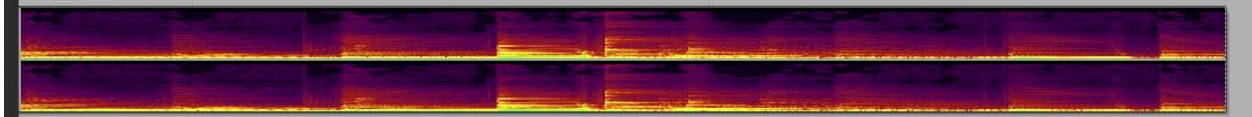


Figure 1 A spectral sound profile of the buzuq played with a pick.

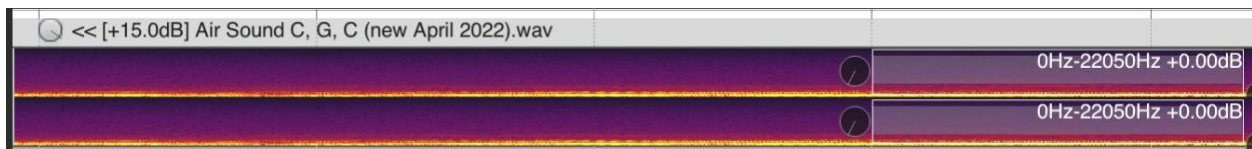


Figure 2 The overall spectral shape of the 'air sound' on open strings, when air is blown toward the strings, is compared to the normal spectral shape of the buzuq sound produced using a pick, as shown in the figure above

Limitations and challenges

The challenges and limitations in such a project were manifold, encompassing technical, aesthetic, and ethical dimensions. From a technical perspective, the challenges were first concerning the documentation of the work method, having a sound quality recording, finding a variety of sonic materials since the buzuq is somehow limited in its range of sounds, as well as technical challenges in working with the sounds in digital workstation, which also merge into aesthetic and ethical concerns. Finally, one of the significant challenges is using gestures with the instruments to create latent sounds, (some gestures can be taxing on both the body and mind, leading to physical and mental fatigue).

Ethical concerns arose regarding the documentation of latent sounds, mainly focusing on how far I could push the boundaries of the buzuq through unconventional sampling techniques

without compromising the instrument's tonal quality and unique timbre. Utilizing open strings yielded the most robust outcomes. As my experimentation evolved into a structured sampling method, these ethical considerations extended to synthesizing and altering the latent sounds in a digital workstation. The most significant shift in my ethical concerns occurred when I began conceptualizing a virtual, motion-based interface, raising questions about whether creating such an interface would necessitate altering the construction or visual representation of the buzuq, potentially requiring the addition of external tools.

Regarding the sampling and archiving processes, the creation and archiving of latent sounds were conducted with great care and precision. My work primarily focused on capturing sonic information using a piezo microphone, a key tool in this research. The piezo microphone is particularly effective in detecting frequencies and nuances beyond the typical range of human hearing, necessitating amplification to make them perceptible. To musically diversify the collection of sonic information, including various pitches and sonorities, I had to alter the tuning of the buzuq. However, the buzuq's string tension is limited, especially when tuning to higher pitches commonly used in open string configurations.

Experimentation with closed positions yielded notable results; however, they were less satisfactory and raised aesthetic considerations, which will be elaborated upon subsequently. Sampling the buzuq yielded a distinctive finding the potential to generate homophonic textures of chords incorporating fixed microtones from the *buzuq*. For instance, by placing my fingers carefully on frets that indicate quarter tones, I could produce a homophonic texture of drone sound with microtones. Some of these results resembled the timbre of violins executing constant tremolos using the *sul ponticello* technique. Further, there are two places on the buzuq where harmonics can be created; to collect a number of different harmonic pitches, altering the string

tuning was necessary. However, the range of lowering and increasing the string's tuning was also limited.

Recently, I have expanded my collection to include sounds derived explicitly from the wood timbre of the buzuk. These percussive samples emerged during the sampling processes for designing the digital music interface system, a topic I will elaborate on in the subsequent section on constructing digital music interfaces. This new category of percussive sounds is promising for capturing unique textures and specific moments of percussive sound, providing raw materials for innovative musical ideas, and distinguishing itself from other sound categories in the collection.

Indeterminacy

As shown in the four figures, I initially conducted a visual spectral analysis of the sounds to understand the type of sonic information in the latent sounds and to determine what information I had lost in these processes. The usual spectral analysis captures the sonic information present in each recording technique at different gain levels, which assists in the creative processes of sound sculpting. This process has become more specific in selecting certain samples and extracting specific moments, which could serve as compositional elements. This work involves finding creative solutions within the digital workstation to extract moments of sonic information or manipulate aspects of time and duration. It is important to note that the "air sound" duration ranges between thirteen to fifteen seconds, while other sound categories range between 2 to 5 seconds. Therefore, working in the DAW involved not only filtering but also the craft of stitching and merging raw materials to create longer durations for compositional purposes at the time.

Technological Mediation: Exploring Aesthetic Choice and finding creative solutions.

The creative process involved in documenting the sounds and audio cleanup which encompasses a spectrum of ambiguity, abstraction, and indeterminacy, contributed significantly to the resultant creative outcome. These spectrums were pivotal in leading to creative processes involved in uncovering more sonic layers. The processes of sound cleanup also played a crucial role in constructing my aesthetics and methodology for sound sculpting, aimed at first at "cleansing" the raw materials of non-musical sounds (white noise resulting from the recording conditions) where, subsequently, this aesthetics changed over time. I have viewed this process as also sound restoration and preservation. This process was taken with much sensitivity and meticulously, but still, it is a process that offered a space for sound improvisation with digital tools.

There is a critical repeated practice component in the recording methods and sound design process; this practice documentation of the creative processes grow to be a work methodology⁴⁴. As noted earlier, the raw materials in the DAW stations undergo a process of cleansing by means of each soundtrack being fixed to contain the attack point of the vibrating string and the release point, which means I conceal any non-musical sounds.

This process leads me back to the recording process. The recording session should contain, first, silence and, second, position the instrument in an way to achieve a "pure" sound of string vibration [see figure 6.]. However, what is required from the musician in order to capture only a

⁴⁴ Due to the high gain level in the sampling, the processes in the DAW station at first focused on lowering the highest frequencies in order to get rid of the white noise however these processes raised many aesthetic concerns since this action itself deletes some of the sonic layers and transforms the sounds from its organic nature.

musical noise is to be patient, where the process starts to take the shape of a ritual and an intimate listening experience. Although positing the instrument in an way as it shown in figure 6. the musician achieves pure sound of string vibration, other gestures which were included in the sampling processes,



Figure 3 Positioning the buzuq in an uncommon way for sampling purposes.

Virtual Orchestra- The Buzuq Phantom

The process described above has evolved into the practice of audio composition, encompassing electroacoustic fixed media compositions and multimedia compositions for dance music. A crucial aspect of this practice involves engaging imaginatively with these samples, particularly in their sound synthesis and sculpting. My curiosity about the sounds and my examination of my relationship with the newly discovered sounds of the buzuq have been pivotal in pursuing further creative endeavors, with digital tools playing a significant role.

My objective and motivation in manipulating these latent sounds and delving into their nuances were to reexamine my relationship with the newly discovered sound of the buzuq, with digital tools as a key enabler.

Sound synthesis and manipulation methods advanced the concept of a virtual, computer-based orchestra extrapolated from the buzuq. The sound sculpting that led to the composition of fixed media pieces was approached by forming elements and musical themes with an orchestral language that emerged organically. The discovery and manipulation of resonant sounds, combined with digital filtering techniques, facilitated a compositional vision aligned with my broader compositional interests in orchestral music, which goes beyond the perspective of a buzuq player and transcends what the instrument represents culturally. This process resulted in unexpected and surprising outcomes, where the buzuq's latent sounds began to resonate with those of other instruments.

As Kane observes regarding Schaeffer's work, there is an endeavor to find a method in working with sounds such that their "intrinsic qualities" become audible and amenable to being

combined into new "musical" relationships.⁴⁵ In the course of this investigation, two discoveries surface. Firstly, as Schaeffer engages in experimentation with a bell recording, he notes that through precise adjustments of the potentiometer, it becomes feasible to attenuate the bell's initial attack and counteract the reduction in its amplitude, thereby inducing a metamorphosis of the bell sound akin to that of an oboe.

The sound design procedures have revealed numerous potentials and hidden layers within the sounds, igniting my curiosity. The approach to exploring various characteristics and timbres of the sound has proven instrumental in this discovery. This coincided with the creation of several pieces inspired by the tradition of *musique concrète*, which I have used in commissioned dance pieces. This process transcended mere frequency adjustments; it entailed meticulous sound manipulations involving tasks such as stitching, layering, and amalgamating sonic materials to forge a distinct subset of sounds. I approached each sound object as a complex entity, metaphorically associating it with an archaeological artifact, excavating its layers to create new sounds.

