

BOOKS

Art Mirrors Physics Mirrors Art

Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc

▶ Arthur I. Miller
Basic Books (Perseus),
New York, 2001. \$30.00 (357 pp.).
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Reviewed by Stephen G. Brush

Arthur Miller addresses an important question: What was the connection, if any, between the simultaneous appearance of modern physics and modern art at the beginning of the 20th century? He has chosen to answer it by investigating in parallel biographies the pioneering works of the leaders of the two fields, Albert Einstein and Pablo Picasso. His brilliant book, *Einstein, Picasso*, offers the best explanation I have seen for the apparently independent discoveries of cubism and relativity as parts of a larger cultural transformation. He sees both as being focused on the nature of space and on the relation between perception and reality.

The suggestion that some connection exists between cubism and relativity, both of which appeared around 1905, is not new. But it has been made mostly by art critics who saw it as a simple causal connection: Einstein's theory influenced Picasso's painting. This idea failed for lack of plausible evidence. Miller sees the connection as being less direct: both Einstein and Picasso were influenced by the same European culture, in which speculations about four-dimensional geometry and practical problems of synchronizing clocks were widely discussed.

The French mathematician Henri Poincaré provided inspiration for both Einstein and Picasso. Einstein read Poincaré's *Science and Hypothesis* (French edition 1902, German translation 1904) and discussed it with his friends in Bern. He might also have read Poincaré's 1898 article on the measurement of time, in which the synchronization of clocks was dis-

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LES DEMOISELLES D'AVIGNON: Picasso's 1907 excursion into a fourth dimension.

cussed—a topic of professional interest to Einstein as a patent examiner. Picasso learned about *Science and Hypothesis* indirectly through Maurice Princet, an insurance actuary who explained the new geometry to Picasso and his friends in Paris. At that time there was considerable popular fascination with the idea of a fourth spatial dimension, thought by some to be the home of spirits, conceived by others as an “astral plane” where one can see all sides of an object at once. The British novelist H. G. Wells caused a sensation with his book *The Time Machine* (1895, French translation in a popular magazine 1898–99), where the fourth dimension was time, not space.

Picasso actually incorporated the fourth dimension into his creations before Einstein did. Miller discusses in great detail the history of a single painting, *Les Femmes d'Alger*—completed and first exhibited in 1907, now in the Museum of Modern Art in New York City. It is generally consid-

ered a seminal painting, which led directly to what is now called “modern art.” In its final form, “the painting represents five prostitutes in a bordello. Although in close proximity, they do not interact with each other, only with the viewer—the client.” From left to right we see: “a partially clothed demoiselle . . . with an Egyptian–Gauguinesque face, whose seemingly disembodied arm is pulling open a curtain; then there are two more attractive demoiselles of Iberian–Oceanic likeness . . . The standing demoiselle on the far right is also parting a curtain, while the squatting demoiselle is in a grotesquely impossible posture, with her back facing the picture plane and her head turned 180 degrees as if on a swivel . . . [with] a face that is shockingly hideous in comparison to the others” (page 89). The “plot” of the painting is the increasing geometrization of the figures as one goes from left to right, ending up with a four-dimensional view of the squatting whore.

In striking contrast to Marcel Duchamp's *Nude Descending a Staircase* (1912) where the figures represent successive points in time, seen as coexisting in the fourth dimension, Picasso's painting culminates with a superimposed set of three-dimensional projections of an object in four spatial dimensions. One is seeing the object simultaneously from (a sampling of) all possible perspectives rather than from only one as in classical painting.

Einstein did not appreciate the value of four-dimensional geometry in 1905 but came to it only later, with the help of Hermann Minkowski and Marcel Grossmann. Poincaré's influence was significant here but not so crucial; in fact Einstein rejected the "conventionalist" philosophy that led the Frenchman to the view that no uniquely determined geometry governs the world—you may choose whichever one is most convenient. Poincaré even proposed a "principle of relativity" but failed to grasp the consequences that Einstein drew from it.

Miller's point is that both Einstein and Picasso discarded the empiricist view—"what you see is what you get"—in favor of the realist-intellectualist view—thinking, not seeing, leads to the truth. The purpose of science is not to provide the most economical representation of the facts (as Ernst Mach claimed), and the purpose of art is not to provide the most accurate representation of what we can see (Why compete with photography?). The purpose of both science and art is to discover the reality that lies hidden behind the appearances.

This reality must, of course, conform to the highest aesthetic standards. Thus, as Einstein pointed out at the beginning of his 1905 relativity paper, the basic defect of classical electromagnetic theory is that it fails to give a *symmetrical* description of electromagnetic induction, one that is independent of the frame of reference of the observer.

