[Review of: E. Hiebert (2015) The Helmholtz Legacy in Physiological Acoustics]

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Erwin Hiebert. *The Helmholtz Legacy in Physiological Acoustics.* (Archimedes: New Studies in the History and Philosophy of Science and Technology, 39.) xxiii + 269 pp., figs., apps. Cham: Springer, 2015. €105.99 (cloth).

This volume in the Archimedes series publishes a manuscript from the papers of the late Erwin Hiebert (1926–2012). It reflects the work of two decades during which he studied the intertwinings of science and music in the nineteenth and early twentieth century. The book's four parts each focus on one protagonist: Hermann von Helmholtz, Shohé Tanaka, Max Planck, and Adriaan Fokker. All of them were physicists and had a passion for music, and they all used their training and scientific networks to produce and promote new insights in music. What is more, all of them used the same instrument to do so: the harmo-nium. While Hiebert is likely to have encountered it in the context of Mennonite religious services, the harmonium was also a regular—now often forgotten—part of private music making in the mid-nineteenth century. This instrument was a nineteenth-century invention that shared the traditional keyboard with the piano and the pneumatic drive with the organ. In contrast to the organ, the harmonium was relatively small and cheap—enabling it to enter the middle-class home. As the tones in a harmonium are produced with metal reeds of a few inches at most, many separate tone-producing elements could be encompassed in a single instrument that still did not exceed the dimensions of a piano. In contrast to the latter, however, the harmonium's tones would continue as long as the air supply was maintained, and this made them a privileged object of study for the researcher in acoustics. First to realize this was Helmholtz. The "Helmholtz setting" that Hiebert sets out to study is characterized by a "tripod of discipline-connected and discipline-overlapping domains" (p. 9). It is this interaction of physics, physiology, and aesthetics on which Helm-holtz's work rested and which interests Hiebert. If, for a long time, the history of physics was the domain in which Helmholtz's contributions to science were most appreciated, Hiebert insists that this setting called for scientific involvement with the living organism, just as much as it depended on involvement with sensory perception and the arts. Helmholtz's ingenuity in bringing the three domains together, for Hiebert, consisted in his making musical intonation the touchstone for the viability of his speculations on the functioning of the ear. Starting from the problem of nonlinear distortion in vibrating media, "Helmholtz was led to perceive that the vibration of small non-negligible dimensions represents the essential anchor point for research on the problem of intonation in fixed-tone keyboards" (p. 33). The intervals used in European traditional music exposed such distortion, especially when out of tune. The range of questions Helmholtz could tackle on the basis of this assumption is impressive, comprising, among others, nonlinear distortions, the decoding of sound in the inner ear, and insights into the attribution of "dissonance" to musical intervals. This did not fail to attract further researchers to the device that allowed Helmholtz to substantiate his claims. Although the harmonium was soon overtaken by the piano in private households, it persisted as an experimental device in the laboratory.

The case studies assembled in Hiebert's manuscript are exemplary for the expansion and outreach of the "Helmholtz setting." The Japanese physicist Tanaka traveled to Europe to discuss with Helmholtz his Enharmonium, which allowed late nineteenth-century music to be played in just intonation. What seems a *contraditio in adjectu* nevertheless convinced Tanaka's contemporaries, such as the composer Anton Bruckner. Another *afficionado* of the harmonium was Max Planck. He used an instrument commissioned by Helmholtz for the University of Berlin to experiment on intonation habits among singers, publishing the results in a respected musicological journal. The Dutch theoretical physicist Adriaan Fokker, to whom the third case study is devoted, constructed an instrument with thirty-one rather than twelve tones in an octave that is still in use today at the Muziekgebouw in Amsterdam.

Although it is clear that parts of Hiebert's manuscript were left in an unfinished state, the book presents them in the best possible way to facilitate further research. Readers will profit from the rich archival materials that have been translated into English and can easily be traced through the separate bibliographies that conclude each chapter. In particular, the sources on Tanaka and Fokker, including an appendix devoted to the Dutch composer Willem Pijper, provide new insights into Helmholtz's afterlife in music that will be of interest to both historians of science and musicologists.

The piano also won the central place in Erwin Hiebert's own household, when in 1943 he married Elfrieda, an accomplished pianist who later earned a Ph.D. in musicology and initiated and directed the chamber music program at Harvard's Mather House. In their joint contribution to the volume *Universalgenie Helmholtz* (1994), Erwin and Elfrieda Hiebert claimed that Helmholtz's work has to be seen against the background of his engagement with musical practice. Their article opened up a new field. A generation of researchers ventured to investigate the entanglements of music and science; and many of them have been directly indebted to the generous intellectual support of the Hieberts. *The Helmholtz Legacy in Physiological Acoustics* thus celebrates a chapter in the history of the history of science—one that embodies the bridging between disciplines and cultures.

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