This endeavor ultimately led to new sounds, categorized as instrumental sections within an additional library termed the 'imaginary ensemble.' The brief example of Schaeffer's work illustrates my initial objectives in working with latent sounds and my discoveries in the art of sound manipulation to create a digital-virtual ensemble. This classification of instrumentation is particularly evident in the classification of harmonic sounds and the retuning of strings.

The methodological approach entailed crafting structures emphasizing the temporality and timbre inherent in each sample. The visual cues embedded within the digital audio workstation (DAW) informed the compositional procedures. Initially, this approach facilitated the generation

⁴⁵ Brian Kane, "L'Objet Sonore Maintenant: Pierre Schaeffer, Sound Objects and the Phenomenological Reduction", *Organised Sound* 12, no. 1 (2007): 15–24.

of supplementary materials from raw elements. Additionally, the recurrent utilization of digital compositional techniques evolved into a systematic methodology, documenting the sound sculpting process while addressing creative solutions for compositional works and aesthetic concerns.

These sound sculpting procedures constitute a crucial component for projects aimed at exploring these results in live performances. Despite the repetition of sound sculpting techniques, the concept of ambiguity and chance played a key role in the creative process within digital workstations such as Reaper and Ableton Live. These software platforms offered paths to expand and transform the sounds into different identities, or as Smalley (1993) noted, the "possibility of grammar."⁴⁶

Dance Compositions

The medium of dance, coupled with collaborative work with choreographers, provided a fertile ground for examining the sounds in theatrical context. The collaboration with MFA dance students from the Department of Dance at the University of California, Irvine (UCI), in creating compositions for choreographers Tamer Abdo and Joey Navarrete-Medina, is a significant aspect of my intermedia compositional practice. Working within the medium of dance allowed for an exploration of sound, and the context facilitated the integration and positioning of the acoustic *buzuq* within the sonic landscape⁴⁷.

⁴⁶ Brian Kane, "The Fluctuating Sound Object," in *Sound Objects*, ed. James A. Steintrager and Rey Chow (Duke University Press, 2019), 53-70.

⁴⁷ The impetus to expand the *buzuq*'s sonic capabilities and refine my performance techniques originated a decade earlier, during my master's program at SUNY Buffalo (NY). Engaging in improvisational practices within modern dance techniques, my experimentation primarily involved the utilization of a violin bow to elicit robust sonic expressions from the instrument.

My approach incorporates other elements in the piece such as soundscape and text. Further, the compositional strategy was to focus on sound transformation, which significantly influenced the structure and momentum of the pieces. Throughout these collaborative endeavors, I strategically utilized latent sounds, preserving the enigmatic origin of the sound source. By prominently featuring the acoustic buzuq in my performances, I examined my improvisational interactions with these sounds, composing with the mindset of a virtual orchestra.

In this context, collaborations the focus was on meticulously crafting specific sonic textures and atmospheres tailored to each piece's narrative and choreographic essence. This endeavor involves manipulating latent sounds in terms of frequencies and timbre. A crucial aspect of this process involved layering and merging sonic materials, with particular emphasis on pitch manipulation, and extracting moments of uniformity or distinctive sonorities to create something new.

Consequently, the selection of samples for each of the three pieces was determined by temporal elements, quality, and character, their integration with the choreography and movements of the dancers, and their relation to the role of the acoustic buzuq in each performance. The dance soundtracks evolved throughout the rehearsal period. At that time, the latent sounds were still new to my ear, and the process of sculpting them daily significantly influenced how I learned and approached them in subsequent projects.

Four notable aspects emerge from these compositions. First, detaching the latent sound from its source (the *buzuq*) essentially renders the buzuq as a phantom. Second, the profound influence of sound on the form and structure of the pieces, sometimes even determining them. Third, an acute awareness of the temporal dimension inherent in latent sounds. Lastly, there is a discernible evolution in timbre. The latter two concepts became focal points in developing

performance techniques with the MUGIC® motion sensor. During that period, my strategic plan and vision were to translate these sounds into notation and to better understand their inherent frequencies and pitches by generating them using Max packages such as *bach* and *cage*. An important aspect of this endeavor involves examining sounds outside of the studio setting for the first time. This exploration occurs in diverse performance spaces, such as the Claire Trevor Theatre and the Experimental Media Performance Lab (xMPL) at the University of California, Irvine (UCI). Therefore, I have delved deeper into the realm of sound design to ensure the adaptation of sounds to the performance space and to the sound system in the two different spaces.

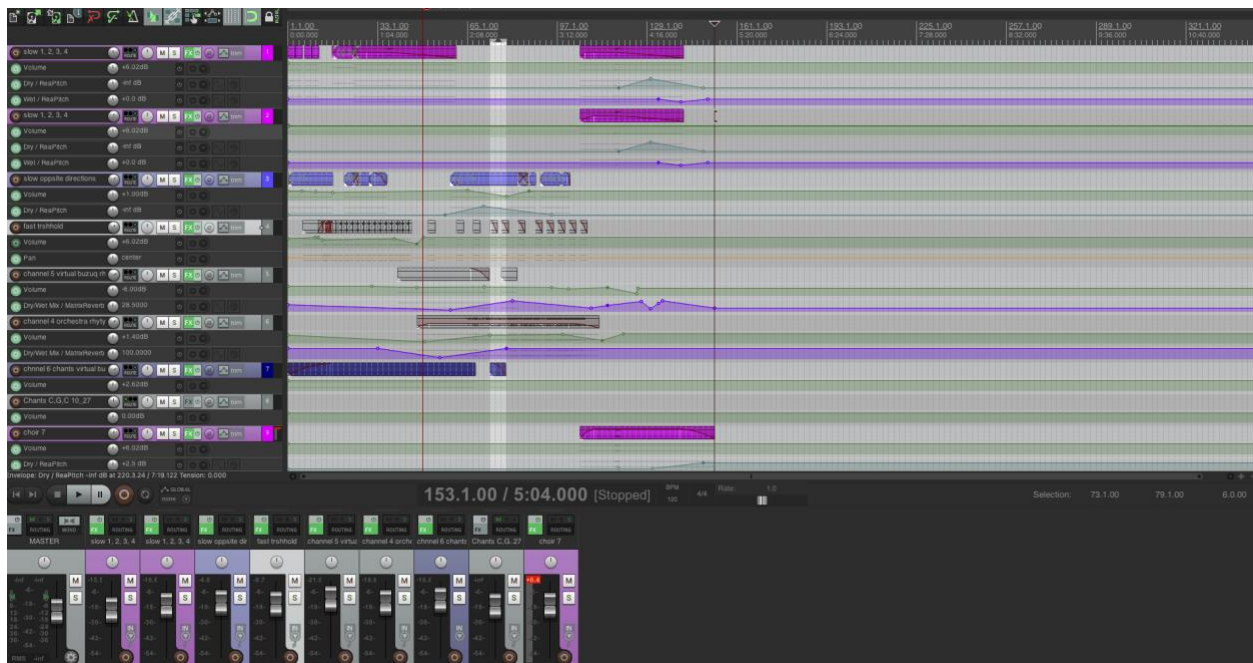


Figure 4 presents an example of the Digital Audio Workstation (DAW) used in the "Breaking Barriers" composition.

What sets these compositions apart is the engagement with the aspect of temporality and time that are embedded within the latent sounds, and which also influence the time and spaces within the sound through sound manipulation, particularly in applying different types of delays. This has influenced the narrative and choreography to some extent. In Abdo's composition, "Breaking Barriers" (2022), the sounds initially served as a primary element, shaping the form and structure of the piece, which initially spanned ten minutes but was later extended to thirty minutes with live performance on the acoustic *buzuq*. Furthermore, they contribute to the melancholic narrative of the piece, which addresses the separation wall in the West Bank and the political reality of the Palestinian people under Israeli occupation. This piece also included a traditional *dabkeh dance* which was composed on the acoustic *buzuq*, focusing on the maqam music system, particularly composed on *C bayati*, as well as soundscape. Unlike Abdo's piece, in the other two pieces, the latent sounds function not as a main element but more as an accompaniment to the live performance with the acoustic *buzuq*. This experience was important for my perspective in checking the auditory relation between the latent sounds and the sound of the acoustic *buzuq*. These compositions were also a forum to examine the response to the latent sounds in collaborative works, mainly with choreographers who have consistently been integral collaborators, contributing their responses to my developing new musical concepts with the *buzuq*.

The Latent Sounds as Active Agents in Ensemble Compositions

Regardless of their qualities or duration, the temporal and spatial characteristics of these sounds delineate their roles within composed and improvised musical compositions. This section introduces two unique composed-improvised electroacoustic pieces for the ensemble:

"Luminescent Mote" (2023) and "Fixed Dabkeh" (2024). These pieces stand out for their rhythmic character of the latent sound and their active role as mediators between myself as a composer and the instrumentalist-improvisers.

