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ORIGINAL RESEARCH

# The two ideals shaping the content of modern science

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**Abstract**
Much has been written over the years regarding the norms, values, and ideals of modern science—in a word, what is expected of science and scientists. Most frequently, however, attention has focused on the conduct expected of scientists (e.g., Merton's norms) rather than on the specific content expected of their scientific contributions, and attention has also tended to focus on the current scene rather than on the events that produced it. So. a kind of two-fold gap exists in our understanding of our scientific heritage. Why is this important? Because it turns out that the two general ideals that have shaped the content of modern science right from the start seem to contradict each other. Nonetheless, they both have enjoyed weighty reasons offered in their defense and they both have exerted strong holds through the centuries on scientists and nonscientists alike, and still exert these holds. And the tradition has not offered any satisfying resolution. So, it is high time we deal with this situation. At least, that is what I attempt to do in this paper.

**Keywords** Ideal of value-free science · Francis Bacon · Vannevar Bush · Social good · Modern science · Humanism

Much has been written over the years regarding the norms, values, and ideals of modern science—in a word what is expected of science and scientists. Most frequently the **CUDOS** norms, offered nearly a century ago by sociologist of science Robert Merton, have been at the center of such discussions (see Merton [1942] 1973). These are, remember, **C**ommunism or **C**ommunalism (that all discoveries should be community owned and publicly shared), **U**niversalism (that everyone should be welcomed

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into science and their contributions treated equally), **D**isinterestedness (that scientists should work for the good of science, not their own personal good), and **O**rganized **S**kepticism (that all scientific claims should be exposed to the critical scrutiny of the scientific community). But other norms, billed as additions to Merton's list (such as replication and originality), as well as other norms counter to Merton's norms (such as particularism and secrecy), have also entered the discussions, and so have the epistemically related values underlying all these norms (such as honesty, openness, and accountability). Note, however, that none of this has concerned the *content* of science, but only the conduct of scientists with respect to that content, whatever it happens to be. Of course, equally general ideals related to the content of science have also entered the discussions, only not so frequently, and the items discussed have been far fewer than the above. Perhaps, in fact, they have been just two: that science should be free of social values, and that science should serve the public good. Still, these two are very special: they both go back all the way to the dawn of modern science, they both have had weighty reasons offered in their defense, they both have exerted strong holds through the centuries on scientists and non-scientists alike, and they both appear to contradict the other. What status do these conflicting ideals have for us today, and what status should they have? Those will be my questions. But to answer them it will be best to start at the beginning.

## 1 The origin of modern science's two content-shaping ideals

Start with the value-free ideal. Its pedigree is impressive. Some see it already functioning in ancient times with the Platonic separation of the theoretical and the practical and the privileging of the theoretical. Most, however, see it emerging with the dawn of modern science in the sixteenth and seventeenth centuries and the idea that nature is merely matter in motion, devoid of qualities such as good and evil. They see it as well in the seventeenth-century idea that the study of nature is distorted by social concerns in just the way Bacon claimed such study is distorted by the various idols he described. The ideal of value-free science is seen functioning again in the eighteenth century with Hume's separation of "ought" from "is", and in the nineteenth century with the push toward academic specialization and the emphasis on the increasingly technical specialties and subspecialties of science as impartial resources for the solution of social problems. And the ideal of value-free science is seen once again in the twentieth century with the many historical and philosophical and sometimes even sociological accounts of science in which social values either play no role at all or at least no very helpful role (for more details regarding this history, see Proctor, 1991). As the twentieth century progressed, moreover, scientists and non-scientists alike found additional reasons to support the ideal of value-free science. For one thing, it offered an intuitively plausible way to critique, and thereby ultimately clear from science, biases such as sexism and racism in research. For another, it promoted trust in science in a public that was at times widely divided in their ethical and political commitments and leery of any value commitments on the part of scientists. And it thereby promoted the necessary economic and other modes of public support for science. So the ideal of value-free science continued to function in a serious way both in and out of science.

In short, the ideal of value-free science has offered impressive credentials, now, for centuries.

