

and Jesus *preaches* our peace. The people I have known over the years whose differences were labeled and diagnosed have ministered the peace of Jesus to me in ways that are too deep for words. They have taught me what friendship is, and reading this book I have come to understand that John Swinton's life and teaching is devoted to cultivating friendship and creating communities in which there are no dividing walls—where all people in need of grace and redemption, love and forgiveness, healing and hope come together as one body with many members.

There are precious few things I would change about this book. I would make the last chapters in the section "Gently Living in a Violent World" the first chapters: I think they are much more inviting to readers, and from my perspective, they contain more information on how to live out this theology of friendship.

Overall, I would encourage all Christians whose lives intertwine with people on the margins of ability and disability to read this book and let it speak to their hearts and their minds. I am looking forward to being able to use this book both as a practitioner and a professor, and in these roles, I am thankful to have read about all the ways I can learn to be a deeper and better friend and human being.

Reviewed by Bob Bowen, Adjunct Professor of Social Work, Malone University, Canton, OH 44709.

HISTORY OF SCIENCE

DOI: <https://doi.org/10.56315/PSCF3-24Caneva>

HELMHOLTZ AND THE CONSERVATION OF ENERGY: Contexts of Creation and Reception by Kenneth L. Caneva. Cambridge, MA: MIT Press, 2021. 735 pages, including notes (138 pages), bibliographies of primary and secondary sources (80 pages), and an index (17 pages). Hardcover; \$125.00. ISBN: 9780262045755.

By examining the pagination details mentioned above, one could easily surmise that one will be reading and examining a book grounded in textual detail. And one would be spot on. The weight of the author's research is, quite honestly, breathtaking. Kenneth L. Caneva has devoted his academic life to an examination of energy concepts. He is a professor in the Department of History at the University of North Carolina-Greensboro. A former student of Thomas S. Kuhn, he has also authored two other books: *The Form and Function of Scientific Discoveries* (Dibner Library Lecture, 2000) and an authoritative biography, *Robert Mayer and the Conservation of Energy* (Princeton University Press, 1993). *Helmholtz and the Conservation of Energy* is his latest contribution.

Before we examine the book proper, the obvious question arises: Who was Hermann von Helmholtz? To answer that question one can best turn to the 937-page

scientific biography of Helmholtz by David Cahan (*Helmholtz: A Life in Science*, The University of Chicago Press, 2018). Helmholtz (1821–1894), a German physiologist and physicist, is described by Steven Shapin in his review of Cahan's book as "a theorist of (not quite) everything." Helmholtz had an immense range of scientific and cultural interests: physics, physiology, psychology, aesthetics, philosophy. He invented the ophthalmoscope, measured the nervous impulse, contributed to meteorology and atmospheric physics, and helped build some of Germany's scientific and technological institutions.

Caneva wants to explore the context and reception of one of Helmholtz's early (1847) seminal essays, "*Über die Erhaltung der Kraft*" ["On the Conservation of Force"] by examining how this essay shaped the discussion and acceptance of a physical principle: the conservation of energy. How was "conservation of force" eventually transformed into a principle of energy conservation? Caneva offers us a contextualist historiography of this long and complex transition by providing an in-depth analysis of Helmholtz's contribution and influence in the discovery process.

The discovery of the principle of energy conservation is a classic case in the history of nineteenth-century science. Although overshadowed in the public mind by Charles Darwin's principle of natural selection, its historical development raises similar issues. Who discovered the principle of energy conservation? An easy question to pose, but a very complicated one to answer. And more to Caneva's point of interest: Is conservation of energy what Helmholtz initially meant by the conservation of force?

Caneva offers this book as an example "of how what is generally accepted as scientific knowledge is reshaped as it passes through the hands of people with different agendas using different language." It is not an individualistic process, but rather reflects a "collective construction of scientific knowledge." Caneva concludes the book with this assertion: "The cumulative force of this study has implicitly rendered otiose the question of who discovered the conservation of energy" (p. 466). In a real sense, no one individual has discovered the conservation of energy: one could reference Robert Meyer (1842), Helmholtz (1847), William Thomson (1851) [force to energy], and Helmholtz (1853) again. With meticulous detail Caneva highlights the terminological shifts that have taken place as well as the rhetorical skills exercised when the "law" or "principle" was presented to various publics, even in popular scientific settings.

