Music, Sensation, and Sensuality

edited by
Linda Phyllis Austern

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To the memory of my father,
who took me folk-dancing, to many sorts of concerts,
and walked me to my violin lessons

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SERIES EDITOR'S FOREWORD

General Introduction to Critical and Cultural Musicology

Martha Feldman

Musicology has undergone a seachange in recent years. Where once the discipline knew its limits, today its boundaries seem all but limitless. Its subjects have expanded from the great composers, patronage, manuscripts, and genre formations to include race, sexuality, jazz, and rock; its methods from textual criticism, formal analysis, paleography, narrative history, and archival studies to deconstruction, narrativity, postcolonial analysis, phenomenology, and performance studies. These categories point to deeper shifts in the discipline that have led musicologists to explore phenomena which previously had little or no place in musicology. Such shifts have changed our principles of evidence while urging new understandings of existing ones. They have transformed prevailing notions of musical texts, created new analytic strategies, recast our sense of subjectivity, and produced new archives of data. In the process they have also destabilized canons of scholarly value.

The implications of these changes remain challenging in a field whose intellectual ground has shifted so quickly. In response to them, this series offers essay collections that give thematic focus to new critical and cultural perspectives in musicology. Most of the essays contained herein pursue their projects through sustained research on specific musical practices and contexts. They aim to put strategies of scholarship that have developed recently in the discipline into meaningful exchanges with one another while also helping to construct fresh approaches. At the same time they try to reconcile these new approaches with older methods, building on the traditional achievements of musicology in helping to forge new disciplinary idioms. In both ventures, volumes in this series also attempt to press new associations among fields outside of musicology, making aspects of what has often seemed an inaccessible field intelligible to scholars in other disciplines.

In keeping with this agenda, topics treated in forthcoming volumes of the series include music and the cultures of print; music, art, and synesthesia in nineteenth-century Europe; music in the African diaspora; relations between opera and cinema; and music in the cultural sensorium. Through enterprises like these, the series hopes to facilitate new disciplinary directions and dialogues, challenging the boundaries of musicology and helping to refine its critical and cultural methods.

Introduction

Linda Phyllis Austern

> We never cease living in the world of perception, but we bypass it in critical thought[.]
>
> —Maurice Merleau-Ponty, *"Un inédit de Maurice Merleau-Ponty"*

The scholar and the critic have been taught to reduce the savory stew of experience to the texture of words on paper. Convention demands silence of the "musical examples" at the core of a learned journal article and discrete fragmentation of the orgiastic experience of a rock concert in a review. How can those who labor in the pristine world of the intellect return to the rich sensorium of music? How can those who work with words as theorists or critics of perceptible experience re-member an embodied art? The varied essays in this collection, written by scholars from across the arts and human sciences, begin to address these questions. They bring us from modern Hungary to colonial Mexico, from Enlightenment France to the Bolivian Andes over two centuries later. They speak of the artifice of museum display and the manic pace of dance video; of the scientific study of acoustics and the impact of noise; of love, death, tears, and the classification of knowledge. But they never abandon the kaleidoscopic world of perception. This book is an attempt to gather together some of the many ways in which manufactured sound can be perceived as part of the corporeal world of human culture and contemplation.

The experience of music remains firmly rooted in the senses. The production of ordered sound involves not only the intellect, but, depending on the medium, also touch, taste, sight, and smell as well as hearing. Advertising executives and purveyors of goods and services toy with our sensory expectations, particularly as one pleasure suggests the intoxication

of another. "Sleep-inducing piano compositions that are as soothing as a warm tub soak before slipping between cotton sheets," proclaims the advertisement for a compact disc packaged in soft, glowing colors. A famous billboard image suggests the ancient synaesthetic pleasures of musical notes and alcohol every Christmas in North America. One French master-perfumer likens her art to symphonic composition, while a major-label recording offers "a romantic Italian feast for your ears." Behind the counter of an upscale cookware and gourmet shop, "Sunday Brunch" is served as an audio disc. Across the way, "Harmony," "Music," "Rhapsody," and "Whisper" are proffered as tiny pots of rich color and luxurious texture at a Swedish cosmetic boutique. The list is endless, yet the phenomenon escapes serious critical attention.

On any given evening in any large Western city, the symphony patron moves across smooth marble and plush carpeting whose contrasting textures and colors invite the caress of eye or hand. Moving through a sea of bodies whose attire has been selected to draw the gaze and suggest pleasure to the other senses, she passes stalls purveying aperitifs and dainty foods. As she sinks into a cushioned seat covered with sumptuous fabric, she becomes aware of the carved and glittering architectural details of the hall before being plunged into darkness designed to draw the vision toward the stage and accentuate the sense of hearing: crystal chandeliers, velvet draperies, gilded coats of arms, voluptuous plaster nymphs, and sirens. Not many blocks away, the club-goer gyrates in an equal darkness punctuated by flashes of vivid light in a haze of smoke and the mingled scent of alcohol, human sweat, and fragrances meant to allure. Amplified music, selected by a headphone-crowned disc-jockey isolated in a soundproof booth, vibrates through the bodies of dancers, drinkers, and auditors alike, drawing them together in communion. Scattered across town stand still, silent houses of worship awaiting the canonical hours at which the faithful will join in celebrations which link music to the objects of the other senses in an effort to contemplate the otherworldly. Yet the scholars and critics who consider these musics—or those of the cinema, theater, passing automobile, or other venues that incorporate the art across time and space—tend to isolate them from their full sensory complement.

> To return the word to the flesh. To make knowledge carnal again; not by deduction, but by immediate perception or sense at once; the bodily senses
>
> —Norman O. Brown, *Love's Body*

The last two decades of the twentieth century witnessed an explosion of popular and scholarly works about the senses. Shifting between the poles of philosophy and social science, or cognition and culture, the common

point of these reconsiderations has been a return to an epistemology of embodiment.[1] "When a person becomes ill, he is likely to become aware of it through his own senses," begins one of the *Cambridge Texts in the Physiological Sciences* (1982). Gravely pronouncing a fundamental truth to "a medical student in the second or third year of a preclinical course," the passage continues:

> If the condition progresses to the point where he seeks help, his advisor, even while *listening* [italics mine] to the patient's story, will use his own senses to pick up what he can of the cause of illness, and in very many cases what he sees, hears, feels, and smells will be enough for him to diagnose the condition. . . . Of course it is not just in sickness that the senses tell one about one's own body. . . .
>
> Thus the senses are the bodily mechanisms for gathering up-to-date information, and as such it is hard to exaggerate their importance.[2]

Hard to exaggerate, indeed. In a bold new study from the end of the twentieth century, George Lakoff and Mark Johnson, representing a radical branch of cognitive science, overthrow at least 2,500 years of Western assumptions about the link between mind and body. Using the sort of lush language most often banished from philosophical and clinical studies of the intellect, they conclude that:

