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Histories of Hearing

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Testing Hearing: The Making of Modern Aurality, edited by Viktoria Tkaczyk, Mara Mills and Alexandra Hui. New York: Oxford University Press, 2020. x + 403 pp. ISBN 9780197511121 (hard cover); 9780197511138 (paperback); 9780197511169 (ebook).

Gascia Ouzounian, *Stereophonica: Sound and Space in Science, Technology, and the Arts*. Cambridge, MA: MIT Press, 2020. xv + 231 pp. ISBN 9780262044783 (hard cover); 9780262361231 (ebook).

In January 2019, the Centre de Recherches sur les Arts et le Langage (CRAL) at L'École des Hautes Études en Sciences Sociales (EHESS) in Paris presented the conference Sound and Music in the Prism of Sound Studies.[1] A spectacular video announces the event: a heavy-metal band screams about the conference's themes and cries out each speaker's name, which is in turn spelt out on screen in gothic-bloody font. The band's song lyrics note that the focus of sound studies is on topics such as soundscape, noise, silence, recording techniques and listening. Most critically, the band shouts: 'These are issues that musicology has been dealing with for a long time. What is then the place of musicology in the wake of sound studies?'

When academics pose such questions about the interrelations between emerging, established or even 'imperialist' disciplines, the tone of discussion – whether with or without ironic undertones – may be fiercely heated. After all, issues of institutional affiliation and scholarly authority and legitimacy, as well as careers, are at stake. With each interpretation of the field of sound studies, such as Jonathan Sterne's elegant definition of it as 'the interdisciplinary ferment in the human sciences that takes sound as its analytical point of departure or arrival',[2] discussions about who belongs to the field and who has jurisdiction over it are almost inevitable. However, when we actually centre our focus on the theories, research questions and methods relating to what sound means for the study and understanding of music (or vice versa), as the participants at the CRAL/EHESS conference did so wonderfully well, such issues of disciplinary competition seem to dissolve into thin air.

My observation about scholarly connectivity should not be taken to mean that it makes no sense to consider how different strands of music and sound scholarship speak to each other.

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[1] 24–26 January 2019; see <https://www.mediateletipos.net/archives/41637> (accessed 17 November 2021).

[2] Jonathan Sterne, 'Sonic Imaginations', *The Sound Studies Reader*, ed. Sterne (London and New York: Routledge, 2012), 1–18 (p. 2).

Such a consideration should start, however, with acknowledging that it is only when applying for research fellowships, grants or tenure-track or tenured positions that many scholars working in the humanities and qualitative social sciences feel the need to identify with one or more specific disciplines. In practice, they converge on questions that are similar in kind – sharing a literacy in particular pockets of interconnected and overlapping scholarly traditions, and valuing comparable styles of research and writing, argumentation and substantiation. As I shall illustrate, this shared literacy is a key starting point for implementing sound studies as spelled out by Sterne in the sentence following his definition above: 'By analyzing both sonic practices and the discourses and institutions that describe them, [sound studies] redescribes what sound does in the human world, and what humans do in the sonic world.'[3] The extent to which work in sound studies can present genuine – and therefore productive – *re*descriptions is, in my view, highly dependent on how authors frame their research in terms of the literatures they enrol, thus opening up, integrating or bypassing particular strands of research.

