tell us how the story that he has just given us illustrates the generalizations that he made in the beginning. Perhaps he believes the story speaks for itself, but more of his own interpretation would be helpful.

Electricity was not the only subject of experimental physics in the 17th and 18th centuries; heat, optics, and chemistry were equally important. Historians have tended to treat them as separate disciplines, and this is surely a mistake. There are signs of change, however. Historians of chemistry in particular have begun to emphasize the importance of theories of heat in the chemical revolution. We need to know how the sciences of electricity, heat, optics, and chemistry all grew out of the single subject of experimental physics, if indeed that is what happened. Heilbron's excellent book is an important beginning for this promising new investigation.

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Looking for Insights

A Retrospective Technology Assessment. Submarine Telegraphy: The Transatlantic Cable of 1866. VARY T. COATES and BERNARD FINN, with Thomas Jaras, Henry Hitchcock, and Robert Anthony. San Francisco Press, San Francisco, 1979. xvi, 264 pp., illus. Paper, $8.50.

The play-within-a-play or book-within-a-book, a literary device familiar to readers of *Hamlet* and *The World According to Garp*, has now been extended to social science. The history of the transatlantic cable has been embedded in a book whose main concern is helping to define a new discipline: retrospective technology assessment.

In the outer book, social scientist Vary Coates and historian Bernard Finn lead a multidisciplinary team seeking to link the past and the present by retrospectively carrying out a technology assessment (defined as "a systematic attempt to anticipate the potential impacts of technology on the economy, the environment, social institutions, and behavior"). In the inner book, businessman Cyrus Field leads a consortium of industrialists, engineers, and scientists seeking to link the Old World and the New by an undersea telegraph cable. Field's effort and its impacts make up the technology the outer book attempts to assess.

In the inner book, money is raised from businessmen and governments on two continents; naïve expectations are crushed as the initial straightforward attempts to lay the cable fail; an expert commission gets the project back on the right track; and, finally, with the aid of the world's mightiest steamship, the *Great Eastern*, and the world's most productive scientist-technologist, William Thomson (later Lord Kelvin), the cable team succeeds not only in connecting the continents but even in grappling from the depths and splicing a failed earlier cable.

In the outer book, money is raised from the National Science Foundation to pay for the study; naïve expectations persist; an expert commission meets at the George Washington University Library to eat a buffet supper and unconvincingly impersonate its 1861 predecessor; and rejecting two of the most productive tools in the historian's kit—archival research and imagination—the authors grapple in the depths for "productive insights and provocative hypotheses."

The conclusions that surface are unsurprising. Mankind ought to assess in advance those technologies that give entirely new capabilities—like instantaneous world communication, nuclear power, and genetic engineering. Networking technologies are especially worthy of assessment. The public is more interested in how technologies can be used than in how they work. Technology assessments can be biased by the assumptions and the interests of the assessors.

Unlike William Shakespeare and John Irving, the authors of this book fail to surround their inner plot with an outer story worthy of it. The play here is the only thing.

It features the impetuous Cyrus Field, whose energy made the cable project succeed at the same time as his impatience nearly doomed it. After the 1858 cable failed within a month of operation, businessmen learned to listen to their engineers' demands for quality standards. And those engineers, in turn, learned to listen to scientists' insistence that physical theory could be translated into guidance about power levels and detection methods. Governments learned to listen to technical experts: the 1861 Parliamentary Inquiry on Cables is a direct ancestor of the Kemeny Commission on Three Mile Island. The cable's direct impacts on the economics of shipping and futures markets, as well as its surprisingly damped and delayed impact on diplomacy, also make interesting reading.

But it is the outer book that carries the authors' real purpose. A retrospective technology assessment, we are told, is history not for its own sake but "in the hope of providing new insights into the relationship between technological change and social change."

The way the authors (particularly Coates and physicist Robert Anthony) seek this aim is through a positivist method of reaping a historical harvest already standing in the field, winnowing it according to mechanistic views of "impact," and grinding it in the mill of generalization. The tools of the technology assessor are employed: the Delphi method (here applied incorrectly); fully articulated impact trees; and the authors' own invention, the period profile approach.

The results totally lack the richness and the grace of recent books that rejected the armory of new methods and sought instead sympathetic yet critical involvement in the historical situation. Examples are Leslie Hannah's *Electricity before Nationalization*, an insightful administrative history of the impact of electricity in Britain; Anthony Wallace's *Rockdale*, an evocative account of the impact of the textile industry on 19th-century America; and even David McCullough's lively popular history of the Panama Canal, *The Path between the Seas*.

It would be unfortunate if the muse of history that inspired such works should find it necessary to disguise her virtues beneath the lab coat of positivist history for no better reason than to secure funding of studies in retrospective technology assessment from the hard-science-oriented funding officers of the National Science Foundation.

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A Memoir of Computing

From Dits to Bits. A Personal History of the Electronic Computer. HERMAN LUKOFF. Robotics Press, Portland, Ore., 1979 (distributor, International Scholarly Book Services, Forest Grove, Ore.). xvi, 220 pp., illus. $12.95.

Herman Lukoff's warm and human *From Dits to Bits* fills a void in the rapidly growing literature of computing. In the double introduction by John W. Mauchly and J. Presper Eckert, Mauchly writes,

> Until now, [the] history of the computer field has not been told in human terms by any of those who helped to create that history.