> The embodied mind is part of the living body and is dependent on the body for its existence. The properties of mind are not purely mental: They are shaped in crucial ways by the body and brain and how the body can function in everyday life. The embodied mind is thus very much of this world. Our flesh is inseparable from what Merleau-Ponty called the "flesh of the world" and what David Abram refers to as "the more-than-human world." Our body is intimately tied to what we walk on, sit on, touch, taste, smell, see, breathe, and move within. Our corporeality is part of the corporeality of the world. . . . The mind is not merely corporeal but also passionate, desiring, and social. It has a culture and cannot exist culture-free.[3]

It can hardly be coincidental that the same twenty years of theoretical re-emphasis on the senses also marked the rise of the music video worldwide, and a sharp increase in the Western marketing of music to accompany an ever-expanding array of routine physical tasks. From exercise to shopping, from public travel to waiting for service, even the most mundane ventures are now regularly enhanced by commercially designed mood-altering soundtracks. Music scholars and critics have nonetheless been as slow to join their multidisciplinary colleagues in the investigation of bodily modes of

knowing, as others have been to recognize the full impact of music on the human sensorium and its cultural extensions.[4]

The senses clearly help to mediate consciousness and communication. There has, however, been little agreement about their nature, value, or even number across human time and geography. Are they valid or invalid means to recognize the self and the world? How are they linked to each other and to which additional cognitive faculties? Are they shared with other entities, visible or invisible? Are their data trustworthy? In what ways are they linked to the arts and sciences, to morality, emotion, or social structures? Even the five senses of common Western parlance owe their categorical foundation to Aristotle and are far from universal. Their definition and order have been seriously questioned by many experts from our own culture, let alone from others that evaluate them differently.[5]

For over two millennia, even Western intellectual inquiry has been torn between rationalist and empiricist models of the human processing of sense-data, roughly based on the Aristotelian idea that knowledge was ultimately derived from information gathered by five discrete senses, and its Platonic opposite that found sense-data as a distraction from true wisdom.[6] For the past century, especially its final quarter, perceptual modalities and the very conditions of sensory experience have undergone rapid and unprecedented transformation as new technologies and new forms of intellectual inquiry have emerged.[7] We belong to an overtly visual age in which less "pristine" senses are sometimes underestimated, an age of passive reception of artificially created sense-data. Ours is an era in which machines from seismographs to televisions enhance and transmit sense-data before it reaches us. How easy it has become to surrender our sensory consciousness, to let others feel and think for us: how easy and how dangerous. For sensation, as concept or process, is far from simple.

One of the most vexing questions has long been the relationship between emotion, intellect, and the senses. Is there a higher form of contemplation that stands divorced from physical stimuli and bestial desires? How and when does bodily perception contribute to the cognitive process, visceral reaction, or aesthetic judgment? Through what processes do sensory responses become part of narrative, ritual, or creative vision? In an intellectual culture that has traditionally divorced subject from object and fact from feeling, Western thinkers have tended to separate perceived from perceiver, to create separate faculties for processing things sensed and things known.[8] "Man communicates with his whole body, and yet the word is his primary medium," writes Walter Ong, "and communication, like knowledge itself, flowers in speech."[9] Nowhere is this attitude more strongly reinforced than in scientific studies of the sensory process or its objects, especially in

their pristine publication as silenced speech. "Sensing is to knowing as a cry is to words," adds medical doctor Erwin Straus, "A cry reaches only him who hears it, here and now; but words abide, they can reach everyone when and where ever they may be. In sensing, everything is for me. But knowing seeks the 'in itself' of things."[10] However, "to sense" is not merely "to feel." It is to become aware of the hidden meaning of something, to be affected, concerned, pleased, or displeased, or aroused by it. Sensibility is both perception and apprehension by sense. It is only a short step from sensation to metaphor, from sense to symbol, or from bodily sensation to intellection and back again.[11] One of the results of recent inquiry into the nature of sensation and its relationship to thought has been a recognition that, in spite of the traditional opposition between reason and sensation in Western culture and aesthetics, any human faculty of thought is ultimately inseparable from bodily experience. "The perceiving mind is an incarnated mind," wrote Merleau-Ponty some forty years ago.[12] Music, with its physical origin and paradoxical intangibility, with its beginning in the mind and end in the imagination or memory between mind and body, must necessarily occupy a complicated place in any scheme linking corporeality and contemplation. The essays in this book barely begin to intimate just how complicated it can be.

Music is most immediately rooted in the perception of sound. Sound, through which music becomes inextricably tangled with language, communication, and bodily ways of locating the self in culture and in space, reaches outward toward the other senses, and toward the senses of others. "Sound is literally disembodiment, an emanation from the bodies producing it that leaves their materiality and concentrated localization behind," writes David L. Burrows in a pioneering study of sound, speech, and music:

> The singers themselves have the sensation of expanding, in attenuating form, into surrounding space, and filling it, and when their listeners close their eyes, the whole auditorium becomes their music. What expands outward from them in every direction presses in on the audience from all sides, neutralizing the normally charged issue of here and there.
>
> All of this takes place without any overt activity on the part of the listeners. Looking is an outwardly active process, involving as it does active movements of the eyes, head, trunk, and body to achieve favorable orientation and focus. . . . [I]nwardly, listening may be just as active as looking, but outwardly we often arrest movement and wait for the sound to come clear. Seeing is like touching, hearing like being touched; except that the touch of sound does not stop at the skin. It seems to reach inside and to attenuate . . . the biologically still more basic one between within and without.[13]

No wonder those medieval and early modern thinkers who retained more than a slight suspicion of the power of music over the body likened its effect to the rape of the ear, or the forcible theft of the soul.[14] And no wonder so many rituals that draw together multiple senses and multiple bodies from across multiple dimensions feature music at their very centers.

If sound itself may be likened to a disembodied emanation, its "grain," its uniqueness, its individually identifying factors come from and refer back to the materiality of the producing body. Sound unites its listeners communally within the orbit of its motion even as it dissolves the bounds between the senses of its performer.[15] From infancy, children learn their place in the world and the overlapping powers of their senses through the production of sound:

> [S]ound, a medium of communication since the child's first cry, manifests new potential of meaning as the child passes through the lalling stage, where he constructs around himself a vast bubble of sound, burbling, gurgling, playing with his diversifying vocal powers— and with his lips at the same time, for sound, both in speaking and in hearing, is closely linked with touch and kinaesthesia. One "mouths" words quite literally, and our hearing is partly feeling.[16]

Hearing begins in the womb and helps the newborn identify his mother and the warm nourishment she provides. From this primal sensory coccoon, the female body has easily been refigured in sound or remembered as an ear.[17] Perhaps for this reason, as Adshead-Lansdale's and Tolbert's essays in this collection particularly make clear, the music-language knot has often been tied with gendered strings and copious strands from Nature instead of Artifice. Perhaps this is a contributory factor to the many forms of opposition between (manly) restraint and emotional response to music that Christensen, Craig-McFeely, Kramer, and McIver present in such different manifestations. Likewise, absence of the rich, vibrant texture of living sound is often read or figured as a metaphor for death or the dehumanization of the landscape, as Grover Friedlander and Kassler remind us quite differently in their essays.[18]