A great occasion for thinking about the redescriptions of sonic worlds has been provided by the publication in 2020 of two books that set out to understand the construction of aurality in the modern era. The books are *Testing Hearing: The Making of Modern Aurality*, edited by Viktoria Tkaczyk, Mara Mills and Alexandra Hui, and Gascia Ouzounian's *Stereophonica: Sound and Space in Science, Technology, and the Arts.* Temporally, while Tkaczyk, Mills and Hui's edited collection traces the making of aurality between 1870 and the present day, Ouzounian's monograph covers a broader timespan by starting in the early nineteenth century. Conceptually, Tkaczyk and her co-editors use 'testing', both '*of* hearing and *with* hearing' (p. 2), as the lens through which to study the rendering of sound and hearing. Ouzounian discusses many past demonstrations of audio technologies – a particular form of testing – to show how such demonstrations staged sound as *spatial* and what this spatiality meant for music, sound art and sound mapping. In her view, spatiality is a defining dimension of sound and hearing: the notion of 'stereophonica' in fact refers not so much to two-channel or multichannel sound, but to the understanding of acoustic phenomena as spatial. Geographically, the two books overlap. They are concerned with the Global North, but they both also take a few steps beyond it to examine (in *Testing Hearing*) Taiwan, Murray Island in Australia and the Marshall Islands in the central Pacific Ocean, and (in *Stereophonica*) Beirut. Both books show awareness of how coloniality and postcoloniality have affected notions of hearing *within* the Global North, an awareness for which Gavin Steingo and Jim Sykes have recently called.[4]

The two volumes share further similarities. In terms of theory, neither of them takes the ontological turn seen in recent sound studies – a turn discussed as well as criticized by Brian Kane.[5] Instead, *Testing Hearing* explores 'the co-creation of epistemic and auditory cultures – indeed, the creation of modern aurality' (p. 2); it therefore considers aurality as a culture that constitutes sound, hearing and listening, rather than as an unchanging ontology of perception. Similarly, *Stereophonica* examines 'three recurrent figures of acoustic spatiality' – propagation, reflection and projection – and considers how these figures emerged 'at the intersection of historically situated scientific, technological, philosophical and musical cultures' (p. 3). Ouzounian does so in order to understand the practices and discourses 'that give form and

[3] Sterne, 'Sonic Imaginations', 2.
[4] Gavin Steingo and Jim Sykes, 'Introduction: Remapping Sound Studies in the Global South', *Remapping Sound Studies*, ed. Steingo and Sykes (Durham, NC: Duke University Press, 2019), 1–36.
[5] Brian Kane, 'Sound Studies without Auditory Culture: A Critique of the Ontological Turn', *Sound Studies: An Interdisciplinary Journal*, 1 (2015), 2–21.

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sense to those relationships today' (p. 3). The historicity of sound and hearing is key. Both books are also interdisciplinary in orientation, finding inspiration in a wide range of fields, but specifically referring to and showing a solid understanding of science and technology on every other page. Finally, in terms of the practices studied, both books move beyond audio technologies and the instruments of science. Instead, they refer to the practices of music and/or sound arts in almost every chapter.

I shall evaluate the books in terms of their own substantial and theoretical ambitions, before I discuss the themes that I consider most insightful. *Testing Hearing* has a thematic architecture, with sections focusing on the history of tests that screened human hearers 'out' and 'in' (more on this below); on listening exercises that put musical instruments, devices and theories to the test; on forms of testing meant to facilitate control of sound and assess space; and on testing of hearing beyond human auditory perception. This structure greatly helps readers to find their way through the book. Each chapter discusses a well-researched intervention in testing hearing, showing how epistemic cultures in the academic, corporate or military settings in which such testing materialized have drawn on and, in turn, shaped auditory practices – and often with far-reaching consequences for Global North societies *made of* sound and hearing in the long twentieth century.

For example, in a world filled with advertisements for hearing tests and hearing aids, Mara Mills's chapter on the audiogram is highly welcome. Mills shows how, in the USA, the audiogram had moved by the 1920s from presenting results of standardized mass testing of hearing with pure tones to testing hearing with phonographic speech samples – syllables or words. Her chapter, however, is not simply an account of how the construction and increasing use of such a speech-centred audiogram contributed to define 'normal' hearing – that is, the kind of hearing considered necessary for people to participate properly in communication in school, the military and the workplace. What makes her chapter particularly insightful is that she shows how audiometry used ideas about quality testing from the telephone industry, which was designed not only to identify things below a particular quality standard (screening 'out'), but also to find out which of these might still be 'repairable' (screening 'in'). Examining how testing with phonographic speech samples was rooted in intelligibility standards in narrowband telephony, Mills shows how screening was transposed from corporate to medical settings. Rather than merely indicating who can *not* be admitted into the army or other settings, medical screening also provided options for rehabilitation. Medical screening increasingly distinguished between the hard of hearing and the deaf, between those in need of a hearing aid and those in need of special schools. It is this kind of insight in Mills's work that opens up seemingly self-evident aspects of known practices around sound and hearing that makes *Testing Hearing* so valuable.

