

Connection of science and technology with various cultural settings

[Sociology](#)



**ASSIGN
BUSTER**

Science, Knowledge, and Cultural Baggage

There are viable reasons history shouldn't be taught from a storybook. Apparently some "historians" (or, more specifically, scientists temporarily masquerading as historians) take issue with this. One such scientist in historian's clothing is Steven Weinberg, author of the aforementioned authoritative title. Seeking to "distance [himself] from...historians who try to explain not only the process but even the results of science as products of a particular cultural milieu" (xi), Weinberg's claims one goal in publishing this book is to scrape away what he views as cultural excess to reveal every age's pure scientific endeavors that culminated in his idea of "modern" science. Culture, that annoying set of social norms and behaviors that shape every human not raised by wolves, has no place in the process or products of scientific thought. Weinberg, like so many others, conceptualizes modern science as a superior process that just exists and must wait patiently to be discovered by the "right" people with the "right" intelligence and the most freedom from cultural baggage. ("In this sense, [modern science] is a technique that was waiting for people to discover it.") Readers have to wonder how even a scientist could conceive of cultural tides as mere fluff instead of dynamic forces shaping scientific thoughts and goals. By distancing his understanding of modern science from the cultures that fed and raised it, Weinberg implies the false notion that science exists in a vacuum, and what has been coined as "progress" is, to him, a steady march toward an obvious goal. Dismissing cultural influences on the development of scientific thought, as Weinberg attests is necessary for understanding modern science in its "essential" form, obstructs a comprehensive

understanding of not only the science of the past, but also the science of this gilded modern age.

Insisting that history, let alone the history of science as we currently know it, be a convenient avenue of study that perfectly parallels contemporary ideas is borderline insulting. Worse, it flirts with the edge of what has come to be known as Whig history, a form of historical inquiry that takes for granted the biases shaping modern critical thought. This questionable approach to understanding the past is better described by author of *The Scientific Revolution: Introduction to History and Philosophy of Science* author John Schuster: “ We make our present values and beliefs...the measure and the explanation of what they [historical figures] did and why they did it” (Schuster, 17). As Schuster goes on to explain, this approach to studying the past reveals contemporary biases more than it reveals any useful insight into the past. Weinberg approaches the thought of bracketing one’s modern cultural biases as a herculean effort that ought to be dismissed as unnecessary fluff. Realistically, as Schuster maintains, reliable insight can be gleaned only when we accept that modern people, and modern expectations of what science is and does, are fundamentally different from those of the past. Science as we know it may appear similar, but science’s cultural context—politics, religions, gender roles, economic systems—has changed. We do not reflect them. Our circumstances are not their circumstances. And expecting this to be the case is a weak foundation from which to consult the past, a foundation that Weinberg appears to perceive as not merely appropriate, but preferable for its tidiness, which seems to exist by virtue of chronological distance alone.

<https://assignbuster.com/connection-of-science-and-technology-with-various-cultural-settings/>

Preferable though it may be to modern society where straightforward causes determine equally straightforward effects, tidiness has never been a human virtue. In his preface, Weinberg posits, “[A]t its most fundamental level science is not undertaken for any practical reason” (xiii), a sentiment that seems to accept, if undervalue, the complexity of scientific “purpose.” It does, however, invite criticism; after all, if he openly admits to viewing the past through the unchecked eyes of a modern physicist (xii), his notion of practicality is likely just as troublesome. This is a simple conclusion to arrive at when one so assiduously dismisses culture as a driving force of scientific thought and endeavors. There are two major issues raised in this statement. What, exactly, is science to this physicist? And what does he regard as practical? If his approach to science is simply a pursuit of understanding natural phenomena, then how in the world does he relegate endeavors like agriculture and astronomy, even in their “developing” years, to the realm of the impractical? Perhaps while insisting he maintain academic distance from the goings-on of the past, Weinberg has misplaced his sense of practicality. It has certainly illustrated one of the primary differences between modern science and that of the past; modern science exists in the rather insulated world of academia, observing natural phenomena for the sake of distilling fact after fact. The science of the past was woven so tightly to everyday life that the clear-cut distinction between science and religious faith, for example, was not always evident. While perhaps the academically driven physics and astronomy of the modern age were absent from ancient people’s lives, to object to their uses of, and methods for understanding, the natural phenomena around them is to cling to the concept of science as a

static thing that exists outside of a context—as if it would exist even if no human were around to use it. With these two vastly different concepts of science, it is understandable that a modern physicist would discredit much science of the past as simplistic or impractical—it is not, however, acceptable.