Turn to the second general content-constraining ideal of modern science, the one that enjoins science to serve the public good. The pedigree of that ideal is not nearly as impressive as that of the other. This second ideal, in fact, seems to have emerged at the dawn of modern science backed simply by a promise. Francis Bacon, one of the chief architects of the new science as well as one of its more exuberant press agents, promised that the knowledge science would offer would "establish and extend the power and dominion of the human race itself over the universe" for the benefit of all humankind (see, for example, Bacon [1620b] 1960b, I, 129). What did Bacon mean? The problem, as he saw it, was that the human race had been thrust into "immeasurable helplessness and poverty" by the fall from Eden and needed to be rescued. And science would be the rescuer. Science, in short, would provide a solution to the plight of humankind (Bacon [1603] 1964).

To explain how this would go, Bacon offered a blueprint for the organization of the new science, a blueprint that was later adopted by the Royal Society as well as other early scientific societies and that is still in effect today. In it, he included illustrations of the benefits he expected from the new science. Science, Bacon suggested, would make possible the curing of diseases and the preservation and prolongation of life; science would produce the means to control plant and animal generation; science would lead to the development of new materials, including new building materials and new clothing materials; and science would provide new modes of transportation ("through the air" and "under water") and even new modes of defense (Bacon [1627] 2008). In all these ways and others too, science would make humans once again the masters of nature as they had been in the Garden of Eden, and hence once again "peaceful, happy, prosperous and secure" (Bacon [1603] 1964).

True, religion would have to play an important role in this achievement. Bacon, in fact, emphasized the theological dimensions of the scientific activities he supported. For him the study of nature, the study that would bring all manner of practical benefits, would also be the study of the Creation, thereby increasing human knowledge and glorification of the Creator, and thus adding to the justification of the study. And this study would require spiritual as well as intellectual discipline, and would involve spiritual as well as intellectual purpose. "We have certain hymns and services," Bacon had the scientists in his utopian *New Atlantis* report, "which we say daily, of Lord and thanks to God for his marvellous works: and forms of prayers, imploring his aid and blessing for the illumination of our labours, and the turning of them into good and holy uses" (Bacon [1627] 2008). So religion was to be a necessary complement to the new science (McKnight, 2005), but a religion very much reformed—"purified"—by the dominant intellectual movement of the day: Humanism. Indeed, Bacon's promise regarding what science would achieve for humanity incorporated central tenets of Renaissance Humanism: that humans were essentially good, or at least deserving of the benefits that God had placed in nature for their use (the benefits that Bacon's science would uncover and further develop); that God had given humans vast intellectual and creative powers, powers that should be cultivated to the fullest (just the powers that Bacon's science would require); and that such powers should be used to improve the lot of humanity, their intellectual and physical worlds as well as their moral and social

ones (which was at least a good deal of what Bacon's science was about). Without these humanist tenets, in fact, Bacon's promise would not have been nearly so compelling (see for further details Sargent, 2002, 2005, 2012).

At the dawn of modern science, then, Bacon promised all manner of societal benefits if science were pursued. And over the centuries that followed many other distinguished representatives of the scientific establishment made the same promise, though generally without the theological trappings of the original. As a result, the second general ideal constraining the content of modern science, the ideal of humanist-value-full science, ultimately took its place in science alongside the first, the ideal of value-free science.

## 2 The joint career of modern science's two content-shaping ideals

But didn't these two ideals contradict each other? They certainly seemed to. Still, that didn't prevent the two of them (together!) from informing the thought of even the most eminent scientists. Take Bacon himself. As already explained, Bacon supported—indeed, was the leading figure behind—the value-full ideal of science. But Bacon also supported the value-free ideal. The reason ultimately lay with his view of the human mind itself and the prejudices it is subject to. The human mind, said Bacon, "is far from the nature of a clean and equal glass, wherein the beams of things should reflect according to their true incidence; nay it is rather like an enchanted glass, full of superstition and imposture, if it not be delivered and reduced" (Bacon [1605] 1955, p. 295). And the prejudices, or "idols," the mind is subject to fall into four categories:

- "Idols of the tribe," the prejudices stemming from human nature itself
- "Idols of the cave," the prejudices stemming from each individual's "own proper and peculiar nature" (inborn and acquired) rather than human nature in general
- "Idols of the marketplace," the prejudices stemming from the inadequate modes of discourse frequently used
- "Idols of the theater," the prejudices stemming from the inadequate systems of thought frequently relied on (see Bacon [1620b] 1960b, I, 39–68)

Each of these types of prejudice, said Bacon, causes human understanding of the true nature of things to be distorted "by mingling its own nature with it." Hence, each of these types of prejudice "must be renounced and put away with a fixed and solemn determination, and the understanding thoroughly freed and cleansed" (Bacon [1620b] 1960b, I, 68), all by the methods of a proper experimental science. Only in this way might scientists hope to bring about the improvement of the human condition that Bacon promised.

Note, however, that Bacon included values among the idols (in particular, among the idols of the tribe) that distort human understanding.

> For what a man had rather were true he more readily believes. Therefore he rejects difficult things from impatience of research; sober things, because they narrow hope; the deeper things of nature, from superstition; the light of experience, from arrogance and pride, lest his mind should seem to be occupied with things mean and transitory; things not commonly believed, out of deference to the opinion of

> the vulgar. Numberless, in short, are the ways, and sometimes imperceptible, in which the affections color and infect the understanding.
> (Bacon [1620b] 1960b, I, 49)

So, values had to be "renounced and put away" by scientists along with the other distorting influences on the understanding. And this extended even to the value of utility—the centerpiece of the value-full ideal—which, Bacon warned, could lead scientists to "mow the moss or to reap the green corn" rather than "wait for harvest-time" and a more detailed and deeper understanding of their results (Bacon [1620a] 1960a, p. 24). The value of utility could also lead scientists to limit themselves to "experiments of fruit" rather than "experiments of light," and thereby jeopardize "hope for the further advance of knowledge" (Bacon [1620a] 1960a, p. 12; [1620b] 1960b, I, 99). Did this mean, for Bacon, that the value-free ideal had not only to play its important role in scientists' search for knowledge but had also, in so doing, to undercut the role of the value-full ideal in that enterprise—had also to undercut the humanist goal of that enterprise? It certainly seemed so: "the contemplation of truth is a thing worthier and loftier than all utility and magnitude of works" (Bacon [1620b] 1960b, I, 124). On the other hand, Bacon also emphasized the overriding importance of the value-full ideal and science's humanist goal:

> Lastly, I would address one general admonition to all—that they consider what are the true ends of knowledge, and that they seek it not either for pleasure of the mind, or for contention, or for superiority to others, or for profit, or fame, or power, or any of these inferior things, but for the benefit and use of life, and that they perfect and govern it in charity. For it was from lust of power that the angels fell, from lust of knowledge that man fell; but of charity there can be no excess, neither did angel or man ever come in danger by it. ([1620a] 1960a, pp. 15, 16).

In short, Bacon fully supported both the value-free and value-full ideals of science, though, unfortunately, he never resolved or even acknowledges the conflict between them. Nor did his many followers in the seventeenth century and beyond do any better.

By the nineteenth century, however, all this had changed, and the conflict between the value-free and value-full ideals commanded serious attention. Consider, for example, the scene in the United States (see Lucier, 2012 for a fuller account of what follows). There two schools of thought that corresponded quite closely to Bacon's value-free and value-full ideals dominated the discussions regarding science. The first of these schools of thought urged that science should be "pure," that is, "cherished for its own sake, and with a due respect to its own dignity" (Benjamin Silliman, 1818, p. v). For, the "function of the scientist is to attain new truths" (Benjamin Apthorp Gould, 1869, p. 16). And this involves "abstract researches [that] pertain not immediately to wants of life" (Joseph Henry [1850] 1998, p. 90). Note that this was the position of some of the most distinguished scientists of the time. Benjamin Silliman was a professor of chemistry and natural history at Yale. Benjamin Apthorp Gould was an internationally recognized astronomer who founded the first journal of professional astronomical research in the United States. And Joseph Henry was a professor of physics at Princeton. And it was these scientists and their likeminded, pure-science-supporting colleagues who founded the Smithsonian Institution in 1846, the American

Association for the Advancement of Science in 1848, and the National Academy of Sciences in 1863.