Testing Hearing is also exemplary in its involvement of two experts in testing in the sciences, Hans-Jörg Rheinberger and Trevor Pinch, who offer supplementary commentaries on the collection's chapters from, respectively, the perspective of the history of science and that of science and technology studies (STS). Both Rheinberger and Pinch identify new threads in the book. Tkaczyk, Mills and Hui distinguish between testing as witnessing an event and testing as putting something to the test; crucially, putting to the test – such as, for instance, screening in and out – has gained societal significance over time. Rheinberger suggests another typology by distinguishing between an exploratory testing, which is 'oriented toward roaming and thus aperture' and expressing an 'epistemic attitude', and another type, which is 'oriented toward containing and closure' and marking a 'technical' attitude (p. 352). Interestingly, the varieties between exploratory testing and testing as demonstration help to situate a testing narrative

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by Alexander Rehding on Friedrich Wilhem Opelt's nineteenth-century polyphonic siren. The story is hard to classify in terms of the two definitions of testing presented in the Introduction to *Testing Hearing*, but is much easier to position and understand in terms of Rheinberger's scale. The siren designed by Opelt had a densely punched cardboard disk that could sound up to 'four-voiced chords' and was aimed at demonstrating a new music theory of correlations between rhythmic patterns, intervals and pitch (p. 142). To Rheinberger, Opelt's work is an example of probing, as the siren 'probes the limits of human hearing' (p. 353). Drawing on Rheinberger's continuum between testing aimed at aperture and closure, such probing can be reinterpreted as an exploratory activity with the expectation of reaching closure.

Pinch, in turn, defines the purpose of testing as being to provide 'a framework whereby things can be compared to the same standard' (p. 360), and underlines that the tacit knowledge about testing instruments consistently leads to questions about the testing process itself. Capturing what testing is about also affords critical thinking about its alternatives, Pinch contends. This claim helps him to situate another hard-to-classify case study from Benjamin Steege's chapter on Herbert Eimert's electronic music composition *Epitaph für Aikichi Kuboyama* (Kuboyama being the earliest victim of nuclear testing on the Marshall Islands) as such an alternative to established approaches to testing. Steege sophisticatedly discusses the philosopher Günther Anders's appeal to articulate an 'affective language of horror', for instance in musical experiments, to undo our 'illiteracy of fear' (p. 335) of the violence of unchecked science and technology. He then unravels how Eimert aesthetically enacts both this fear and hope for a better future. As a scholarly strategy, inviting essays such as those by Pinch and Rheinberger extends the collective nature of the edited volume, while generously granting external authors what is usually the prerogative of the single-authored monograph: presenting the materials brought together under one's own headings. These 'Afterwords' essays are additionally important because they elucidate, after the fact, why Tkaczyk, Mills and Hui were capable of phrasing their project in the way they did. Without deep knowledge of the history of testing combined with their mutual interests and literacy in sound, the editors could not have come up with the idea of examining testing as constitutive of the history of modern 'aurality' in the first place.

Stereophonics is, at first sight, episodic in its architecture. When browsing through the section titles of the book's first chapters, the reader meets an impressive range of experimental instruments and setups – the differential stethoscope, the rotating chair and the acoustic goniometer to mention just a few – before Ouzounian discusses what these meant for spatiality in art. Yet behind it is a wonderfully narrated and highly compelling argument that excavates for each instrument and sonic experiment what it was that it crucially contributed to the modern conception of spatial sound. The mid-nineteenth-century differential stethoscope, for instance, built by the British physician Somerville Scot Alison, had hearing pieces for both ears, and was thus binaural, but also had two 'sound collectors'. This not only enabled physicians to listen to two spots on the body at the same moment, but also opened up the conception of sound as having different components, as being channelled and as having tactility. The rotating chair, an experimental setup used at the Harvard Psychological Laboratory by the American psycho-physicist Arthur Henry Pierce at the end of the nineteenth century, situated listeners at the centre of a construction that could position telephone receivers flexibly in the space around the listener. By emitting sounds at different locations, it could map directional hearing and permit a conceptualization of the phenomenon of hearing *inside* the listener's head, a new auditory space. The acoustic goniometer was one of many mobile and increasingly complex sound locators built for the military to locate enemy aircraft during the First World War. The bigger

