



Albrecht Dürer' *The Draughtsman of the Lute*, 1525 (feat. al-Urmawī's 'ūd)

Instruments of Global Music Theory
Princeton University, May 19–20, 2023



Friday, May 19: afternoon session (3:00 pm–6:15 pm)

Saturday, May 20: morning session (9:00 am–12:45 pm), afternoon session (2:00 pm–5:00 pm)

Venue: Woolworth Center for Music Studies, room 102 (Department of Music)

A conference on musical instruments as tools of experimentation and as audible embodiments of theoretical ideas about music across cultures and historical periods.

Organized by Marcel Camprubi (PhD candidate, musicology) with the assistance of Sophie Brady (PhD candidate, musicology) and Joyce Wei-Jo Chen (PhD candidate, musicology and IHUM).

The event is made possible through the generous support of the Princeton University Department of Music, the Humanities Council, the Center for Collaborative History, and the Graduate School.

Open to the public. No registration required.

SCHEDULE

FRIDAY, MAY 19

Welcome (3 pm)

Marcel Camprubi (Princeton University)

Keynote (3:15 pm)

Alexander Rehding (Harvard University): “Alexander Ellis between Empiricism and Empire”

Session A (5 pm)

Aruna Kharod (University of Texas at Austin): “Tuning Up *Sa*: Scientific Debates, Hindu Nationalist Musicology, and Retuning Sitar in Late Colonial India and Beyond”

Lina Sofia Tabak (The City University of New York): “Globalization, Intonation and Resistance: Equal-Tempered Marimbas and Equi-Heptatonic Voices in Afro-Colombian *Currulao*”

Respondent: Sophie Brady (Princeton University)

SATURDAY, MAY 20

Breakfast (8:30)

Session B (9 am)

Adebola Ola (Boston University): “Recentring Afro-Eurasia: Human and Musical Migration in the Global Middle Ages (700–1500 CE)”

Patrick Connor Dittamo (University of Chicago): “Turn of the Century Instrument Collections as Material Theorizations of Music”

Respondent: Jamie Reuland (Princeton University)

Session C (10:15 am)

Giulia Accornero (Harvard University): “When Height Becomes Depth: Rethinking Pitch Through the Medium of Wax”

Addi Liu (Cornell University): “Spirals, Loops, and Ladders: Playing Chinese and European Guidonian Hands”

Respondent: Natalie Miller (Princeton University)

Session D (11:30 am)

Henry Burnam (Yale University): “Gestalt Psychology and Erich von Hornbostel’s Instruments of Music Theory”

Henry Spiller (University of California, Davis): “Visual Equidistance and the Genesis of Sundanese Scales and Modes in West Java, Indonesia”

Respondent: Gavin Steingo (Princeton University)

Lunch break (12:45 pm)

Session E (2 pm)

Daniel Walden (Durham University): “Reconstructing Ballanta’s “African Harmonium” (1927) and Tanaka’s “Enharmonium” (1890/1939): Digital Instrument Construction as a Tool for Global History of Theory”

Loren Ludwig (Johns Hopkins University) “‘The Viol is my Monochord’: Instruments, Affordances, and an Occult History of Eighteenth-Century Temperament

Respondent: Joyce Wei-Jo Chen (Princeton University)

Final panel (3:15 pm)

Presentations by Elizabeth Hoffman (New York University), Mariusz Kozak (Columbia University), Dan Trueman (Princeton University), and Myles W. Jackson (Institute for Advanced Study, Princeton). With the participation of Alexander Rehding. Marcel Camprubi moderates.

ABSTRACTS

KEYNOTE SESSION

Alexander Ellis between Empiricism and Empire (Alexander Rehding)

Alexander Ellis is widely acknowledged as a founding father of comparative musicology, the precursor of ethnomusicology, largely in recognition of his “Cent scale” and his measurements of non-Western scales, which caused him to overthrow the European speculative tradition that clung to the belief of a universal scale that somehow underlies the musical traditions throughout the globe. This paper examines the role of the music-theoretical instruments that he led to this earth-shattering pronouncement. For his measurements, Ellis relies not on one instrument, but on two very different types of instruments in parallel, the tuning fork and the Wheatstone concertina. Ellis’s complex instrumentarium befits the monumental scale of the task, marking the shift from speculation to empiricism. And yet, Ellis’s method is not a panacea: his insights are compromised by certain blinders that can best be understood in direct connection to his position at the heart of the British empire.

