Introduction

This book is about how a new style of listening emerged in certain corners of nineteenth-century Europe. It is concerned with how this supposed "new style of listening" relied in turn on a new kind of listener. An initial premise is innocuous enough: namely, that this listener became preoccupied with certain kinds of *detail*, with the chord, the tone, the syllable, the phoneme – in other words, with highly particular, elemental sensations. By the beginning of the next century, that preoccupation (however qualified and transformed) would be put to unforeseen uses, by turns aesthetic, philosophical, literary, and indeed ethical and political, many of which will be explored in later chapters. To be sure, *Helmholtz and the Modern Listener* aims primarily at an extended analysis of the particular situations in which this new listening *began* to appear. But in order to project some of these later retoolings in advance, let us begin with a moment when the "modern listener" I have in mind has been sketched out in an already familiar text.

Henry Higgins, Professor of Phonetics

Consider *Pygmalion* (1913), George Bernard Shaw's class-obsessed theater work – a drama of phonetics situated within just the sort of cultural environment we will be exploring. An acoustics laboratory provides the dramaturgically improbable, if thematically fitting, setting for much of the play. The space is modest but decked out with arcane paraphernalia:

> It is a room on the first floor, looking down on the street, and was meant for the drawing room … In [the] corner stands a flat writing-table, on which are a phonograph, a laryngoscope, a row of tiny organ pipes with a bellows, a set of lamp chimneys for singing flames with burners attached to a gas plug in the wall by an indiarubber tube, several tuning-forks of different sizes, a life-size image of half a human head, shewing in section the vocal organs, and a box containing a supply of wax cylinders for the phonograph.[1]

[1] George Bernard Shaw, *Pygmalion* (London: Penguin Books, 2000), p. 23.

That this workroom also serves as the drawing room of Henry Higgins, "Professor of Phonetics," is of course a function of the character's comic aspect, obstinately bringing together what was otherwise kept politely apart: an esoteric branch of experimental physics and what might be called "applied sociology" in the Eliza Doolittle case. From the privacy of his home, Higgins stages a full assault on class inequality, yet his effort is rooted in little more than *rigorous listening*, aided by an emblematic battery of instruments: a phonograph for close, repeated study of recorded voice samples, a common laryngoscope to observe live vocal cords, the popularly fascinating (if esoteric) gas flames that caused tuned pipes to "sing" delicately at various pitches, and so on.

For all its quixotic irony in the play, though, Shaw's fixation on the *aural* as a perceptual modality of critical social significance was typical for the playwright and music critic, who began his London working life at regional offices of the Edison Telephone Company, and later published one of the era's richest interpretations of Wagner's *Ring* tetralogy.[2] And indeed, Shaw's Higgins was anomalous neither in his obsession with mapping out the acoustical landscape of modern language in infinitesimal detail – witness the cottage industry of amateur and semi-professional phonetics research in England and Germany between 1850 and 1900 – nor, more intriguingly, in his broader commitment to the ameliorative effects of investment in minute sensation.[3] In fact, by 1913, heightened attentiveness to sensory marginalia came to typify an ethical and aesthetic culture Walter Pater had characterized as devoted to "getting as many pulsations as possible into the given time." Pater's high-pitched acoustical metaphor, which in another context might have attached to a cliché plaint about the dangers of sensory overstimulation, was here meant to articulate the sense that a "quickened, multiplied consciousness" could lead to an ethically affirmative "sense of

[2] George Bernard Shaw, *The Perfect Wagnerite: A Commentary on the Ring of the Niblungs* (London: G. Richards, 1898). Though his link to the Edison Company was short-lived, and less well known than that to Wagner, Shaw boasted that he was "the only person in the entire establishment who knew the current scientific explanation of telephony," and that he discharged his duties "in a manner which … laid the foundation of Mr. Edison's London reputation." Shaw, *The Irrational Knot* (New York: Brentano's, 1905), p. xi.