A brief dip into ancient astronomy, for just one example, provides a much-needed objection to Weinberg's unhelpful perspective. Anthony Aveni, author of *Stairways to the Stars*, explores the cultural relevance and practical, everyday applications of astronomy to the ancient Maya, the Inca, and the many peoples who constructed Stonehenge. Aveni makes the case that, rather than being a quaint extracurricular that, at its best, contributes to the "common sense of mankind," (a phrase which implies such observations are childish and unpolished in their uses), ancient people's astronomical observations allowed them to predict and actively plan for seasonal changes (x). More than just predicting when to plant and harvest certain crops, however, these observations allowed for rich cultural interpretations that fed social regard for celestial events. Thoroughly steeped in everyday matters like religion (it is necessary to note that the current concept of religion as a discrete social structure, conceptually isolated from politics and other facets of society, may not be a useful platform from which to conceive ancient people's beliefs), observing the sky informed, in the case of the Maya, everything from the number of days in a month to the concept of paying dues to the gods who maintain a balanced cosmos (Aveni, 121). Unlike the modern world's conception of astronomy and astrology as separate and diametrically opposed systems for observing

the cosmos, the Maya depended on an intricately woven system of the two. At the risk of over-interpreting Maya life from the distant future, Aveni makes note that “[f]or the ancient Maya, sky phenomena were laden with powerful messages” (144). Messages portended such events like droughts, coups, and imminent war, so it was especially useful to have skilled individuals spend a great deal of time and energy studying the stars and planets, and relaying what these patterns meant for the maintenance of Mayan society. The Maya had much to gain by observing Venus in particular—and, of course, “much” cannot be exaggerated. The extant writings of the Venus Table illustrate that Maya scholars “were conducting a dialog with the sky both in the poetic meter of myth...and in the precise and rigorous language of mathematics,” essentially blending astronomy and astrology (Aveni, 115). Using data from daily observations, Maya scholars interacted with Venus, whose representation was the sky deity Kukulcan. Depending on the manifestation of the cycle, Kukulcan’s omens would change, along with the type of sacrifice demanded for maintaining cosmic balance. Because these omens were central to Mayan society, it forced scholars to observe the cycle with unwavering precision—essentially obtaining “scientific” knowledge from a religiously driven activity (115-119). This overt blending of human belief and what Weinberg perceives as objective science requires an equally blended, nuanced approach to understanding how astronomy, as defined today, developed in Mayan society and how it influenced subsequent generations of thought. If it weren’t for the culturally accepted concept of the Venus deity Kukulcan, the need for tracking the Venus cycle might not have existed. The

social context drove the science, and the science allowed for more precise observations for social purposes.

A more exaggerated example of culture shaping science, and vice versa, can be seen in the physical structuring of the Inca capital city, Cuzco. While the Inca and the Maya had a similar cosmology—that is, a universe to be explained by a sophisticated interaction of math and myth—their interactions with the sky and its inhabitants directly affected all citizens of the Inca empire. Organized in a ray-like fashion, the urban site of Cuzco expanded outward, via ritual pathways called ceques, to usefully divide the empire for purposes of water rights, ritual offerings, and other methods for maintaining social order in the fickle climate of the Andes. Here, not only the social landscape but the physical landscape of the mountains dictated adherence to a unique cosmology, whereby kin groups were assigned their duties to maintain good standing with their sun god. Aveni effectively observes of this system's complexity, "The ceque system was a giant cosmographic map, a mnemonic device built into Cuzco's natural and man-made topography, the served to unify Inca ideas about religion, social organization, calendar, hydrology, and astronomy" (156). This system dictated who did what and when, and all routes of order led from the Coricancha, the temple of the sun at the heart of Cuzco. Literally, all social organization in the Inca empire radiated from the four points of the temple of their primary deity, a representation of the Sun. And, because the Sun was inarguably vital to the Inca worldview, carefully observing its path was equally vital. The astronomical reality of the Sun's movements provided the common factor necessary for integrating the people of this diverse,

<https://assignbuster.com/connection-of-science-and-technology-with-various-cultural-settings/>

widespread empire. A modern conception of science may not be immediately evident, as it intermingles so complexly with Inca social order, but that in itself is the point—modern science is so far removed from the everyday reality of life that the astronomical observations of the Inca may seem irrelevant to the “ progress” of astronomy. It may be easy to suggest that this system had more social significance than astronomical, but that would again be a modern bias projecting itself onto the past.

