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Rethinking the Conceptual Space for Science in Society after the VFI

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Abstract

Replacing the value-free ideal (VFI) for science requires attention to the broader understanding of how science in society should function. In public spaces, science needed to project the VFI in norms for science advising, science education, and science communication. This resulted in the independent science advisor model and a focus on science literacy for science education and communication. Attending to these broader implications of the VFI that structure science and society relationships is crucial if we are to properly replace the VFI with a better ideal.

1. Introduction

With the demise of the value-free ideal (VFI) for science, many philosophers have turned to accounts of the acceptable versus unacceptable roles for values in science, kinds of value in science, and particular values in science (Douglas 2021a; Holman and Wilholt 2022). This rich debate—one we support—includes an examination of the nature of values and their democratic political legitimacy for use in science. However, this debate cannot be pursued properly without also paying attention to the other conceptual structures that were built around and from the VFI.

The VFI was an ideal that influenced a set of concepts and norms about how science in society should be structured. This article will describe implications of the VFI for how the relationship between science and the general public was conceptualized. We will focus on ideals and norms for science advice, science education, and science communication. While these aspects are not a complete set of domains where science and the public interact, they are crucial to science–public relationships.

As we argue elsewhere (Douglas and Branch Under Review), the VFI was cemented in importance through the post–World War II social contract for science. The success of science in World War II clearly demonstrated society's need for science. How society should support science in the postwar context became an important locus for debate. The resulting social contract for science (developed initially in the United States and then spreading widely in the postwar context) was composed of three interlocking components: that there was a clear distinction between basic and applied research, that scientists pursuing basic research were not responsible for the societal impacts of their work (this was part of scientific freedom), and that the public purse should support basic research in particular (as private industry would not support it). The basic science funded by government would be justified by the eventual public good that would be produced in application, generating the linear model of science funding. The combination of these norms and justifications for science helped make obvious the idea that good science should be value free. Basic research, pursued with public funds, under the direction of scientists who were not to think about the societal impacts of their work, created an ideal of scientific activity separate from society, and ideally insulated from all societal pressures, including social values. Scientists doing basic research would only be concerned with epistemic concerns, isolated from societal responsibility. Thus, the VFI seemed both a good and an attainable ideal.

In recent decades, the conceptual components of the social contract have come under heavy critique or even outright rejection. The basic versus applied research distinction, a part of science policy still, has received potent critiques (e.g., Kitcher 2001; Douglas 2014). The model of freedom of science including freedom from societal responsibility has been decisively dismantled by scientific societies in the past two decades (Alters 1997; Douglas 2021b). Finally, the linear model of science funding has similarly been undermined (Sarewitz 2016, 3). These critiques have occurred concurrently with the robust debate about values in science within philosophy of science.

Just as the components of the social contract and the VFI have been largely rejected, similar scrutiny is needed for the impact of these ideals on norms for the science–public relationship. We focus here on three areas where science and society are deeply intermeshed, but for which an isolationist independence for science was asserted: the use of scientific advice in policy making, science education, and science communication. We argue that these three areas created an ecosystem of support for socially isolated science, an ecosystem that must be reexamined along with alternatives to the VFI.

2. Independent science advice in the policy process

World War II and the Cold War hammered home the idea that scientific and technical issues were central for government decisions, and thus scientists needed to be involved in such decisions. Further, the scientists in academic institutions, the ones for whom the linear model ensured public funds for the pursuit of research for the first time in US history, were considered the elite of the scientific community. It was their advice and consultation that was sought and around whom were built the science advisory practices of the Cold War (Wood 1964; Douglas 2009). This growing demand required clear norms for science advising.

Walter Lippmann, in his 1922 Public Opinion, proposed an apolitical role for the technical expert (in Lippmann's time, an employee of government). The expert was to provide advice to the decision maker in government, but not to make any decision themselves. The public had no role to play in this advisory practice—they knew too little to have a sensible say. They could vote elected officials in and out of office, but rarely did so on the basis of this rather hidden practice of advice giving and receiving in government. Lippmann's account helped shape norms for science advising in the Cold War context, fitting well with the new social contract for science. Value-free basic science provided the informational basis for science advice, and the apolitical nature of expertise undergirded its legitimacy. A good science advisor was one with independent status, someone who eschewed political goals (other than the protection of scientific integrity), who could neither be captured by power nor be contaminated with social values yet could bring the knowledge needed to inform government decisions.

