

I highlighted some glaring deficiencies—perhaps less elegantly than Robert M. Friedman’s lukewarm review of the same book¹—based on quotations with specific page references can hardly be called bias. Bennett whines about my having written two reviews: In fact, PHYSICS TODAY invited me to review the book after having been informed that I had already accepted an earlier request from *American Theatre* for a major rebuttal—rather than just a review—of Shepherd-Barr’s book.

Bennett’s two paragraphs dealing with *Copenhagen* have nothing to do with my review, in which I describe Shepherd-Barr’s chapter as a “genuinely thorough and sophisticated analysis,” although I expressed surprise at her quoting approvingly the French director Jean-François Peyret’s wisecrack that *Copenhagen* is “fake theatre.” Bennett then regurgitates historical facts about Bohr and Heisenberg with which I am in total agreement. But his last paragraph, notably the last two sentences, is ludicrous. Nowhere do I state that the fact that my “science plays” have been translated into 15 languages, performed in many theaters, published in book form, and broadcast by the BBC World Service, National Public Radio, the German public broadcasting institution Westdeutscher Rundfunk, and other media make them great triumphs. What I did say is that Shepherd-Barr’s listing of dozens of plays that have been neither staged nor published and are thus beyond the scrutiny of any reader, biased or unbiased, can hardly justify some of her sweeping generalizations. Even Bennett concedes that “judging them theatrically would have been premature.” In that case what utility does such a hodgepodge list have in a book that emphasizes theatricality of science on the stage?

Reference

1. R. M. Friedman, *EMBO Reports* 8, 445 (2007).

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Simon Newcomb, astronomer and personality

Expending the time and effort to write a book review is a selfless service that often goes unrecognized. We thank Bradley Schaefer for his knowledgeable and incisive review of *Simon Newcomb: America’s Unofficial Astronomer Royal* (PHYSICS TODAY, February 2007, page 66).

However, one of our primary goals in writing the book was to dispel the notion that Newcomb was “cold, ruthless, and more feared than liked,” a characterization that we found little basis for in the extensive collection of correspondence archived at the US Naval Observatory Library and the Library of Congress. Newcomb knew and corresponded with virtually every leading astronomer of his era, not to mention many of the physicists, mathematicians, and economists. Colleagues regularly stayed at his home when visiting Washington, DC, and he and his family reciprocated in visiting colleagues across Europe and South Africa.

It should not be surprising to learn that when Newcomb left the Naval Observatory for the Nautical Almanac Office, he left behind more than a few jealous colleagues, who would await their opportunities to “get even” for any number of imagined slights. But the world-class astronomers of the day recognized his achievements with nearly every prestigious award, and dozens of universities conferred honorary degrees on him as well.

We did not mention in our book that some have suggested Newcomb as the “intentional prototype for Arthur Conan Doyle’s arch-villain Professor James Moriarty” or as the “learn’d astronomer” in Walt Whitman’s famous “When I heard the Learn’d Astronomer,” because we found only speculations¹ but no credible evidence that either claim is true. In fact, several scientists have been suggested as possible models for Professor Moriarty, among them Carl Friedrich Gauss. But the model that Doyle seems to imply in *The Valley of Fear*² is the London arch-criminal of the 18th century, Jonathan Wild. Why would Doyle choose as his prototype for Moriarty a relatively remote American astronomer rather than Wild, the locally well-known British villain and criminal?

Historians who do not practice science seem often to see differences of opinion between scientists as indicative of personal dislike, but scientists on opposing sides of scientific issues are frequently close friends. Scientists Virginia Trimble and Markus Aschwanden concluded that “Simon Newcomb has, in recent years, been something of a victim of bad publicity, being cited for his reluctance to include spectroscopy . . . in our discipline and societies. . . . In his own later writing, however, he comes across as the sort of person you might well want to go on an observing run or a country ramble with.”³ It is about time that many of the unfounded myths about Newcomb be exposed and ex-

punged. He was certainly one of America’s greatest astronomers, a respected colleague, and a devoted husband and father, fully worthy of the respect and honors accorded him in his own time.

References

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2. A. C. Doyle, *The Valley of Fear*, originally published by A. L. Burt, New York, 1914; available at <http://www.gutenberg.org/etext/3776>.
3. V. Trimble, M. J. Aschwanden, *Astron. Soc. Pac.* **114**, 475 (2002).

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Schaefer replies: Bill Carter and Merri Sue Carter take issue not with my review, which was glowing, but with the opinion of most other historians that Simon Newcomb had a “cold” and “ruthless” personality.