Perhaps the most significant projection of modern thought onto past artifacts rests with the myriad interpretations of the remains of Stonehenge. Aveni quotes Jacquetta Hawkes, who succinctly notes, “ Every age has the Stonehenge it deserves—or desires,” recognizing a continuous tendency for people to place upon the ancient stones “ whatever kind of antiquity he or she is particularly fond of at the moment” (70). Sometimes this means going so far as to equate the sophisticated stonework to a modern computer, which was obviously used to calculate eclipses and other phenomena; to another’s eyes, this is clearly the space of prehistoric sky god worship. Clearly, although astronomical events are fairly consistent and dependable, human social settings cast varying lights on them and allow these events to be interpreted in infinite ways—if they are worthy of interpretation at all. Astronomy is a useful tool, perhaps, but just as not every society has equal need for a wrench, not every society has equal need for understanding lunar phases or for navigating open water with the use of the Pleiades constellation. Observing past people’s uses of celestial events from the lens of modern uses for those same events ignores every change from then to now and assumes a certain “ correctness” to modern ideas; and, consciously

<https://assignbuster.com/connection-of-science-and-technology-with-various-cultural-settings/>

or otherwise, it is easy to assign value to past people's views when they seem congruent with modern views. Weinberg takes the simple route, succumbing to Aveni's notion of "naturalistic narcissism," the propensity to "[believe] that if we cannot reduce the astronomy of another culture to some form of our own, then it may not be worthy of our attention" (193). This is likewise the case with any form of what modern thinkers call "science"; and, in any case, this uncompromising perspective erases the cultural context necessary for understanding both current and past motives for observing and interpreting natural phenomena. In its currently insulated form of academic study, modern astronomy does not look today as it did to the people's who used it for more socially immediate purposes than theorizing about gravitational waves or determining the density of exoplanets; thus, it is unfair to project this modern concept onto peoples of the past and expect current standards of "scientific" thought to be met.

Very often, these current standards of science and its methods for fact gathering are attributed to the intellectually bustling years of the Scientific Revolution, a time that was not just worlds apart, but worldviews apart, from any ancient peoples'. The much enamored and glorified years of this "revolutionary" time make a brief cameo in Weinberg's preface and seem to be the anchor for his primary idea: the modern scientific method developed in the genius minds of seventeenth century Europeans, independent of their cultural milieu. Unfortunately for Weinberg, that anchor is awfully rusty, and crumbles under firm questioning. Modern thinkers tend to forget that even the chronological distance of a few hundred years is enough to allow drastically different expressions of scientific thought. Indeed, scientific

thought in its modern definition—that is, empirically through rigorous, “correct” method of studying natural phenomena—was heavily contested during the Scientific Revolution, and it certainly did not occur to these European academics in a stroke of divine genius.

In fact, divinity and religion played a much larger role than many a contemporary scientist like Weinberg prefers to admit. The “Scientific Revolution” is often referred to as more than just a scientific venture, but a venture toward an almost atheistic rationality—but the ancient Maya, Inca, and Stonehenge peoples were not alone in their religiously driven scientific and cosmological convictions. The religious traditions of Christianity offered its followers a unique cosmology, which dictated that God’s will pervaded the observable universe and maintained it. In this view, which pervaded the Middle Ages before the introduction of the “handmaiden formula,” intellectual curiosity about the natural world was considered a form of personal vanity. The Bible had everything there was to say about God’s universe, so seeking one’s own sense of understanding, even if it fit Biblical ideas, defied God’s unquestionable will over the world(s) He had created (Lindberg, 18-19). While this did not completely halt intellectual progress, as modern scientists repeatedly accuse of the Middle or “Dark” Ages, the leash on scientific enterprise was comparatively tighter, loosening with the gradual reinstatement of the classical scientific tradition. The root of modern science, the classical tradition of ancient Greece, espouses a highly rational methodology for acquiring knowledge. (A methodology, one must note, that often led to objectively incorrect conclusions about such phenomena as planets’ orbits and cause-and-effect relationships, later revised by Islamic

<https://assignbuster.com/connection-of-science-and-technology-with-various-cultural-settings/>

scholars [Saliba, 362].) This methodology leaves little room for the concept of a universe- or world-governing God (Lindberg, 10), yet this did not divide science and religion into discrete and warring schools of thought. In fact, much of this “pagan” method had gradually been “Christianized” throughout the Middle Ages. These two institutions essentially co-evolved to support the authority of the other.