Western thinkers have traditionally positioned music somewhere in the shifting space between mathematical abstraction and corporeality, between reasoned creation and emotive response. To contemplate, study, or compose enduring music is to be intellectually active; to abandon oneself entirely to the pleasures of listening (or even performing) has become the passive partner in a potentially damaging physical entanglement. "Pure" taste and the aesthetics that provides its basis, even in scholarship, has been founded on a refusal of "impure" taste and the simple, primitive delights of sensation.[19] The discipline of music theory has long emphasized the clinical

relationships between notes with the ultimate goal of preserving such interplay as printed text, proceeding through what Roland Barthes refers to as the "toilette of the dead."[20]

Psychoacoustical studies of the phenomenon have tended to be based on the physics of sound and hearing, on the clean reception into the ear (and thence summarily to the brain) of waves of motion, on sound as an element of itself; Amy Graziano's historical summary in the present collection illuminates this long-standing tendency even through its very language. "A musical note is just pulsating air stimulating the organs in our ears," proclaims Diane Ackerman in her *Natural History of the Senses*.[21] Nonetheless, there is always a tacit understanding that, somewhere at the basis of these manipulations and these abstract studies, lies pulsating, affective embodied music, received by the senses through physical and cultural filters.[22] "The score of a Bach fugue cannot be understood in the complete absence of mathematics; nor can it be understood with mathematics alone," says Straus of even the silent skeleton of a piece of music, awaiting the stroke of a hand to give it sonic flesh.[23] "We listen with our bodies," concludes Ackerman.[24]

Even the most erudite discussions of music from beyond the narrow confines of traditional academic musicology and theory have tended to dissolve the boundaries between sensations, between action and passive reception. Orphic legend and the myths of the sirens and of similar beings worldwide emphasize the overwhelming admixture of sensation and desire in attentive listening. St. Augustine's famously lachrymose account of his baptism conjoins music, water, tears, and overwhelming passion into a powerful unity that appears again and again in Western thought, as in Kramer's article in the present volume.[25] William Barley invited the would-be purchaser of his Elizabethan book of lute tabliture "to have a taste of so ravishing a sweet science as music" with a deliciously synaesthetic metaphor.[26] Over three-and-a-half centuries later, the German physician Erwin Straus evoked multisensory images of intoxication, addiction, and erotic fulfillment in an anachronistic flight of fancy triggered by echoes of Bach, birds, and Roma violins:

> The gypsy, like the bird, knows only surrender to the individual tone: a sometimes stormy, sometimes tarrying progression from one resting point to the next, a rhapsodic outpouring and an intoxicated dilatoriness. . . . His music-making is Dionysiac; his slow relishing of individual sounds and moods is drunkenness. . . . Classical music is strict, strinctly exact in measurement and laws. . . . the listender, too, may be carried away into dreams of landscape; or he can become an attentive listener who understands the language of music and who perceives its manifest expression.
>
> Let us once more recall the intoxicated addict. They all long for the space

> of landscape; they find their fulfillment in the Dionysiac lingering by their dreams, intoxications, ecstasies, by turning from the bright waking world of the day to the night, to sleep and to that music of which the gypsy is the master. The tavern is the sympathetic landscape of the drinker and his center of life.[27]

In an interview conducted by Hector Biancotti and published in December of 1973, French critic Roland Barthes drew on a multisensory vocabulary to describe the unique qualities of Gundula Janowitz's voice in a performance of Mozart's *Le nozze di Figaro*: "To describe [Janowitz's vocal] grain, I find images of milkweed acidity, of a nacreous vibration situated at the exquisite and dangerous limit of the toneless."[28] Through hearing, through an engagement with the performing body, Barthes's senses of sight, taste, touch, and smell became aroused in auditory-linguistic imagination. These are, in turn, transmitted to the interviewer through the sound of his words and transformed into verbal images of pearly luster and the smoothness of milkweed. It was also Barthes who, in 1970, famously divided practical music, bodily music, and fully sensed music into "the music one listens to, [and] the music one plays," music received through the ear and music engaging the entire body.[29] Finally, at the end of the twentieth century, it has been recognized that the music of the theater and the cinema, unfolding in darkness along with narrative and visual stimulation, permits public indulgence in private fantasy and forbidden emotional release.[30]

The eighteen essays in this book share a number of common themes. They reinforce each other even as each raises new issues from contrasting perspectives. I have organized them not according to specific sense, culture, or historical epoch, but by the questions they raise and the manner in which they raise them. Each one is unique, self-contained, and can also be read in any order at the reader's own pace. The collection begins with Descartes as do many studies in the philosophy of mind or history of cognition. But here Van Orden reevaluates the synthetic work of a youthful scholar, which draws on over a millenium's worth of information about music and on early-modern developments in mathematics, experimental science, and applied kinaesthetics. Like the other two essays with which it is grouped, it shows some of the dynamic tensions inherent in any attempt to categorize and delimit particular effects of music on the body physical and the body social from which it cannot be separated. Christensen also brings us into a world in which sounding music merges with theory, philosophy, prescriptive action, and premodern Western medicine conjoined to physics. Here, it is the sense of touch that circumscribes all others. Musicians surrender aspects of the rational mind to pure corporeal instinct and tonal sensibility before improvising a keyboard prelude. It is with this blend of music and

overflowing affect that Kramer's article opens, considering the German Romantic cultural conjunction of tears, song, and sympathy. Tears, so often linked to the primal, prelinguistic utterance at the boundary between sensation and rationality, are conjoined through a varied musical vocabulary to sublimation and erotic longing, to hidden truth and vivid pain expressed through voice and keyboard.

The next section includes four essays that feature contrasting forms of sensory overload, excess, and transgression from one sense to another through the use of music. Tolbert's essay begins in the same primal realm of emotive sensuality as Kramer's. She draws on cultural criticism, semiotics, and gender theory to shed new light on the tangled reception of music as standing somewhere between the natural cries of animals and the pure "manly" rationality of language. Stobart begins with the complexities of the subjectivity and embodiment of the musical voice with which Tolbert ends. He takes the reader through the multisensory landscape of Andean music with its cultural and calendrical oscillation between excess and austerity, and its numerous links to evident and hidden energies. Adshead-Lansdale unifies the strains of sensory intoxication and the powerfully feminine capacities of embodied music raised respectively in the two preceeding essays. Her reading of a multimedia piece of performance art from the end of the twentieth century adds the dimension of dance to the linguistic argument articulated by Tolbert, and returns to the cusp between the physical and metaphysical worlds where music is so often located. Here, primal myth, sound, light, and movement work together through the body and the camera to reinforce a deeply rooted misogynist vision. Gordon-Seifert's paper also works with the multimedia retelling of mythological material through the highly gendered and sexualized body in performance. In this case, parody, scatology, politics, and erotica serve as a focal point for exposing the foibles of a royal court that favored unlikely narrative romances full of stock male and female character archetypes; and for the experience, through music, of a powerful sexual energy that ran counter to the culture's didactic images of men and women in control of their passions.

