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BOOK REVIEW

Hartmut Petzold. *Eine Berliner Waage im Münchner Deutschen Museum.* München: Deutsches Museum Verlag, 2019. 203 pp.

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Hartmut Petzold has contributed the third volume in the publication series "Deutsche Museum Studies" and focuses on a rather disregarded exhibit at the Deutsche Museum in Munich: the precision balance constructed by Paul Stückrath in 1890, shown in the permanent exhibition "measures and weights." The author, who studied electrical engineering and history, served as a curator at the said museum until 2009. Three physicists, Arthur König, Franz Richarz and Otto Krigar-Menzel, used the balance once installed in the citadel of Berlin-Spandau (hence called for short the Spandau project) of Wilhelmine Germany in order to determine the gravitational constant at the end of the nineteenth century.

Petzold begins with early scientific discoveries like Newton's law of gravitation and experiments on gravitation by the British scientist Henry Cavendish, or the Munich based Professor Philipp von Jolly. Petzold concentrates on actors and their biographies.

The second chapter continues accordingly, providing details about precursors of the Spandau project. Jolly, who helped prepare the international metre convention in 1875, built a beam balance (in contrast to Cavendish's torsion balance) to measure finest differences in gravitational force. He was assisted by the instrument maker Carl Stollnreuther. Hermann von Helmholtz is rewarded with special attention in this book for his role as a kind of patron of the Spandau project, although he was never directly involved in the measurements and died before the project was completed. Yet, the three scientists who worked on the measurement of the gravitational constant had all been Helmholtz's students.

In the third chapter, the Spandau project itself comes into focus. First, König started working on it, later joined and replaced by Richarz and Krigar-Menzel. Richarz left Berlin, so Krigar-Menzel remained the only one carrying on. A big project like that came with a lot of material obstacles and imponderabilities. Not only the balance needed to be very precise, but also, a huge amount of lead was needed to simulate an attractive force. This amount of lead could only be procured because the scientists had close ties to the German ministry of war (the citadel of Spandau was a military site, too). And again, the assisting practitioners were of considerable importance, because the balance needed careful attendance, which could only be provided by a single expert. Atmospheric humidity, temperature change, bad lighting conditions, material defects or human deficits were sticking points for scientific practice, all described at length by Petzold.

The author closes the book with two short chapters. One on Krigar-Menzel's biography and his unobtrusive career as a lecturer at the Berlin technical university after 1898, when the final report on the Spandau project was published. The gravitational measurement project took 14 years to finish, but it did not cause much echo, except when Max Planck cited it in his proposal to introduce natural units of measurement in 1908. The last chapter describes how the balance became part of the Deutsches Museum when its collection was newly established. A miniature model of it still remains in the citadel in Spandau that houses a museum today.

Petzold's writing style is very detailed. He does tell a story based on "research into cultural and social history, and the history of physics" (p. 16) by describing, for example, how Berlin's townscape changed at the end of the nineteenth century and how the political atmosphere under the ruler Wilhelm II shifted towards nationalism and warmongery. Another one of the book's strong points is to highlight the mechanic's role in scientific endeavours besides the scientist's one, in contrast with the many narratives of experiments or science in which practitioners remain unmentioned. The lay readers, however, get easily lost when the author jumps between different years in his accounts of the actors' careers.

Some passages in the book are not entirely convincing because of their speculative tone. For example, Petzold acknowledges that Helmholtz was not directly involved in the Spandau project, but nonetheless considers him to be an "integrating character" and calls Helmholtz's

important influence a "historical reality" (p. 15). Also, the author often indulges in speculation when describing the background of the project. He writes, for example, that Helmholtz "probably" asked König for a correction of Jolly's measurements (p. 83). These uncertainties are unsurprising as Petzold mostly relies on scientific reports or publications, only in a few instances on personal letters, and thus has to reason indirectly on the motives of the historical actors.

For readers from the history of science, medicine and technology, the book provides a basis for further theoretical studies. Petzold himself does not reflect on theories, although the material presented easily affords it. Manifold studies on the materiality and social construction of experiments (Steven Shapin & Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* [Princeton NJ: Princeton University Press, 1985]) could serve as an analytical superstructure. Petzold, however, remains in the role of a chronicler.

The balance itself also remains a rather unobtrusive actor. It would be tempting to try and reconstruct Krigar-Menzel's work according to an experimental history of science (Olaf Breidbach, Peter Heering, Matthias Müller, Heiko Weber, *Experimentelle Wissenschaftsgeschichte* [Munich: Wilhelm Fink, 2010]). Reconstructing a complicated balance like that, however, and coming up with the required pile of lead probably makes this wishful thinking. In the end, Petzold had to rely on written sources and images only.

Eventually, although Petzold tries to embed the Spandau project in its social and political context, the narrative seems slightly internalist. The project results hardly had any repercussions, not even in the scientific community of physicists. This could have been because of the theoretical physicists' struggle to establish their professional standing. The characters of Petzold's story were relatively well-off, privileged men (Krigar-Menzel was financially supported by his famous uncle, the artist Adolph Menzel, and could afford to work on the project without payment for years). The project was connected to the ministry of war, but it was not used for martial rhetoric, possibly because of the scientists' reservation about war. Thus, the Spandau project appears to have existed in a scientific bubble, almost unaffected by war and colonialism. It would be an interesting endeavour, to analyse the ways this project and politics served each other nevertheless (in the vein of e.g., Mitchell G. Ash, "Wissenschaft und Politik als Ressourcen füreinander. Programmatische Überlegungen am Beispiel Deutschland," in *Wissenschaftsgeschichte heute*, ed. Jürgen Büschenfeld, Heike Franz and Frank-Michael Kuhlemann, 17–134 [Bielefeld: Verlag für Regionalgeschichte, 2001]).