With the Carters raising the issue, I should report why most historians use words like “intimidating,” “sanctimonious,” and “grim” to describe Newcomb. Many incidents contribute to that broad conclusion, including his use of disguised influence to deny tenure, grants, jobs, and publications to one of America’s greatest mathematicians;¹ the perceived attempt to steal the credit for Asaph Hall’s discovery of the Martian moons;² and long-running feuds with many of the leading astronomers in America.³ As contrary evidence, the Carters’ letter offers only the generality that Newcomb visited and corresponded with leading scientists and won prestigious awards. Such evidence confirms only that Newcomb was the greatest astronomer of his day; it says nothing about his personality.

Regarding Professor Moriarty, many frivolous claims have been made over the last century of Sherlockian literature, but only Newcomb has a long list of identical and unique matches with the biography of Moriarty. Newcomb also has three documented personal connections with Arthur Conan Doyle at the time the author was inventing the arch-villain. But Newcomb has no connection with Moriarty’s criminal side. Doyle often used multiple sources for characters, and he explicitly told friends that the criminal side of Moriarty’s career was modeled after Adam Worth,⁴ a London arch-villain famous at the time, and not after Jonathan Wild, a forgotten criminal from two centuries earlier. We all agree that Doyle did not

model the criminal side of Moriarty after Newcomb.

References

1. J. Brent, *Charles Sanders Peirce: A Life*, Indiana U. Press, Bloomington (1993).
2. J. Ashbrook, *The Astronomical Scrapbook: Skywatchers, Pioneers, and Seekers in Astronomy*, Cambridge U. Press, New York (1984), p. 290.
3. B. Carter, M. S. Carter, *Simon Newcomb: America's Unofficial Astronomer Royal*, Mantanzas, St. Augustine, FL (2006), p. 157.
4. B. Macintyre, *The Napoleon of Crime: The Life and Times of Adam Worth, Master Thief*, Delta, New York (1998), p. 222.

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Gauss on the mountaintops

Michael Marder, Robert Deegan, and Eran Sharon discuss Carl Friedrich Gauss's measurement of the angles of a triangle across mountaintops (PHYSICS TODAY, February 2007, page 33), but their discussion is simply wrong. They write, "Some believe that Gauss performed his mountaintop measurement to check whether three-dimensional space itself is Euclidean, but in the paper he published at the time he did the work he made no reference to any such question."

The theoretical spherical triangles of Gauss and Adrien-Marie Legendre that are discussed in the article have edges that are great circles on the surface of the sphere. They thus obey Euclid's definition of being the "shortest distances" on that surface. But for Gauss's mountaintop measurements, there is no simple way to construct or observe such great circles, because the light rays that were used to make the angle measurements are not constrained to follow Earth's assumedly spherical surface. They are, rather, geodesics within 3D space, if one ignores atmospheric refraction. Gauss's measurement therefore could not have been anything but a test of the Euclidean nature of 3D space. Gauss understood that perfectly well, and his lack of reference to any such test probably simply reflects his well-known reluctance to discuss non-Euclidean geometries.

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Marder, Deegan, and Sharon reply: Many people, including Douglas Robertson, believe that Gauss per-

formed his mountaintop measurement to check whether three-dimensional space itself is Euclidean. Ernst Breitenberger's careful analysis (our reference 1) persuaded us to the contrary. From 1821 to 1825, Gauss spent many months in the field, mapping Hanover with a heliotrope, an instrument he had invented. The mountain peaks forming the corners of his great triangle were base stations; he measured and plotted 26 smaller triangles between them. The edges of all those triangles were assumed to be great circles, projected down to sea level.

Inconsistencies in the measurements were minimized with a global least-squares adjustment, a method Gauss had invented, and he projected them onto flat surfaces with conformal maps, also his invention. The purpose of the great triangle between Hohehagen, Brocken, and Inselberg was to check the results he had obtained by patching together the 26 smaller triangles. He wanted that check both to ensure the map's accuracy and to measure deviations of Earth's shape from a perfect sphere. For the latter task he needed to invent differential geometry. Perhaps amid his phenomenal exhibition of creativity, Gauss also wondered whether space itself is Euclidean, but the great triangle is easily justified without invoking that question, and Breitenberger cites much evidence against it.

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Laws, theories, and the passage of time

I found the Letters Department discussion of laws versus theories (PHYSICS TODAY, July 2007, page 8) quite interesting. I have observed that Boyle's law, Ampère's law, Faraday's law, conservation laws, Newton's laws, and the laws of thermodynamics all precede the Industrial Revolution, whereas relativity theory, evolutionary theory, quantum theory, and such all follow it. The term "law" seems to have fallen out of favor after the Industrial Revolution. I cannot attribute this observation to any cause; perhaps others can.

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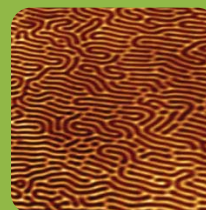
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- 56µm XY scan range, 4.8µm Z range with 20 Bit resolution
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