In addition to giving detailed accounts of Einstein's discovery of relativity and Picasso's creation of *Demoiselles*, Miller provides fascinating biographies of both men. Both were isolated from most human concerns by their preoccupation with discovery; for instance, both attracted women whom they felt free to discard at will. Picasso had more lovers than Einstein did, but it was Einstein who "had the kind of male beauty that, especially at the beginning of the century, caused such havoc." (This anonymous quote, on page 50, provides part of the subtitle for the book.)

I strongly recommend this book to anyone interested in physics or art: It enhances a reader's understanding of the connection between art and science. It also underscores the breadth and pervasiveness of an epoch's intellectual ferment.

Adventures in the Atomic Age: From Watts to Washington

▶ Glenn T. Seaborg
with Eric Seaborg
Farrar, Straus, and Giroux,
New York, 2001. \$25.00 (352 pp.).
ISBN 0-374-29991-9

Glenn Seaborg, discoverer of plutonium, Nobelist, and the only scientist to have an element (seaborgium-106) named for him during his lifetime, is surely the most prolific scientific diarist of the 20th century. Part of his journal, covering his 10 years as chairman of the Atomic Energy Commission, contains 18 000 pages. That and his scrupulously kept diary (begun when he was 14 years old) attest to and explain (in part) Seaborg's great strength as a nuclear chemist: He simply worked harder than anyone else! I never could understand why some who worked with him at the Chicago plutonium laboratory ("Metallurgical" Laboratory) thought he worried too much about the Nobel Prize; everybody knew all along that he would win one!

His memoir, *Adventures in the Atomic Age: From Watts to Washington*, written with his son, Eric, a professional writer (who completed the memoir after his father's death in June 1999), is a fascinating distillation of these journals: We learn about Glenn's origins as the grandson of Swedish immigrants, his career as the discoverer of transuranium elements; his tenure as respected and often envied boss of chemical research at the Metallurgical Laboratory, his chancellorship of the University of California, Berkeley, his stint as chairman of the Atomic Energy Commission, and more.

The book has great historical value. It is especially interesting to old-timers like me, who knew and liked Glenn. Besides bringing Glenn the person into focus, the book clarifies many puzzling aspects of the nuclear enterprise. For example, the controversy over Glenn's *in absentia* letter to Robert Oppenheimer, in which Glenn reluctantly argued, "I have been unable to come to the conclusion that we should not develop the H-bomb." Oppenheimer's negligence in not sharing Glenn's views with the rest of the

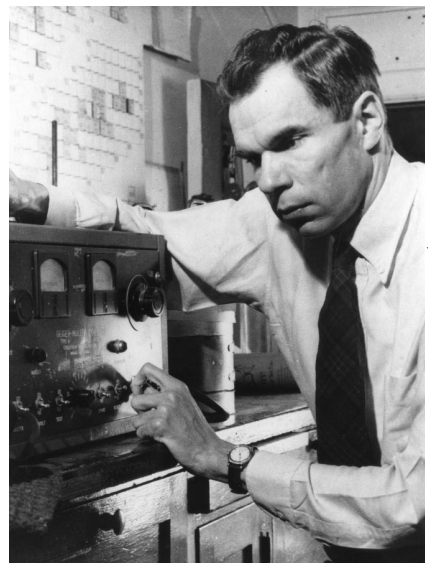
General Advisory Committee was a factor in Oppenheimer's loss of security clearance—an outcome that Glenn bitterly opposed.

We also learn that 41 of the nuclear weapons tests were aimed at the Plowshare Project (the peaceful uses of nuclear explosions). Although I was at Oak Ridge during this time, I had no idea that so many of the tests were part of the Plowshare program.

Aside from Glenn's massive contribution to chemistry, we read of his deepest views on arms control and nuclear power. Although, as the father of plutonium, he could hardly have said otherwise, his arguments favoring nuclear are cogent.

I admire Glenn very much for pushing the Comprehensive Test Ban Treaty—which President Clinton signed, but which the Senate has side-tracked. Glenn thought little of Star Wars, and he adduced the standard arguments against defensive missiles. In this respect, I believe he was shortsighted. Star Wars makes sense if, as many hope, the number of intercontinental ballistic missiles is eventually reduced to, say, 100 on each side. Some arms control experts (as well as Presidents George W. Bush and Vladimir Putin) seem to support this ultimate posture. I wish Glenn had expressed his views on such a long-range scenario.

In reviewing Glenn Seaborg's life, I can only stand in awe. The diligence and common sense displayed in this book are *sui generis*. The essence of the man is captured in his "Letter to a Young Scientist," which Eric Seaborg added as an appendix. Here Glenn Seaborg says, "A particularly necessary element in the makeup of a good scientist (is) simple hard work!"



GLENN T. SEABORG at Berkeley in 1941.

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