Staying the Course: On the Value of Social Studies of Science in Resistance to the "Post-Truth" Movement[1]

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Abstract

Scientific knowledge has been under attack recently, especially during and from the Trump administration. This article discusses the value of research in social studies of science (or STS) in relation to scientific practice and post-truth attacks on science. STS literature analyzes the expert work and social values that enter into the production of evidence, the development and testing of methods, and the construction of theoretical and epistemological frames for connecting evidence, methods, and methodologies. Although STS argues that there are politics in science, this article demonstrates that STS's analyses of the processes of adjudicating evidence and epistemologies contribute to science. In contrast, post-truth attacks on scientific expertise exemplify a particular kind of politics aimed at supporting a particular group's political and economic interests.

Keywords: Social Studies of Science, Post-Truth, Epistemologies of Science, Expertise, Politics

Introduction

This essay considers where Science and Technology Studies or Sociology of Science and Technology (STS) stands in relation to science and the "post-truth" movement in the United States.[4] STS makes scientific practices more transparent by providing knowledge that helps to locate science in its social, institutional and material contexts. After spending several decades resisting uncritical acceptance of scientific authority and studying the production of scientific authority, should we now *resist* the *resistance* to scientific authority? We argue that we should avoid being distracted from our work by the "post-truth" movement. Instead, we argue that we should continue to analyze and critique science. STS is a science of science that opposes both uncritical acceptance of all science and uncritical rejection of all science. Our expertise is in the social analysis of science, and our aim is to continue that work to provide citizens/consumers of science with knowledge. We are sociologists of science and want to demonstrate to sociologists what sociology of science contributes to sociology and society. (We use the term STS in the rest of the paper, because there are more than sociologists in this interdisciplinary field.)

STS Origins and Practices

The twentieth century saw a culmination of scientific achievement in the U.S., and along with it a mainstream culture of admiration, respect, and deference for scientists and their expertise. As the U.S. government increased science funding during the Cold War, "techno-scientific" fields and disciplines proliferated in universities and private industries, which provided full-time professional jobs. Science had grown into a field of established disciplines

[4] Throughout this article, we will continue to use quotation marks around "post-truth" to emphasize that we do not accept the definition about truth and post-truth used by "post-truthers."

comprised of professionals who could devote their full attention to specialist inquiries. This growth in scientific work accomplished a great deal: scientists developed medical treatments for many devastating diseases, and they and engineers made the world a smaller place by giving humans the ability to travel across great distances at great speeds, and by allowing us to communicate more efficiently across those distances. On the other hand, they also developed weapons capable of extinguishing life on earth. Science became powerful, and scientists had a lot of visible and invisible influence on our daily lives.

In the late 1960s and early 1970s, scholars in the interdisciplinary community of science and technology studies (STS) began to resist an uncritical acceptance of scientific authority. This resistance was partly in reaction to the nuclear arms race, the post-Sputnik race for control of outer space, many medical atrocities (e.g. experiments on African American men, on institutionalized people in Guatemala) and the invention of Agent Orange and other health and environmental pollutants that were commonly used. At the same time, these and subsequent STS scholars became interested in the processes through which scientific knowledge was produced. As STS developed, scholars sought to understand how scientific research and production of knowledge were actually planned, situated, accomplished, and practiced (Clarke and Fujimura 1992, Collins 1985; Fujimura 1996; Latour and Woolgar 1979; Lynch 1985; Shapin and Schaffer 1985; Star 1989; Suchman 1987; Traweek 1988). Other STS scholars were interested in the governance of science (Jasanoff 1990).

Through these early studies, STS scholars demonstrated that the practices of science did not always align with the "scientific method" taught in grade and high school. This was not for lack of trying, but because they too were human, not omniscient, beings. Some STS scholars demonstrated how scientists' social assumptions entered into the production of knowledge.

Scientists are people who live in societies that are often not equitable. They are shaped by their societies and carry the cultural views and values of those societies with them as they go about their scientific work. Some STS studies examine how social understandings and assumptions find their way into scientific knowledge; how they help to shape the questions asked and the answers created.