The latent sounds possess a stationary and stagnant character. Each sound produced with any of the three main gestures contains several musical and non-musical events. However, experiencing and working with these sounds over time has revealed a deeper, more diverse, and dynamic character, which has been brought to light through digital manipulation. This manipulation involves processes such as augmenting the sounds to prompt imitative timbres and unveil a dynamic rhythmic character. As a composer, I find the multifaceted nature of time and space encapsulated within these sounds equally captivating, along with the manner in which both the creator (myself) and the listener could interpret them.

This intricate texture is a compelling source of inspiration. Each sound file has its uniqueness. Many of the air sound recordings, while manipulating them by taking down their high frequencies and lowering their middle frequencies, give an impression that sounds have encountered this specific texture within latent sounds, both in their raw states and through sound manipulation, mainly by layering and merging different sonorities and tonalities of various recordings of latent sounds. This exploration necessitates further development, considering that

effects such as reverb, delay, and parameters like panning play a significant role in achieving specific musical textures and manipulating the sense of space and time in sound production. Some latent sounds with ambient characteristics resemble specific musical textures within the sound of an Arabic music ensemble, mainly when the ensemble plays a collective improvisation section. For example, introducing vocal improvised segments in Arabic music featuring drone sounds with ornaments executed by bowed and plucked string instruments with ornamental embellishments called *irab* aligns with the prevailing mode. The phenomenon of collective improvisation, characterized by the interplay between the ensemble and the soloist, conveys the impression that they are improvising in different temporalities and meters yet unified by the tonality of the mode.

Luminescent Mote (2023)

In practical terms, I sought to integrate and evaluate these sounds outside the studio environment through a fixed media compositions in ensemble settings. This approach aimed to test the interaction and role of these sounds among musicians, offering a potential avenue for an interacted environment of electroacoustic composed or improvised musical contexts.

In one of my recent compositions, "Luminescent Mote" (2023), an intermedia piece composed for buzuq, violin, and viola for the ICIT student annual concert, the second section transitions from acoustic string sounds with fixed notation to a layer of ambient sounds. The accompaniment tracks combine sounds of fixed musical events and textures, expressed in traditional Western notation, and consist of samples derived from pizzicato techniques. These samples are shaped to resemble a string and percussion ensemble.

In "Luminescent Mote," I intended to guide the ensemble through latent sounds. Specifically, the electronic track of latent sounds is intended to guide the violin and viola players, serving as a foundation for improvisation. The graphic notation provided to the musicians depicts gestures, techniques, and timing cues, creating an additional layer of events based on their interpretations and the graphic score. The track is triggered by the viola player using the MUGIC® sensor, employing sudden Bartók pizzicato techniques. During this section, the MUGIC® motion sensor measures the range of the viola player's energy, specifically when the player exaggerates their vibrato, affecting the track's volume.

During rehearsal, I observed that musicians responded to the concealed rhythmic pattern within the ambient sounds with a precision that was awe-inspiring, akin to responding to a conductor. Although there were no verbal comments on how they achieved this level of precision to the sonority of the recorded track, this fixed media section assumed the role and agency of an ensemble leader in a chamber music setting. Technical difficulties during the performance prevented the sound file from being triggered, resulting in a moment of confusion among the musicians. However, despite the sonic outcome not meeting expectations, the unity and communication within the ensemble remained intact. This experience motivated me to explore the same piece, both with and without the latent sounds, which typically serve as agents in establishing meter, time, rhythmic patterns, or events.

Fixed Dabkeh (2024)

"Fixed Dabkeh" (2024) is a fixed media piece in my dissertation capstone project. This electroacoustic piece is for a group of improvisers consisting of acoustic buzuq, percussion, and a brass ensemble of bass trombone, trumpet, soprano, and alto saxophone. It features a new presentation of the latent sounds that serve as a backing track⁴⁸. However, in this piece, the latent sounds play a much more prominent role, not only as an agent that guides the ensemble in terms of unity, rhythm, and tempo but also in the learning process of the ensemble members regarding the sounds themselves. The level of interactivity with the latent sounds was higher than in the previous piece.

One of the key interactions in this piece involves the sound's evolution over twelve minutes and its shifting tonality over time. This tonal change significantly influences the musicians' improvised phrases, sparking intriguing discussions during rehearsals. Constructing a track of recorded drumming samples on the buzuq's body with varying rhythmic propulsions was a deliberate compositional stylistic choice. The raw recording captured the drumming sound and unique string vibration. Intending to expand my compositional language, I extracted and amplified segments of this recording. This approach shifted the focus from merely texture and sonorities to also include rhythm and temporality.

The compositional work was conducted in Ableton Live since it offers a wide range of sound manipulation, mainly in rhythmic music. The compositional work focused on changing the sample's identity, transforming and structuring it as a piece. The manipulation focused on

⁴⁸ https://soundcloud.com/user-357776929/fixed-dabkeh-2024?si=7b2dec70760143c1aef516d916bbf21f&utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing

altering its rhythmic character and tempo by gradually transforming its frequencies. The final result evoked elements of electronic dance music of a Levantine folk dance called dabkeh. Despite extensive digital manipulation, the resonances of the buzuq's strings, generated by the drumming, proved impervious to extraction or attenuation, which later determined the tonality and mode of improvisation during the rehearsal phase with the brass instrumentalists.



Figure 5 Fixed Dabkeh (2024) Capstone Concert, University of California, May 20, 2024.

Exploring Digital Interface Construction

Phase 1. hardware music interface

Following the construction of the virtual orchestra projects involving dance pieces utilizing novel *buzuq* sonic materials with various choreographers, my focus shifted towards exploring the integration of these sounds into my personal performance practice, thereby extending beyond the confines of the studio context. Consequently, my attention gravitated towards the conceptualization and development of a digital music interface.

Through three phases, I have explored significant avenues involving different approaches to designing digital music interfaces. The practical research conducted in this exploration is to initiate sounds from the sound library and, to some extent, manipulate them in interactive music performance. The initial experimentation involved a customized interface utilizing an electric circuit, functioning at the intersection of MAX/MSP and Arduino software platforms through OSC messages. This bespoke interface operates like a MIDI keyboard, replacing traditional piano keys with buttons connected to an electric circuit. A MAX/MSP patch lists multiple sound files, with each button connected to a specific playlist.

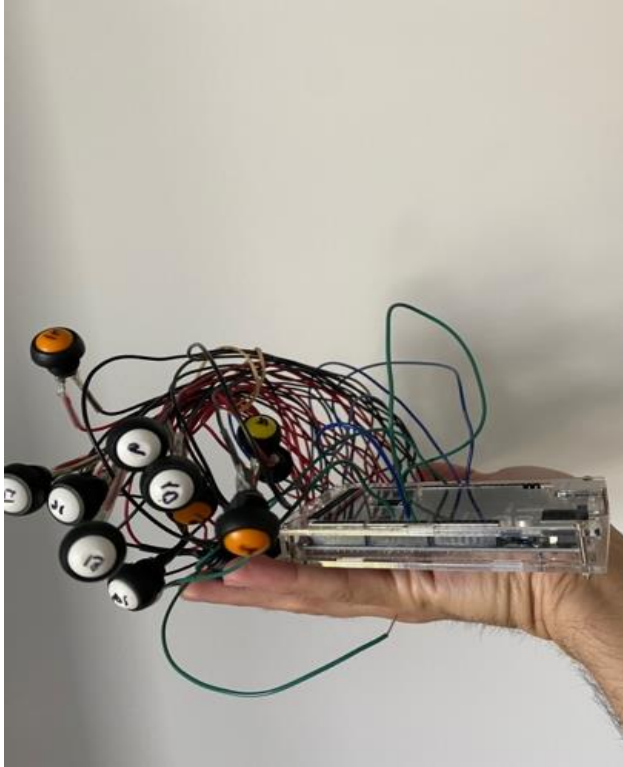


Figure 6 Custom-made interface of electric circuit.