[3] The enthusiasm for sonic (and other sensory) detail in Victorian literary culture is explored in John M. Picker, *Victorian Soundscapes* (Oxford University Press, 2003); Gillian Beer, "Helmholtz, Tyndall, Gerard Manley Hopkins: Leaps of the Prepared Imagination," in *Open Fields: Science in Cultural Encounter* (Oxford: Clarendon Press, 1996), pp. 245–8, and "'Authentic Tidings of Invisible Things': Vision and the Invisible in the Later Nineteenth Century," in Teresa Brennan and Martin Jay, eds., *Vision in Context: Historical and Contemporary Perspectives on Sight* (London and New York: Routledge, 1996), pp. 85–98.

life" and to an avoidance of perceptual habit, which might otherwise mute one's affect, aesthetic experience, social judgment, and personal ties alike:

> In a sense it might even be said that our failure is to form habits: for, after all, habit is relative to a stereotyped world, and meantime it is only the roughness of the eye that makes any two persons, things, situations, seem alike … Not to discriminate every moment some passionate attitude in those about us, and in the very brilliancy of their gifts some tragic dividing of forces on their ways, is, on this short day of frost and sun, to sleep before evening.[4]

I adduce Pater and Shaw, otherwise so different in critical style and politics, to indicate how readily their shared aesthetic desideratum of sensory particularism was linked to ethical concerns in the period between around 1860 and 1910. Pater's exhortation to "discriminate" among others' dispositions in order to avoid stereotype funnels directly enough into Shaw's (Higgins') parodic attention to the sensory particularity of each moment of speech, and into his corollary development of mechanisms by which such sensations could be harnessed and reconfigured in order, in an idealized emancipatory gesture, to rebuild speech anew.[5] *Pygmalion*, easily read as a case of falsified identity in which its various speakers' reformed hearing helps to eradicate phonetic difference (and thus, purportedly, class difference), is perhaps better interpreted as dramatizing the *prior* observation, and indeed the very production, of such differences. Careful sundering, sorting, and gradation of phonetic elements come first; mimicry, (spurious) identification with a new social class, and the stabilization of Eliza's renovated persona come second.[6] When we first see Professor Higgins at home, his more

[4] Walter Pater, "Conclusion," to *Studies in the History of the Renaissance* (New York: Macmillan and Company, 1873), pp. 210–13. Rebecca L. Walkowitz reads this passage as a precursor to the more explicitly politicized aesthetics of Jean-Paul Sartre: "To be certain, Pater disavows the claims of social or political commitment, but he prefigures Sartre's contention that aesthetic constraints, including hierarchies of subject matter, reinforce social rigidity." Walkowitz, *Cosmopolitan Style: Modernism Beyond the Nation* (New York: Columbia University Press, 2006), p. 26.

[5] As Michael North points out, the Victorian language reform movements into which the Higgins persona was born were driven by urbanization and mass migration, which brought together languages and dialects kept largely separate before the late nineteenth century. The impulse to confront cultural difference with standardization and rationalization can be said to have provided certain forms of modernism with both their model and their antipode, and in this sense is particularly significant for the present study. See North, *The Dialect of Modernism: Race, Language, and Twentieth-Century Literature* (Oxford University Press, 1994), pp. 3–34; and Mark S. Morrisson, *The Public Face of Modernism: Little Magazines, Audiences, and Reception, 1905–1920* (Madison: University of Wisconsin Press, 2001), pp. 54–83, esp. 60ff.

[6] These questions, and above all the relationship of the "new speech" to what Shaw called a "new sort of human being," are explored in Jane Reynolds, *Pygmalion's Wordplay: The Postmodern Shaw* (Gainesville: University Press of Florida, 1999), esp. pp. 1–19.

moderated friend, Colonel Pickering, is at work with a tuning fork to help him distinguish the characteristic resonant pitches of various vowel sounds. Presently he gives up, impeded by the overwhelming obstacles of sensory unity and perceptual habit, where he is meant to cultivate sensory difference and perceptual innovation:

HIGGINS: Tired of listening to sounds?
PICKERING: Yes. It's a fearful strain. I rather fancied myself because I can pronounce twenty-four distinct vowel sounds; but your hundred and thirty beat me. I cant [*sic*] hear a bit of difference between most of them.
HIGGINS [*chuckling, and going over to the piano to eat sweets*]: Oh, that comes with practice. You hear no difference at first; but you keep on listening, and presently you find theyre [*sic*] all as different as A from B.[7]

Bluntly put, "difference" precedes "identity" in the dramatic structure of the play. In his simultaneously matter-of-fact and mystifying attunement to sensory particularity, Higgins bears the marks of what the historian of science Hans-Jörg Rheinberger supposes a characteristic behavior of modern scientific experimenters generally: contrary to conventional wisdom, they "are not interested in identities" – that is, in pinning objects down to irreducible, singular fixities once and for all – but rather "proceed in the search for 'specific differences.'" The iterative and finally "subversive" gesture through which this "production of differences" unfolds, then, is caught up in the spectacle of a dogged and highly constrained repetition that begets the New, as if from nowhere.[8]