The second school of thought defended a very different sort of science, a so-called "practical" or "applied" sort of science, and according to that school of thought the proper object of science was to promote the welfare of the people—as Robert H. Thurston, dean of Cornell University's Silbey College of Engineering, explained in 1884 at a meeting of the American Association for the Advancement of Science (see Thurston, 1884). As the editors of the then newly relaunched journal *Science* had emphasized a year earlier: "Research is none the less genuine, investigation none the less worthy, because the truth it discovers is utilizable for the benefit of mankind." But that research is even more worthy, they added, when it discovers the truth together with that truth's utility. As they put it:

> Granting, even, that the discovery of truth for its own sake is a nobler pursuit [than] that [of] the man who discovers nothing himself, but only applies to useful purposes the principles which others have discovered. …But when the investigator becomes himself the utilizer; when the same mind that made the discovery contrives also the machine by which it is applied to useful purposes, the combined achievement must be ranked as superior to either of its separate results. (*Science* editors 1883, p. 1)

In other words, the kind of research that, for example, Alexander Graham Bell, a professor of vocal physiology and elocution at Boston University, carried out in the 1870s, the experiments with sound that produced Bell's patented invention of the telephone, was, the *Science* editors argued, superior to the kind of research the pure science advocates supported. And Bell's kind of hybrid research, aimed at promoting the welfare of the people, was precisely what was meant by the term "practical science" or "applied science."

By the nineteenth century in the United States, then, value-free science and value-full science were fully recognized as competing ways of doing and assessing science, though the conflict between them still remained unresolved. But all that changed again in the twentieth century due to Vannevar Bush, the MIT engineer and inventor who had headed the U.S. Office of Scientific Research and Development (OSRD) during the Second World War. In 1945 Bush composed his famous report *Science—The Endless Frontier* in response to a request by U.S. President Franklin D. Roosevelt. In it the conflict between pure (value-free) science and practical (value-full) science had completely disappeared. Pure science and practical science had become, instead, different stages of one linear developmental process—one continuous research program rather than two different, and competing, research programs. At least that is the way Bush presented what he claimed was the most promising plan for science's future development, and his account became the basis of U.S. science policy for nearly the rest of the twentieth century.

According to Bush's account, "scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown" (Bush, 1945, p. 10). This "free play of free intellects" was, for Bush, "basic science." It was, Bush said, the pursuit of the truth wherever it may lead, performed without thought of practical ends,

entirely unpredictable, and refractory to direction from above. It was, in fact, the value-free/idol-free/ "pure" science of the past. Nonetheless, it was the most important kind of scientific research, Bush insisted, because it produced the discoveries that would make "applied science," the former value-full "practical science," possible (see, for example, Bush, 1945, pp. 12 and 17–18). And applied science, in turn, would make possible the technology that would bring:

> More jobs, higher wages, shorter hours, more abundant crops, more leisure for recreation, for study, for learning how to live without the deadening drudgery which has been the burden of the common man for ages past. Advances in science will also bring higher standards of living, will lead to the prevention or cure of diseases, will promote conservation of our limited national resources, and will assure means of defense against aggression. (Bush, 1945, pp. 7–8)

In short, Bush's basic science and its advances would provide all the benefits to humanity that Bacon had promised. What's more, Bush's basic science and its advances would be crucial for attaining these benefits, for without them "no amount of achievement in other directions can insure our health, prosperity, and security as a nation in the modern world" (p. 8).

So, Bush had demonstrated that the value-free and value-full ideals of science were compatible after all. Or so it seemed in 1945. But by the end of the twentieth century, the demonstration appeared to be falling apart. At least, "the free play of free intellects" was no longer considered "the best precondition for maximizing the utility of science," the utility that value-full science was to provide (Rohe, 2017, p. 745; and see, also, Gibbons, 1999; Guston, 2000; Krishna, 2014). Science had just gotten too big and too costly, with no end in sight to its continued and ever-increasing demands for support. "The sheer size of the system and its need for sustainable allocation of funds [was] finally unbalancing Bush's claim for the 'free play of free intellects'" (Rohe, 2017, p. 746). Worse still, science appeared to be "in deep trouble" under the plan of development set for it by Bush:

> Stoked by fifty years of growing public investments, scientists are more productive than ever, pouring out millions of articles in thousands of journals covering an ever expanding array of fields and phenomena. But much of this supposed knowledge is turning out to be contestable, unreliable, unusable, or flat-out wrong. From metastatic cancer to climate change to growth economics to dietary standards, science that is supposed to yield clarity and solutions is in many instances leading instead to contradiction, controversy, and confusion. Along the way it is also undermining the four-hundred-year-old idea that wise human action can be built on a foundation of independently verifiable truths. (Sarewitz, 2016, p. 5)

And the conclusion many were thus finding unavoidable? "Scientific knowledge advances most rapidly, and is of most value to society, not when its course is determined by the 'free play of free intellects' but when it is steered to solve problems—especially those related to technological innovation" (Sarewitz, 2016, p. 8). Was this, then, the final outcome of the 400-year-long value-free/value-full duo: limelight for the value-full ideal along with a full eclipse of the value-free ideal? Not quite. The scene was actually more complex than this conclusion suggests.

## 3 The twenty-first century legacy of modern science's two content-shaping ideals

If the truth be told, by the end of the twentieth century both the value-free and value-full ideals of science had suffered severe setbacks. Regarding the value-free ideal, historical scholarship had suggested that the work of even the greatest scientists —even scientists such as Boyle, Darwin, and Freud, and even, perhaps, the great Newton and Einstein themselves—was shaped by social values (see, for example, Bernal, 1971; Merchant, 1980; Elkana, 1982; Shapin & Schaffer, 1985; Gilman, 1993; Ruse, 1999; Potter, 2001). If our conception of science was to be true to actual science, it could hardly ignore such science as this. Sociological research, in addition, had suggested that such value-informed science was all but inevitable. Indeed, any scientific contribution, we were reminded, was a product of a particular time and place, of a particular social and cultural location, of particular interests and values; a "view from nowhere," from a psychological and sociological vantage point, was simply naive (see, for example, Knorr-Cetina, 1981; Knorr-Cetina & Mulkay, 1983; Latour, 1987). The ideal of value-free science, in short, seemed unlikely ever to be fulfilled—at least seemed unlikely to be a viable ideal, useful for actual science. Philosophical analysis, finally, had gone one step further. It had challenged the very distinction between social values and the scientific—the distinction between, for example, social values and economists' data about poverty, or sociologists' and psychologists' measures of domestic abuse, or archaeologists' accounts of human evolution and human flourishing, or medical researchers' criteria of health and disease (see, for example, Putnam, 2002 and Dupré, 2007; and see, as well, Rooney, 1992 and Longino, 1996 on the difficulties of even distinguishing between epistemic values and social values). The ideal of value-free science, in short, according to this line of reasoning, may have ultimately been incoherent.

The humanist value-full ideal of science, on the other hand, may have appeared to be in better shape by the end of the twentieth century. After all, science had provided, or helped to provide, such things as food in ever greater variety and abundance, produced more quickly and efficiently; the near eradication of such dreaded diseases as scarlet fever, smallpox, and polio, and impressive progress on other diseases such as HIV/AIDS; better insulated, more comfortable homes with more conveniences, produced more quickly and efficiently; more sophisticated communications systems; and quicker, more convenient modes of transportation. And in the future even more extraordinary benefits were expected, such as tiny, inexpensive computers that are thousands of times more powerful than current machines, flying automobiles and other kinds of vehicles that help us multitask, and human lives that are nearly disease free and last for 150 years or more. All this was precisely the kind of outcome the humanist value-full ideal had called for.

But science had also provided, or helped to provide, such things as a food supply tainted with every manner of pesticides, herbicides, antibiotics, growth hormones, and other harmful chemicals; polluted air and water and the looming menace of global warming; ever-rising mountains of garbage and toxic wastes; ever more prevalent heart disease and strokes, cancer, diabetes, gallbladder disease, and other dreaded diseases related to unhealthy (fat-filled, sugar-filled, salt-filled, calorie-filled) diets and polluted

environments; ever more depleted supplies of the world's resources and widespread extinction of plant and animal life; and, of course, enormous stockpiles of nuclear and other weapons. What's more, the benefits that science had provided had improved the lot of only some of humankind, not all of humankind. Indeed, scientific investigation had largely ignored the needs of many in the developed world and nearly all in the developing world. Medical research, for example, had devoted more than 90% of its resources into problems that affect only 10% of the world's population. Left out of research were.