SESSION A

Tuning Up *Sa*: Scientific debates, Hindu Nationalist Musicology, and Retuning Sitar in Late Colonial India and Beyond

(Aruna Kharod)

During the mid- to late 1800's, European and Indian musicologists' heated debates over the scientific basis (or lack thereof) of Hindustani music theory centered on a common note of concern: how to reconcile *Sa*, the movable tonic at the heart of Indian *raga* music, with Eurocentric theories of tuning? Indian musicologists such as Raja Sourindro Mohun Tagore sought to have the final word in this debate by proposing alternate tunings for the sitar, a popular instrument in late colonial India. In a slew of globally-circulated publications between 1875-1886, Tagore proposes an alternate tuning for the sitar, a popular instrument he presents as a direct descendant of the exalted Hindu mythological instrument: the *vina*. In his efforts to legitimize the sitar's tuning as a product of ancient Hindu scientific thought, however, Tagore draws heavily from Western European tuning systems and debate. Thus, European music theory and acoustics breathe life into Tagore's Hindu nationalist reconstruction of the sitar's body.

Drawing upon postcolonial theory, I argue that Tagore's attempts to reshape and standardize sitar tuning is an attempt at "translating" (Prakash 1999), "mediating" (Chatterjee 1993), and superimposing colonial systems of knowledge on Indian (instruments') bodies and practices. As an ethnographer and sitarist who is attuned to the "material discourses" (Tobin 2004) that instruments embody, confound, and shape, I consider Tagore's writings alongside early photographs and recordings of sitarists, object biographies of sitars from Tagore's museum collections, and ethnographic research with sitar makers and players in India and the US. This multisensory approach can more thoroughly help us unpack the continuing political, cultural, and material echoes of Tagore's sitar retuning project in today's global worlds of sitar making, playing, and listening.

Globalization, Intonation and Resistance: Equal-Tempered Marimbas and Equi-Heptatonic Voices in Afro-Colombian *Currulao*

(Lina Sofia Tabak)

In recent decades, *marimba de chonta* makers in the rural, southern Pacific region of Colombia have increasingly had their traditional marimbas returned to them because musicians from urban centers claim that they are "out of tune" (Miñana Blasco 2010). This has resulted in a shift away from tuning practices that were traditionally done by ear, toward the use of electronic tuners to tune marimbas to 12-tone equal temperament. However, the assumption that equal temperament is "in tune" for these marimbas has

resulted in some telling effects in musical practice: some modern *currulaos* (traditional genres from the region) use contrasting tuning systems in the marimba and voice parts (Ochoa et al. 2014).

Using Sonic Visualizer to analyze intonation in several *currulaos* (“Mirando” by Grupo Naidy and “Quitate de mi Escalera” by Grupo Socavon), in this paper I argue that *currulao* is traditionally equi-heptatonic—a tuning system which contains seven equally-spaced notes in an octave—even when the marimbas that accompany the singers are often no longer tuned to such a system. Vocalists consistently cadence on salient neutral thirds, an interval between a major and a minor third that is characteristic of equi-heptatonicism, while marimbas have more variable pitch systems due to the changes in tuning practices by the instrument makers.

The tension between (sometimes) equal-tempered marimbas and the equi-heptatonic vocal parts reflects larger developments in the southern Pacific region of Colombia, a region which until recently did not have close contact with the rest of the country: it is becoming increasingly affected by globalization and thus influenced by traditions outside of the region. Thus, the persistent use of equi-heptatonic vocal tuning in *currulao* serves as resistance and as a memory of a recent past, while indeed, it is the colonized, equal-tempered marimbas that are “out of tune.”

SESSION B

Recentring Afro-Eurasia: Human and Musical Migration in the Global Middle Ages (700–1500 CE) (Adebola Ola)

This paper examines the circulation of short-necked, pear-shaped lutes throughout Afro-Eurasia, focusing on the historical interconnectedness of five musical instruments: the *barbat*, *ūd*, (European) *lute*, *pipa*, and *kwitra*. Furthermore, this paper identifies the role of musicians, instrument makers, and musical instruments as a nexus of active agents that function as cultural conduits, serve as artifacts, and embody the nature of a constantly changing world of technology. Focusing on these instruments, this study serves as an impetus for rethinking and reinterpreting our inherited musical past, not as an isolated phenomenon but as an overlapping, collective, and interconnected musical history. Therefore, occasioning the reconfiguration and redefinition of the Middle Ages (5th – 15th centuries CE) as global and the Indian Ocean human and cultural exchange before the 16th century as complementary to the Atlantic Ocean cultural exchange. The term “Global Middle Ages” or “Global Medieval Era,” which is becoming increasingly popular among scholars (Heng 2009 & 2012; Kusimba 2012; Holmes & Standen 2019), recognizes the limitation of a historical disciplinary scope of reference and invites new methodologies and epistemologies for understanding music history and theory in the 21st century. Drawing from archival

sources, (musical) treatises, literary descriptions of performances and events, surviving instruments, iconography, cartography, and traveler's accounts, this paper establishes Afro- Eurasian musical and cultural exchange before the 16th century as a core component of our present discourse on music.

