



universal application, the very idea of standard pitch itself was (and continues to be) limited by a particular elite idea of Western musical canons.

Ultimately, *Tuning the World* reveals the intricate interconnectedness of science, music and globalization in the making of a fragile transnational sonic modernity, while offering, in a highly nuanced way, insight into its very limits. As such, this book should appeal to historians and students of scientific diplomacy and standardization, as well as those interested in the intersection of music and science, and the history of music and acoustics in particular.

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Victoria Tkaczyk, *Thinking with Sound: A New Program in the Sciences and Humanities around 1900*

Chicago: The University of Chicago Press, 2023. Pp. 304. ISBN 978-0-226-82328-7. \$55.00 (cloth).

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In *Thinking with Sound*, Victoria Tkaczyk takes us on an exciting journey through the intellectual reception of auditory neuroscience from 1860 to 1930. By examining the ‘political conditions, material infrastructures, and epistemologies’ (p. 3) of various newly emerging scientific disciplines in and around Paris, Geneva, Vienna, Prague and Berlin, Tkaczyk shows how the identification of the auditory cortex in 1860s neuroanatomy inspired many scholars across the sciences and humanities to create concepts of auditory cognition and to position auditory cognition at the core of their epistemologies, leading to new and challenging ways to think with sound. The book sensibly correlates the rise of neuroanatomy around 1900 with the increased interest of scholars and scientists in ‘what humans hear when listening to themselves’ (p. 2).

Divided into five chapters, the book explores divergent, discipline-specific ways of thinking with sound, each chapter highlighting how these different ways also ‘discipline’ auditory cognition itself. First, Tkaczyk focuses on ‘thinking with sound’ in neuropathology and psychoanalysis, tracing the genesis of Sigmund Freud’s ‘talking cure’. Inspired by the French neuropathologist Jean-Marie Charcot and his disciple Gilbert Ballet, Freud built his psychoanalysis around the assumption that verbal images make internal thought processes audible and thus ‘the unconscious both results from cognitive language processing and intervenes in the constitution of verbal images’ (p. 37). Relating his concept to the switchboard of a telephone operator, Freud described the dynamic between ego, superego and the unconscious as a triad of interior audio communication. If this triad is pathologically disturbed due to suppressed traumatic experiences, it can be turned inside out by means of the ‘talking cure’ to make the unconscious speak. Hence Freud’s theory of the psyche, as well as his psychoanalytic practice, is closely related to his interest in inner speech and (mis)translations of verbal images, as Tkaczyk emphasizes.

Verbal images and auditory thinking are also at the core of Ferdinand de Saussure’s linguistics and Henri Bergson’s metaphysics, as the next chapter illustrates. Here,

Tkaczyk argues that Saussure's theory of signs also borrows from Charcot's and Ballet's (as well as Victor Egger's) notion of the acoustic image. After reading Egger's *La parole intérieure* (1881), Saussure developed his concept of language as a system of acoustic oppositions, in which auditory images are psychic pendants to the material unit of the phoneme. Thinking with sound and psychological and neuroanatomical theories of interior speech thus also inform and structure Saussure's influential concept of linguistic signs. Bergson, on the other hand, used the concept of auditory images to argue for the independence of the human spirit from the material world and physical perception. According to him, acoustic perception serves as an interface between the physical and metaphysical. Auditory images therefore arise from the interaction of physical and mental activities and are essentially a product of the mind, which 'combines the numerous sounds that are materially perceived and assembles abstract auditory images out of them' (p. 85). Ballet, Freud, Saussure and Bergson thus all worked with neurophysiological findings on the acoustic image to inform their own research and develop distinct, discipline-specific epistemologies.

After tracing the reception of scientific research on the brain's auditory cortex around 1900 in psychoanalysis, linguistics and metaphysics, in the next chapter Tkaczyk examines its impact on physics, material sciences and architecture, following the sound experiments of Ernst Mach and Siegfried Exner. Both merged physics, psychology and psychoacoustics, and investigated acoustic phenomena as well as auditory perception by applying empirical acoustic research. However, whereas for Mach acoustic data had to be obtained, compared and interpreted through the physicist's body, Exner distrusted sensory judgement and preferred using machines to hear for him, replacing Mach's sense-based epistemology with mechanical objectivity.