> Diseases that predominantly affect developing countries (the "neglected diseases"), …the specific needs of developing countries in relation to diseases with a global incidence, and … the development of affordable medicines for all. But the problem of neglect extends beyond the developing world, as becomes clear from the global lack of R&D for new antibiotics, appropriate children's medicines (and other products), and orphan diseases (Viergever, 2013).

Scientific investigation may even have helped to intensify the needs of those it had ignored.

> The experience of the past 30 or more years shows that the phenomenon of science-and-technology-based economic growth seems to be accompanied by increasing inequality in distribution of economic benefits…. This inequality appears on numerous fronts, including high unemployment and underemployment rates, persistent levels of poverty, and soaring concentration of wealth, each of which are apparent both within nations and between nations on a global basis, even as global wealth continues to grow…. (Sarewitz et al., 2004, p. 69).

And two decades into the twenty-first century the scene appeared to be getting no better (see, for example, Qureshi, 2019; Gaskell, 2019; Kourany, 2021).

In short, after four centuries of societal support for science, the value-full ideal of science seems in no better shape than the value-free ideal. So, what valuable legacy for the twenty-first century can possibly be forthcoming from two failed ideals of science that, in addition, still appear to contradict each other?

Start with the value-full ideal, and remember the scene just now traversed. To say that the humanist value-full ideal failed is not to say that this ideal was in any way wanting—incapable of being fulfilled or unjustified in some other way. On the contrary, in the case of the value-full ideal it is to say that the science failed, that the science produced was wanting—that, in other words, the science simply failed to live up to the ideal. This is abundantly clear in the case of the failures of the ideal cited above. That scientific investigation has largely ignored the needs of many in the developed world and nearly all in the developing world, for example, means that scientific investigation has also ignored science's humanist value-full ideal. That our food supply is tainted with every manner of pesticides, herbicides, antibiotics, and growth hormones and filled with salt, sugar, and fat means that parts of chemistry, biology, economics, nutrition science, and other sciences too have been more intent on making money than on providing safe, nutritious food to keep people healthy—that is, on fulfilling science's humanist value-full ideal. And so on. All these sciences could have lived up to the value-full ideal—many of them actually did on many occasions,

although they failed abysmally on too many other occasions. And what this means is that the value-full ideal is now more needed than ever, and its legacy, therefore, is to call for renewed efforts on the part of scientists to serve the public good, and to waste no time in doing so.

But what about the value-free ideal and its legacy? As we have seen, historians, sociologists, and philosophers of science have all insisted that the value-free ideal is not a viable ideal for science because there is simply no value-free science. Every aspect of scientific research, they point out, involves values. The areas of the world scientists choose to explore, the specific questions scientists raise about those areas, the methods scientists devise to answer those questions, the time and resources (even the number of scientists) they devote to the research, and the concepts and assumptions scientists rely on for the job—every one of these aspects of research involves values, social values as well as epistemic values. The values in question might be those of the scientists doing the research or the values of the funders of the research or the values of the scientific community that encourages and publishes the research, or the values of still other individuals or groups. In all these cases, describing what is going on as "the free play of free intellects," or the pursuit of "the truth wherever it may lead," or the cherishing of "knowledge for its own sake," or the like, as advocates of the value-free ideal like to do, simply amounts to a coverup of the values involved in the research and their roles in the research.

