Atomic Franklin

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In 1955, the Harvard historian of science I. Bernard Cohen visited Princeton to conduct what turned out to be Albert Einstein's last interview, published in *Scientific American* later that year. Cohen had immersed himself in detailed studies of the scientific work of Benjamin Franklin and Isaac Newton (his *Franklin and Newton* was published the next year) and was eager to discuss "great men in the physics of the past." Einstein praised Newton's achievements but also lamented his vanity and aggressive competitiveness toward his contemporaries. Yet when Cohen praised Franklin's avoidance of controversy, Einstein suggested that he perhaps lacked the courage of his convictions. Had Franklin, Einstein asked, really achieved anything of importance beyond the invention of the lightning rod? Yes, Cohen replied: framing the principle of the conservation of charge. Einstein concurred. That did indeed deserve "a place of honor in the history of physics." While Einstein identified Franklin with technological ingenuity, Cohen successfully countered that his most meaningful scientific legacy was in theoretical physics.

This is not how Franklin himself had characterized his work, describing his electrical research instead as a series only of "experiments and observations," which he would leave to others to endorse or refute as they saw fit. "Theory," meanwhile, was the term he used to hint at the dogmatic system building of his leading rival, the Abbé Nollet. Emphasizing Franklin's theoretical work was both historical revisionism on Cohen's part and a move in a much broader debate about the nature of scientific research during the early years of the Cold War. In emphasizing Franklin's theoretical achievements, Cohen was using Franklin as evidence to press the claim that science was driven by its own internal logic rather than by external circumstance. Cohen's strategy reveals dramatic changes in the history of science from the mid-twentieth century to our own time. Through

Talking Natural Philosophy in the Atomic Age:
I. Bernard Cohen and David P. Wheatland, curator of scientific instruments at Harvard, and the Pope Orrery in 1946.
Courtesy of Harvard University Collection of Historical Scientific Instruments.

the figure of Franklin we can see how Cold War concerns shaped an influential view of the origins of American science by emphasizing notions of genius, nationalism, and universalism. But we can also see how the turn in recent decades from laboratory epistemology to the sociology of networks—roughly speaking, from the questions first raised by Thomas Kuhn to those of Bruno Latour—has recast the significance of Franklin's science. The new perspective puts Franklin against a background of global trade, non-Western knowledge traditions, and the geographies of empire.

To understand how the modern scholarly image of Franklin's science was produced, we have to look more closely at I. Bernard Cohen and his work. Born in 1914, Cohen was the second scholar in the United States to receive a PhD in the history of science, from Harvard in 1947, for his scholarly edition of Franklin's *Experiments and Observations on Electricity* (1751). He'd begun his work in 1937 under George Sarton, the Belgian-born editor of the journal *Isis,* as well as Giorgio de Santillana, Samuel Eliot Morrison, Perry Miller, and Crane Brinton (*Franklin and Newton* was dedicated both to Miller, the doyen of Puritan studies, and to Alexandre Koyré, the influential historian of science). Cohen worked under the aegis of Harvard's Committee on Higher Degrees in History of Science and Learning. This program had just begun in 1936 under the leadership of Harvard President James B. Conant at a time when Marxist analyses of science had been stimulated by Boris Hessen's influential 1931 essay, "The Socio-Economic Roots of Newton's *Principia.*" Hessen polemically equated scientific knowledge with economic interest in Newton's work. His influence was clear even among his critics: the American sociologist Robert K. Merton denied that economic factors shaped the content of science, but questions about the link between military technologies and ballistic sciences (suggested by Hessen) were evident in Merton's work. Cohen was initially sympathetic to Hessen's approach, a consequence in part of his own antifascist politics during the Spanish Civil War. Cohen had spent time at a utopian community in Massachusetts referred to simply as "The Farm" (where he met his wife and spent time with friends like the composer Leonard Bernstein), as well as in the coal fields at Valley Forge, Pennsylvania. He had also approached the Marxist *New Masses* for employment as a writer. He described himself in private letters (excerpted in his *Isis* obituary in 2009) as an "earnest revolutionary" who was "longing to join the forces of revolt" and "study (mathematics and Marx)." Then he went to Harvard in 1937. Over the next several years, during the Second World War and the onset of the Cold War, both his politics and his scholarly inclinations were transformed.