The emergence of *newness* (as opposed to mere verification of the given) in the Higgins drawing room, otherwise so banal and "academic," is critical. More explicitly than most of their contemporaries, Pater and Shaw sketched, respectively, the starry-eyed dream of bourgeois "self-improvement" and a crude means of realizing it. That the one cast his lot with aestheticism and the other with a kind of do-it-yourself technoscience is perhaps less significant than that both envisioned producing a new kind of person through attention to sensation, in all its material, if fleeting, particularity.[9] What Georg Lukács described (a few years before *Pygmalion*) as the "Shavian new human type" rests precisely on such an "unmasking" of habit

[7] Shaw, *Pygmalion*, p. 24.
[8] Hans-Jörg Rheinberger, *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube* (Stanford University Press, 1997), p. 79.
[9] Recent scholarship has seen ample recognition of the links between scientific knowledge and Romantic and Victorian literature. In addition to Picker, *Victorian Soundscapes*, see Catherine Gallagher, *The Body Economic: Life, Death, and Sensation in Political Economy and the Victorian Novel* (Princeton: Princeton University Press, 2006); Gowan Dawson, *Darwin, Literature and*

and semblance to reveal the "brutal" reality of gesture, matter and sound. Yet this new, perhaps more pragmatic, person does not thereby forsake the aesthetic:

> A strange aura of poetry surrounds this human type … The way these characters walk conveys resolve and a sense of rhythm, and their physical appearance is made attractive by regular sport and exercise; their voices are clear and pure; altogether there is something radiant, appealing about these characters. When they come in contact with others, they appear like a shaft of light in a dark cave, or like a burst of fresh air in a stuffy room with closed windows.[10]

The fine changes in persona Lukács celebrated – tokens, in part, of a stereotyped shift from earnest Victorians to sportive Edwardians – manifest the "complex kind of training" to which Walter Benjamin famously suggested technology since around 1850 had "subjected the human sensorium."[11] Benjamin was referring to a range of everyday, highly public sites of sensation and spectacle, from big-city streetlife to machine labor to the amusement park. But there is no reason to exclude from view more private sorts of experience, such as those which Higgins practices in his drawing room, and which produce the new Eliza Doolittle, whose reformed command of dialect allows her to reject the "foolish romantic tradition that all women love to be mastered," to marry as she chooses, and thus to approximate one writer's vision of the politically emancipated New Woman emerging at the turn of the century.[12] The dream, however utopian, was that even the highly local, indeed minute, discipline of a single sensory mechanism could have far-reaching effects. For all its constitutive insularity and decontextualizing force, the modern laboratory could only be as effective as its ability to neutralize the apparent distance between itself and the outside world, and to render material changes in that world dependent on its interior functioning.[13]

Victorian Respectability (Cambridge University Press, 2007); and Noel Jackson, *Science and Sensation in British Romantic Poetry* (Cambridge University Press, 2008).

[10] Georg Lukács, "Bernard Shaw," in *The Lukács Reader*, ed. Arpad Kadarky (Oxford: Blackwell, 1995), p. 129.

[11] Walter Benjamin, "On Some Motifs in Baudelaire," trans. Harry Zohn, in *Selected Writings*, ed. Howard Eiland and Michael W. Jennings, vol. IV: *1938–1940* (Cambridge, MA: Belknap Press, 2003), p. 328.

[12] Shaw, *Pygmalion*, p. 110. This, at any rate, is what emerges in the brief prose "sequel" to the play Shaw wrote for the published edition of 1916. Of course, Shaw's conceit substantially diverges here from the 1956 Broadway adaptation, *My Fair Lady* (and its 1964 film version), in which Henry and Eliza marry.

[13] See Bruno Latour's classic essay, "Give Me a Laboratory and I Will Raise the World," in Karen Knorr-Cetina and Michael Mulkay, eds., *Science Observed* (New York: Sage Publications, 1983), pp. 141–70.