Robert Wood's "Science and Politics: The Rise of an Apolitical Elite" (1964) expressly argued for this ideal. Although the scientific advisor wielded political power, Wood argued that they could only do so by eschewing politics. Rather than pursuing political goals, the science advisor elite had the "widely shared goal . . . to protect the 'integrity' science or assure respect for scientific knowledge and the means and institutions through which we acquire it" (49). Thus, the science advisor viewed their work as having the central job of representing the importance and value of science and transmitting the available scientific knowledge of import to policy makers, while ensuring that the practice of science continued unfettered and undamaged. Only if the science advisor was properly independent of politics and political pressures could they be presumed to present science accurately in their advice. Their central political agenda was to protect the continuation of research endeavors, which given the linear model already in place and control scientists had over how (basic) research was to be directed was also construed as an apolitical agenda.

Such an independent, apolitical science advisor depended on science being a value-free, apolitical endeavor. It was in the transmission of objective, disinterested truths from the scientific community to the political realm that the science advisor provided something of value to the policy maker and that provided their authority to speak in the policy realm. The apolitical nature of the science advisor ensured that they would be above corruption by politics, that they would not promote claims simply because they served their political interests. Outside of support for science generally, they were not to have any.

This ideal of the independent science advisor found its most potent expression in Donald Price's *The Scientific Estate* (1965). He argued that the relationship between science and government was best understood through four "estates," or sets of institutional practices and expectations for those who occupied roles within the estates: (1) scientists (who pursued truth), (2) professionals (who applied science for particular ends), (3) administrators (who ran large bureaucracies and organizations), and (4) politicians (who held political power). This was the "spectrum from truth to power"; the further one moved from science to politics, the less truth was a guiding norm and more power was (Price 1965, 132–36). In setting up this spectrum, Price depended upon the distinction between basic and applied science. He thought of scientists as being in pursuit of basic science, unconcerned with the contexts of application, whereas professionals were tasked with the complex job of actual application, constrained by professional codes of practice and pursued for clients with particular ends. Further, the modern success of science rested in part in its value-freedom. "[A] basic approach of modern science has been to purge itself of a concern for purposes and values in order to deal more reliably with the study of material phenomena and their causes and effects" (122). Science was the space of value-free pursuit of truth. Moving away from science along the spectrum added in additional value considerations and constraints on those estates.

The spectrum across the four estates also captured norms about freedom and responsibility. As Price wrote, "[I]t is possible to see [the spectrum] as ranging not from pure truth to naked power, but from inhuman abstraction to moral responsibility" (155). Scientists, in the pursuit of pure truth, were absolved from all moral responsibilities for their work, engaged in "inhuman abstraction." Moral responsibility and political responsibility were closely tied together, coming with oversight and external control. Scientific freedom was freedom from both moral responsibility and external oversight. As Price explained earlier in this chapter, "(1) the closer the estate is to the end of the spectrum that is concerned solely with truth, the more it is entitled to freedom and self-government; and (2) the closer it gets to the exercise of power, . . . the more it is required to submit to the test of political responsibility" (137). Whether one focused on political or moral responsibility, neither were part of the scientific estate. The value-free pursuit of the truth brought freedom from oversight and responsibility. It was this independence from the political that also gave science advisors such a potent authority when speaking truth to power.

By the 1970s, the model of the independent advisor could no longer be maintained. Science advisors were in the thick of public disputes about important contemporary political issues and were even accused of disloyalty by the Nixon White House (Douglas 2021c). Rather than fully recognize the inherently political nature of science advising, the model shifted to one of collective management of advice. Attending more carefully to the makeup of advisory panels (ensuring "balance") as well as enshrining legal requirements for transparency of advice, the 1972 US Federal Advisory Committee Act enabled the science advisory system to keep functioning. But the political aspects of science advising would keep returning, devolving into the junk science versus sound science debates of the 1990s and 2000s (Douglas 2009, ch. 1). The ideal of the independent (and value-free) science advisor has not served us well. A better normative model is needed.

3. Science education: Setting the store of basic facts

The successful launch of Sputnik (1957) spurred the United States to invest more in science education. Twelve months later, the National Defense Education Act (NDEA) to "strengthen the national defense and to encourage and assist in the expansion and improvement of educational programs to meet critical national needs" (Committee on Education and Labor 1958) was passed. The influx of funding for science education was aimed at improving science literacy, or "the ability of the individual to read about, comprehend, and express an opinion on scientific matters" (Miller 1983, 30). Enthusiasm for science literacy stemmed from science literate publics being assumed to be more interested and supportive of science, better positioned for decision making, and instrumental to producing the next generation of scientists, which helped to keep science literacy as a goal throughout the 1960s (Kimball 1967; Klopfer 1969).