Instead of Hessen, it was Sarton, Cohen's principal academic sponsor at Harvard, who played the more influential role in his formation as he researched, began teaching, and eventually assisted Sarton at the Carnegie Institution for Scientific Research in Washington. In bringing *Isis* to America in 1915, Sarton had looked to import his personal utopian vision of the history of science. For him, the discipline was integral to the triumph of civilization over the twin threats of religious acrimony and military conflict. The historian Marwa Elshakry has explained how Sarton was a committed Orientalist, versed in Arab and Medieval studies, as well as a historian of science. Preoccupied with non-Western decline, Sarton contrasted it with the emergent narrative of the "Scientific Revolution" taking place in Europe. In response to the crisis of the First World War, Sarton envisioned the history of science as a "new humanism," the only possible bridge, as he saw it, between scientists and humanists. It would be the foundation for an international movement of global cooperation based on Sarton's cherished assumption that science furnished universal rational truths on which all men could agree, unlike the divisive metaphysical pronouncements of mere faiths like Buddhism and Islam. Such assumptions helped drive notoriously teleological questions—such as the sinologist Joseph Needham's, "Why didn't modern science emerge in China?"—and modernization-theory paradigms like George Basalla's model of "the spread of Western science." During the Cold War, the Western science tradition was defined against Soviet-Marxist materialism in grand narratives like those of Herbert Butterfield, as the progress of a timeless "spirit" of truth-seeking inquiry.

Cohen endorsed the view that modern Western science was a uniquely authoritative intellectual accomplishment. His *Science, Servant of Man: A Layman's Primer for the Age of Science* (1948) was dedicated to Sarton. The book used Albrecht Dürer's *Melencolia I* (1514) as its frontispiece to illustrate its argument about "the direction given to blind Practical Skill by Theoretical Insight." The history of science, Cohen later wrote in 1955, could "illuminate a significant thread of our civilization." The history of "pure science," in particular, revealed "the stream of scientific activity" dating back to Babylonian astronomy. Medieval versions of Archimedes or Euclid were historically relevant insofar as they provided information concerning "the state of science preparatory to the notable advances which prepared the way for Galileo and Newton." This Sartonian vision presumed a unified historical identity for science, envisioning its function as a history of civilization that subordinated the contributions of non-European traditions as supporting context for the Scientific Revolution. "Studies on Islamic science," Cohen echoed his mentor, "and the role of Islam in transmitting the science of antiquity to the Middle Ages…are of interest to the historian of science because they fill the gap in the continuity between ancient and medieval-to-modern science." According to this view, elements of what turned out to be Western science might pass through other traditions, but those traditions had no substantial claim on modern science itself. That was reserved for Western Europe and, as Cohen's work on Franklin helped to clarify, the United States.

As part of his professionalization, Cohen also engaged in a variety of extracurricular activities. These included helping to run the History of Science Society, editing *Isis,* developing Harvard's General Education program, and teaching physics to military personnel. He helped to develop the history of science as a professional discipline at a point of epochal convergence between scientific research and global history: the triumph of the United States in the Second World War, made possible by the success of Big Science in the form of the Manhattan Project. As the United States soon embarked on a nuclear arms race with the Soviet Union, postwar American discussions of the nature and practice of scientific research assumed unprecedented intensity. Here, Cohen pragmatically played his part as an advocate of federal support for scientific research in the atomic age—a far cry from his earlier revolutionary leanings.