The next three essays focus on the evident transcendence of this world of sensuous excess. In them, music takes its place of ontological mystery by spanning the distance between things physical and metaphysical. Wagstaff and Wilkinson present contrasting rituals of mourning, death, and burial, in which objects of many senses and many sorts of formal gesture blend together and help to create different senses of community. Wagstaff demonstrates how music mixed with other sensory stimuli not only to bridge the temporal and the eternal, the living and the dead, but reinforce a sense of colonial power and concomitant cultural hierarchy in sixteenth-century Mexico. Kertész Wilkinson outlines the funereal and mourning

rites of the minority Vlach Roma people of present-day Hungary against the rich sensory texture of their lives. Instead of strengthening an external cultural hierarchy, the music and associated ritual coalesce into a unifying signifier of community, a hedge against the perceived impurity of the majority people. Grover-Friedlander presents a mid-twentieth century opera that raises questions of vocality, embodiment, and death through the metaphor of the telephone, a machine that displaces the rich sensuality of the (operatic) voice. Her reading of the work emphasizes death as an outcome of vocal excess—a topos as old as the myth of Orpheus. Consequently she begins to raise vital questions about the fragmentation of voice and body in the machine age.

The next three essays continue the theme of multisensory fragmentation and synechdotal refiguration of the body as one or more of its senses. In each one, mechanical dominance of the sensorium becomes a creative media triumph instead of a loss, an artificial resurrection of the displaced performing body of Grover-Friedlander's piece. The potentially overwhelming power and danger of music as heard and felt has been replaced. Here, for the final part of the twentieth century, sound has been subjugated to sight. And the senses of touch, movement, and involuntary physical response so closely linked to music have been obliterated or ceded to the camera's or curator's eye, or to the absent director's or technician's hand. Citron discusses a production of Mozart's *Così fan tutte* not only translated from the medium of theater to that of television, but from a late-eighteenth-century setting to a late twentieth. Through such techniques of dissolving boundaries, and a set of slangy English subtitles sharply juxtaposed with the elegant Italian sung on the recorded soundtrack, the work distances the viewer/listener in ways that raise questions about art, culture, history, and the packaging of older representational works for new "media-savvy" audiences. Dodds, like Adshead-Lansdale, presents a multimedia form conceived and born in an age of enhanced production, and not incidentally, consumerism. Her essay raises questions about the relationship between sound and image in music video and video dance in terms of the performing body captured by the camera, and of the watcher/listener for whom the works are created. Zecher gives us a completely different take on anachronism, media update, commercialism, and the manipulated musical body. Her essay literally presents older musics as museum pieces, with sound utterly severed from the other senses so necessary to full participation in the art. Instruments in glass cases are literally silenced and left to lie untouched in sterile surroundings. Meanwhile, visitors hear disjunct recorded sound through headphones that isolate them not only from the musical bodies they are meant to hear, but from other members of the "audience." Where now is the *jouissance*, the communal experience of embodied music?

The next three essays also consider sound displaced by sight, but to the opposite end. Here, in "old master" paintings, visual images are meant to stir the other senses, and through such imaginary stimulation to lead to cogitation. We learn of the cultural position of music and musical activity through these works, and of music's position as an object of embodied listening and performance in relation to other sensory-intellectual stimuli. Minamino brings us into the richly sensuous world of late-medieval Netherlandish painting, in which imaged sound is as vibrantly textured as the shapes and colors of the landscape. He shows us how much of the social and cultural world of the musician is given by the painterly hand and eye, from which point it may be further corroborated by extant music and documents, and by biography. McIver returns the reader to the allegorical world and to the figurations of women featured in several previous essays, but this time with a visual focus. Her work presents the multisensory message of sixteenth-century Italian images that unite eroticism and objects of bodily pleasure against a didactic background. Craig-McFeely follows up by locating verbal and visual evocations of early modern female musicians at the permeable boundary between the aural, the visual, and the tactile. She reminds us of how easily voice and body have been refigured as musical instruments, which themselves have taken on animate and even erotic qualities in metaphor.

The collection closes as it had begun, with considerations of sound and the listening process as they extend to the entire body, cognition, and consciousness; and to the acoustic culture within which the body is located. Kassler raises questions about noise, sonic overload, and psycho-physical response to extreme stimulation of the human auditory mechanism, as well as their history and need for future multidisciplinary study. Graziano also gives us a phenomenological history with a crossdisciplinary intellectual future. Her essay raises provocative questions about an empirical study of human sound reception that arises from a science that had all but ignored the richly sensual dimensions of the musical experience.

Notes

1. Among scholarly studies, see, for example, David Abram, *The Spell of the Sensuous: Perception and Language in a More-Than-Human World* (New York: Pantheon Books, 1996); Diane Ackerman, *A Natural History of the Senses* (New York: Random House, 1990); H. B. Barlow and J. D. Mollon, eds., *The Senses* (Cambridge: Cambridge University Press, 1982); David Chidester, *Word and Light: Seeing, Hearing and Religious Discourse* (Urbana: University of Illinois Press, 1992); F. Gonzalez-Crussi, *The Five Senses* (New York: Harcourt, Brace Jovanovich, 1989); David Howes, ed., *The Varieties of Sensory Experience: A Sourcebook in the Anthropology of the Senses* (Toronto: University of Toronto Press, 1991); Mark Johnson, *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason* (Chicago: University of Chicago Press, 1987); Alphonso Lingis, "The Sensuality and the Sensitivity," in Richard A. Cohen, ed., *Face*

to Face with Levinas (Albany: State University of New York Press, 1986), 219–30; Jillyn Smith, *Senses and Sensibilities* (New York: John Wiley, 1989); Paul Stoller, *The Taste of Ethnographic Things: The Senses in Anthropology* (Philadelphia: University of Pennsylvania Press, 1989); Gary Taylor, "Feeling Bodies," in Jonathan Bate, Jill L. Levenson, and Dieter Mehl, eds., *Shakespeare and the Twentieth Century: The Selected Proceedings of the International Shakespeare Association World Congress[,] Los Angeles, 1996* (Newark: University of Delaware Press, 1998); and Charles Wegener, *The Discipline of Taste and Feeling* (Chicago: University of Chicago Press, 1992). Of course, the serious investigation of the senses is far older, although the emphasis was more often on historical changes or the internal processing of data than the input of signals through bodily receptors; for an idea of the range of mid-twentieth century studies see, for example, Edwin G. Boring, *Sensation and Perception in the History of Experimental Psychology* (New York: Apleton-Century-Crofts, 1942); Frank A. Geldard, *The Human Senses*, 2nd ed. (London: John Wiley and Sons, 1972); D. W. Hamlyn, *Sensation and Perception: A History of the Philosophy of Perception* (London: Routledge and Kegan Paul, 1961); Maurice Mandelbaum, *Philosophy, Science, and Sense Perception: Historical and Critical Studies* (Baltimore: Johns Hopkins University Press, 1964); Maurice Merleau-Ponty, *Phenomenology of Perception*, trans. Colin Smith (London: Routledge and Kegan Paul, 1962); Merleau-Ponty, *The Primacy of Perception*, ed. James M. Edie (Evanston: Northwestern Unviersity Press, 1964); and Erwin Straus, MD, *The Primary World of Senses: A Vindication of Sensory Experience*, trans. by Jacob Needleman (London: Collier-Macmillan Ltd., 1963).