STS of the 1980s organized itself around the theme of the social production or construction of scientific knowledge. That theme, influenced by the idea of the social construction of society that was prevalent during that same time period in the social sciences, argued that science was a human endeavor and could not help but be influenced by its social and interactional contexts.

Some STS scholars showed that scientific knowledge is the product of negotiations among what Collins (1985) called the "core set" of scientists engaged in a particular field of study, which can be rife with internal politics (Latour and Woolgar 1979). Facts are not simply waiting to be discovered in nature. They are negotiated within a community of experts based on the imperfect evidence that they are able to produce, which is usually not the ideal evidence that they would like to produce. Scientific results are often ambiguous and do not have a clear and obvious interpretation. Individual scientists and laboratories produce results and decide how to interpret them (including whether to consider them "results" at all), and members of the wider research community accept, reject, or revise the conclusions they draw.

Other STS scholars wrote about how scientific facts and theories develop within core sets, but also based on bandwagons (Fujimura 1988) that can develop within institutional contexts (careers, publishing requirements, technological developments, etc.) Over time, scientists come to a consensus about many important facts, but there is almost always some

degree of uncertainty and disagreement. But they are also trained within different schools of thought (Traweek 1988) which influences their divergent interpretations of evidence, and they compete with one another for resources, including funding, jobs, and status. STS researchers also wrote that different fields had "cultural differences" (Knorr-Cetina 1999) that affected their ways of producing knowledge. All of these factors determine which questions are asked, which results are believed, who is rewarded, and, ultimately, what is considered scientific fact.

But Collins' core set theory often left out many contributions by and perspectives of women scientists, which some historians of science worked to bring forward. Feminist studies of science also contributed new ideas about including "values" in science. That is, many feminist studies of science argued that science studies should take stands or positions for making positive changes in the world and conduct their research from those positions (Haraway 1991; Harding 1986). Haraway proposed feminist-inspired and cultural studies-inspired science and science studies in opposition to what she called the "view from nowhere" or the "God's eye-view" that characterized most scientific writing, if not research. She argued against science that represented knowledge as having no human author or positioning and for science that aimed to make a positive difference in the world. Harding went on to engage both epistemologically and politically in postcolonial studies of science (1998).

Collin's core set theory also originally left out the knowledge of "lay experts" who contributed knowledge and expertise beyond the work of professional scientists. These included "lay people," like sheep farmers who understood much more than the scientists how radioactive fallout accumulated on their grazing lands (Wynne 1996) and 1980s AIDS patients who closely examined their disease and lobbied the medical establishment to transform their ways of understanding it (Epstein 1996). Collins and Evans (2002) later named these lay experts

"specialist experts" and brought them into the fold of experts. These are only a few discussions of expertise in STS. For example, feminist science studies scholars had also been discussing expertise (see below).

As the twentieth century closed, a few scientists responded to STS by initiating the "science wars," in which they asserted their epistemic authority by trying to discredit STS research that they believed challenged their special status (Fujimura 1998). But, as many writers noted, STS studies aimed not to discredit science, but to make the actual processes of producing scientific knowledge more transparent and less mystical. Most STS studies acknowledged that scientists attempted to raise themselves out of their social contexts by organizing their research around methods and technologies which they hoped would allow them to produce reliable knowledge, but recognized that they could not entirely escape their assumptions. For example, STS research showed that what counts as reliability is usually negotiated with respect to particular goals and priorities. These negotiations and decisions around particular cases are part of doing science.

In other words, there was no war on science, at least not on the part of most STS researchers. We consider STS researchers to be experts on the production of knowledge, or at least on the sites of knowledge production they study. Although differently positioned than the practicing scientists we study, we provide a kind of scientific knowledge to citizens/consumers of science. Some STS studies also aim to make science better in some way (Fujimura et al. 2014; Haraway 1991; Harding 1986). Other STS scholars hope to use their research to expand science's epistemic and technological possibilities to seek greater social and environmental justice (Fortun 2001; Fortun 2008; Wynne 1996). Regardless of the approach particular STS

researchers take, when they critique science, they are generally interested in positively influencing science and the societies in which it is practiced.