The historian of science Michael Dennis has argued that Cold War discussions of scientific research produced an early version of the externalism-internalism debate that raged during the 1990s. The key question was framed over whether innovations in science arose from an "internal" logic of research or from "external" factors such as economics and politics (many historians of science today reject any such crude duality). This question hearkened back to Hessen's provocative essay on Newton and achieved more lasting influence through Thomas Kuhn's *The Structure of Scientific Revolutions* (1962), which argued that shifts in "paradigms" were best grasped by understanding science as a form of collective problem solving rather than any march of ideas or genius across history. Kuhn used Franklin's account of electricity to illustrate a dominant paradigm that unified an entire community of practitioners in eighteenth-century science—a rather more social analysis than Cohen's, which emphasized Franklin's individual genius instead. This difference of approach may also explain the strained relationship between the two men at Harvard, where Cohen had initially advised Kuhn in the late 1940s during his transition from physics to the history of science (Kuhn was relieved to put distance between himself and his senior colleague when he moved to Berkeley in 1956). Writing in the years between Hessen and Kuhn, Cohen's outlook remained both individualist and fervently internalist, as he actively enrolled public support for Cold War science research. He participated in President Conant's program to raise awareness about science throughout American society, promoting the National Academy of Sciences's project for a National Science Fund, drafting a history of American science for general readers, and explaining "the practical use to which pure science is put." Echoing the reports published by Vannevar Bush and the Manhattan Project, he emphasized science's production of domestic comforts (downplaying its terrifying association with atomic weaponry) to persuade the public that autonomy in fundamental research was a necessity that harmonized with core American values. Scientific innovation was by nature inimical to nonscientists' direction.

Enter Benjamin Franklin. Cohen's work on Franklin provided an origins story for American science as it achieved preeminence in the mid-twentieth century. Thanks to Cohen's handling, Franklin epitomized a transatlantic experimental tradition, which he identified primarily with the heroic figure of Newton in England. This tradition Cohen characterized as "speculative Newtonian experimental science"—a crucial qualification, as it turned out. Franklin, he argued, was a natural philosopher who engaged in conjectural theorization in the tradition of Newton's *Opticks* (1704). Here Cohen was taking exception to the enduring popular nineteenth-century image of Franklin as a homespun techno-tinkerer and vulgar materialist, whom Max Weber had made the poster boy for his *Protestant Ethic and the Spirit of Capitalism* (1905). Franklin himself had, of course, carefully shunned the pretensions of "theory" that learned Europeans, who claimed exclusive rights to pronounce on nature's causal operations, had denied him as an American Creole—but this was largely a strategic ploy to get his letters on electricity a fair hearing in London. Cohen's promotion of Franklin's theoretical achievements overturned this European hierarchy in the moment of American ascendancy, at the conclusion of World War II and the onset of the Cold War. In this sense, the explosion of atomic bombs by the United States in Hiroshima and Nagasaki made Cohen's Franklin both possible and necessary. It was not materialism that made Franklin exemplary, Cohen insisted in *Benjamin Franklin: His Contribution to the American Tradition* (1953), but his combination of what he called "practicality and idealism." This combination incarnated both national and universal virtues of freedom of inquiry and technological mastery that would serve the common good ("the practical use to which pure science is put," as he had delicately phrased it), now of vital importance in America's struggle against the Soviet Union. This Franklin was atomic.

"Forget the kite," Cohen implored both his academic and general readerships through magazines like *Scientific American*—a reference to the famed kite experiment Franklin performed to demonstrate the identity of electricity and lightning, and which in turn made possible the invention of the lightning rod. This experiment, Cohen insisted, was unimportant. Instead, he emphasized that

Franklin was "one of the great founders of pure science"—a mantra-like phrase that was to become a touchstone for seeking federal funding, for keeping research free from intrusive oversight, and for defending the idealism of scientific practice. As a pure scientist, Franklin demonstrated the "intensely personal manner in which the creative scientist interprets and transforms the general scientific point of view of his age." This talk of "creativity" was characteristic of American intellectuals in the 1950s: the Franklinist Enlightenment exemplified a desirable and liberal autonomous selfhood, defined against both Marxist materialism and company-man conformism. No grubby tinkerer, Poor Richard incarnated the transcendent power of the American Mind: he stood out from the crowd with original ideas and made history by doing so. Because the lightning rod was an entirely unintended consequence of his electrical theorizing, Cohen could use Franklin to model his own argument, repeatedly quoting him in his finest homespun to underscore his commitment to pure science. On hearing observers question the utility of the dramatic new balloon flights he witnessed in Paris during the 1780s, Franklin allegedly retorted, "What use is a newborn baby?" For all his native common sense, Cohen's Franklin was invented for the atomic age, pressed into the service of Cold War polemics favoring massive federal support for scientific research, which had to remain free from direction because the nature of science itself, as Franklin's career showed, made it impossible to direct or predict.