2. H. B. Barlow and J. D. Mollon, eds., *The Senses* (Cambridge: Cambridge University Press, 1982), p. 1.
3. George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought* (New York: Basic Books, 1999), 565. For an outline of the complete development of this thesis, see 551–68.
4. Tia DeNora's recent study of the social uses of music in Great Britain and the United States, *Music in Everyday Life* (Cambridge: Cambridge University Press, 2000), begins to raise important issues of the relationship between music, social institutions, and the body, especially 75–108. On the current widespread use of background music to alter mood, see Joseph Lanza, *Elevator Music: A Surreal History of Muzak, Easy-Listening, and Other Moodsong* (New York: St. Martin's Press, 1994).
5. See Ackerman, *Natural History of the Senses*, xv; Pierre Bourdieu, *Distinction: A Social Critique of the Judgment of Taste*, trans. Richard Nice (Cambridge: Harvard University Press, 1984), 486–88; Chidester, *Word and Light: Seeing, Hearing and Religious Discourse*, pp. 1–24; Constance Classen, *The Color of Angels: Cosmology, Gender and the Aesthetic Imagination* (London and New York: Routledge, 1998), 13–35; Jonathan Crary, *Suspensions of Perception: Attention, Spectacle and Modern Culture* (Cambridge, 1999), 1–10; Geldard, *The Human Senses*, 258–59; David Howes, "Sensory Anthropology," in Howes, ed., *The Variety of Sensory Experience: A Sourcebook in the Anthropology of the Senses*, 167–91; Hamlyn, *Sensation and Perception: A History of the Philosophy of Perception*; Merleau-Ponty, *Phenomenology of Perception*, 2–12; Walter J. Ong, "The Shifting Sensorium," *The Variety of Sensory Experience*, 25; Straus, *The Primary World of Senses: A Vindication of Sensory Experience*, 373; and Anthony Synnott, *The Body Social: Symbolism, Self, and Society* (London: Routledge, 1993), 128–49.
6. See Morris Berman, *The Reenchantment of the World* (Ithaca and London: Cornell University Press, 1981), 27. For a succinct summary of traditional Western insights concerning the senses, particularly from an anthropological perspective, see Anthony Synnott, "Puzzling Over the Senses: From Plato to Marx," in Howes, ed., *The Variety of Sensory Experience*, 61–78.
7. See Berman, *The Reenchantment of the World*, 16–17; Crary, *Suspensions of Perception*, 1–10; 13, and 46–48; Johnson, *The Body in the Mind*, 141–72; and Lakoff and Johnson, *Philosophy in the Flesh*, 3.
8. See Bourdieu, *Distinction*, 486–88; Johnson, *Body in the Mind*, 139–40; Lakoff and

Johnson, *Philosophy in the Flesh*, 16–44; Alphonso Lingis, "The Sensuality and the Sensitivity," in *Face to Face with Levinas*, ed. Richard A. Cohen (Albany: State University of New York Press, 1986), 220; Merleau-Ponty, *Phenomenology of Perception*, 207; Aaron Ridley, *Music, Value and the Passions* (Ithaca: Cornell University Press, 1995), 19–28; Leone Vivante, *Essays on Art and Ontology*, trans. Arturo Vivante (Salt Lake City: University of Utah Press, 1980), 58; and Charles Wegener, *The Discipline of Taste and Feeling* (Chicago: University of Chicago Press, 1992), 37–38.

9. Ong, "Shifting Sensorium," 25. See also Abram, *Spell of the Sensuous*, 73–76; Ackerman, *Natural History of the Senses*, 213–14; Roland Barthes, *The Grain of the Voice: Interviews 1962–1980*, trans. Linda Coverdale (New York: Hill and Wang, 1985), 3–7; and Vivante, *Essays on Art and Ontology*, 63.
10. Straus, *Primary World of Senses*, 312–13. Shakespeare scholar Gary Taylor has pointed out the paradoxical gap between the study of narrative and representational art and the work itself, reminding his readers that even the academic act of live presentation of material is a staid reading of a written text, cleansed of sensual and emotive content, "Feeling Bodies," 258–59.
11. See Chidester, *Word and Light*, 25–50; Classen, *Color of Angels*, 13–35; Lakoff and Johnson, *Philosophy in the Flesh*, 564–65; Lingis, "Sensuality and Sensitivity," 219; and Vivante, *Essays in Art and Ontology*, 58–59.
12. Merleau-Ponty, *The Primacy of Perception*, 3–11. See also Bourdieu, *Distinction*, 488; Crary, *Suspensions of Perception*, 11–79; Johnson, *The Body in the Mind*, 166–70; Lakoff and Johnson, *Philosophy in the Flesh*, 3 and 16–44.
13. David L. Burrows, *Sound, Speech and Music* (Amherst: University of Massachusetts Press, 1990), 20–21. See also Barthes, *Grain of the Voice*, 183–84; and Barthes, *Image, Music, Text*, 188–89.
14. See Linda Phyllis Austern, *Music in English Intellectual Culture, 1550–1650* (forthcoming).
15. See Abram, *Spell of the Sensuous*, 73–76; Ackerman, *Natural History of the Senses*, 175–80; Barthes, *Image, Music, Text*, 182; Straus, *Primary World of the Senses*, 378; and Vivante, *Essays on Art and Ontology*, 63.
16. Ong, "Shifting Sensorium," 25. See also Abram, *Spell of the Sensuous*, 74–75.
17. See Burrows, *Sound, Speech and Music*, 17–18; Henry Alden Bunker, Jr., "The Voice as Female Phallus," in *The Psychoanalytic Quarterly* 3 (1934), 392; Chantal Chawaf, "Linguistic Flesh," trans. Yvonne Rochette-Ozello, in Elaine Marks and Isabelle de Courtivron, eds., *New French Feminisms* (Amherst: University of Massachusetts Press, 1980), 177–78; Luce Irigaray, "The Fecundity of the Caress," in Richard A. Cohen, ed., *Face to Face with Levinas*, 249–51; and Thomas Pavel, "In Praise of the Ear (Gloss's Glosses)," in Susan Rubin Sulieman, ed., *The Female Body in Western Culture: Contemporary Perspectives* (Cambridge: Harvard University Press, 1986), 46–51.
18. For further information on this topos, see Burrows, *Sound, Speech and Music*, 22–23; and for the connection between music that ceases and death, see Carl Dalhaus, *Esthetics of Music*, trans. William Austin (Cambridge: Cambridge University Press, 1982), 11, as well as several of the essays in this collection.
19. See Bourdieu, *Distinction*, 486–87; and Lydia Goehr, *The Imaginary Museum of Musical Works: An Essay in the Philosophy of Music* (Oxford: Clarendon Press, 1992), 155–57.
20. Barthes, *Grain of the Voice*, 3.
21. Ackerman, *A Natural History of the Senses*, 212.
22. See, for example, Carl E. Seashore, *Psychology of Music* (New York: McGraw-Hill, 1938; reprint ed., New York: Dover Books, 1967), 1–2; and Mary Louise Serafine, *Music as Cognition: The Development of Thought in Sound* (New York: Columbia University Press, 1988), 35–36. Even in the pre-modern period of the glorification of musical abstraction there were dissenting thinkers who followed the Epicurean idea that the beauty of music should be judged not by its mimetic or referential qualities, but by the pleasurable and passionate responses it triggered through sensation; see Goehr, *Imaginary Museum of Musical Works*, 138, 141–47, and 154–57.