The last two chapters cover the impact of auditory cognition research on theories of aesthetic perception and programmes for speech therapy and language education. According to Tkaczyk, research on auditory cognition inspired new ways of analysing aesthetic perception, especially experiments on involuntary micromotions and muscle feelings. The philosopher and psychologist Carl Stumpf, for example, examined physical micro-movements that apparently occur alongside musical practices such as singing or listening to music and hypothesized that laryngeal sensations are probably tied to specific musical cultures. Stumpf's research on aesthetic experience and motor perception influenced many subsequent studies on perfect pitch and testing musicality (for instance in the experiments of Otto Abraham). Even today covert laryngeal activities are measured to investigate musicality, revealing 'striking similarities with the questions, technologies, and methods applied a century ago' (p. 169).

Lastly, Tkaczyk highlights how the scientific insights into auditory perception and language processing that were gained from the discovery of the auditory cortex in the 1860s also informed political agendas in Germany around 1900 that regarded speech training as an instrument of language policy and planning. This is most evident in the work of Hermann Gutzmann, who developed a special speech-training programme to cure language disorders called 'neurological gymnastics', which aimed to alter certain language pathways in the brain. However, even though Gutzmann's method might have helped to heal speech disorders, it also established and standardized techniques of speaking.

Over the course of the book Tkaczyk conclusively demonstrates that, in the period around 1900, thinking with sound became 'key to the development of a rich diversity of sonic epistemologies' (p. 212) across the sciences and humanities, and, moreover, that concepts of auditory cognition promoted the emergence of interdisciplinary networks. Most impressively, Tkaczyk is able to reveal how the formation of this knowledge is closely intertwined with certain sound technologies (especially the phonograph) and

the development of sonic skills. *Thinking with Sound* is an important and worthwhile contribution to the study of sonic epistemologies of the twentieth century.

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Omar W. Nasim, *The Astronomer's Chair: A Visual and Cultural History*

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Based on images of seated astronomers and their seating furniture, Nasim tells an interdisciplinary story about the understanding of Western science and scientific labour in the nineteenth century, revealing the cultural interplay of bourgeois notions of comfort, the ideal of heroic energies in science and the prevailing view of the history of humanity and civilization. The astronomer's observing chair as an object and image, Nasim argues, should not be understood as a representation of 'armchair science' but as a cultural artefact within a broader self-image of science that comfortably bundles the supposedly abundant and restless energies of the observer, thus guaranteeing optimal observational output. These very energies drove the modern world, empire and science and shaped the design of astronomical chairs. Nasim thus uses the example of the mechanized observing chair to show relationships between specialized chair design, bourgeois postures and epistemology.

Nasim, whose previous work has dealt with forms of representation in astronomy, especially photography and drawing as astronomical practice, combines history of science and of design, as well as material and art history, in an exciting interdisciplinary approach by placing the astronomical observation chair at the centre of his analysis, both as an image and as an object, following W.J.T. Mitchell's approach. In his exploration of the 'representational field shared by both image and object' (p. 16) of the chair, Nasim dissects the visual, epistemic and moral economies of (the representation of) chairs and the seated. Contrasting the Western astronomer working on chairs with the European phantasm of the 'Oriental' astronomer sitting cross-legged, he sharpens the self-image of the allegedly superior occidental science analysed and thus places the chair as an artefact in global and imperial contexts. Nasim dissects themes of comfort, historicism and the Oriental and Western energies and their influences, which build on each other in the individual chapters of the book, ultimately bringing them together in a broad overall picture.

The book starts with a brief overview of representations of astronomers seated since the Middle Ages, moving to a general association of chairs with prestige and hierarchies. In Chapter 2, 'Home, hierarchy, history', Nasim shows how chairs and postures in general conveyed aesthetic, social and moral orders regarding gender and ideas of civilization by discussing the basic moral economies in which the (observing) chairs are to be understood. Introducing the notion of a new and bourgeois sense of comfort in the nineteenth century, the chapter explains how chairs and their associated postures were informed by norms of behaviour of European middle classes, linking (specialized) design not only with