Consider, as Steven Shapin does in his book *The Scientific Revolution*, the nature of the clock, or the microscope, or any number of sense-enhancing devices hailing from this “revolutionary” era. These devices existed by the will of human hands and human intellect, but their intricate workings (and in the case of the microscope, its shocking findings) supported the idea that “[e]verything in God’s created nature displayed his power, goodness, and wisdom” (Shapin, 144). Humans were unveiling God’s thoughtfulness, employed down to the humble housefly and the microbes wriggling in a raindrop. Empirical observation did not deny the existence of God, but rather reaffirmed His place as a governing power in an orderly universe. Clearly, the classical tradition offered undeniable benefit to the Church, for it was “a religious duty that human beings use their God-given faculties of observation and reason to read the Book of Nature and to read it properly” (Shapin, 139). Scholars who pursued this tradition equally benefited from the authority vested in it by the Church. This mutually beneficial relationship allowed for a sense of stability—or stagnation, modern scientists like Weinberg would argue, in need of a revolution.

In truth, the Scientific Revolution was much more tentative than its moniker suggests. To reconcile itself with ubiquitous religion, science—and those who wished to pursue it with methods contested by the Church—had to become useful to the theological tradition of the day. Essentially, science had to become an extension of faith, an extension of understanding the world God had made. Hence, through much skirmishing during the Middle Ages, science crept toward a more socially validated position of assistant to Christian faith, including its cosmology. Unfortunately for Weinberg, this cosmology, along with the intellectual tradition of “natural philosophy,” did not simply fall away with each “modern” scientific understanding of the universe. In fact, possibly the most useful understanding of science during its “revolution” is that it was heavily influenced by its immediate supporters. As Weinberg’s nemeses, social constructivists, point out, European science from the Middle Ages through the seventeenth century acted as religion’s handmaid, condoning scientific endeavors primarily for its benefits for the Church; as should be obvious, the inferior position of science to religion necessitated a certain level of submission to the dominant social structure. Hence, even if some genius adamantly believed, and could prove with unquestionable data, that the Earth revolved around the Sun, it could only be accepted and proliferated on the basis that it validated the Christian worldview. Shifting away from religiously sanctioned science was a gradual process marked by much social contention; so while it is accurate to argue that the sharp divide between religion and science as we currently know it had its roots in the Scientific Revolution, it is equally accurate to argue that modern science

would not be so defined were it not for its past relationship with religion, its mistress.

Of course, even the most loyal handmaid can serve multiple mistresses, and science is no exception. Since the volatile years of the early 20th century, science has seemingly begun to serve a new employer—war. There may be no greater irony than a physicist like Weinberg claiming culture had minimal influence on “pure” science when physics itself developed exponentially, and with hyper-focused goals, in the fervor of international tensions during the 20th century. As Naomi Oreskes argues in her book *Science and Technology in the Global Cold War*, American science frequently depended on its applicability to national defense; indeed, research and development in physics secured “about 95-98 percent” of its federal support from the Atomic Energy Commission and/or the Department of Defense (19). Oreskes asserts that this patronage could not help but affect the direction of research. After all, if the military is funding the scientist, and the scientist wishes to keep his or her paycheck, it was in the scientist’s best interests to make research not just plausible but useful. Though not exactly coercive—it should be noted that scientists are still people who want to see their life’s work validated—this “mutual orientation” of useful research and positive feedback for that research created an atmosphere in which “the physics that physicists ended up with...was focused in areas that had not previously been viewed as priorities by physicists, but were priorities for their military patrons” (Oreskes, 20-21). While some may argue that physicists received ample funding to pursue their own projects, and perhaps some did, the positive feedback loop created by military funding almost entirely ensured

that money went directly to projects that were most likely to avoid rejection. The cycle fundamentally changed the goal of science, especially physics, from the pursuit of Weinberg's "pure" science (science for science's sake) to the pursuit of readily usable, relevant science. During the tense years of the Cold War, this demanded greater focus on nuclear weaponry, surveillance technology, and an academic push for students to enter fields of engineering, math, and science. Much like the natural philosophers of yesteryear, modern scientists of the Cold War era either consciously or unconsciously catered to the needs of their sponsors. Thus, much like the past religious pressure to reaffirm God's place in the universe, the modern social pressure of military prowess directed the course of scientific enterprise.