23. Straus, *Primary World of Senses*, 324.
24. Ackerman, *A Natural History of the Senses*, 212.
25. Saint Augustine, *Confessions*, trans. R. S. Pine-Coffin (London: Penguin Books, 1961), Book IX, Chapter 6, 190. Michel Poizat notes that tears and shivers, the usual sign of bereavement and suffering, are the outward manifestation of overwhelming musical pleasure, *The Angel's Cry: Beyond the Pleasure Principle in Opera*, trans. Arthur Denner (Ithaca: Cornell University Press, 1992), 3–4.
26. William Barley, *A New Book of Tabliture* (London: William Barley, 1596), sig. A2v.
27. Straus, *Primary World of Senses*, 324.
28. Barthes, *Grain of the Voice*, 184.
29. Barthes, *Image, Music, Text*, 149–50.
30. See Simon Frith, *Music for Pleasure: Essays on the Sociology of Pop* (Oxford: Polity Press, 1988), 129; and Poizat, *Angel's Cry*, 3–8.

Minding Affect

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1

Descartes on Musical Training and the Body

Kate van Orden

> The object of [Musick] is a Sound. The *end*; to delight, and move various Affections in us.[1]

These are the opening lines of René Descartes's first treatise, the *Compendium Musicae* (1618). Sound, delight, the passions. It would seem that Descartes began his philosophical career in the body, a body craving sensual delight and pleasure. The world of the *Compendium*—to recall its own examples—is one where thunder and cannon fire offend the ear, where animals dance to music, where duple meter excites "gentle and sluggish motions, such as a kind of Languor, Sadnesse, Fear, Pride, and other heavy and dull Passions," where antipathy causes a drum made of wolf skin to silence one made of sheepskin.[2] It is a world still far from the philosopher's celebrated dislocation of mind and body, even while the intellectual method by which he would arrive there is very much on the horizon.

The *Compendium* is vexed, superficial in places, and occasionally contradictory; as such, it is perhaps justifiably ignored by many historians of philosophy. After all, Descartes never revised it for publication. It was a private gift for his newfound friend, Isaac Beeckman, a manuscript for the latter to tuck away in his library, far from the judgment of others. As for the choice of subject matter, we know from Beeckman's journals that he was interested in music himself, making it easy to suppose that Descartes hoped only to please his friend by writing on music.[3] Music historians, for their part, have quickly spotted Descartes's reliance on Zarlino's *Istituzioni harmoniche* (1558), a comparison that shows up the *Compendium*'s lack of theoretical novelty.[4] Rehearsing the work of earlier writers, its treatment of rhythm, consonance, dissonance, degrees, counterpoint, vocal ranges, and modes reaches few new conclusions, even though the path by which Descartes comes to them is rather unusual.

My own interest in the *Compendium* lies somewhat outside the history of music theory and the history of philosophy, in the messy stuff of cultural history. It lies in the real world, so to speak, in the world often invoked by Descartes in the *Compendium*, where living, breathing, dancing, hearing beings sought the pleasure of music. Beginning here, in the body, grates against the usual interpretation of the *Compendium* as pure math, a tendency nicely summed up by H. Floris Cohen's quip that the *Compendium* is "Zarlino, *more geometrico*."[5] With this Cohen claims that Descartes only furthered Zarlino's urge to explain music geometrically.[6] But Descartes' geometry in no way negates the phenomenological orientation of his musical science. On the contrary, geometry proved a humane alternative to arithmetic precisely because it proceeds in terms that can be verified by sight and—in those cases where lines represent string lengths—by hearing. Indeed, the first two "ground rules" Descartes establishes at the outset of the *Compendium* make clear that his will be a study of sounding music, of music as heard:

1. Each Sense is capable of some Delectation.
2. To this Delectation is required a certain proportion of the object to the sense.[7]

For Descartes, the appeal of simple geometrical figures rested in one's ability to perceive their proportions directly with the senses. Hence even the geometry in the *Compendium* invites the reader to *see* the beauty in music, building a visual analog to the beauty one hears. The math does become slightly abstract in Descartes's chapter on degrees, in which arbitrary numbers are assigned to each pitch, making middle C [*c'*] = 180, *c* = 360, and *c"* = 90, the whole representing string lengths with numbers that allow him to avoid fractions; but Descartes always works into math from the sensible. The "anecdotes" threaded throughout the treatise should be taken quite seriously for this reason, because they too fix Descartes's musical analysis in the body, bidding the reader to feel the shock of cannon fire, hear a leaping bass line as an aggressive counter to an attractive soprano line, and take physical delight in an evaded cadence as it denies the listener satisfaction and rest.

The *Compendium* was not written for the small circle of polyphonists, music theorists, and Aristotelians that formed the usual audience for music theory treatises at the time. It was written in the first instance for Beeckman, of course, but it also speaks to a general public with an inclusiveness that invites the broad reading I propose. Only good sense is required to understand its arguments, and just as Descartes would begin the *Discours de la méthode* (Leiden, 1637) by stating that "good sense or reason is by nature equal in all men," so too the *Compendium* asks nothing more of its

readers than sound mind and senses.[8] Descartes disregards ancient and Renaissance authorities (there is no prerequisite reading for his course); intellectual, professional, social, and moral hierarchies are largely banished; and even the class distinctions implicit in the elevated status of vocal polyphony crumble when he heaps praise on the simplest music around: namely military drumming.[9] Armed with good sense, he cuts through the prevailing labyrinth of harmonic theory and its elaborate calculations to find a more direct and rational explanation of how music brings delight and moves "various Affections" in listeners.[10]

Already in his preliminary remarks, Descartes strips the cosmos of its philosophical mysteries, laying it bare with his example of an astrolabe (Figure 1.1). Looking upon such an object, he remarks, the viewer takes pleasure in the simple proportions of its net (the fretwork cut from a sheet of metal that rotates over its face), but not in the complex proportions of its mother (the circles of altitude and azimuth engraved in its face). We will turn to the exact nature of proportions and their action on the senses subsequently; what we should remark here is the significance of the astrolabe as a tool of contact with the heavens and why Descartes may have chosen it as an example at the outset of his treatise. Astronomers used astrolabes to measure the altitude of stars, and navigators, so equipped, used them to determine their position at sea. These were fairly precious instruments, part of the expensive technical equipment prospectors paid for when financing exploratory ventures such as the Magellan voyage, and sumptuous enough to offer as gifts to suitably wealthy patrons.[11] Since they were certainly not commonplace at the time of Descartes's writing (though Beeckman would have been familiar with them), they had special significance as a device whereby man might solve problems in positional astronomy. Engraved with the houses of the zodiac and the major constellations, the astrolabe appears to be a mobile model of celestial gyrations, a toy version of the cosmos to be held in the hand and manipulated at whim.[12] Whereas music treatises traditionally paid homage to the idea that the celestial spheres produced divine music as they spun in their orbits, Descartes offers up this cosmos for human inspection, implying that the senses are capable of judging heavenly truths.