Cohen's work has endured. It is still regarded in many ways as the standard history of Franklin's work on electricity. But more recent studies have placed Franklin's science in relation to questions in which Cohen showed little interest: namely, the larger colonial American environment and the imperial dynamics of transatlantic knowledge-making. The questions asked of Franklin's science have shifted, one might say, from Kuhn's focus on temporal revolutions in physical science (how do the questions we ask through science change over time?) to spatial questions about how science works through the extension of networks—questions forcefully posed by the sociologist Bruno Latour in works like *Science in Action* (1987).

The issue in recent Franklin scholarship is no longer objectivity or epistemology, but the relationship between what we demarcate as "science" and the "other" forms of knowledge and practice with which it is entangled but which are often left invisible. Joyce Chaplin's *The First Scientific American* and my own *A Most Amazing Scene of Wonders,* both published in 2006, resituated Franklin in his colonial Atlantic context rather than using him to launch the origins of a national American scientific tradition. Cohen was quite correct about the unanticipated character of the lightning rod and Franklin's penchant for theorizing everything from electricity to morality. But he overlooked the genteel ambitions and imperial energies that animated Franklin's career. When American independence came in 1776, after all, Franklin was seventy years old. For most of his life, the first scientific American had in fact been driven by the desire to become a wig-wearing member of British America's colonial elite, not to mention the British establishment in London, where he served for many years as colonial agent before moving to Paris at the outset of the Revolutionary War. The leisurely pursuit of natural philosophy was a highly self-conscious expression of that social aspiration. Franklin's 1754 Albany Plan of intercolonial union and his support for the Stamp Act were driven by faith that the colonies and mother country were firmly united by military, commercial, and political interests. His various projects in natural knowledge were useful, profitable, and imperial. These included using the anatomies of leaves to print paper money for colonial governments of such intricate design that they could not be counterfeited (a project from which he profited personally) as well as drawing on the vernacular knowledge of New England mariners to produce new charts of the Atlantic Gulf Stream, and thus improve the efficiency of the British imperial postal service. Franklin's epistemology *was* the networks he navigated: his account of electricity functioning as an economy of positive and negative charges emerged as a form of analogical reasoning from the commercial networks of the Atlantic world that were animated by accounting systems of credits and debits. As one scholar has aptly called him, he was the "bookkeeper of nature."

The forces that allowed Franklin's science to emerge were empire, colonization, and commerce, which turned plants, animals, and people into dynamic forms of biocapital for Europeans and Creoles alike. Tellingly, the two men most responsible for getting Franklin's electricity papers read in England, Peter Collinson and John Mitchell, were London-based experts in the early modern science of colonial botany, which commonly relied on the labor of enslaved Africans and indigenous American guides to accumulate specimen collections of scientific and economic value. In traditional histories of science, Franklin's Philadelphia appears in the guise of a European laboratory—if it appears at all. In reality, Pennsylvania was a colonial outpost, soon to erupt in violence as the Seven Years War (1756–1763) expelled the French and unleashed Western settlers on indigenous societies. Not for nothing did demonstrators of electricity tell of both Native American and enslaved African witnesses overcome with astonishment at the wonderful shocks and sparks produced by their enlightened electrostatic generators. In one macabre display of the power of electricity in Jamaica in 1760, the British authorities even meted out electric shocks to the leaders of the slave uprising known as Tacky's Rebellion at the place of their execution. The profile of experimental natural philosophy was thus both globalized and racialized in the eighteenth century: a frontier science that defined the knowledge of white Christian settlers against the superstitions of non-Europeans.