Of course, what the humanist value-full ideal requires is that such values serve the public good. By contrast, what the value-free ideal allows or even requires under its clever coverup is the freedom to pursue these values even when they do not serve the public good. One of the conflicts between the value-full and value-free ideals, then, amounts to a commitment to the public good versus a commitment to scientists' freedom of research, or the public good versus scientists' choice of a different good. And the enduring legacy of the value-free ideal is the safeguarding of this freedom of research. Is this an important legacy? It might certainly seem to be. After all, why must scientists serve the public good by their research rather than some other good of their own or others' choosing even when pursuing this other good poses no harm to the public (although also no benefit)? Why must scientists serve the public good by their research rather than other goods when no other inquirers—neither philosophers nor historians nor mathematicians nor linguists nor literary critics, and so on—labor under such a requirement? If all those other enquirers enjoy a generous stash of freedom of research even when they also enjoy generous funding of that research, why not scientists?

The potential problem with this legacy, of course, lies with the particular values the scientists enjoying such research freedom choose to direct their research. They might undermine socially worthy objectives with their research or take up resources that could have been used to pursue them in order to pursue far less important goals. And they will be able to do all this totally free of accountability for their choices because, of course, they will simply be pursuing "knowledge for its own sake" with their research or engaging in "the free play of free intellects." So, there are definite downsides to this legacy of the value-free ideal. Might the ideal also have another less worrisome legacy, one with clearer benefits? Absolutely! The value-free ideal, after all, like the value-full ideal, are ideals—directives that may not actually be fulfilled but can still be aspired to. And in the case of the value-free ideal, what it inspires

is vigilance and skeptical questioning. Of course, every aspect of scientific research involves values, social values as well as epistemic values. But which social values are involved, and even that social values are involved, is not always very obvious, nor is it always obvious that social values must be involved and which social values ought to be. This is where the ideal of value-free science comes in. It primes us to press for this kind of information and to demand rationales for the answers we receive—in short, to get respectable justifications for all departures from value-freedom taken as the scientifically appropriate norm. And this is where the humanist value-full ideal comes in as well, for that ideal helps us determine what are the respectable departures even though, for that ideal, those so-called departures define, in fact, the scientifically appropriate norms. So, the value-free and value-full ideals can really work together amicably to improve our science even though they contradict each other—a truly happy kind of resolution of one of modern science's very oldest problems.



## References

Bacon, F. ([1605] 1955). The proficience and advancement of learning, divine and human. In Hugh G. Dick (Eds.), *Selected writings of Francis Bacon*. Modern Library

Bacon, F. ([1620] 1960a). The great instauration. In F. H. Anderson, J. Spedding, R. L. Ellis, & D. Denon (Eds.), *The new organon and related writings*. Liberal Arts Press (Bobbs-Merrill).

Bacon, F. ([1620] 1960b). The new organon. In F. H. Anderson, J. Spedding, R. L. Ellis, & D. Denon (Eds.), *The new organon and related writings*. Liberal Arts Press (Bobbs-Merrill).

Bacon, F. ([1603] 1964). The masculine birth of time. In B. Farrington (Eds.), *The philosophy of Francis Bacon*. Liverpool University Press.

Bacon, F. ([1627] 2008). *The new Atlantis*. Project Gutenberg EBook #2434. At https://www.gutenberg.org/files/2434/2434-h/2434-h.htm. Retrieved 1/16/20.

Bernal, J. D. (1971). *Science in history, the scientific and industrial revolutions*. MIT Press.

Bush, V. (1945). *Science the endless frontier: A report to the president*. U.S. Government Printing Office.

Dupré, J. (2007). Fact and value. In J. Dupré, H. Kincaid, & A. Wylie (Eds.), *Science and values.* Oxford University Press.

Elkana, Y. (1982). The myth of simplicity. In G. Holton & Y. Elkana (Eds.), *Albert Einstein: Historical and cultural perspectives.* Princeton University Press.

Gaskell, A. (2019). Technology isn't destroying jobs, but is increasing inequality. *Forbes* (May 3). At https://www.forbes.com/sites/adigaskell/2019/05/03/technology-isnt-destroying-jobs-but-is-increasing-inequality/#10ecc4de5e78. Accessed 2/3/20.

Gibbons, M. (1999). Science's new social contract with society. *Nature, 402*, C81–C84.

Gilman, S. L. (1993). *Freud, race, and gender*. Princeton University Press.

Gould, B. A. (1869). Address. *Proceedings of the American Association for the Advancement of Science, 18*, 1–37.

Guston, D. H. (2000). Retiring the social contract for science. *Issues in Science and Technology, 16*(4), 32–36.

