books

Innovation and its discontents

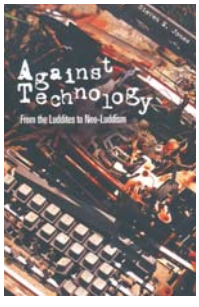
Against Technology

From the Luddites to Neo-Luddism

Steven E. Jones
Routledge/Taylor & Francis, New York, 2006. $90.50, $24.95 paper (277 pp.). ISBN 978-0-415-97867-5, ISBN 978-0-415-97868-2 paper

Reviewed by Robert L. Park

There is a little Ned Ludd in us all. And why not? Who hasn't felt the urge to attack his or her laptop with a hammer? *Homo sapiens* evolved as hunter–gatherers in a Pleistocene wilderness. Our oversized brain prepared us to outthink quarry that were faster and stronger, not to meekly watch as mindless machines take over. So we empathize with workers in England who toiled two centuries ago in "dark Satanic mills," as poetically described by William Blake, and felt driven to smash the weaving machines that were replacing them.



Those workers were the original Luddites, now a term of derision directed at individuals who oppose technological progress. The motive of the neo-Luddites is rarely simply job security: It is usually ideological. In *Against Technology: From the Luddites to Neo-Luddism*, Steven Jones, a professor of English at Loyola University Chicago, traces the movement from the historical Luddites of the early 1800s, led by Ned Ludd, their imaginary general, to Ted Kaczynski, the Harvard-educated "Unabomber" who maimed and killed in a personal war against progress for 18 years before being unmasked in 1996.

Scientists and technologists should pay close attention to what Jones has written. In tracing the history, he follows a very different set of footprints than a technologist would. The path Jones takes is, for example, not marked by rewriting the first law of thermodynamics to arrive at Lenz's law, which allowed factories to make the energy shift from steam to electromotive force. He views the history apart from science. Jones begins with Romantic poets—Blake, William Wordsworth, Lord Byron, and Percy Shelley—who were contemporaries of the original Luddites, but he does not forget to mention the power of popular ballads that stirred men to violence.

Jones's path leads him through novels that have come to symbolize the dangers of technology taken too far, particularly Mary Shelley's *Frankenstein*, even though, as Jones points out, that book had little actual representation of technology. In the story, Dr. Frankenstein crudely stitched his monster together from body parts. Film makers added in the electrodes and levers—and the Frankenstein movies just keep coming. The props change in every new adaptation to reflect recognizable icons of current technology.

Technology that becomes uncontrollable has been the subject of countless science fiction stories, and the Luddite theme has been perfect for movies. In 1936, Charlie Chaplin starred in *Modern Times* as the little assembly-line worker, who, as Jones describes, with "wrench in hand, is caught up bodily in the giant gears and wheels of his machine," from which he emerges unscathed to escape from the factory. Then there are Stanley Kubrick's 1968 film classic *2001: A Space Odyssey*, with the mistake-prone computer "Hal," and the more recent *Matrix* trilogy. The first *Matrix* movie was in 1999. All of the above films exploit society's machine paranoia.

I found Jones's path to be much more interesting than the predictably defensive route taken by technologists, who invariably aim to show that the benefits of technology outweigh the negatives. That conclusion is probably true, but it doesn't get at the underlying anxieties of the overwhelmingly nontechnical public. In 1950 MIT mathematician Norbert Wiener coined the term cybernetics in his book *The Human Use of Human Beings: Cybernetics and Society* (Houghton Mifflin) and made the ethical argument that humans should be liberated from work that machines can do better. Like most worthy goals, Wiener's vision may be unattainable, but we can strive to come closer to it—and we have come closer. In most of the world today, machines are freeing humans from the mind-numbing toil that had been the lot of common people everywhere, for all of history.

Ironically, the most egregious example of using humans to perform menial and dangerous work is in space exploration. The telerobot rovers Spirit and Opportunity have explored the Martian surface for three years. Living on sunshine, the rovers have never taken a break for lunch or complained about the cold nights. Yet NASA plans to replace them with astronauts at a staggering cost, with little idea of how to keep the astronauts alive or what they could do that a telerobot could not. Meanwhile, today's arrayed forces that are against technology are led by religion, which generally opposes change. Biotechnologies involving human reproduction, stem-cell research, and even vaccinations are declared unnatural within some religions.

In *Against Technology*, Jones has opened up a rich field of study that cries out for more examination. The unintended consequences of technology, such as global warming, should not be seen as a call to retreat to a simpler time. By nature's cold calculus of survival, *Homo sapiens* is doing very well—so well that the road back is blocked by population growth. A simpler world is no longer possible.