In the spirit of such aspirations, the following study is concerned with the historical emergence of a novel register of human experience, memorably dramatized in *Pygmalion*, yet now largely obscure, in its origins and particulars, to our own contemporary moment. As the family of objects – organ pipe, tuning fork, phonograph, and so on – in Higgins's laboratory would indicate, his quest after ever-more refined grades of sensory experience was ultimately rooted not just in aural practices generally, but in musical ones specifically. In the decades leading up to and including Shaw's coming of age in Victorian London, such objects were implicated in a broad effort to reform habits of hearing, from the everyday to the exclusively musical. It is true that, in comparison with the more "respectable" approaches to musical listening one might have learned in upper-middle-class concert life, many of the aural practices supported by the scientific use of the tuning fork or the organ pipe were unabashedly defamiliarizing and alienating – particularly in their compulsive insistence on attention to acoustic minutiae, as in the sort of listening that frustrates Colonel Pickering. Yet however much this listening might have disturbed the ideological self-containedness of a properly "musical" listening, it remained an offspring as much of European musical thought as of scientific culture. Much of the following study, then, will aim to show how the well-known Enlightenment and Romantic faith in music's capacity to change and better the attentive listener also operated beyond the walls of the salon, concert hall and opera house, in aural contexts less open to public view, but still formative for the "complex training" Benjamin supposed typical of bourgeois high modernity.

In short, this book narrates an episode in the history of listening, a primary source for the ambivalent scenes of sensory challenge and cultural-political adventurism familiar from Shaw's *Pygmalion*.[14] This episode occurred at a complex junction of music theory, musicology, aesthetics, the births of experimental physiology and modern psychology, the expansion of European industrialism, the heydays of German liberalism, British liberalism and colonialism, and – emerging amid these elements in a situation of ambivalence with respect to them – early glimmers of what

[14] The intellectual genre of the "history of listening" (to some extent overlapping with "sound studies") is now amply exemplified by Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham, NC: Duke University Press, 2003); Veit Erlmann, ed., *Hearing Cultures: Essays on Sound, Listening, and Modernity* (Oxford: Berg, 2004); Mark M. Smith, ed., *Hearing History: A Reader* (Athens, GA: University of Georgia Press, 2004); Peter Szendy, *Listen: A History of Our Ears*, trans. Charlotte Mandell (New York: Fordham University Press, 2007); Nikolaus Bacht, ed., *Listening: Interdisciplinary Perspectives*, special issue of *Journal of the Royal Musical Association*, vol. 135, supplement 1 (2010); and Veit Erlmann, *Reason and Resonance: A Cultural History of the Ear* (New York: Zone Books, 2010).

might be retrospectively identified as a kind of modernism. One might say, further, that this is the story of what happened when a somewhat traditional figure – the European concert listener, refined and idealized through the discourse of several prior generations of musicians, scholars, and citizens – was abruptly relocated into the foreign surroundings of the experimental laboratory. With this change of context, some elements of that traditional figure were robustly retained: beliefs in the salutary value of attention to aesthetic perception, in self-cultivation, in aspiring to a state of centeredness and self-possession. But other features of the original configuration were indelibly marked in the encounter, indeed often in ironic resistance to the very elements one tried hardest to maintain or shore up. Our narrative, then, will witness a series of increasingly overt, and thus increasingly fraught, ruptures in the status of what I will generically refer to as "aurality" – in other words, loosely analogous to "visuality," a network of experiences, practices, and discourses of hearing and the ear.[15] Such ruptures include natural science's challenge to the authority of practitioner-based musical knowledge (Chapter 1), an acknowledgment of the mechanical components in aesthetic experience (Chapter 2), the reluctant recognition of listeners' proneness to distraction and fatigue (Chapter 3), an ironic mitigation of idealized aesthetic freedom in the very act of laying down a strong position for autonomy (Chapter 4), and the simultaneous empowerments and dispossessions that accompanied new regimens of aesthetic, perceptual, and bodily discipline (Chapter 5).