"Post-Truth" Resistance to Scientific Authority

In the twenty-first century, we STS scholars find ourselves in a "post-truth" era and must (re)consider the place of science and our analyses of science in our society. "Post-truthers" have, for example, used ideas of uncertainty or change in scientific knowledge to argue against knowledge about global climate change. In contrast to the broad respect for science that existed during most of the twentieth century, there is now more skepticism of scientific endeavors and an increase in what have been dubbed "alternative facts."

There are as many interpretations of the idea of "post-truth" as there are interpreters, but we suggest that there are at least two distinct types of resistance to the authority of official scientists. One type of resistance comes from some people in politics, business, law, media, and religion who compete with scientists for epistemic authority and influence in the wider culture. They promote versions of the "truth" that are more consistent with their worldviews, interests, and experiences, and they reject inconvenient scientific evidence, for example, about global climate change and the links between tobacco and cancer (Oreskes and Conway 2011; Proctor 1995, 2014). For them, facts are to be manipulated to achieve a goal. Scientific projections of climate change are inconvenient to those whose fortunes depend on the sale of fossil fuels, and to those whose political careers depend on the support of the fossil fuel industries (Oreskes and

Conway 2011). While people react to outrageous "truthiness" tweets[5], the Environmental Protection Agency under the current administration is quietly removing restrictions on the fossil fuel industries (Dillon et al. 2019).

The second type of resistance comes from people who assert a populist approach to science. Rather than rely on the conclusions drawn by scientific experts with their opaque and arcane evidence, they rely on their own experiences and proclamations of people they trust. They often are suspicious of authorities in general. They adhere to what they consider to be a more "pure" empiricism that is not influenced by what they believe are complex theories or concerns about career advancement. They may reject the notion of global climate change not because doing so suits their interests, but because their own sensory experience suggests that the climate is not changing and because politicians they admire claim that climate change is a hoax.

The above is a far too neat description of "post-truth," in part because we do not have the space to devote to a more in-depth analysis.[6] We recognize that there may be some credentialed scientists who agree with "post-truth" positions such as "climate change is not caused by humans." However, a majority of credentialed or expert practicing scientists disagree with that position.

STS in the Age of "Truthiness"

[5] Stephen Colbert of *The Colbert Report* on Comedy Central defined "truthiness" as "the belief in what you want to be true rather than something that can be supported by evidence," October 17, 2005.

[6] See, for examples, Lynch's (2017) and Sismondo's (2017) discussions of post-truth using an STS lens.

In this essay, we consider where STS stands in relation to science and the "post-truth" movement. After spending several decades resisting uncritical acceptance of scientific authority and studying the production of scientific authority, should we now *resist* the *resistance* to scientific authority? If we react to "post-truthers," are we not allowing them to control our actions? With his tweets and antics, Trump has served to distract many of us as he and his agents go about changing U.S. institutions and government agencies, laws and procedures, and democratic governance to fit their desires or those of their supporters. In a similar fashion, other "post-truthers" may be distracting many of us from the work that we should be doing to analyze science and to critique it when necessary. We acknowledge that "post-truthers" dismiss, dismantle, or misuse science and try to replace it with "truthiness." But our focus should not be on battling them. Our expertise is in the social analysis of scientific work, and our aim is to continue that work. We hope that our analyses will be useful for citizens/consumers of science, but we are less sanguine about reaching "post-truthers."

We argue, first, that STS researchers should continue to do the work that we have been doing. That is, we should continue to put forward *our* expert knowledge. Second, we argue that science, in combination with STS analyses of the production and use of scientific knowledge, provides more reliable information for consumers/citizens to make informed decisions on how to act about the scientific information they receive. The scientific work process and science institutions have their flaws, but they are better than their alternatives: ad-hoc "truthiness" and some profit-oriented commercial science that does not have knowledge production as its primary motive. We also recognize that there are uncertainties that make some citizens skeptical about scientific knowledge and that scientists can sometimes act imperious rather than uncertain about

their knowledge. In this regard, our third point is that scientists (and STSers) need to acknowledge these uncertainties, yet still advocate for action because we cannot wait.

So what does STS research do that can help consumers/citizens?