The book has eleven chapters, followed by a "Historiographical Excursus: How Others Have Interpreted Helmholtz's Achievement" (pp. 471–99). In chapter 1, "Helmholtz's Self-Described Principal Concerns,"

Book Reviews

Caneva traces out four factors that were central to Helmholtz's thinking: (1) a conviction that the construction of a perpetuum mobile is impossible, (2) a concern with the nature of heat and the source of animal heat, (3) a belief in the illegitimacy of a vital force, and (4) the application of rational mechanics' principles of vis viva [mv^2] and its conservation. According to Caneva, Kantian philosophical concerns do not dominate, nor does Helmholtz's reliance on industrial mechanical steam-engine considerations or metaphors. Succeeding chapters (2–6) trace out the broader and more immediate contexts, the question of Kantian influence, and what Helmholtz believed he had accomplished.

Chapters 7–9 consider the reception of "The Conservation of Force." In chapter 9, "Helmholtz's Place in the Acceptance of the Conservation of Energy" – by far the longest (pp. 235–428) and most important chapter – Caneva traces how Helmholtz's formulation in his 1847 essay, "The sum of the existing living and tensional forces is thus always constant" (p. 239), has been transformed into a principle of the conservation of energy. How does a paper first rejected by the physics community, yet hoping to find unifying elements in nature, lead finally to the conservation of energy (the first law of thermodynamics)? Even if one looks closely at the phrase, "tensional" forces, one notices that Helmholtz integrates force over distance, that is, force is thought of in terms of the velocity of a body rather than its acceleration. Force, for Helmholtz, is a measure of the quantity of motion rather than a cause of motion. Caneva's goal is to render intelligible Helmholtz's role and significance in the complicated transition to the final expression of the conservation law.

Near the end of the book, in the "Historiographical Excursus," Caneva critically assesses the work of earlier commentators who have written about Helmholtz and the conservation of energy. Thomas Kuhn (Caneva's advisor), Yehuda Elkana, Peter Harman, Norton Wise, all are subject to criticism. Caneva detects anachronistic tendencies, lack of sound textual evidence, and a desire to confirm a preconceived idea that lie at the root of most failed interpretations (p. 499).

The book is not an easy read. Amidst all the intricate detailed analysis and convoluted arguments what can an ASA member profitably learn? First, clarification of concepts can be a long and complicated process. Think just of the historical development of the concept of biological evolution. Secondly, ideas and concepts are shaped by a myriad of causes and influences. The art or skill lies in learning how to weigh the stunning array of causes. In the case of Helmholtz, historians have identified several causes: philosophical, physical, technological, physiological, and even cultural. How to accurately weigh each factor without becoming ahistorical, that is, misreading an author's intent by

reading modern concepts into it and becoming anachronistic, has been Caneva's goal.

Reviewed by Arie Leegwater, Department of Chemistry and Biochemistry, Calvin University, Grand Rapids, MI 49546.

TECHNOLOGY

DOI: <https://doi.org/10.56315/PSCF3-24Coeckelbergh>

ROBOT ETHICS by Mark Coeckelbergh. Cambridge, MA: MIT Press, 2022. 272 pages. Paperback; \$16.95. ISBN: 9780262544092.

Mark Coeckelbergh is Professor of Philosophy of Media and Technology at the University of Vienna. This compact and easy-to-read book is his second on technology-related ethics, following his earlier *AI Ethics* (2020). In *Robot Ethics*, Coeckelbergh surveys situations where robots might be incorporated into daily life, and then explores ethical implications in each.

The book begins by introducing the reader to the field of robot ethics. As a first principle, "a robot cannot and should not be reduced to the material artifact 'robot' but instead must be connected to its use, and its social and cultural contexts" (p. 8). The author then identifies a major stumbling block, namely, that there is no clear definition of the term "robot." To make matters even more problematic this same definition limitation exists for the closely related concept of artificial intelligence (AI). In light of this lack of specificity, Coeckelbergh casts a large net around multiple technologies and machines that he considers related to robots or artificial intelligence.

Coeckelbergh first explores the effect of robots in the workplace and the resulting consequences for employee safety and job security. He then discusses robot companions and how these can be connected to a form of deception. Coeckelbergh provides the following example. Your elderly parent requires more care. You do not have the time to provide said care. You hire or purchase a robot that looks and behaves human-like to help. Do you tell your elderly parent that the companion is a robot? What if you do tell your parent that it is a robot, but your parent insists that it is alive—are there ethical issues with a robot providing care to someone who believes it is alive?

The author then explores the negative side of robot companionship, the ethics of robot abuse. Since robots are objects and the property of its owner, is it ethically permissible for people to be violent or abusive to their robots? Robot companionship leads to special forms of robotic companions, such as healthcare robots and personal assistant robots. When robots begin to replace healthcare workers or other experts, then additional problems arise, such as in quality of service, expertise,