Also implicated in these dynamic years was the rapid growth and application of astronomy. Previously overshadowed by physics and other "practical" science in the modern world, astronomy regained relevance when, as W. Patrick McCray illustrates in his book *Keep Watching the Skies!*, countries began tentative steps toward satellite technology. Aptly referred to as the Space Age, the years following World War II were characterized by tensions between America and the Soviets, a tension based, among other things, "knowledge about knowledge"—who had it, who could use it, and who could win with their "superior" engineering and understanding of weaponry (Oreskes, 13). Besides the constant pressure to create and successfully utilize bombs and missiles, much of this knowledge hinged on understanding how one might launch and track man-made satellites; after all, if one could accomplish this, bombs could then theoretically be launched into orbit and

loom over adversaries as a constant reminder of their national (or, as it were, economic) inferiority. One might assume this process of creating and tracking satellites to be the province of only the most educated, specialized individuals. Throughout history, and whether for religious purposes or otherwise, one of the most inarguable conclusions is that only highly valued individuals were granted the opportunities to study and pose legitimate observations of culturally significant events. But the Space Age in Cold War America, McCray asserts, relied much more heavily on the contributions of “citizen scientists”—starry-eyed amateurs, in other words. In 1956, the year preceding the surprise launch of Sputnik, the Smithsonian Astrophysical Observatory initiated Operation Moonwatch, an amateur network of satellite spotters that would provide the United States’ first deluge of information and would prove to be a critical component in the U. S.’s participation in the International Geophysical Year. This was no simple matter. Underestimated by their own military (the Naval Research Academy griped that amateur efforts would prove “unsatisfactory” and would leave unpaid volunteers feeling “demoralized” [80-81]), the individuals invested in Moonwatch nonetheless regularly provided exemplary data. In fact, one SAO report comments that Moonwatchers provided ““ with very few exceptions, the only scientifically valuable visual observations”” (152). This validation, coupled with mounting tensions between the U. S. and the Soviets, created a social atmosphere ripe for a boom in science—although, as Oreskes points out, this science was characterized by its applicability to national defense and prestige. Citizen scientists provided more than supplemental eyes and ears for professional satellite trackers; by highlighting ideals of civic duty and

teamwork, Moonwatchers' efforts proved that science was accessible, applicable, and exciting to the average American.

But if science should not be treated as a product of culture, as Weinberg argues, where does that leave either amateur or professional satellite trackers? Where does that leave most of the physics and astronomy hailing from the Space Age? Where do hydrogen bombs, stealth satellites, and manned flights to the Moon fit into a "science for science's sake" worldview? The brief answer is that our modern understanding of the universe, and the science we currently laud, developed over the roughly 45 years of covert aggression between a capitalist America and the communist Soviets. The Cold War was the catalyst for both the U. S. and the USSR missions to the Moon, from the success of which derived a new appreciation for a modern cosmology. Beginning in the 20th century, prominent mathematicians and physicists concluded that this once mythologized universe governed by gods of varying powers is a vast, expanding abyss, littered here and there with galaxies only recently discovered. While this obviously rattled the scientific world, the implications of humanity's place in an accelerating, expanding universe provided a useful framework from which to contemplate the humbling photographs taken of Earth during the many Apollo missions. The images of a vulnerable, cloud-wisped Earth hovering in the void of space sparked a curious reaction in its viewers. Accountability, tenderness, language-defying awe—these feelings and more constituted the nearly ubiquitous response to our lonely little planet, and our place on it as earthlings above any other contentious identity (Poole, 36-38). Inarguably, and rather ironically, the missions to the Moon provided a sobering context

<https://assignbuster.com/connection-of-science-and-technology-with-various-cultural-settings/>

for the nationalistic strife that fueled them. Petty competition between countries of opposing economic ideals churned out more scientific and technological “advances” than could be safely put to use. It is difficult to imagine how these “advances” would be useful, and thus even conceived, without the context of international tension.

Undoubtedly, science and technology developed as they have in tandem with their various cultural settings. Whether that setting is a Mayan temple, a 14th century Christian monastery, or a 21st century NASA testing facility, any examination of the history of science requires its examiner to bracket his or her worldview in order to more usefully study the myriad worldviews of the past. Since science, and what is considered legitimate scientific knowledge, continuously proves to be dynamic, valid knowledge today might be the source of scorn for the Weinbergs of future decades. Weinberg may very well be an exemplary physicist, steeped in a field where a firm idea of one cause triggering one effect is useful. But history is a tangled, messy beast that ought to be left to the historians who, unlike Weinberg and his like-minded colleagues, understand and appreciate the nuance required for its untangling.