One area of STS tries to break down the division between the production and the consumption of scientific knowledge; to encourage active engagement and means for making information and data available in a way that is more accessible than pronouncements by authorized agencies and institutions.

An example is the study that the first author and her colleagues (Fujimura et al. 2008; Fujimura and Rajagopalan 2011) have conducted on the processes through which geneticists have built infrastructures to make knowledge about genomics. As social science researchers in race theory, we have analyzed how racial categories and assumptions have been used in the work of building data and data infrastructures. Some geneticists and science writers have interpreted results of research using those data infrastructures as showing that racial differences map onto genetic differences. We use our expertise in the sociology of science and the sociology of race to critique those claims, by showing how they were constructed based on the very human assumptions and decisions that were built into the data infrastructures during the processes of doing biomedical and human population genetics research (Fujimura et al. 2014; Rajagopalan and Fujimura 2018).

Another excellent example is provided by the Environmental Data and Governance Initiative (EDGI) group (Dillon et al. 2019). They are responding to "post-truthers" by proactively building data infrastructures to retain and maintain data about global climate change, to make the information available to the public, and to track any changes in the data that the

Trump Administration might make to those infrastructures. They are not arguing with "post-truthers", they are making global climate change data available to the public.

Earlier ethnographic studies of the production of science are also useful to consumers/citizens. Most people know simplified and condensed science from textbooks and popular media, or do not have the time to devote attention to ongoing, arcane scientific work. So they may not recognize that ambiguity, uncertainty, and change are all part of the daily work of science. By change, we refer to the ways that knowledge about, say, nutrition tends to change over time in contradictory ways. For example, coffee is considered to produce health effects one year, but not in the following year. STS research shows that scientists recognize that their knowledge can change in "a month, a year, over ten years," as one of Fujimura's respondents testified. STSers spend our work lives studying the processes of producing or using or governing science. Ethnographers of science show how nature does not simply reveal itself to scientists. They/we study the practices involved in producing knowledge and reveal the complex decisions and ambiguous results underlying it. This work shows that producing scientific knowledge requires decision-making by human actors with material, political, and economic constraints and interests at every step of the way. Reading STS studies, or summaries of them, can help consumers to avoid misinterpreting the uncertainty and ambiguity in scientific knowledge as reasons not to trust the science. They also can help citizens to understand that the complexity, contention and debates are critical towards making good science. As we noted above, scientific knowledge is collectively produced.

STS can also be used to change science curricula. The changing, contentious, and complex nature of science needs to be stressed in our educational system, so as to reassure students that change in science is normal. STS addresses the complexities and the changes that

occur in science and understands them to be part of the process of doing science. Change and debate are normal. Rigidity is ideology and not science. Some of the first author's STS graduate students who study education have argued that schools, even K-through-12, should teach students how science actually happens. They want the kind of information we teach in STS courses, although in a little less complicated language, to be taught in grade schools and high schools. Instead of teaching students to celebrate technology and innovation, why not teach them the realities of doing scientific research and creating technologies? The teaching of the "scientific method" should be recalibrated so students learn that doing science is dynamic, messy, and nonlinear. We still have to teach students current knowledge as it stands, even if it changes tomorrow. But why not teach them how knowledge is actually made?

Just as we do research on the medications prescribed for us by our doctors or by direct-to-consumer advertisements from pharmaceutical companies, all citizens have to decide which science or medicine to trust. Indeed, pharmaceutical companies are now considered to be responsible for the opioid crisis, because they hid the truth about the addictive potential of their drugs. Could this crisis have been avoided if citizens had done their research on these pain medications? But this phrasing of the question is problematic because it puts the responsibility for evaluating science on citizens, instead of requiring pharmaceutical companies, other corporations, doctors, coaches, the FDA, and others to take responsibility.