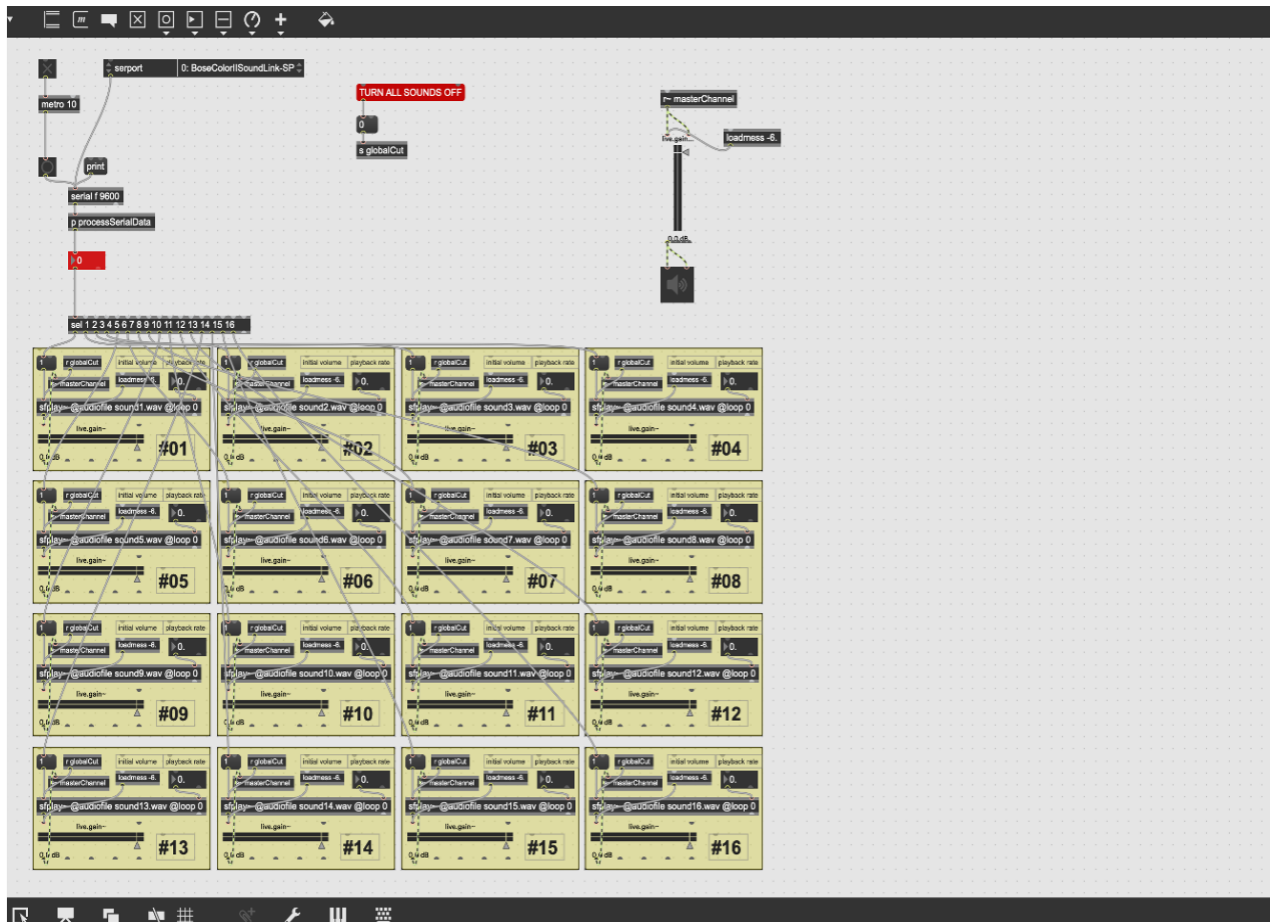


Figure 7 The Max patch contains a library of latent sounds, wherein the numeral argument of the ‘select’ object corresponds to the buttons on the electric circuit.

While these endeavors yielded some successful outcomes, they appeared to distance the practice from the intrinsic essence of the acoustic *buzuq*. At the time, the primary objective was to create a disconnection between the physical acoustic *buzuq* and the latent sounds. This aligned with the concept of the enigmatic nature of these unknown sounds. However, one of the factors prompting the dismissal of this avenue involving the electric circuit was its aesthetic appearance. Secondly, its passive nature in sound execution limited the musician's control over parameters such as attack and release points. In essence, this system was better suited to fixed media composition than interactive music systems.

Consequently, I have chosen to expand upon this exploration by conceptualizing a digital music interface that utilizes a piezo microphone. This tool, instrumental in revealing latent sounds, serves as a mediating instrument for interactive music performances. Through this approach, I aim to shift my musical perspective towards integrating latent sounds into my performance with the acoustic *buzuq*.

Phase 2. Machine Learning

The second phase involved delving into machine learning systems, explicitly employing the MAX/MSP package within FluComa. FluComa, a system developed by composers and technologists James Bradbury, Ted Moore, Alex Harker, Jacob Hart, and Frédéric Dufeu, served as the focal point of this exploration.

The decision to embark on this path emerged from minimizing my interaction with the laptop during performance. I also decided to use unconventional *buzuq* techniques as a triggering system, which became part of my lexicon of techniques in performance on the acoustic *buzuq*. This path took the form of collaborative experimentation with the composer Omar Hamido, who contributed as a technical advisor to the project. This decision was informed by iterative experimentation with Hamido, aiming to develop an audio recognition system within the MAX/MSP environment.

The FluComa system is meticulously designed to concentrate on neural networks that analyze and label specific timbres and spectral shapes, translating them into data that triggers audio files. Notably, the experimentation has centered on utilizing a data trainer that harnesses sounds and timbres produced through unconventional techniques applied to the *buzuq*, coupled with the integration of piezo microphones.

The comprehensive procedural framework encompasses the following stages:

1. Machine learning of timbre and spectral shape characteristics
2. Presentation and prediction of data values (see Figure X)
3. Minimization of errors during the training phase
4. Prediction of values encompassing the timbral and spectral attributes intrinsic to the instrument, including periods of silence, which will be presented through message boxes in MAX/MSP or audio triggering.

The methods I used encompass various gestures, such as drumming on the *buzuq*'s wood, tapping on the soundboard with my fingers or the back of the instrument, generating harmonics near the bridge, and identifying harmonic areas positioned at specific locations on the instrument's neck.

Hence, some of the *buzuq* gestures and techniques in uncovering some of the latent sound collection now play an active role, serving as sonic information for the construction of the digital interface in algorithm language. However, due to the high sensitivity of piezo microphones posed challenges. The triggering system was activated by even the slightest body movements, and in some cases, any environmental causes that made the strings vibrate and produce harmonics potentially confused the machine learning system.

I actively recorded new samples for new data and training purposes within FluComa, exercising caution during playback. This strategy involved playing harmonics efficiently with improved intonation. In addition, it involved executing percussive patterns on the soundboard and muting the strings to minimize their vibration during the sampling. Subsequently, the samples underwent noise reduction before being applied to the FluComa Max patch. Despite these efforts, refining the training system from the samples required greater precision. After

adjustments, minimal error messages persisted (see Figure 10), and the triggering system with the two gestures remained unsuccessful.

Consequently, I integrated additional sensory systems, such as a camera sensor (using the laptop webcam) and a MUGIC® motion sensor, to enhance the interface's functionality. The functionality of the intersectionality system necessitated testing, prompting the development of a data recording system. This system collected raw data from two primary sources: MUGIC data, delineating unconventional gestures with the *buzuq*, placing the motion sensor on the right hand's rest, and camera sensor data. Subsequently, these datasets were integrated into the main FluCoMa patch with OSC messages, which means two patches of Max/MSP are open simultaneously, facilitating playback. The recorded data was then activated in real-time gestures using the MUGIC® motion sensor, synchronized with the machine learning-based triggering system for identifying timbre and spectral shapes. An intriguing aspect of this system involved adjustments to the sensory camera system. Instead of solely recognizing the hand and transmitting information, the system was reconfigured to respond even when the camera could not detect the right arm.

Classification Buzuq's timbre

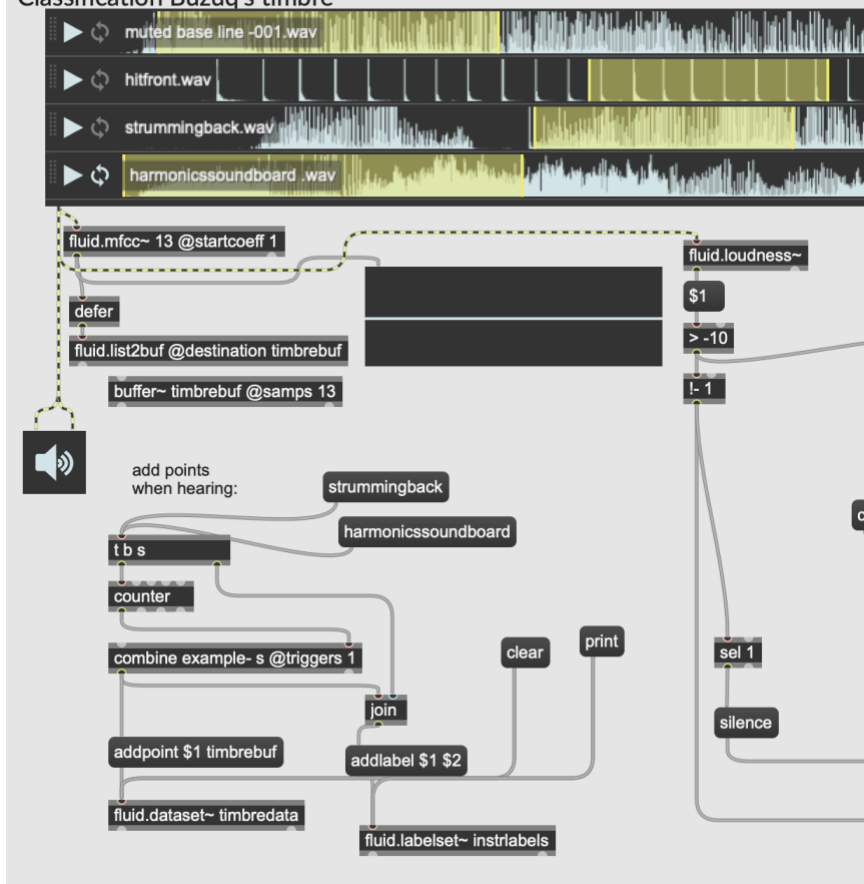


Figure 8 . Classification of the buzuq's timbre in FluComa.

