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It Took a Scientist to Historicize One!

It is easy to forget that Thomas Kuhn's *The Structure of Scientific Revolutions* came out at the height of the Cold War, an era when science and global politics became even more inseparable in American life than during World War II. On October 4, 1957, the draconian Soviet Union launched Sputnik into an elliptical low Earth orbit and thereby threw our free press and public media into a tizzy. I remember entering the eighth grade in September 1959, when our science and mathematics "aptitudes" were tested, and we were selected for special "science preparation" sections in junior high school. In these classes, science teachers presented the cutting edges of the "new" sciences in the 1950s. These subjects were now required of us, if we were to keep pace in the space race with the communists. Some of us were plucked out of high school altogether when we were seniors and sent to universities as bogus freshmen, so that we could get the training in calculus and higher mathematics that our high school couldn't offer.

The revolution in science education was a matter of national security. Otherwise, head for the bomb shelters. We were guinea pigs for the new textbooks called "PSSC Physics" and "CBA Chemistry," which science teachers hastily assembled at the Bronx School of Science and other big-city mega-high schools. Literature? Latin? Social Studies? History? They were still there, but the right to study them in the future hung in the balance, if we didn't match the Russian's Sputnik. Looking back on it, the "Sputnik Age" seemed to me, albeit for a brief time, all-encompassing and unifying. We felt we were all in it together. When our Vanguard rocket initially failed to get off the ground, we all shared in that December 6, 1957, failure. How had the Russians done it?

"Us" versus "Them" had its lighter side, of course, when as the same junior high school students we were entertained and intrigued from 1959 to

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1964 by the weekly late-afternoon cartoon clash on the TV screen between Rocky and Bullwinkle, standing for the United States, and Boris and Natasha, fronting for the USSR. As bogus freshmen we discovered that real college freshmen cut classes and hung out in campus coffee shops. Despite feeling guilty, we quickly realized that our poor teaching assistant for our calculus lectures (Where was the professor? Saving the world?) had no pedagogical tools or teaching skills whatsoever. She chalked up the blackboard with endless differential equations that none of us could understand until we worked through the analytical geometry and calculus textbook by ourselves. Who needed high school? We had a good time being bogus freshmen.

Fortunately, the U.S. space program picked up after Vanguard, and NASA was soon on its way to the moon by 1968. No one “in charge” waited long enough for us to contribute to America’s future, though many of us marched into college convinced that science and engineering were the way to go . . . until the Vietnam War ominously diverted our resources and our attention to a war of technology and attrition in which some 58,000 of us, including college students, perished for pretty much nothing, a simple-minded theory never tested, which considered it essential to contain Red China and the Russian communists in Asia, even though the Sino-Soviet split was well along by then. It was conveniently known as the “domino theory.” If South Vietnam fell to the “Reds,” then every other domino in Southeast Asia would fall, one by one, and we would be in a global fix, again. But this time our cutting-edge science and technology, mobilized to deal with the Russians, was aimed at an agricultural society in which ninety-five percent of the people were peasant farmers, some doubling as guerrilla soldiers. We napalmed them back to primitive life.

Sputnik and Vietnam were only part of the longer-term context in which Kuhn’s *Structure* appeared. It was a time when big science was king, enough so that even President Eisenhower, a former five-star general, warned of the “military-industrial complex” when he stepped down in 1960. Paralleling the American (and Russian! and Chinese!) belief in science and technology as the means to maintain our domestic front and spread our footprint globally, the field known as the “philosophy of science” ruled the theological bandwidth where the “truth” and “beauty” of science were debated at Oxbridge and the Ivies. Recall how Karl Popper’s much-ballyhooed *Conjectures and Refutations*, also published in 1962, magisterially explained the “growth of scientific knowledge” by appealing to the falsifiability or refutability of assertions about the natural

world.¹ Earlier theories of science, however empirical or empiricist, deductive or inductive, had never factored in the corrosive acid of skepticism, Popper explained. The theory-ladenness of scientific facts was just beginning to be reconceived in light of the culture-ladenness of scientific theories. But like enlightened Renaissance theologians before them, most 1960s philosophers of science like Popper could only imagine their role as the priestly voice of their high-minded meta-science. Realistic novels, such as Sinclair Lewis's *Arrowsmith* (1925), had already warned us that there was more to it than that and linked science to possible fraud, but few after Sputnik discussed the limits of science to mold and improve our lives.

Hence, we forget the brouhaha that greeted Kuhn's claims that science was historically contingent and grounded in its time and place, precisely because my peers and I forget that the Cold War was a time when science was proclaimed universal. As a trained scientist, Kuhn had seen through the scientism of his peers; as a trained historian he unraveled the allure of the philosophy of science, which allegedly explained the universal "logic" of scientific discoveries. Instead of conjectures versus refutations, Kuhn argued that the claims of science were always tied to what we might call a *zeitgeist* or *weltanschauung*, but that he defined in terms of a "paradigm," a bloated concept that he later regretted coining and retracted.

When a research paradigm was dominant in any field of science and relatively unchallenged, whether Newtonian or Einsteinian for example, then scientists labored primarily as worker bees filling in the puzzle with new pieces and improving the scope and reach of the current, dominant theory. When an anomaly was recognized and finally taken seriously enough to challenge the paradigm in place, however, scientists no longer seemed to follow the golden rules of objective science. All hell broke loose, and scientists subjectively tried pretty much anything to achieve a new synthesis and explain the anomaly, on one hand, and everything that the previous paradigm had already explained, on the other. So much for the rules of geometry, deductive and inductive logic, or hypo-deductive reasoning enunciated by philosophers of science. Refutations were essential for Popper's philosophical version of scientific discovery, but for Kuhn even the worker bees of science learned from exemplary cases, not logical rules, while the queen of a scientific revolution danced to an altogether different drummer.

1. See also Karl Popper, *Logik der forschung; zur erkenntnistheorie der modernen naturwissenschaft* (Vienna: J. Springer, 1935), which was published in English as *The Logic of Scientific Discovery* (New York: Basic Books, 1959).

In its time, Kuhn's theory explaining the historical logic of scientific revolutions was shocking. He had historicized science and almost single-handedly begun to tilt the academic playing field for the study of science in favor of the history of science, at the expense of the philosophy of science. Science in the laboratory and the resident scientist in his white robe were together unmasked and undressed. We began to ask questions that only fiction had entertained before. What actually did scientists do and how, and why? Most importantly, who paid for it? For those like me educated in the 1960s, during the Sputnik Age followed by the Vietnam War, Kuhn's historically minded voice—unintentionally, I think—provided a rallying point around which to mobilize our growing disenchantment with science. We began to question why and how the allure of science had yielded such unintended and unsavory consequences, both in the laboratory and in the world out there. Europeans had previously produced a technological Armageddon in World War I, which they repeated in World War II.

Whether in the United States or the Soviet Union, scientists were subjected to unspoken political constraints that belied the idealized story of the progress of science that Kuhn carefully unraveled in 1962 as a fantasy, precisely because he had been trained as a physicist himself. For those of us who were not scientists, we first required an anthropology of the scientific laboratory to understand the scientist. For its capitalist version, Bruno Latour successfully completed his field work within the precincts of Euro-American complexes of science and then proceeded, politely, to undress the scientists and betray their internalist secrets. Kuhn's breakthrough had made that undressing thinkable. We still await the parallel undressing of socialist science on similar anthropological terms, whether in Moscow or now too Beijing. After all, how had the Russians done it in the 1950s? What will the Chinese do with all their worker-bee engineers who produce modern science and technology? First one to Mars anyone?