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the instruments became, with multiple and larger horns, the more extensive were the teams of listeners required and the more fragmented the listening became. In Ouzounian's analysis, these instruments concretized how sound travels, and prefigured machine listening.

Those familiar with sound studies literature will know many such instruments, but Ouzounian brings them together with a truly synthesizing strength and often with an analytical novelty (as testified by her observations on the rotating chair and the sound locators in particular). Her argument elegantly unravels the steps leading up to our modern understanding of spatial sound without being finalistic, presenting the technologies discussed with great clarity and with an ear for appealing stories. All these result in a book with an impressive density of relevant insights, discussed at a remarkably quick tempo. The lavish number of illustrations helps the reader visually to witness the experiments and to follow the author in her many transitions between settings.

Both books have a great deal to offer to musicologists (be they historical musicologists, organologists, ethnomusicologists, radical musicologists or even music theorists) as well as to musicians interested in the archaeology of their own identities. For those interested in excavating their professional identity, for instance, Tkaczyk's own chapter in *Testing Hearing* shows how nineteenth-century psychophysiological tests on musical abilities underpin tests that are still in use to determine musical listening capacities for conservatory music students today. While Joshua Navon has recently shown how nineteenth-century conservatory pedagogy in Leipzig allowed a focus on *Werktreue* by distinguishing between *Technik* and *Vortrag* (the former being invisibly in service of the essence of key compositions),[6] Tkaczyk captures the rise of the 'cultivated ear' (pp. 50, 52) that students supposedly needed for such devotion. She traces how Salomon Otto Abraham, a Berlin-based physician and physicist, developed a survey on 'absolute tone consciousness' (p. 49) in the early twentieth century. Crucially, Abraham drew on work by the physiologist William Thierry Preyer, the musicologist Alexander J. Ellis and the music theorist and educator Hugo Riemann, who were uninterested in the putatively inherited ability of absolute pitch. Rather, they approached it as 'a sense of subtle distinctions that was not innate, but the outcome of musical and linguistic cultural practices and standards' (p. 53). This shift away from an innate hearing capacity and towards a development of listening skills that were trainable and memorizable fed into the tests still in practice in present-day conservatory admission procedures.

While Abraham and his collaborator Erich von Hornborstel showed cultural sensitivity in acknowledging that Western music notational systems failed to capture the rich microtonality and rhythm of non-Western musics, early practitioners of audiometry were generally more conservative in their approach. Nevertheless, for ethnomusicology, Sebastian Klotz's chapter in *Testing Hearing* shows how this conservatism ran ashore at times. While turn-of-the-century scientists assumed that intelligence and hearing acuity were connected, they could not substantiate their claim by testing the hearing of the 'primitive' people on Murray Island, whom they had believed to have inferior intelligence in comparison with the inhabitants of Aberdeenshire.

Both Tkaczyk, Mills and Hui's volume and Ouzounian's monograph speak to organology. In *Testing Hearing*, Emily Dolan's subtly humorous chapter on the comparative testing of violins should be compulsory reading at any conservatory. Dolan traces the history of tests that compare the sound of expensive violins built by renowned seventeenth-century luthiers such as

[6] Joshua Navon, 'Pedagogies of Performance: The Leipzig Conservatory and the Production of *Werktreue*', *Journal of Musicology*, 37 (2020), 63–93.