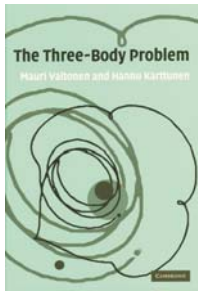
Robert L. Park is a professor of physics at the University of Maryland, College Park. He writes an online weekly interest column called *What's New* (http://www.bobpark.org) and is the author of *Voodoo Science: The Road from Foolishness to Fraud* (Oxford U. Press, 2000).

The Three-Body Problem

Mauri Valtonen and Hannu Karttunen
Cambridge U. Press, New York, 2006. $85.00 (345 pp.). ISBN 978-0-521-85224-1

Mauri Valtonen and Hannu Karttunen have chosen a fine title for their unusual book, *The Three-Body Problem*, which covers a wide range of both theory and

applications of an issue central to basic physics. In the late 1600s, Isaac Newton tested gravity among three massive bodies by studying the Moon's motion in the combined field of Earth and the Sun. But it was only in 1878 that astronomer George W. Hill found a method yielding results that matched the ancient Greek observations.



Three-body problems are also fundamental in atomic and high-energy physics. The negative hydrogen ion, which consists of one proton and two electrons, determines the Sun's surface temperature to be 6000 K; we here on Earth can count on an average temperature of about 300 K. The proton consists of three quarks, and yet its magnetic moment is still not adequately explained. Overall, three-body problems are important but difficult to understand.

Valtonen and Karttunen work at the Väisälä Institute for Space Physics and Astronomy at the University of Turku in Finland. Their introduction offers a long and surprising list of examples from modern astrophysics, all based on classical mechanics. Except in the book's final chapter, the three bodies are treated as point particles, where the mass is concentrated in a mathematical point without such further properties as angular momentum. The systems without a stable configuration are emphasized—for example, an asteroid whose motion is determined by the Sun and Jupiter. In the first five chapters, the authors provide a classical mechanics course that goes well beyond the ordinary graduate textbooks.

The Kepler motion, including the hyperbolic trajectories, is the necessary starting point. But three-body systems have four degrees of freedom that cannot easily be separated by a canonical transformation, so one cannot avoid some careful formal development. Valtonen and Karttunen have carefully written down every step in the arithmetic and included helpful diagrams. Each chapter ends with problems, some involving numbers from astronomy.

The authors' main achievement is their coverage in the last five chapters of the many different applications in astrophysics in which one of the three bodies is much lighter than the other two. Those applications are based on an unperturbed two-body system that rotates in a fixed plane. A rotating reference system for the third body then becomes most natural and introduces a Coriolis force, in addition to the gravitational field. This feature causes all kinds of marvelous things to happen, like the neighborhood of the Lagrangian points, where the third body can remain at rest. Depending on the initial condition, however, the third body can scatter and thus change the orbital elements of the two heavy bodies. There is a whole catalog of disasters, such as capture, exchange, flyby, collision, and even ionization, that are important to comets from the Oort cloud. The authors describe such phenomena with approximate arguments and numerical results.

In the last chapter, Valtonen and Karttunen step outside the solar system and consider three bodies of comparable mass, but with known volumes like our nearest neighbor in space, Alpha Centauri, where all bodies are self-sustaining stars. Slow or fast three-body encounters with more or less dramatic consequences may exist. Sometimes those encounters resemble phenomena in atomic and molecular physics or even nuclear and particle physics. Although the chapter's title, "Some Astrophysical Problems," sounds innocent, it starts immediately with a section on binary black holes in the centers of galaxies. The reader now advances to the post-Newtonian formalism, which includes the effect of gravitational radiation. The mathematics is greatly simplified, and the arguments are kept within the bounds of reasonable models without undue speculations. The reader gets involved in whole galaxies colliding and melting together so that individual stars find binary companions for life. The chapter concludes with comets—fuzzy balls on a haphazard journey through the solar system.

In *The Three-Body Problem*, readers will find the necessary theoretical ingredients and will also enjoy the great variety of technical explanations for phenomena in the solar system and beyond. The book would be useful for a graduate course in modern astrophysics and makes interesting reading for an amateur who has some background in classical mechanics.

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Nano-Hype
The Truth Behind the Nanotechnology Buzz

David M. Berube
Prometheus Books, Amherst, NY, 2006. $28.00 (521 pp.).
ISBN 978-1-59102-351-7

The Nanotech Pioneers
Where Are They Taking Us?

Steven A. Edwards
Wiley-VCH, Weinheim, Germany, 2006. $32.50 (244 pp.).
ISBN 978-3-527-31290-0

Nanotechnology has entered today's general discourse. This trend has provided an opportunity for society, particularly its young people, to learn