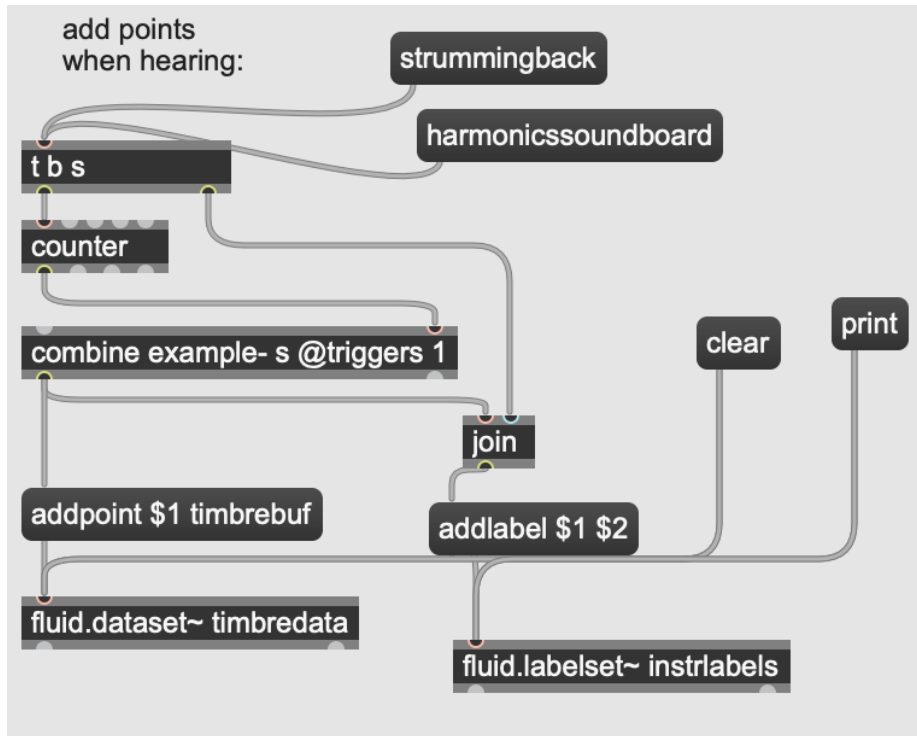


Figure 9 Adding points in the training processes

```

max console
fluid.labelset~ • LabelSet instrlabels:
  rows: 191 cols: 1
  example-238 harmonicssoundboard
  example-239 harmonicssoundboard
  example-240 harmonicssoundboard
  ...
  example-426 strummingback
  example-427 strummingback
  example-428 strummingback

fluid.dataset~ • DataSet timbredata:
  rows: 191 cols: 13
  example-238 1.4211e-142.7001e-13-2.1316e-13 ...-3.8369e-13 0-3.6948e-13
  example-239 1.4211e-142.7001e-13-2.1316e-13 ...-3.8369e-13 0-3.6948e-13
  example-240 1.4211e-142.7001e-13-2.1316e-13 ...-3.8369e-13 0-3.6948e-13
  ...
  example-426 1.4211e-142.7001e-13-2.1316e-13 ...-3.8369e-13 0-3.6948e-13
  example-427 1.4211e-142.7001e-13-2.1316e-13 ...-3.8369e-13 0-3.6948e-13
  example-428 1.4211e-142.7001e-13-2.1316e-13 ...-3.8369e-13 0-3.6948e-13

```

Figure 10 Set of values. The neural network is trained one this set of values to make predictions.

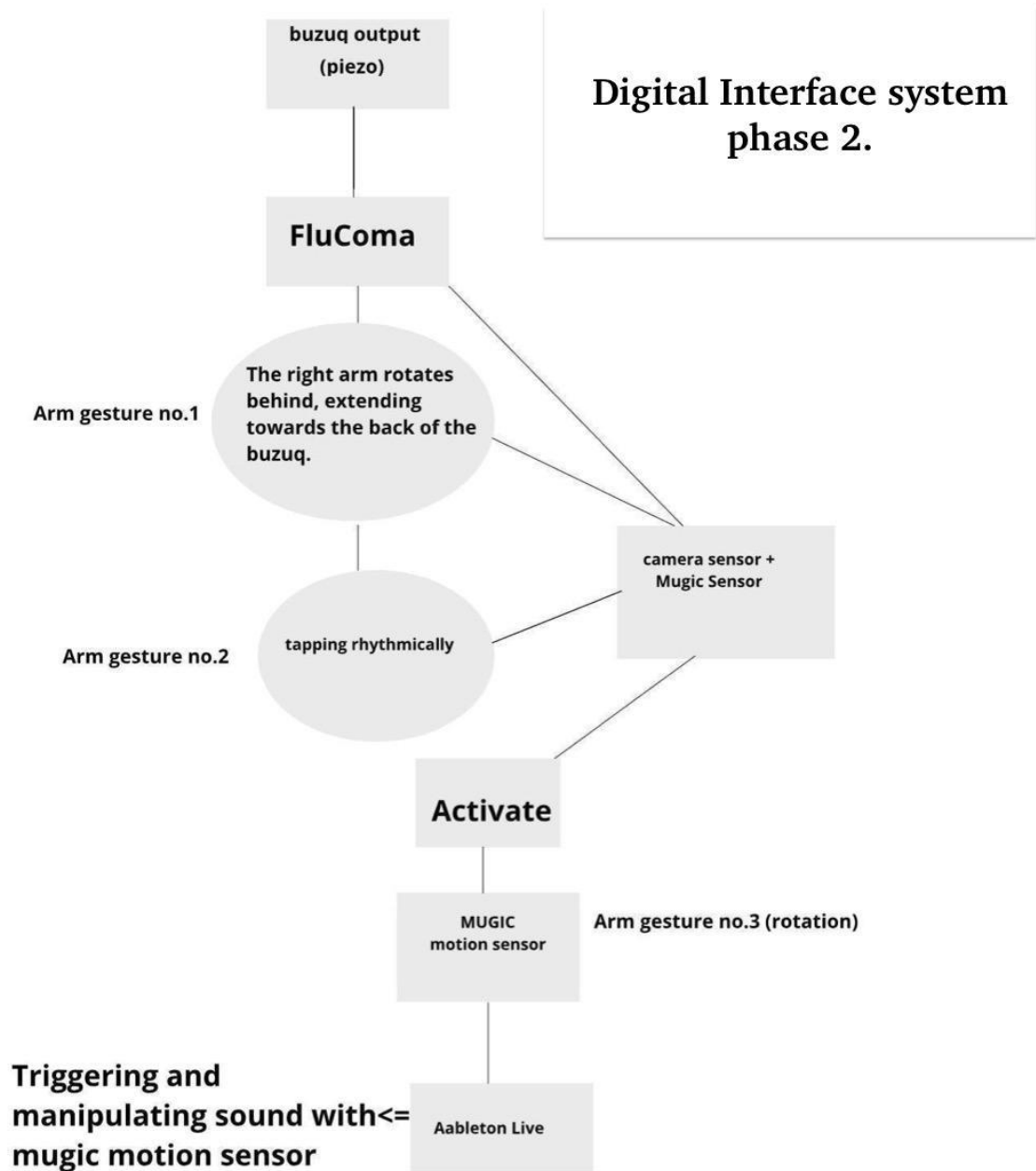


Figure 11 Mapping the intersection of three interactive sensory systems to construct a digital interface.

Conclusion of phase 2.

In conclusion, integrating the camera and MUGIC® motion sensors served as pivotal agents in filtering the triggering mechanism through hand gestures, facilitating the activation of sound triggers via MIDI messages from Ableton Live. This marked a significant juncture in focusing efforts towards achieving enhanced resolution in hand gesture mapping, encompassing conventional and unconventional *buzuq* techniques. Furthermore, considerations expanded to include posture and arm movements within the interactive framework. Addressing concerns raised during discussions, particularly regarding apprehensions about diminished sonic control and timing uncertainty, emerged as guiding factors in developing a digital music interface. However, due to the time constraints of my doctoral studies, the experimentation with machine learning, camera sensors, and MUGIC® motion sensors had to be halted. Recommendations from Rodrigo Constanzi included exploring additional filters for the FluComa Max patch to recognize and train more specific spectral shapes of sonic results from the *buzuq*.