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Stradivarius with the sound of violins made by present-day makers. None of the usual science-centred double-blind tests has actually declared the antique violins as winners. In fact, modern violins have consistently emerged as the better-sounding and more playable instruments. Instead of choosing sides or trying to explain this perhaps unexpected outcome, Dolan does something else: she points out how efforts invested in testing the instruments by the scientists involved – whose high status as authoritative experts could only benefit from putting exquisite instruments to the test – have contributed to the existing status of the old violins. Dolan's conclusion thus enables us to understand how, paradoxically, such tests do not actually harm the acclaimed superiority of the old violins. Instead, the tests contribute to the formation of what Dolan calls 'mendacious technology' (pp. 124–5). Mendacious technologies, such as the musical instruments discussed, embody forms of storytelling that keep the myth of this putative perfection intact.

Sterne does not present his *Testing Hearing* chapter on software for modelling analogue signal processing in music devices as a contribution to organology. Yet if we follow John Tresh and Emily Dolan's plea for a 'new organology' that has an eye for the historical moments in which science and music converge or depart, and for the material and social configurations in which musical instruments acquire the ethics projected onto them,[7] Sterne's analysis would fit into new organology perfectly well. Sterne examines the digital modelling and the skeuomorphic (that is, employing the non-functional mimicking of appearance) design of analogue spring reverb devices and electric guitar amplifiers, showing how users interact with these digitally enacted amplifiers. When producers test whether the signal processing in digital models is indeed capable of reproducing the timbres and unpredictable sonic derailments of analogue devices and instruments, the 'software passes the test when the user fails it' (p. 179) – that is, when participants in the experiment are unable to hear the difference between the analogue original and its digital counterpart. The modelling process itself is, however, impossible without (re)defining what is inside and outside the original analogue device, or what is essential to the sound and operation of the device. While time-invariant convolution of sound in signal processing and planned randomization of the convolution may capture analogue timbre and unpredictability, the modelling pushes the embodied experience of playing an amplified guitar in a room to the periphery of what analogue 'is'.

Both books are important to historical musicology, notably for understanding the shifting standards of reproducing and evaluating three-dimensional (3D) sounds. Ouzounian's amusing sections on Oscar, a mannequin with microphonic ears developed by Bell Telephone Labs, is particularly revealing in this respect. As a top attraction at the Chicago World's Fair of 1933, Oscar was made to demonstrate that it was possible to share both sound and the experience of binaural listening itself by electroacoustic means. Oscar was a kind of mechanical sound-locating operator that allowed anyone interested to listen to his listening in real time. Interestingly, the Oscar Show was only the first of many such demonstrations and experiments. Indeed, Stefan Krebs investigates in *Testing Hearing* how in Germany between the 1950s and the 1980s, dummy-head systems (that is, 'artificial hearing testees' (p. 14)) were used for recording binaural listening aimed at improving the acoustics of concert halls and for broadcasting in 3D sound. Ouzounian furthermore describes a 1933 show where the audience expected a concert with Leopold Stokowski conducting the Philadelphia Orchestra in Washington DC. The audience members heard an orchestra, yet with the stage curtains

[7] John Tresh and Emily I. Dolan, 'Toward a New Organology: Instruments of Music and Science', *Osiris*, 28 (2013), 278–98.

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'accidentally' remaining closed. It was only when the music had stopped and the theatre staff had lifted the curtains to reveal no musicians but only loudspeakers onstage that people realized they had just listened to a stunning 'acoustic facsimile' of the orchestra (p. 73). Such experiments embodied new ideals of acoustic modernity (of sound-as-signal, clear and efficient), as Ouzounian concludes in line with Emily Thompson's *The Soundscape of Modernity.*[8] It also marked the start of an era with new acoustic productions for the masses, and the beginning of the stereo boom.