By choosing music as the object of his first scientific essay, Descartes struck at the very heart of the musical cosmology favored by Renaissance philosophers. Music enabled him to interrogate the order of the world through a subject that, since the time of Pythagoras and Plato, had explained the coherence of terrestrial and heavenly matter in the mathematical language of harmonic proportions. What distinguishes the *Compendium* from prior thought is its method, which—in addition to its well-noted mathematics—enlists the senses in sizing up this order, heightening the tension in a treatise marked by the dualism of rational inquiry and bodily perception. I examine his method in the following section *Mathesis Universalis* and the Senses.

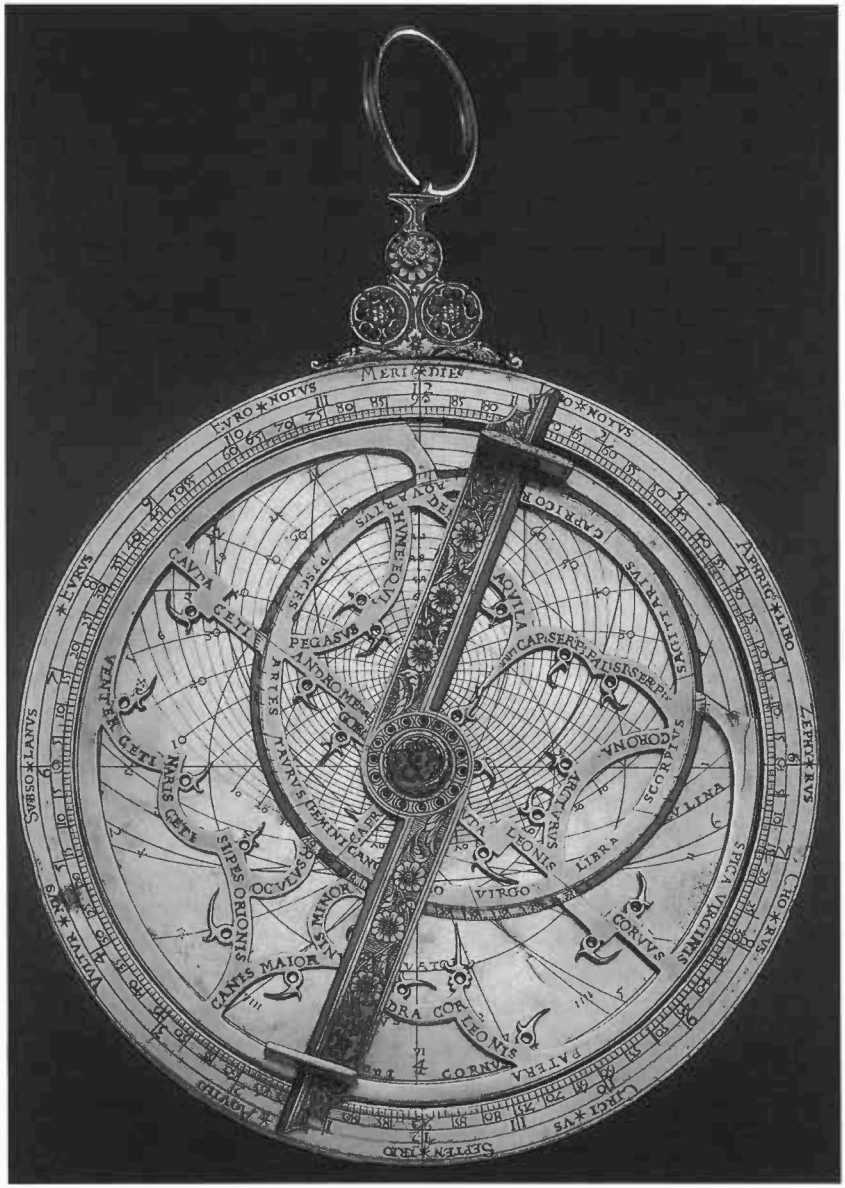

Figure 1.1. Brass Astrolabe by George Hartmann (1558). Courtesy of the Science & Society Picture Library, London.

Why make the senses arbiters of proportion and, by implication, of beauty?[13] Why limit mathematical order to the blunt ratios that can be seen and heard? Not only must we acknowledge the importance of the body in Descartes's early work on music, we must assess the way Descartes construed the body and its senses to learn more about the cultural office of music at the time. For in the end, the *Compendium* is a cultural document, and Descartes was a witness to, participant in, and commentator on a set of deeply imbedded practices regulating the body's proper form and conduct. This physical discourse of civility or manners operated on the assumption that the visible language of the face and limbs and hands signaled a person's inner virtue and moral relationship with the world at large. As we shall see, music remained the touchstone of goodness as Renaissance thought gave way to rationalism, but did so only after the body was reconstructed and the senses retooled to be able to judge beauty more assuredly. This is the subject of the last section of my essay Music, Measure, and the Body.

Mathesis Universalis and the Senses

At the time Descartes wrote the *Compendium*, his methods were largely scientific, and his motives were characterized by a yearning to measure the physical world with the yardstick of mathematics. According to Stephen Gaukroger, Descartes's early work strove to give a naturalistic account of perceptual cognition, and it does appear to be in the spirit of natural philosophy that we find him studying sympathetic vibration by plucking lute strings tuned an octave apart and blowing on a flute to study the physical production of octaves on wind instruments.[14] This is observational science at its purest—the science of acoustics—which Descartes pursued in order to explain human perception in terms of basic mechanical actions. Music was the perfect object for a study of the senses because its sounds could be rationalized in terms of simple mathematical formulae: consonances please the ear because of their basic proportions (octaves stand in a 1:2 ratio, fifths 2:3, and fourths 3:4, all of which can be observed by dividing a string in parts), and we like duple and triple meter because they are based on the simple proportions 1:2 and 1:3.[15] But we should not see in Descartes's rationalization of string divisions a move toward mathematical abstraction. For Descartes, string divisions were actual sounding parts, hence the extraordinary opening line of the treatise: the object of music is sound. When manipulating string divisions, he is actually adding and subtracting sounds, which is unprecedented in the canonic tradition.[16] Early theory centered around the monochord, a scientific instrument strung with one length of string and fixed with moveable bridges that theorists used to divide the string according to simple proportions. But whereas Descartes used the monochord to manipulate sounds, early monochord

theorists employed the instrument primarily as a calculator, or tool for compounding continuous ratios.[17] Although number theory and music theory intersected—particularly in precisely this domain of representing physical relationships in terms of proportionalities—Descartes made sound, rather than number, his primary object.