However, this necessitates further research on acoustic instruments, particularly non-Western folk instruments and AI. One striking outcome of this process is the human (the instrumentalist) ability to recognize subtle differences in timbre more effectively than computers, particularly AI systems.

Phase 3. MUGIC® motion sensor

Choosing the MUGIC® motion sensor as the primary digital music interface, which I perceive as an extension of the acoustic *buzuq*, constituted a final avenue of exploration following the number of experiments detailed earlier. The current section will delve into the integration of the MUGIC® motion sensor in my recent compositions and improvisational contexts, while exploring sonic art and mapping hand gestures. It will include pieces that I have recently composed integrating the latent sounds and will be followed by a concluding discussion addressing the main research question.

The initial interaction with the MUGIC® motion sensor involved placing it on the *buzuq*. These early experiments occurred during the exploration of latent sounds, preceding the conceptualization of constructing digital interfaces as the primary artistic project for my Ph.D. research. The fundamental rationale underlying the choice to integrate the MUGIC® motion sensor into my performance practice was its alignment with my objective as a performer: to broaden the spectrum of my physical movement and liberate myself from the constrained gestures inherent in my performance and behavior with the *buzuq* during live performances. Additionally, it aimed to expand the range of performance possibilities, both with and without the acoustic *buzuq*.

Drawing with The Latent Sounds (2023)

I consider the piece ‘Drawing with the Latent Sounds’ (2023), which was first performed at ‘Listen to the Motion Festival’ at UCI, marked a significant turning point wherein I discovered the potential of new performance practice, amalgamating calligraphic arts—a medium previously explored for potential professional development but which I had maintained as a hobby. Mari Kimura, however, catalyzed my decision to pursue this specific course of action despite my initial hesitations arising from the novelty of taking the stage without the acoustic *buzuq*.

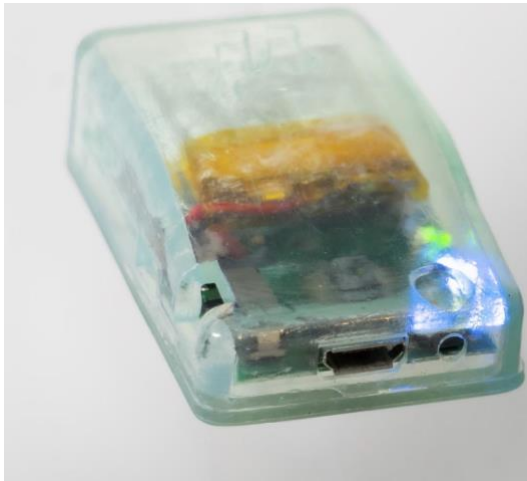


Figure 12 MUGIC® motion sensor.

The composition entitled 'Drawing with the Latent Sounds' integrates linear and nonlinear sonic expressions, exploring hand gestures in conjunction with the artistic materials employed in this particular piece. Motion data, captured by the MUGIC® motion sensor, is utilized to manipulate various timbral and technical aspects of unconventional and conventional *buzuq* sounds, encompassing techniques such as bowing, fretting, and pressure-differential string vibrations, all enacted digitally. In intricate detail, within a MAX patch I devised, five distinct scenes featuring

different sonorities were constructed—each incorporating its unique mapping of right-hand gestures to manipulate sounds with one sense of triggering sounds. My improvisatory drawing process parallels the compositional journey, whereby hand gestures' speed, energy, and quality are translated into sonic information.

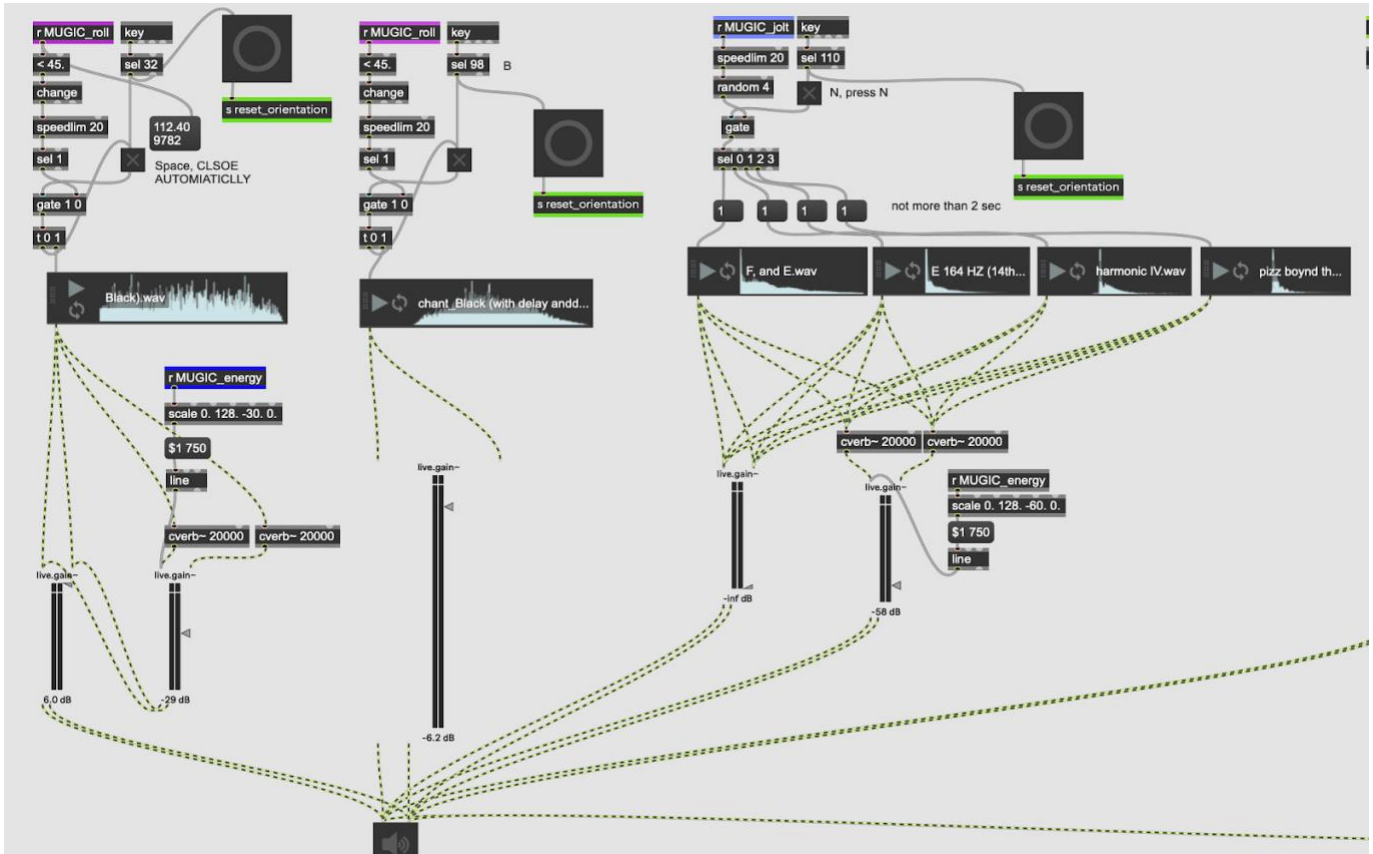


Figure 13 Screenshot of the max patch of 'Drawing with The Latent Sounds' piece (2023).



Figure 14 Drawing with Latent Sounds', Listen to the Motion Festival (Winter, 2023), organized by Mari Kimura, University of California, Irvine.

The composition involved in synchronizing various types of color materials with the mapping of hand gestures revealed distinctions in the use of ink instead of watercolors or charcoal. Within segments of the piece, I opted for a particular ink pen, allowing for gentle yet abrupt hand movements, coinciding with the pitches of the *buzuq*, specifically focusing on the collection of sounds forming the tetrachord *jins*⁴⁹ *D bayati*, which are triggered randomly, accompanied by a background *buzuq* track featuring traditional classical Arabic music with a compound 10/8 meter.

⁴⁹ A tetrachord in Arabic music, means type, where two *jin* create the concept of *maqam* (mode)

This segment prompted numerous intriguing aesthetic considerations concerning the algorithmic language employed within the MAX patch. One notable concern was the manifestation of single pitches, which express the jins D *bayati* tetrachord. The specific hand gestures, called "jolts," tended to interrupt the sound midway and introduce new pitches. This concept has since been further developed, constructing a tailored algorithmic language to align with my musical vision, particularly in generating polyphonic textures within *maqam*-based music utilizing the digital interface provided by the MUGIC® sensor.