Turn of the Century Instrument Collections as Material Theorizations of Music (Patrick Connor Dittamo)

The turn of the twentieth century was an era of increasingly conspicuous displays of musical instruments in Western society. Temporary exhibitions proliferated, while collectors (often amateurs) accumulated extensive private collections. These collections seeded numerous instrument museums, and curators' subsequent grappling with their voluminous holdings set the agenda for the nascent discipline of organology.

This paper considers the conceptual underpinnings of these collections, drawing on the written prefaces of early catalogs. While the motives and interests of collectors varied, a recurring sentiment was that a sufficiently systematic encyclopedic collection would more than illustrate the musical past but immanently supply breakthroughs in the understanding of musical acoustics and the evolution of music itself. The ambition of many collections was thus a material theorization of music, assembled for the benefit of scholarship, but also displayed to the public after the manner of contemporary museums of art and natural history.

The place of instruments outside of the Western art music tradition in these collections varied. Entirely excluded by some collectors, others found aesthetic or musical value in the instruments of Asian traditions but not in indigenous instruments of Africa or the Americas. A few included instruments of all cultures, but couched the value of so-called "primitive" instruments in evolutionary terms, characterizing them as a glimpse into the distant Western past.

Despite the heady rhetoric surrounding the formation of these collections, their promise largely failed to materialize in their time. Once assembled, the enormity of the analytical task became apparent. The public-facing components of collections – their guidebooks, catalogs, and labelling – were limited in depth in comparison to their breadth. Ultimately, the attempted material theorization of music in these instrument collections was only a proxy for the synthesis of knowledge. The task of theorizing music through instruments would fall to subsequent generations of curators and scholars.

SESSION C

When Height Becomes Depth: Rethinking Pitch Through the Medium of Wax

(Giulia Accornero)

Every instrument of music theory Alexander Rehding describes in his seminal article (2016) allows for music-theoretical insights to become audible. But what if ‘audibility’ was not the only means through which musical sound could be sensually encountered? Could there be instruments of theory that are not endowed with the power to produce sound, but nevertheless allow musical theories of sound to emerge, as music theorists think *with* them?

In this paper, I focus on how the malleable material qualities of wax and its related techniques of inscription shaped a conception of musical pitches as “sharp” or “dull”—a rough translation of the Greek *oxus* and *barus*, the Arabic and Judeo-Arabic *ḥidda* and *thiqal*, and Latin *acutus* and *gravis*. Drawing on musical passages from Aristotle’s *De Anima*, al-Fārābī’s *Great Book of Music*, and an unedited commentary by Ibn Yaʿīsh to Ibn Sīnā’s *Canon*, I argue that the stylus and wax tablet were privileged media with which theorists conceived the impact of different pitches. The way in which sound was thought to be inscribed the human soul was considered analogous to the motion of a sharper or a blunter stylus on a wax tablet: the sharper one moving quickly and penetrating narrowly but deeply, the blunter one moving slowly and impressing the wax broadly but superficially.

Sharpness and dullness were descriptors for the kinds of motion with which sound inscribed the soul—motions endowed with their own micro-temporality. Theorists thus conceived musical pitch in both haptic and kinematic terms, rather than as a static property of sound (e.g., high *versus* low). I conclude by suggesting that wax afforded cultural techniques of inscription that provided a ground for the mutual intelligibility between medieval Islamicate and Christianate music theorists, thus engendering a new cultural geography for the history of music theory.

Spirals, Loops, and Ladders: Playing Chinese and European Guidonian Hands

(Addi Liu)

This paper investigates various Guidonian hands and their different pathways, and in particular, a Chinese Guidonian hand from *Lülü zuanyao* 律呂纂要 (*Essentials of Music*, c. 1680s), a treatise created for the Kangxi Emperor with input from his missionary-tutor Tomás Pereira (1645–1708). This hand, floating on clouds and illustrated with long fingernails — both typical of Chinese iconography — proceeds in the traditional spiral. But rather than *Gamma ut* at the tip of the thumb, it starts from *G-sol-re-ut*, as if *in medias res* with a sequence of hexachords laid out beforehand. At the end of the sequence we see an additional *f*’

(exceeding the traditional Guidonian gamut), located outside of the thumb's upper joint, insinuating a loop back to the thumb's tip. These deviations are not unique: the hand in Lusitano's *Introduçtione* (1561) for example also begins on *G-sol-re-ut* and features an *f'*, although rather than creating one spiral, Lusitano's fingers resemble ladders with the gamut proceeding vertically digit by digit (i.e. from bottom to top — index finger, *c-d-e-f*; middle finger, *g-a'-b'-c'*, etc.) Franciscan manuals such as Manuel Sanchez's *Regla* (1725) likewise feature the *f'* next to the thumb's upper joint.