Latour's network model, together with his discussion of the problematic assumption of a great divide between "nature" and "politics," is useful for integrating environmental and anthropological approaches that can expand our historical understanding of science by, in fact, decentering it. Electrical machines themselves, of the kind Franklin used, evidenced in their very materiality a crucial interface between technology and environment. The ability to experiment depended on wood from trees to make generators' frames, glass blown by artisans into globes, and skins from animals to generate charge through friction (American experimenters used "buckskin"—probably deerskin acquired through Native American trading). Franklin's "Philadelphia Experiments" thus resulted from an entire material complex that relied upon the circulation of texts, techniques, demonstrators, and natural materials of various kinds, both across the Atlantic Ocean and along the eastern seaboard. His theoretical work in electricity, in other words, is historically inexplicable without understanding the technological and environmental interplay of materials and ideas as part of the history of commerce and colonization. More than this, his work can prompt a different and arguably richer set of questions that looks out rather than in: what does the material basis of Franklin's science reveal about broader relationships between knowledge-making, commerce, technological objects, communications, environments, and cross-cultural contacts?

The practice of electrocution in response to Tacky's Rebellion in Jamaica is doubly significant because it returns us to the fundamental question about the relationship between the history of science and global history. Cohen's version of Franklin was preformed in part by the universalist vision of scientific truth espoused by his mentor Sarton. Franklin was a national incarnation of that universalist vision of the progress of civilization. The question of what to count as "science" among the world's different knowledge traditions is not in fact new to the current "global turn" in historiography, but has animated in polemical (if often tacit) fashion the selectivity of history of science from its beginnings. This global turn is driven by preoccupations with the social, economic, and environmental effects of contemporary neoliberal globalization, but it can transform our historical understanding as well. This would involve, among other things, abandoning notions of nationalism and universalism as the carriers of something called "the Western scientific tradition" and understanding the relatedness of things we have learned to see as separate. The reason the British electrocuted the leaders of Tacky's Rebellion was that a number of them were practitioners of "obeah," a syncretic combination of Afro-Caribbean practices including healing, poisoning, social arbitration, and spirit worship that made use of plants, animal and human body parts, and various objects. In executing the rebels, the British were affirming their own belief in the superiority of their science (and religion) over a practice they derided, misunderstood, and feared. Obeah seemed so different from their forms of knowledge yet also produced real effects, both physical and psychological, for colonists often went to African healers when white medicine failed. The point is that electricity and obeah normally belong to very different historical narratives: the universal history of science insists that practices like obeah are not science and thus part of ethnohistory, relegating them to the category of local knowledge. The challenge for scholars is to forge new narratives in which both ways of knowing can appear in order to make sense of them as historical practices that are competing for knowledge and control of material environments. Those settings contained nonhuman actors as well, in the form of plants, animals, and the earth itself. If the divisions between "history of science" and other historical fields break down in the process, preserving disciplinary boundaries surely counts less than understanding long-obscured interactions.

In certain quarters, the present moment in the history of science seems characterized by ambivalence. Retrospection was the official order of the day in 2012, with several conferences commemorating the half century since the publication of Kuhn's *Structure,* while at least one journal marked the quarter century since Latour's *Science in Action.* On the popular front, US debates on science remain mired in staid controversy over the relative merits of Darwinism and Creationism as rival descriptions of the origin of life on Earth. More menacingly, corporate-backed propaganda actively denies the evidence for anthropogenic climate change produced by fossil fuels and the increasingly devastating environmental damage this may cause. In the face of such threats, even Latour, in an article in 2004, stated that his aim had never been to demolish the authority of the scientific fact but to critique its nature so that we might have *better* facts as a result. This is a nice idea, but the notion of somehow returning to a positivist rhetoric of scientific facts, to head off radical antiempirical propaganda, has an unconvincing ring after years of reasoned antipositivist critique. (Publicly exposing the convergent networks of capital and self-interested misinformation seems more promising.) Lorraine Daston, meanwhile, has questioned the direction of the history of science as an academic discipline, despite its scholarly and public contributions, and suggested that it might now benefit from a renewed interaction with philosophy of science. The global, environmental, and economic preoccupations of much current historiography, however, signal a rich and urgent opportunity to deepen our understanding of natural knowledge in all its material forms—building on the insights of Kuhn, Latour, and others, while putting them to use in expanded frameworks. It surely helps to have a fuller understanding of the significance of Franklin's science than that proposed by Cohen's Cold War universalism, but there's no need to stop there. We're still just beginning to see how many other histories Poor Richard's kite string was tangled up in.