The primary component of the compositions comprised a selection of latent sounds, including various string vibrations resulting from air and bowed techniques. I chose to minimize digital manipulations facilitated by the motion sensor, opting instead to utilize almost unprocessed sounds in their raw states as produced during the sampling process. I selected only two parameters for sound manipulation: reverb and the adjustment of high and low frequencies, both influenced by the energy of my right-hand gestures. This decision was driven by a desire to invite the listener to engage with my process of excavating the multiple layers of sounds, a practice typically undertaken within a studio setting. I discovered that these two parameters effectively revealed the myriad of low and high frequencies inherent in the latent sounds.

The primary limitation I encountered in this specific piece lies in the context of its performance. While this type of performance invites the audience to a visual experience, it also calls for a more intimate listening experience. As a concept, to integrate calligraphy and sound underscores the imaginative aspect of constructing such a medium, which can expand significantly. In any context, it is essential to be mindful of the time required to ‘complete a painting’ and succinctly convey a musical idea. In this instance, the piece had a duration of eight minutes. However, the ideal conditions for such a performance would involve a longer duration

and a larger format, utilizing a wider canvas with broader gestures. This approach would better serve the primary component, which is sound, by providing it with ample space and allowing moments of silence to have their own presence.

The outcome of this piece reveals the potential for further advancing the concept of interactive practice between visual and sonic art. Additionally, it provided an opportunity for me to disengage from my primary instrument, the buzuq, for the first time in a performance context. This shift enabled me to focus on musical expression through sound and timbre, aligning more closely with my interests as a composer, rather than solely as a buzuq player.

Additionally, it provides an opportunity to deepen the understanding of the algorithmic language and gestures facilitated by the MUGIC® motion sensor. These advancements were incorporated into the second edition of the pieces, which I performed during my dissertation concert on May 20th, 2024.

The Buzuq Riot (2024)

The use of the MUGIC® motion sensor in combination with calligraphic and sonic art proved to be a success, culminating in the development of the piece "*Drawing with the Latent Sounds*." In the second edition of this interactive performance, I introduced a new version of the piece by altering the setting and experimenting with a broader range of hand gestures using the MUGIC® sensor. Additionally, this version featured a collaboration with cellist Bella Pepke, further enhancing the integration of live music and visual art.

In *The Buzuq Riot*, I aimed to develop a novel medium for improvisational and interactive performance. The interactivity in this piece operates on multiple levels: first, the interaction between my hand gestures and the MUGIC® motion sensor; second, the interaction between my

hand gestures and the art materials used; and finally, the interaction between myself and the cellist, as we both respond to the triggered sounds in parallel with the evolving painting.

In the new edition of my piece, my objective was to expand the concept of small hand gestures by incorporating sound samples of short durations (three to five seconds) along with longer drone sounds for wider hand gestures. I aimed to create a polyphonic musical texture using the buzuq's recorded sounds generated through the drawing process. This approach requires a careful consideration of the types of art materials and tools to be used, factoring in the time it would take to 'complete' a painting during a live concert. Given the context of my capstone recital, I allocated a maximum of ten minutes for this piece.

Although several rehearsals were devoted to this specific work, the outcome during the concert remained largely improvisational. A key aspect of the rehearsal process was developing a strategic plan for the performance, which involved determining what I would draw, the layers of art media I would use, and dividing the piece into four main sections, each with its own distinct character and theme. This strategy facilitated rehearsing and coordinating with the cellist, who accompanied my improvisation using the MUGIC® motion sensor and the generated sounds.

The cello part was fully composed in traditional Western notation, with certain sections quoting and altering specific acts from Igor Stravinsky's *The Rite of Spring*. However, our rehearsals primarily focused on establishing a system of communication during the performance, relying not only on eye contact but also on the cellist's musical instincts as she reacted to the sonic outcomes of the latent sounds. This dynamic interplay between structured composition and real-time improvisation was essential to achieving the intended artistic and musical expression in this piece.

From a technological standpoint, I based the new edition on the older version of the MAX patch while incorporating several modifications. The new piece combined long and short sounds, with a deliberate choice to use heavily processed sounds. In the MAX patch, I controlled the parameters of triggering sounds with hand gestures, affecting the frequencies and applying a small amount of reverb. One of the developments undertaken in my practice in the second edition of this piece is to expand the idea of small hand gestures, using samples of a short duration of three to five seconds. My objective in the new edition was to create a polyphonic music texture with the buzuq sounds in parallel to the calligraphic art in real time, while using the older version of the MAX patch as a base for a new patch.

I made a choice in the new edition to use heavily processed sounds, where in MAX patch I have controlled only the parameters of triggering sound with hand gestures, affecting the frequencies, and lastly applying a small amount of reverb. One of the clear differences in the new edition is that I have triggered a collection of single pitches that form a specific *maqam* in a randomized manner, using the *select* object in MAX. The new edition of this piece utilizes the *poly~* object in MAX/MSP, incorporating abrupt gestures that seamlessly develop into the smooth execution of sound. For instance, raising the hand with a slightly abrupt motion toward the canvas and using a slow, steady hand gesture are both designed for triggering purposes (see Figures 15 and 16).

Another significant change in this piece is the adjustment of my body posture. Instead of painting on a table and projecting the art onto a screen, I used a standing canvas. This shift impacted the algorithmic language due to the different hand gestures required, despite using the same art mediums (ink and charcoal). The new edition of this piece uses the *poly* and *uzi* objects in MAX/MSP with abrupt gestures. However, instead of a jolt, it developed into a pitch gesture,

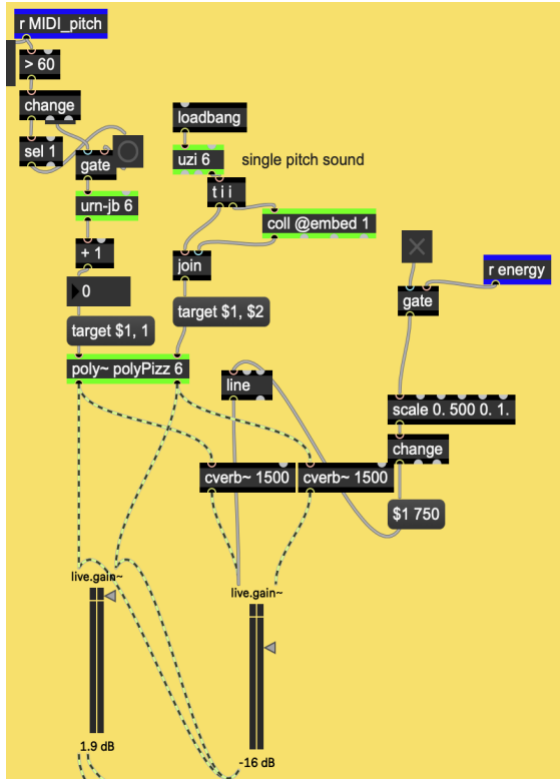


Figure 16 Example from the new edition from the Max patch triggering short sounds with abrupt gestures to trigger buzuq pitches with the MUGIC® sensor.

Upon consideration of these findings and experimental endeavors, one is compelled to recognize that engagement with the MUGIC® motion sensor situates me in the role of a conductor, thereby presenting opportunities for the integration of music ensembles in future compositions.

Moreover, while contemplating a novel arrangement of this particular piece, I entertained the idea of exploring digital drawing. However, the utilization of digital calligraphy art inadvertently eliminates the nuances of human hand gestures, which are more effectively conveyed through tangible materiality, hand pressure, and ink density.



Figure 17 Performance of the Buzuq Riot with Bella Pepke at the University of California, Irvine, on May 20th, 2024.

The Buzuq Riot
Act I

Jiryis Ballan

Allegro Moderato

Cello

6

12

19

26

35

41

mp *mf* *mp* *mf* *p* *mf* *mf* *p* *mf* *pp* *pp*

sul pont. ord. open

sul pont. ord.

sul pont.

ord. sul pont.

sul pont.

sul pont.

Figure 18 Example of the cello composition from Act One of The Buzuq Riot (2024).

Bhalelak (2024)

The characterization of this interactive composition involves the construction of a precise linear structure (see figure 14.), which incorporates a newly manipulated sample of percussive sounds generated by drumming on the body of the *buzuq*. Subsequently, these samples undergo digital manipulation using Ableton Live software, focusing on emulating the rhythmic propulsions commonly found in Arabic music. Additionally, the composition integrates sampling and remixing a piece by the Palestinian singer Amal Murkus, featuring her rendition of the Palestinian folk lullaby *bhallelak*. Within the Max patch, a sample of the *buzuq* harmonic note B is digitally encoded and multiplied to pitches of E, F#, C, and B, accompanying Murkus's vocal recording. For this performance, I made the decision to position the motion sensor on the left hand, which simultaneously triggers the harmonics through an up-and-down hand motion and manipulates sounds through energy, closely correlating with the production of pitches from the *buzuq*, resulting in various effects on both the *buzuq* performance and the degree of sound manipulation of the sonic materials. For instance, in the piece's middle section, percussive sounds emerge following the lullaby, with the MUGIC® motion sensor influencing the frequencies of the recorded materials through energetic gestures. Subsequently, it shifts to affect the tempo of the percussive sounds, controlled by the parameter of steadiness of the motion sensor.