Science literacy was measured through the assessment of grasping scientific facts. This was reflected in the postwar growth of standardized testing of basic scientific constructs and terms (Miller 1983). Scientific facts were a crucial component of the most commonly stated objective for science literacy: developing public knowledge of the nature of science (NOS) (Kimball 1967). In theory, NOS included the empirical findings of science and "the epistemology and sociology of science, science as a way of knowing, or the values and beliefs inherent to scientific knowledge and its development" (Lederman et al. 2002, 498). However, the NOS's rich and socially situated account of science was minimized by the dominance of the economic argument for science education. The economic argument put forward that science is lucrative both for individuals that pursue it and society at large (Claxton 1997). It influenced classroom content by assuming that the next generation of scientists should first and foremost learn the findings of science, leaving the social dimensions of science until later, if at all.

Despite efforts to improve findings-oriented science literacy, assessments between 1969 and 1977 by the National Assessment of Educational Progress (NAEP) found declining science literacy scores across all age groups and almost all socioeconomic subgroups (Miller 1983). Investment in science education appeared to improve only affective perceptions of science, not knowledge of science. In other words, public understanding of science, tested through science literacy, remained low even as post-Sputnik surveys found that society held science in high regard (Nisbet and Scheufele 2009).

To address the unshrinking knowledge deficit, the early 1970s witnessed a shift away from focusing on the findings of science (Abd-El-Khalick 2014). The change resulted in the term "science literacy" fallingout of favor in the mid-1980s (Bauer 2008) and being replaced by "public understanding of science." Public knowledge of NOS persisted under the overarching goal of developing public understanding of science with inclusion of psychological factors such as the theory-laden nature of observation, the role of human creativity in developing scientific explanations, and the social structure of scientific organizations (Abd-El-Khalick and Lederman 2000).

As NOS in the classroom was expanded to include social dimensions of science, debate over which aspects of the NOS to include in the limited class time available arose. Decision makers narrowed down what to teach by focusing on those aspects with agreement around them (Claxton 1997). Debate settled on what has come to be known as the "NOS consensus list" (Alters 1997) or the consensus view. Though no consensus exists among philosophers, historians, scientists, and science educators on a definition for NOS (Lederman 2006, 303), some agreement can be found on the findings of science, and that scientific knowledge is tentative, empirical, and theory laden, and the product of human imagination and creativity (Abd-El-Khalick 2005).[1] But despite the potential of the consensus view, in recent years the approach has lost its wide agreement (Allchin 2017; Hodson and Wong 2017) with questions arising about why the model was even adopted in the first place (see Abd-El-Khalick et al. 1998 and Duschl and Grandy 2013).

One way to make sense of science education's initial focus on the findings of science, the dominance of the economic argument, the move to teach the NOS, and the subsequent rise and fall of the consensus view is through the VFI. First, the influx of funding to improve education was directed toward teaching basic science through

[1] See support for this view from Lederman (2006), Lederman et al. (2002), Abd-El-Khalick (2006), Bell (2006), Cobern and Loving (2001), and Flick and Lederman (2004) who came to make it influential.

the economic argument. This served two purposes, preparing the next generation of scientists and sustaining public support for science, both of which are needed for the linear model for science. This translated into a focus on the facts of basic science that were presented as separate from their application. Second, without agreement around social, ethical, and political dimensions of the NOS under the consensus view, these value-rich and socially situated aspects of science could not be conveyed in the classroom (Branch-Smith 2019). As a result, science could continue to be taught independently from society's needs and controversies, allowing science to maintain its value-freedom and independence, as per the social contract.

4. Science communication: Unquestioned authority in the public sphere

With science education preparing future scientists with basic scientific facts, science communication was tasked with bolstering public knowledge and opinion of science outside the classroom. After World War II, science communication considered scientists the sole experts on science, casting the public as deficient of scientific knowledge. As a result, any public resistance to science, for whatever reason, was blamed on a lack of scientific knowledge.