Ouzounian's discussion about the use of tape recorders and multiple loudspeaker systems in electroacoustic compositions by Schaeffer and Varèse, and about the conceptual sound art of the Fluxus artists, retreads established scholarly ground for musicologists. New and stimulating, however, are her analyses of sound art installations, listening walks and sound sculptures by Max Neuhaus, Andra McCartney, Bernhard Leitner, Heidi Fast, Rebecca Belmore and Nathalie Harb, as well as sound-mapping initiatives organized by (more broadly) acousticians, members of noise-abating committees and sound artists. Given that space is created by listeners' engagement with it, Ouzounian's analyses of these new developments show how such sonic interventions intend to change generic space into localized place, to find listeners rather than concert visitors, to trigger collective identity, to bring in the marginalized voices of First Nation communities, to inspire a new type of civic duty that values the unique acoustic ecologies of urban environments, and to offer acoustic refuge for the underprivileged. Ouzounian's writing, in fact, bears a critical message for music theory: the field should take the spatial qualities of music much more seriously as subjects of analysis than it has done so far. In addition to its consideration of musical properties such as harmony, rhythm and counterpoint, the field should develop a new language and notation for what sound art and sound-art installations do.

Finally, the field of what might be called radical musicology will find inspiration not only in the many examples of sonic destabilizations just listed, but also in both books' chapters that show how widely sound and music have been deployed as tools for emotional and political control. An example given by Ouzounian is the early twentieth-century attempt to manipulate industrial workers' productivity through music. Still today, as several excellent chapters in *Testing Hearing* show, sound is being repacked and monitored to intervene in urban life. This occurs in the control of insect pests by exploiting the limits of human and animal sound perception (Joeri Bruyninckx); in the 'civilization' of populations by tying them to the state through street-noise monitoring in Taiwan (Jennifer Hsieh); and in the protection of marine life from negatively interfering sound through sound surveillance systems (Lino Camprubi and Alexandra Hui).

All of this work identifies the politics of sound that affected the world of and beyond music. The histories of hearing as explored in *Testing Hearing* and *Stereophonica* also clarify how many sonic interventions depended deeply on music theories, musical instruments and musical practices. They show how psychophysical traditions of research – often involving musical instruments – have informed listening tests that subsequently governed access to conservatories or other settings. They enlighten how research in binaural hearing redefined music production; show how digital modelling of analogue timbre resets what it is to listen to sound colour; and illustrate how new technology-infused aesthetics come with alternative ethics. The books, therefore, perhaps unintentionally, also facilitate new dialogues between historically and anthropologically informed branches of musicology on the one hand and music theory and analysis on the other. In-depth knowledge of the *contextualized* science and technology histories

[8] Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics, 1900–1933* (Cambridge, MA: MIT Press, 2002).

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behind electronic and digital music may open up new ways of doing music theory, for instance, by informing it on dimensions of timbre and spatiality that have remained under-researched in musicology. After all, an ear for propagation, reflection and projection follows sound in its trajectory *through* space.

Both books' narratives are so convincing and insightful because they are rooted in long-standing *interdisciplinary* traditions of research in studies of science and technology, urban studies, music and musicology, and because they draw on rigorous research in archives that have been *made* relevant through a focus on sound and hearing. The authors of these two books do not reinvent the wheel, but are able to ask new questions about sound and hearing because they can comfortably navigate claims and approaches at the intersections of fields of which they have intimate knowledge. They remind us of Sterne's take on sound studies: to *redescribe* what sound does in the human world, and what humans do in the sonic world. It is through such genuine redescriptions that these studies can be of value for music and musicology. In his recent *Sensory History Manifesto*, Mark M. Smith claims that sensory history, especially the history of sound, should no longer just welcome each new study in the field, but should more critically scrutinize what these histories have to offer.[9] Redescriptions such as those offered in *Stereophonica* and *Testing Hearing* are what we need.

To respond to the heavy-metal song about the place of musicology in the wake of sound studies, I would like to say this: certainly sound studies includes at times the examination of issues with which musicology has been dealing for some time, yet work in the field of sound studies is worth reading only if it truly redescribes what sound does to the human world and vice versa. These redescriptions usually start with new questions that in turn often draw on a solid literacy in a careful selection of fields that speak to each other. Musicology is one of these fields. Let us hope for new YouTube videos that turn academic debates into music. *Testing Hearing* and *Stereophonica* deserve it.

[9] Mark M. Smith, *A Sensory History Manifesto* (University Park, PA: Pennsylvania State University Press, 2021).

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