My technique involves increasing the vibrato of each note on the *buzuq* to slow the tempo of the percussion sounds, thereby influencing my improvisatory approach to the instrument and the musical phrasing⁵⁰.

⁵⁰ Ballan, Jiryis, 'Bhalelak', 2024. Accessed online: https://www.youtube.com/watch?v=k1tQvbXW49s&ab_channel=UMMENAWEVO

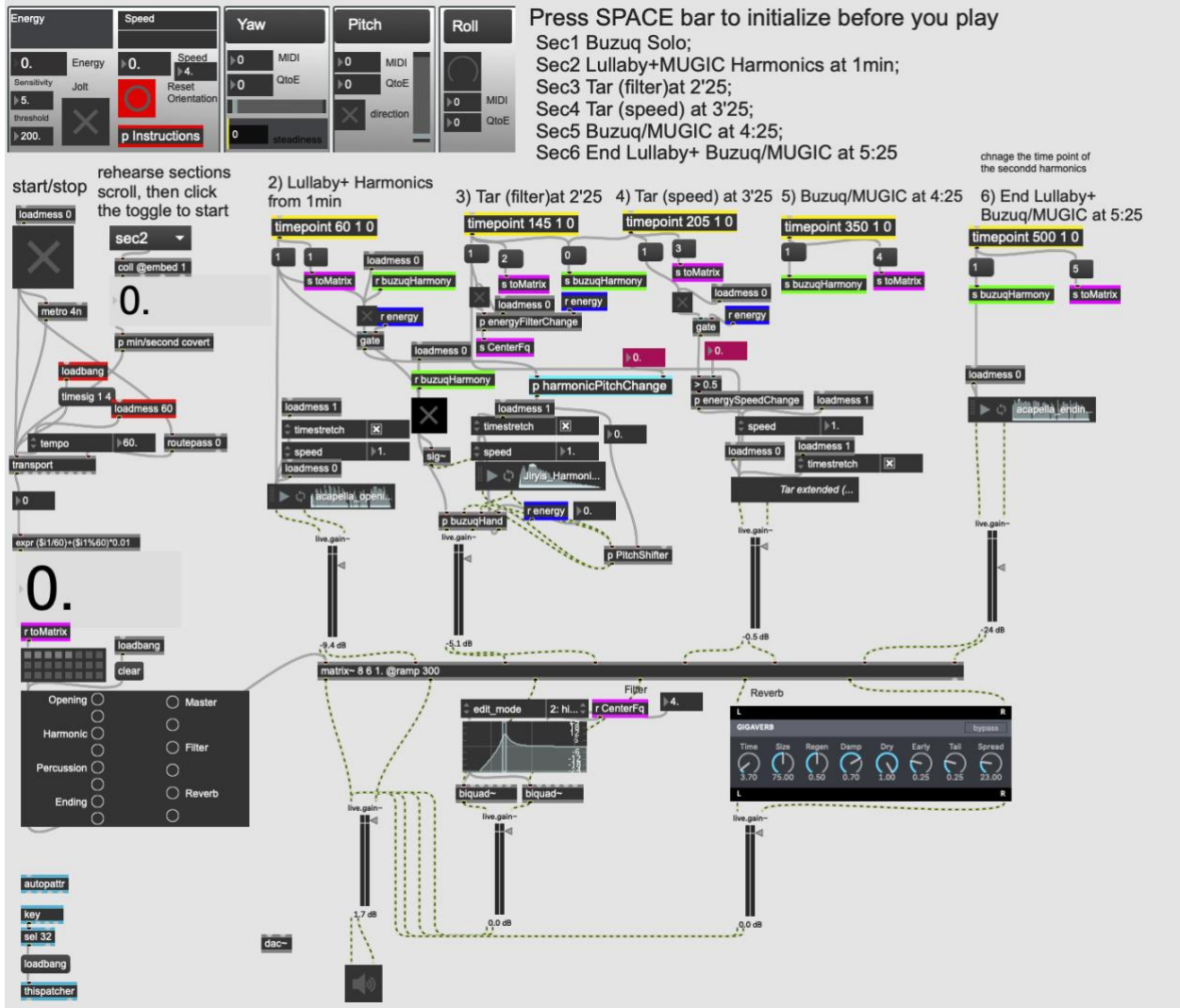


Figure 19 A screenshot of Max patch shows the piece's structure, with the hand gestures of 'Bhalelak' (2024).



Figure 20 Ballan, Bhalelak performance, Listen to the Motion festival, University of California, Irvine 2024.

Conclusion and Thoughts

The exploration of the "other" *buzuq*, metaphorically represented within the MUGIC® motion sensor, signifies the extension of the acoustic *buzuq* into the realm of digital virtual music interfaces. This extension facilitates the manifestation of alternative sonic profiles inherent within the *buzuq*, enabling its integration into a novel performance practice of interactive music. A primary objective accompanying this endeavor is the reduction of laptop interaction during performance, coupled with a deliberate avoidance of prepared *buzuq* instruments, akin to Cage's prepared piano or Shrief Sehnaoui's prepared guitar. Such a choice aims to preserve the distinctive qualities, image, and tradition of the *buzuq*, particularly crucial in contemporary times where the instrument faces more marginalization and confusion with similar long-necked string instruments like the Turkish *saz*, conveying a cultural-political message.

Throughout the sampling phase, I aimed to document the latent sounds; experiments were conducted to produce sound using segments of the strings, occasionally exploring the structural composition of the string sets in terms of thicknesses and tension to vary the collection of sounds within the sound library. This process prompted the fundamental question: what defines the *buzuq* when its specific designed strings or traditional tuning are removed or altered, or if its sound hole is obstructed? In essence, what holds greater significance to the identity of the *buzuq*: its unique feature of possessing a relatively wide sound hole, as a box of information, or its strings? I perceive both aspects of the *buzuq* and the latent sounds as emblematic of concealed contradictions and complexities within ostensibly simple objects, and the boundary between them is intricately nuanced.

Engaging with sound art as a medium for innovative musical expression beyond traditional musical or graphic notation, particularly in addressing structural considerations, sound

transformation, thematic construction, and timbral exploration, I wished to express more in acoustic, concert music composition. However, working with sound originated from the *buzuq*; I have the possibility to explore diverse sources of sonic inspiration and integrate them into my recent compositions in several mediums. The domain of imagination has proven particularly compelling, prompting contemplation regarding the alignment of sounds with their suitable contexts and mediums for application.

Extensive engagement with sound as a central compositional element has facilitated a detailed exploration of its subtleties, particularly in sound transformation within compositions and broader artistic contexts. This emphasis on transformation aligns with previous focuses on acoustic composition in contemporary art music, resulting in a development of my musical taste and aesthetics. Notably, there has been a shift in compositional focus from creating music textures to a greater emphasis on rhythms and temporality, evident in recent compositions within both contemporary art music and vernacular music.

In the investigation of gesture and sound negotiations utilizing the MUGIC® motion sensor, fundamental inquiries emerged regarding the responsibility for rewriting and redefining gestures within compositions, raising questions about the roles of composer-performer and algorithm in this process. These practical inquiries manifested in delineating and mapping hand gestures for performances and modifying sounds, structures, or gestures themselves.

Reflecting on diverse mediums and contexts explored in examining latent sound's role and execution, one particularly impactful experience has sparked potential for further development: immersive surround sound installation. Inspired by endeavors to find suitable applications for new sonic materials derived from the *buzuq*, this immersive experience took place as a 360-degree installation at the SpaceLab at UCI in 2023. Such a format is believed to provide an

optimal environment that demands listening for exploring latent sounds' nuanced complexities, fostering profound engagement with frequencies and timbres for both listeners and composers. The compositional process evolved into *musique concrète* across two stages: initially, the layering of sound files within a digital audio workstation (DAW) accompanied by precise automation, followed by further manipulation using SpaceMap Go software within the Meyer Sound system. This experience revealed an ideal context prioritizing the subtleties of sound, temporal events, and spatial considerations, akin to the ambiance of classical chamber music settings, within an immersive and intimate setting.

This research aims to engage in dialogue with composers and sound artists, particularly those who specialize in non-Western musical instruments and have broadened the repertoire of these instruments beyond their cultural and geographical contexts. The case of Masaoka exemplifies a significant alignment with the objectives of this study. While the circumstances of musicians from the Arab world vary, what unites us is our shared inspiration drawn from Arabic music fundamentals and instruments. More significantly, we are committed to deconstructing forms and materials from the Arabic music culture and disseminating them within the global music community. Furthermore, our collective efforts aim to integrate our creative practices into contemporary art and experimental music domains.

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