Henry, J. ([1850] 1998). Address to the American Association for the Advancement of Science. In M. Rothenberg (Ed.), *The papers of Joseph Henry,* Vol. 8: *January 1850–December 1853: The Smithsonian years*, Smithsonian Institution Press.
Knorr-Cetina, K. (1981). *The manufacture of knowledge*. Pergamon Press.
Knorr-Cetina, K., & Mulkay, M. (1983). *Science observed: Perspectives on the social study of science*. Sage.
Kourany, J. A. (2021). Bacon's promise. In P. Hartl & Á. T. Tuboly (Eds.), *Science, freedom, democracy.* Routledge.
Krishna, V. V. (2014). Changing social relations between science and society: Contemporary challenges. *Science, Technology, and Society, 19*(2), 133–159.
Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Harvard University Press.
Longino, H. (1996). Cognitive and non-cognitive values in science: Rethinking the dichotomy. In L. H. Nelson & J. Nelson (Eds.), *Feminism, science, and the philosophy of science.* Kluwer Press.
Lucier, P. (2012). The origins of pure and applied science in gilded age America. *Isis, 103*(3), 527–536.
McKnight, S. A. (2005). Francis Bacon's god. *The New Atlantis, 10*, 73–100.
Merchant, C. (1980). *The death of nature: Women, ecology, and the scientific revolution*. Harper and Row.
Merton, R. K. ([1942] 1973). The normative structure of science. In N. W. Storer (Ed.), *The sociology of science: Theoretical and empirical investigations*. University of Chicago Press.
Potter, E. (2001). *Gender and Boyle's law of gases*. Indiana University Press.
Proctor, R. N. (1991). *Value-free science?: Purity and power in modern knowledge*. Harvard University Press.
Putnam, H. (2002). *The collapse of the fact/value dichotomy*. Harvard University Press.
Qureshi, Z. (2019). Harnessing technology for more robust and inclusive growth: An agenda for change. *Brookings up front report* (June 3), The Brookings Institution. At https://www.brookings.edu/blog/up-front/2019/06/03/harnessing-technology-for-more-robust-and-inclusive-growth-an-agenda-for-change/. Accessed 2/3/20.
Rohe, W. (2017). The contract between society and science: Changes and challenges. *Social Research: An International Quarterly, 84*(3), 739–757.
Rooney, P. (1992). On values in science: Is the epistemic/non-epistemic distinction useful? In D. Hull, M. Forbes, & K. Okruhlik (Eds.), *PSA 1992, Vol. 1.* Philosophy of Science Association.
Ruse, M. (1999). *Mystery of mysteries: Is evolution a social construction?* Harvard University Press.
Sarewitz, D. (2016). Saving science. *The New Atlantis, 49*, 4–40.
Sarewitz, D., Foladori, G., Invernizzi, N., & Garfinkel, M. S. (2004). Science policy in its social context. *Philosophy Today, Supplement 2004*, 67–83.
Sargent, R.-M. (2002). Francis Bacon and the humanistic aspects of modernity. *Midwest Studies in Philosophy, 26*, 124–139.
Sargent, R.-M. (2005). Virtues and the scientific revolution. In N. Koertge (Ed.), *Scientific values and civic virtues.* Oxford University Press.
Sargent, R.-M. (2012). From Bacon to Banks: The vision and the realities of pursuing science for the common good. *Studies in History and Philosophy of Science, 43*, 82–90.
Science. (1883). The future of American science. *Science, 1*, 1–3.
Shapin, S., & Schaffer, S. (1985). *Leviathan and the air-pump: Hobbes, Boyle, and the experimental life*. Princeton University Press.
Silliman, B. (1818). Plan. *American Journal of Science and the Arts, 1*, 1.
Thurston, R. H. (1884). The mission of science. *Proceedings of the American Association for the Advancement of Science, 33*, 227–253.
Viergever, R. F. (2013). The mismatch between the health research and development (R&D) that is needed and the R&D that is undertaken: An overview of the problem, the causes, and solutions. *Global Health Action, 6(1)*. https://doi.org/10.3402/gha.v6i0.22450