Entering the Cold War, science was generally seen as a positive contributor to societal progress, making life healthier and easier (Withey 1959). This view echoed expectations of the linear model for science funding, with public goods coming down the line from basic research.[2] There were however, important science policy issues, such as the proper management and testing of nuclear weapons, the use of fluoride, and the acceptance of new medical interventions about which informed public opinion mattered. Science communicators were responsible with bridging the epistemic gap between knowledgeable experts and the ignorant public (Scheufele 2000; Nisbet and Scheufele 2009). Specialists like science journalists and popularizers were charged with transforming raw scientific knowledge into consumable content meant to develop science literacy and grow public understanding of science (Burns et al. 2003).

To ameliorate public ignorance, science communication first needed to reach the public. Warren Weaver, a "catalyst" for several public science initiatives with the American Association for the Advancement of Science (AAAS), National Science Foundation (NSF), and the Rockefeller Foundation and the Council for the Advancement of Science Writing (Lewenstein 1992), partnered with Claude Shannon, an engineer at Bell Telephone Laboratories (and the "father of information theory") to apply a mathematical model for entropy to the challenge. The "Shannon and Weaver model of communication" (1949) came to define science communication with its "Scientist-Popularisation-Public" structure (Broks 2014). By "transmitting" messages and "targeting" deficient audiences, the deficit could be paired with an

[2] Even at the height of the Cold War, the US Center for Disease Control (CDC) and the Soviet Union's Institute of Virus Preparations worked together through the World Health Organization (WHO) to eradicate smallpox, further highlighting the marvels of science. By delivering vaccines to Brazil, West Africa, India, Pakistan (including now Bangladesh), Afghanistan, Nepal, and Indonesia, the virus was eradicated in a little more than a decade. The initiative was helped by a strong public science communication campaign and support from local leaders which kept vaccine resistance rare (Henderson 2011).

optimistic framing of the knowledge gap between science and society, one that could be simply solved by communicating more science.

Most active from the 1960s to the 1980s (Gross 1994), the deficit model moved information unidirectionally from experts to the public. At the same, it reflected an institutional anxiety toward the public and the fear that they might pollute science with their ignorance and values. By working through communicators, scientists were able to transmit information, encouraging science literacy and support for science, while remaining removed from society. This reinforced the insulating dimension of the social contract for science.

By the 1990s, criticism of the deficit model began to mount. Critiques of its accuracy and its helpfulness in understanding public rejection of science could no longer be ignored as those who were most critical of science were often the most literate. At the same time, scientists began to consider communicating with the public as a general part of their scientific responsibilities (Douglas 2021c). Further, a shift away from fact-based science literacy deficits to other deficit sources, like a lack of public interest in science, attitudes toward science, cognitive deficits, and public trust deficits have also emerged (Bauer 2016). These approaches still locate the problem or failure in the public, and thus some have argued that the deficit model persists, even if the type of deficiency has changed (Sturgis and Allum 2004; Dickson 2005; Simis et al. 2016). The problem was, and is never, with science itself.

Science communication based on an assumption of public deficit falls in line with the social contract for science and the VFI. It separates science from society by positioning experts as exclusive knowers and the public as homogeneously ignorant. It sustains the elite status of science by not providing means for bidirectional communication with scientists, allowing these experts to remain outside society's influence, while expecting public support for science. Under this model, public values cannot enter science, reiterating the possibility and desirability of value-free science (Branch-Smith 2019). Alternative ideals for science will have to grapple with the legacy of the deficit model for science, its underestimation of public knowledge of science, and the consequences of ignoring society's concerns about science when developing new norms for the communication of science.

5. Conclusion

Philosophers have already made wide-ranging and persuasive arguments that the VFI is not a good ideal qua ideal for science. The social contract for science, composed of the idea that public funds are needed for basic research that should be pursued divorced from social responsibility, is also undergoing revision. Here we identify important interconnected consequences of the VFI and social contract for science in the public sphere. The independent science advisor ideal, the focus on empirical findings in science education, and the deficit model for science communication have all reinforced, both ideologically and practically, that science should be kept separate from society. All of these ideas must be held up, reexamined, and seen for what they are: half-truths that support inapt norms for the relationship between science and society. An explicit reconsideration of the public-oriented structures that supported the VFI is needed.

Rethinking the ecosystem that has supported the VFI will take more than just philosophical expertise. It will also require experts and stakeholders from these areas to be a part of the remodeling process. To exclude them, along with their progress and experiences, risks recreating the missteps of the past, by continuing to see science–society interfaces as isolatable entities, under the purview of particular expertise only. We should include science advisors, science communicators, and science educators in the conversation. Our hope is that a broader discursive space will help to generate more value-apt understandings and institutions for science.

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