philosophy of scientific practice that is naturally in dialogue with history through a common emphasis on skills, performance, abilities, activities and the cultural and social contexts in which interpretive sense-making unfolds. Exploring the trading zones between aesthetics and philosophy of science is thus a strategic entry point to building a new space where practices can genuinely feed into analytical and conceptual categories. And it is precisely in this way that *The Aesthetics of Science* takes the form of a collective act of resistance, setting a standard for what all edited collections should be: by taking philosophers of science outside their comfort zone, the volume reclaims – and puts to work – the time and space we need to engage in that very aesthetic experience of thinking about the multiple roles of aesthetics in science.

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Fanny Gribenski, *Tuning the World: The Rise of 440 Hertz in Music, Science, and Politics, 1859–1955*

Chicago: University of Chicago Press, 2023. Pp. 280. ISBN 978-0-226-82326-3. $55.00 (cloth).

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Fanny Gribenski asks what happens when standardization efforts move beyond tangible materials, technologies or infrastructures to an object that is notoriously intangible. Musical pitch, more than an object, is in fact a product of tuning practices and long-standing musical traditions, saturated with aesthetic judgement and valuation. Combining perspectives from musicology, history of science and transnational history, Gribenski investigates a fascinating *longue durée* of musical pitch standardization. Over a century-long period that ranges from the Second French Empire to after the Second World War, she expertly traces how standard pitch (the tuning calibration for A above middle C) shifted from A435 to (the now-standard) A440 vibrations. Although this may be a negligible difference in terms of hearing, this shift (and its aftermath) was fraught with cultural tension in an increasingly interconnected world.

Readers in history of science and technology may well be familiar with the tensions that often characterize standardization processes; universalizing aspirations frequently meet with material indifference, social and political resistance and innumerable logistical complexity. As Gribenski shows, such tensions were greatly amplified in this case, if only because the subject of musical pitch introduced a fascinating new cast of actors – cabinet members, composers, conductors, performers, instrument craftsmen and radio broadcasters – with whom scientists or engineers shared authority and expertise or forged practical alliances. *Tuning the World* shows the diplomacy of national and international standard-setting to be a product of a remarkably stable set of concerns, such as singers' health, the preservation of artistic heritage, industrial interests and global cultural exchange (or dominance). But at the same time, attending to these interlocking interests in fine detail, the book traces the changing networks and influences that established such standards, as the initiative to standardize shifted from France to Germany and the United

States, and from representatives in the worlds of arts and craftsmanship to professionalized and internationally organized (electro-)acousticians.

In the first chapter, Gribenski examines the creation of the *diapason normal* – the French government's name for a new standard determined by the human vocal range – in 1850s Paris, as acousticians, musicians and instrument-makers lobbied to unify the variety of pitches in use at the time. The effort was motivated by concerns that musicians' tuning for ever-higher pitches (and thus more brilliant tone colour) posed a threat both to singers' health and to the consistency of traditional musical heritage. The chapter traces how the *diapason* thus served to perpetuate that tradition, with the support of the French government. But it also shows how, even in centralized France, enforcing this standard came at significant financial cost and labour: instruments had to be replaced at scale, testing practices organized, musicians convinced.

The second chapter traces how nationalist and imperialist forces shaped the dissemination of the French standard in the second half of the nineteenth century, on an international stage shared with Britain and Austria, among others. Whereas some European powers conceived of the standard as an instrument for economic exchange, others sought political integration. The French standard paralleled an imperial ambition to unify cultural practices at home and in the colonies. But Gribenski also shows such sonic uniformity to be vulnerable to a range of environmental conditions, nationalist counterstandards or local resistances, away from the imperial centres.

The third chapter, moreover, shows how the *diapason normal* was thwarted internationally by the empowerment of the United States, which initiated a *re*tuning of the 'world' – to A440 – after the First World War. American instrument-makers and musicians had initially tuned to the European pitch to facilitate transatlantic exchange and commerce. But as American cultural self-awareness grew along with its entertainment industry, the vector of transatlantic exchange shifted back with a competing standard that was based on a different set of assumptions, about music and the acoustical justifications for proper standard pitch.

In the fourth and stand-out chapter, Gribenski continues this thread to explain how, in the interwar years, the American A440 pitch standard came to be embraced as a means of cultural and technical integration in Europe. The chapter documents how such integration thrived in the medium of radio broadcasting. Showing how professional networks of acousticians and sound engineers, standard agencies and broadcasters formed around the standardization of broadcasting, it offers a fascinating case study in the diplomacy of scientific and technological internationalism. These actors promoted musical pitch as a harbinger of transnational community and peace – even after the war broke out – and used broadcasting technologies as a means to promote the standard's implementation in both Europe and the United States.

Chapter 5, finally, traces how the international consensus that was reached before the Second World War did not necessarily lead to a single unified pitch. While new electroacoustic technologies, international efforts to shore up support for standards by agencies such as the ISO, and the emergence of psycho-acoustic specialisms turned concert pitch into an object of sustained scientific and industrial precision, ongoing divisions nevertheless persisted among musical professionals on the uniform suitability of A440 and the plurality of pitch that this suggests.

This last chapter, in particular, highlights the challenges that Gribenski has had to grapple with. For the same intangibility of standard pitch that complicated standardization also confronts the historian. Standards, when effective, are meant to recede in the background as common practice, and are made particularly visible through failure or negotiation. But *Tuning the World* convincingly shows the limited scope of this hegemonic endeavour. It shows that, although its advocates consistently envisioned a global and

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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,