Descartes performed many of his experiments in the company of Beeckman, who recorded their first encounters in his journal.[18] Their mutual interest in combining physics and mathematics unfolded in meetings and letters, and Beeckman described them as two rare "Physico-mathematicians" in search of a method that could explain natural order with the language of mathematics.[19] The *Compendium Musicae* was but the first result of this project, which later included essays in dioptrics, meteors, and geometry. All of these treatises are, of course, related to the new method of reasoning Descartes began to develop in 1619, a method treating problems in the natural sciences by reducing them to their mathematical core and solving them rationally. Indeed, Descartes's entire science tended to understand fundamental physical concepts such as motion (which will interest us shortly) as the object of pure mathematics.[20] This explains why he appended the *Dioptrics* and *Meteors* to the first edition of his *Discours de la méthode,* for their scientific examples helped to corroborate *la méthode.* Although Descartes did not include the *Compendium* along with these other essays, it would have fit with them quite nicely. In fact, one of the first commentators of the *Compendium*, Père Nicolas Poisson, did issue the music treatise with the other supporting essays in his edition of the *Discours de la méthode* from 1668.[21] As Descartes said in *Regulae ad directionem ingenii* (in a section of it composed in 1619), "The exclusive concern of mathematics is with questions of order or measure and . . . it is irrelevant whether the measure in question involves numbers, shapes, stars, sounds, or any other object whatever. This made me realize that there must be a general science which explains all the points that can be raised concerning order and measure, irrespective of subject matter."[22] The point of this rule and, indeed, of the mathematical project underlying the *Compendium*, is to deny the Aristotelian distinction between pure mathematics (arithmetic and geometry, glossed here as numbers and figures) and mixed mathematics (astronomy, harmonics, optics, mechanics, glossed here as stars, sound, or some other object).[23] By showing that a general science of quantity or *mathesis universalis* applied equally to the concrete objects of mixed mathematics and the abstractions of pure mathematics, Descartes drew the sensible world of stars, sound, and other things to the same level as numbers and figures in all their perfection. Music in this way proved a bridge between pure and mixed mathematics, and the *Compendium* the first glimmer of Descartes's interest in *mathesis universalis*, the search for a set of operations and intellectual procedures proper to all mathematics—whatever the sort of

quantity—that would, in the *Discourse*, be expanded to include the whole of knowledge.[24]

Descartes and Beeckman were hardly alone in their quest to find a mathematical key to the physical world. Their experiments were, in fact, symptomatic of an epistemological shift affecting many disciplines. In *The Order of Things*, Michel Foucault described this shift as a reordering of knowledge that occurred as intellectuals slowly shirked off a Renaissance episteme based on similitude, correspondence, and resemblance in favor of a new episteme based on analysis and representation.[25]

> The empirical domain which sixteenth-century man saw as a complex of kinships, resemblances, and affinities, and in which language and things were endlessly interwoven—this whole vast field was to take on a new configuration. This new configuration may, I suppose, be called "rationalism"; one might say, if one's mind is filled with ready-made concepts, that the seventeenth century marks the disappearance of the old superstitious or magical beliefs and the entry of nature, at long last, into the scientific order.[26]

At the center of the new episteme stood *mathesis*, the universal science of measurement and order, which replaced the magical ordering of the world that had structured knowledge in earlier times.[27] Despite the "capriciousness," as Gary Tomlinson has put it, of Foucault's totalizing description of Renaissance and Classical systems of knowledge, his notion of magical and rational epistemes rightfully draws our attention to the period around the year 1600 when "the order of things" did indeed seem to shudder and shift slowly through all levels of society.[28]

Here we should be clear that it was not mathematical developments per se that created the conditions for the new episteme—many areas of mathematics had achieved a state of rarefaction in the ancient world that Renaissance mathematics hardly surpassed. Rather, in ancient Greece, the speculative science of mathematics and the practical science of measurement remained distinct, whereas during the course of the sixteenth century the development of tools of measurement brought these two sciences firmly into relation with one another. In the period between the years 1250 and 1600, Western Europe experienced a "measurement" revolution that would set the stage for the mathematization of empirical knowledge to follow.[29] Daily life saw the rise of quantification as ordinary folk began to measure out their days to the chime of church clocks, merchants replaced finger reckoning with the abacus and began to employ double-entry bookkeeping, carpenters sized up the world with plumb lines and T-squares, soldiers calculated the trajectory of cannon fire, and generals deployed massive troops in geometrical formations that cast them into "the large sea of Algebra & numbers."[30] In the realm of exploration, quadrants, polyhedral

sundials, and elaborate torqueta enabled sailors to circumnavigate the globe and astronomers to map the heavens. The nature and motion of the heavens became a highly political topic in both positive and negative ways: long before Galileo suffered condemnation for his empirical verification of Copernicus's heliocentric model of the universe, his *perspicillum* (spyglass) helped him discover the moons of Jupiter, which he sagely named for the Medicis in hope of gaining Grand Duke Cosimo II de' Medici as a patron.[31] He subsequently gave the grand duke a copy of the book in which he published his discovery, the *Sidereus nuncius* (Venice, 1610), along with a telescope, gifts rewarded with the position of "Filosofo e Matematico Primario." The case of Galileo—another scientist, by the way, who dabbled in musical experiments—illustrates the politicization of science as court astronomers turned from calculating horoscopes to investigating the natural order of the universe and, implicitly, the political and religious orders modeled upon it. Galileo incurred the wrath of Aristotelian philosophers when he criticized their syllogisms based on sympathy, correspondences, and occult properties, a critique echoed by Descartes, who likewise reasoned using measure and number rather than language.[32] Nonetheless, Descartes took Galileo's condemnation in 1633 as a warning to temper his "physico-mathematical" method with a spiritual component, and he ultimately grafted a metaphysical dimension onto his natural philosophy to save it and himself from the Inquisition.[33] In sum, the measuring devices that allowed man to size up the world flooded domains of knowledge formerly comprehensible only through numerical abstraction with conflicting data. Measurement created new conditions of possibility for knowledge; indeed, it forced intellectuals into a painful empirical reevaluation of the universe.

Music, as Descartes well knew, was a traditional hinge between the magical and the mathematical.[34] Some philosophers—most notably neo-Platonists—still accepted the Pythagorean description of universal order with its basis in the ratios of musical harmony; in this musical cosmos, the spheres in which the sun, planets, and stars were fixed turned according to celestial proportions, producing a music—the music of the spheres—of untold beauty and perfection.[35] Poets paid regular lip service to cosmic harmony in court fête and lyric poetry, and magi such as Marsilio Ficino attempted to harness beneficent heavenly influxes with magical songs.[36] And of course, Johannes Kepler even attempted to measure celestial harmonies and their ratios in his *Harmonices mundi libri quinque* (1619). For some, the entire mathematical domain dealing with ratios and the proportions between them was conceptually bound to music and the method of compounding ratios developed by mathematicians using monochords.[37] Even Isaac Newton limited himself to this "musical" terminology in the first