Lülü zuanyao's instruction to “reckon with fingers” (*tao suan* 掐算) recalls Chinese hand reckoning practices with data often inscribed in circular pathways, e.g. the clockwise loop in Zhu Zaiyu's musical hand mnemonic in *Lülü jingyi* 律呂精義 (1596). Spirals and circles favor a smooth interface as the thumb travels along a continuous path, while finger ladders force the thumb to jump disjointedly from a fingertip to the next finger's bottom joint. This preliminary study explores the hand as a mnemonic instrument and the haptic and theoretical implications of the traditional Guidonian spiral, *Lülü zuanyao*'s suggestive loop, and finger as ladder.

SESSION D

“The Unpsychological Notion That Music is Made Up of Tones”: Comparative Musicology and Gestalt Theory in Berlin, 1906-1913

(Henry Burnam)

In his 1913 essay “Melodie und Skala,” comparative musicologist Erich von Hornbostel claimed that European “harmony, notation, and keyboard [...] work together to make our *Tonsystem* appear as a tool supplied to the musician with which to ‘compose,’ more or less as one might assemble a mosaic out of colorful little blocks.” How might we reconcile “Berlin School” comparative musicology's preoccupation with scales and organology, perhaps most notoriously in the form of the diffusionist *Blasquintentheorie*, with Hornbostel's assertion in “Melodie und Skala” that music notations and instruments with fixed tunings—whether European or non-European—give rise to the “unpsychological notion that music is made up of tones”?

My paper investigates Hornbostel's approach to music-theoretical instruments and his category of the “unpsychological” by situating them within the intertwined histories of “Berlin School” comparative musicology and Gestalt theory. I begin by identifying a methodological shift in early comparative musicology. Beginning in 1909, Hornbostel rejected the scale-centric approach of Alexander Ellis, Carl Stumpf, and of his own earliest publications. Instead, influenced by Benjamin Ives Gilman's “Hopi Songs” (1908), in which Gilman claimed to have identified “methods of composition and

performance which replace and exclude reliance upon a scale,” Hornbostel argued that motivic Gestalten, understood as prior to and other than the sum of tones drawn from pre-existing *Tonsysteme*, should be regarded as the basic units of melodic structure. I then trace the influence of this shift on psychologist Max Wertheimer’s first two publications that invoke the Gestalt concept: “Musik der Wedda” (1910), an article on the music of a Sri Lankan Indigenous group; and “Über das Denken der Naturvölker: I. Zahlen und Zahlgebilde” (1912), which attacked the “dogmatic-European” view that “reality-abstract” combination of arbitrary objects represented the most effective or highly-developed form of numerical thinking. This allows me to link Wertheimer’s critique of the atomism of European psychology and of the limits of arbitrarily-transferrable number to Hornbostel’s rejection of the primacy of object-like notes and scales, and, in so doing, to connect Hornbostel’s views on the instruments of both historical music theories and of comparative musicology to the emergence of “Berlin School” Gestalt psychology.

Visual Equidistance and the Genesis of Sundanese Scales and Modes in West Java, Indonesia (Henry Spiller)

The early twentieth-century physicist Charles Wead and the Philippine ethnomusicologist José Maceda separately have proposed that the intervals of Southeast Asian tuning systems are not derived from acoustical phenomena, but rather are epiphenomena of the symmetrical placement of fingerholes on bamboo wind instruments. This paper considers how the construction of the iconic Sundanese *suling* (flute) of West Java, Indonesia, may lie at the root of Sundanese tunings, scales, and modes, as well as of modern Sundanese music theory. A *suling* is fashioned from *tamiang*—a bamboo variety with thin walls, consistent diameter, and long internodes. Sundanese instrument makers used equidistant measurements to determine the placement of fingerholes. I argue that this visual approach to instrument construction helps to make sense of both (1) the legendary variability in the precise intonation of *salendro* (*slendro*) tunings and (2) the Sundanese predilection for layering hemitonic pentatonic scales over *salendro* accompaniments. It is well known that the pioneer ethnomusicologist Jaap Kunst collaborated with Erich von Hornbostel to validate Hornbostel’s expansive “theory of blown fifths,” which posited a common basis in the overtone series for a variety of Asian tonal systems, using tunings from Java as exemplars. It is less well known that in West Java, Jaap Kunst collaborated with Raden Machyar Angga Kusumadinata, a Dutch-educated Sundanese aristocrat with Sundanese musical training, who also theorized Sundanese scales and modes. Kusumadinata rejected the theory of blown fifths in favor of tuning models rooted in equidistant divisions of the octave that were unrelated to acoustical phenomena—an approach that Kunst could not endorse, but which had compelling precedents in visual/physical approaches to tuning in