Helmholtz as modern

The book's central character, who not only helped to popularize much of the gadgetry on Higgins' work-table but also, I would suggest, did more than anyone to help launch an era of what might be called "sensory criticalism," was the German scientist Hermann von Helmholtz (1821–94). Born into the Prussian *Bildungsbürgertum* (and thus middle-class by education and training rather than purely by inheritance), Helmholtz was the son of a respected German and classics teacher at the Potsdam Gymnasium. His professional

[15] For signs of how this term has passed into common scholarly parlance, see Douglas Kahn, *Noise, Water, Meat: A History of Voice, Sound, and Aurality in the Arts* (Cambridge, MA: MIT Press, 1999); Mark M. Smith, *Sensing the Past: Seeing, Hearing, Smelling, Tasting, and Touching History* (Berkeley: University of California Press, 2007), esp. pp. 41–58; and Frances Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (Berkeley: University of California Press, 2009), esp. pp. 1–17.

pathway through medicine in early adulthood, into experimental physiology as a young salaried academic, and on to theoretical physics in his later career was not what his father had envisioned, and it led to historically illuminating moments of misunderstanding between them. A generational split between the father's humanism and the son's scientism, then, while not a focus of my argument, lingers in the background. This agon was all the more pointed given that the post-1848 drift in German academic culture toward a more pragmatic orientation, marked by the rising prestige of the natural sciences, was especially pronounced in the period leading up to national unification in 1871, a period in which Helmholtz came to prominence as a scientist and as a leading spokesman for German academe.[16]

Yet because he maintained a vigorous involvement in humanist disciplines, especially music, painting, aesthetics and the philosophy of knowledge, Helmholtz was seen to occupy a unique disciplinary position bridging multiple interests within the academy. It was not uncommon for published reactions to his work to emphasize his "mastery" of both humanistic and natural scientific inquiry. This was especially true in the wake of the major music-historical event involving Helmholtz: the 1863 publication of his treatise, *Die Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik*, later translated as *On the Sensations of Tone as a Physiological Basis for the Theory of Music*. Thus, the Scottish physicist James Clerk Maxwell, grandiosely quoting Milton, declared of the book that, "by a series of daring strides," Helmholtz had "effected a passage for himself over that untrodden wild between acoustics and music – that Serbonian bog where whole armies of scientific musicians and musical men of science have sunk without filling it up."[17] In a similar vein (though alluding instead to Schelling or Hegel), the Göttingen music scholar Eduard Krüger characterized Helmholtz's project as an *Ineinsbildung* – a "uniformation," or perhaps better, a "growing into one" – of "the mathematico-physical and the physiologico-anatomical with the properly artistic science of tone," a synthesis Krüger deemed something "truly New" (*ein wahrhaft Neues*).[18]

[16] For an insightful overview of Helmholtz's place in the history of scientific culture, see Robert Brain, "Bürgerliche Intelligenz," *Studies in History and Philosophy of Science*, 26, 4 (December 1995), pp. 617–35. To date, the only full-length biography is Leo Koenigsberger, *Hermann von Helmholtz*, 3 vols. (Braunschweig: Vieweg und Sohn, 1902–3); abridged translation by Frances A. Welby (Oxford: Clarendon Press, 1906).

[17] James Clerk Maxwell, "The Rede Lecture," *Nature* (June 6, 1878), p. 163. In a similar vein, see Sedley Taylor, "Helmholtz' Tonempfindungen," *Nature* (April 13, 1871), pp. 465–6.

[18] Eduard Krüger, "H. Helmholtz, Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik," *Allgemeine musikalische Zeitung*, 1, 27 (July 1, 1863), col. 467. "Diese Ineinsbildung der mathematisch-physikalischen und der physiologisch-anatomischen mit der

The deeply problematic nature of these early assessments of Helmholtz's musical thought as discipline-transcending, even "universal," will be taken up at length later in this study (in Chapters 1 and especially 4); they do not in fact accurately capture Helmholtz's own sense of his agenda.[19] It is enough for now, though, simply to observe the sense of grandeur and even monumentality contemporaries felt on first encounter with the work, almost regardless of its actual content. As recently as 1980, Carl Dahlhaus would claim that *Die Lehre von den Tonempfindungen* was "the only work that actually proved 'epoch-making' in nineteenth-century music theory, influencing practically everyone from the philosopher pondering the problems of aesthetics to the humble musician teaching how to write chord progressions."[20] This is somewhat ironic when one observes that Helmholtz approached the discourse of music theory as a complete outsider, possessing neither professional credentials from any musical institution nor a sustained practical engagement with some active musical community.[21] Yet, at least partly because of his central role in both the early and the late writings of Hugo Riemann, who largely defined music theory as the academic discipline we have come to take for granted, it became difficult to approach speculative questions in theory without engaging the consequences of Helmholtz's work.[22] And although the concrete forms Helmholtz's "influence" took were probably even more multifarious and ambiguous than Dahlhaus indicated, he was certainly correct to remind us of the book's unique, complex and often paradoxical historical position: an enduring touchstone for both aesthetic conservatives and modernists of all disciplines; an eminently specialist work, but one of intense popular ambition; a summa of the materialist knowledge of sound, yet shot through with an

eigenthümlich künsterlichen Tonwissenschaft ist ein wahrhaft Neues zu nennen." Translations are mine except where noted.

19 Of course, the idea of Helmholtz as a "universal genius" persists today, as witnessed by the title of a collection of essays on the occasion of the centenary of Helmholtz's death: Lorenz Krüger, ed., *Universalgenie Helmholtz: Rückblick nach 100 Jahren* (Berlin: Akademie Verlag, 1994).

20 Carl Dahlhaus, *Nineteenth-Century Music*, trans. J. Bradford Robinson (Berkeley: University of California Press, 1989), pp. 192–3.

21 Helmholtz's private musical activities are not a primary focus here, but see A. E. Hui, "Instruments of Music, Instruments of Science: Hermann von Helmholtz's Musical Practices, His Classicism, and His Beethoven Sonata," *Annals of Science*, 68, 2 (April 2011), pp. 149–77; and Hui, "Sound Materialized and Music Reconciled: Hermann von Helmholtz," in *The Psychophysical Ear: Musical Experiments, Experimental Sounds, 1840–1910* (Cambridge, MA: MIT Press, forthcoming in 2012).

22 See, for example, Riemann's early essay positioning himself in relation to Helmholtz and others, "Die Natur der Harmonik," *Waldersee's Sammlung musikalischer Vorträge* 4 (1882), pp. 159–90; published in English in Benjamin Steege, "'The Nature of Harmony': A Translation and Commentary," in Edward Gollin and Alexander Rehding, eds., *The Oxford Handbook of Neo-Riemannian Studies* (Oxford University Press, 2011), pp. 55–91.

idealist's devotion to musical *Bildung* – a document, in short, whose often overlooked ambivalences and antinomies have nevertheless ensured it a wide audience and made it consistently impossible to ignore.

Indeed, it would be difficult to overstate the readiness with which Helmholtz's work has long been greeted as a sign of nineteenth-century "progress" in both scientific and musical knowledge. And, given his self-presentation as a reformist, it has remained easy for readers up to the present day (including, to some extent, Dahlhaus) to cast Helmholtz as the hero of an Ancients-versus-Moderns story, in which Science, with its technocratic accoutrements and inexorably growing institutional leverage, contributed inevitably to post-Enlightenment societal improvement. The occasional pairing of Helmholtz with Thomas Edison as pioneers of a Golden Age of media-technical modernization in the field of sound, its study, and its commercial and aesthetic deployments is symptomatic of this impulse, which often uncritically reinscribes the self-canonization of the Edison persona.[23] In characterizing Helmholtz, his work, and his legacy as "modern" – or indeed possibly modern*ist* – it should go without saying that I do not wish to add further brick and mortar to the many edifices already constructed in honor of a heroic Helmholtz, whose "modernity" would be understood as a straightforward emblem of bourgeois political and socio-economic progress. Nor, clearly, can "modernism" in this context be understood in its usual sense of a singularly aesthetic discourse divorced from other sorts of cultural practice, since we are not dealing with aesthetic production in any direct sense at all.

The perennially problematic terms "modern" and "modernism" require some comment. In an essay collection devoted to exploring the under-acknowledged impact of "modernist impulses" in the human sciences around 1900, Dorothy Ross has drawn a useful distinction between what she calls "cognitive modernism" – that is, the growing philosophical or social-theoretical emphasis on the constructedness and contingency of subjective experience after 1870 by the likes of Ernst Mach, Friedrich Nietzsche, Max Weber, Georg Simmel, and Sigmund Freud – and a more familiar "aesthetic modernism," which by turns repudiated or gradually extended beyond recognition the various Realisms and Naturalisms of mid-century art, literature, and music (which might include, for example,

[23] See, for example, John Durham Peters, "Helmholtz, Edison, and Sound History," in Lauren Rabinovitz, ed., *Memory Bytes: History, Technology, and Digital Culture* (Durham, NC: Duke University Press, 2004), pp. 177–98. Cf. Jonathan Sterne's critique of the persistent (if unintentional) canonization of Edison – and, one might add, Helmholtz – by much contemporary media studies literature, in Sterne, *The Audible Past*.