Southeast Asia. Ironically, neither Kunst's nor Kusumadinata's theories account completely for Sundanese musical practices, but their contradictory approaches do expose how fundamental epistemological biases affect even the most "objective" theoretical work.

SESSION E

Reconstructing Ballanta's "African Harmonium" (1927) and Tanaka's "Enharmonium" (1890/1939): Digital Instrument Construction as a Tool for Global History of Theory

(Daniel Walden)

This talk considers preliminary results from my ongoing grant project New Instruments for Theory (NIFTY), which is focused on reconstructing historical instruments of theory in order to aid research into global histories of theory, and fostering new pedagogies that are more flexible, creative, and socially inclusive. Over the past two years, NIFTY has focused on reconstructing enharmonic keyboards from the turn of the twentieth century, proposed by their inventors as tools for conceptualizing indigenous tonal systems, reviving traditional practices, and fostering pan-nationalist politics. In the first part of my lecture, I will demonstrate one of those reconstructions in person: the NIFTY-*enharmonium*, synthesizing Nicholas G.J. Ballanta's "African Harmonium" (1927) with seventeen digitals per octave, and Tanaka Shōhei's "enharmonium" (1890/1939) with twenty-six digitals per octave, both tuned to approximations of just intonation. I will describe the process by which my team and I reconstructed these instruments as custom MIDI keyboards, making them robust and portable without compromising the peculiarities of their interfaces. In part two, I will investigate some of the initial insights I have gained by practicing on them myself. Drawing on the theories of Viktor Shklovsky (1917) and others, I will explain the value of the concept of "defamiliarization" for explaining how these keyboards originally functioned—by introducing minute alterations to the acoustical and haptic feedback one might generally expect from a standard keyboard instrument, so as to challenge their operators to rethink what was familiar from daily practice on the piano. I will also demonstrate how both instruments prioritized harmonies based on just sevenths (i.e., septimal harmonies): for Ballanta, as a way of incorporating Africa into the five-limit tonal space of Europe, and for Tanaka, as a way of defining an "Oriental" tonal logic superior to that the West.

"The Viol is my Monochord": Instruments, Affordances, and an Occult History of Eighteenth-Century Temperament

(Loren Ludwig)

A familiar narrative chronicles the use of keyboard instruments to formulate "well" and, later, "equal" temperaments during the long eighteenth century. This history, exemplified by generations of scholarship on J.S. Bach's *Das wohltemperierte Klavier*, positions keyboard instruments as both means and ends in a teleological drama that would enshrine equal temperament as the solution to the longstanding problem of the comma. But different tools afford different solutions, and an alternative history of temperament emerges in the less well-known writings of several Englishmen who used their violas da gamba (or viols) to formulate tunings that were easy to execute and prioritized the (relative) purity of frequently used keys. Mathematician Thomas Salmon and clockmaker and inventor of the marine chronometer John Harrison would both, independently, deploy their viols as "monochords" to "discover" tunings that they presented as cutting-edge within the nascent European scientific community. Salmon and Harrison, of course, are just two members of a cadre of viol-playing natural philosophers that includes Constantijn and Christian Huygens, Samuel Pepys (president of the Royal Society from 1684 to 1686), Isaac Newton, Benjamin Franklin, and others. My project considers this conflation of the monochord--a research instrument of incomparably venerable history--with the viol, a musical instrument that had acquired its own venerable history by the eighteenth century. What can we learn from an instrument that was understood as both "scientific" and "musical"? How does such an instrument afford particular solutions to issues that can be understood as alternately (or both) aesthetic and scientific? And how does the intertwined "instrumentality" of the monochord and the viol implicate their histories in the very particular solutions Salmon and Harrison would propose as alternatives to "wohl" and quasi-equal temperaments?

LIST OF PARTICIPANTS

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