In some cases, however, citizens have taken on the work of making science. "Citizen science" has been defined by some STSers as research performed by citizens to protect themselves from, for example, environmental contaminations (Irwin 1995) or as scientific knowledge contributed by other professionals, as in the case of sheep farmers who contested professional physicists' evaluations of the rate of decay of radiation levels in their sheep (Wynne

1996). Wynne's work also showed that the epistemologies of the scientists and the farmers were based on different principles: the farmers developed their understanding of the landscape and their practices in accordance with the principles of uncertainty and adaptation, while the scientists were committed to the principles of certainty and control. This led them to overlook the heterogeneity among farmers and the variable conditions of each farming site, with the scientists' rigid approaches to testing and sampling ultimately producing error and costing the livelihoods of the farmers. These lay experts then contributed knowledge that the scientists could not access. Kimura (2016) adds another twist to this discussion by showing that residents in post-Fukushima Japan took it upon themselves to measure the radiation levels in their food to protect their families when the Japanese government had declared the food safe. Here the contestation was between citizens—including many women—and the government and the nuclear establishment which labeled them as "radiation brain moms" or irrational women obsessed with contamination. But she also shows that there is a huge diversity within citizen scientists and sometimes citizens, like the Japanese government, also do nothing with the measurement data to politically push for more systemic changes necessary to address environmental injustice.

Thus, citizen science is a complex thing that requires examination. The vexing question that arises is: who is a citizen in citizen science? When we see many AstroTurf organizations mobilizing citizens for their industry-backed causes, does their volunteer-generated data count as citizen science (Walker 2014)? How do we distinguish between consumer, client, or citizen and for what purpose and whose benefit, cui bono (Liste and Sørensen 2015)? Scholars who write about citizen science have more work to do, and they should not be distracted from this task.

What Does STS Provide to Consumers of Science?

As we have noted, STS is heterogeneous in the sciences we study and our theoretical and pragmatic approaches to that study. For example, many of those who conducted feminist science studies were not methodological relativists in their approaches, as some STSers in the sociology of scientific knowledge tradition were. More problematically, many of those "outside" STS read Bruno Latour's argument—that scientists battle for their ideas amongst various alternatives by amassing armies of interested supporters—as representative of many of our positions and work, which was and is far from the case. The first author's own position on studying science was a pragmatist-interactionist one, closely related to views of her intellectual ancestors. We believe that scientific knowledge is produced by particular humans in particular situations and our job is to show where and how these sciences are located within particular institutional, social, and material contexts. Like my symbolic interactionist and Pragmatist philosopher ancestors, we believe that things are real in their consequences; that scientific knowledges are real in their consequences (e.g., Fujimura et al. 2008). Fake news, junk science, and artificially generated controversies are real in their consequences, but not equivalent to accurate news reporting, real scientific research, and genuine controversies. The difficulty is with operating in an environment in which labels of 'real' and 'fake' are thrown around so carelessly (and strategically). Our job in STS is to show what, when, where, how, and by whom knowledge is constructed, and what consequences that knowledge has, and for whom. We investigate how scientists come to know what they know and what they do with it. Some of us take positions about particular knowledges. We are not anti-science muckrakers. We never were.

To repeat, *STS provides knowledge that helps to locate science in its social, institutional and material contexts, to make scientific practices more transparent.*

But STS was *interpreted* as anti-science by some scientists who went on the defensive during the "science wars." Some STSers may have taken particular positions of critique against the development of nuclear bombs, the use of race in genetics and genomics research, or blaming iatrogenically induced illnesses in women on the women themselves. But these were not anti-science. Indeed, some STS is a science of science. For example, the first author has published at least two articles that use some science to argue against other science. One article disagreed with a "science warrior" who said that we STSers did not even recognize that there was only one value for pi. Fujimura (1998) used results from mathematics to show that pi can take different values depending on which geometry was being considered. She criticized that article because the math was wrong. In another article, Fujimura joined forces with biological anthropologists, a population geneticist, an epidemiologist, and others to show that a sociologist was incorrect in claiming that races, especially those based on the U.S. Office of Management and Budget (OMB) categories, could be mapped onto genetic or genomic categories/groups. That is, we used science, when appropriate, to argue against the sociologist's claim (Fujimura et al. 2014). These are not anti-science articles, they are science articles.

STS is a diverse field of contention. There are many theoretical positions and many debates amongst those who call ourselves STSers. In addition to those STSers discussed in preceding sections, others write about how the meaning and determination of reliability and validity have changed over time and discipline in the sciences (Daston and Galison 2007, Porter 1986, 1996). Others have examined the detailed, mundane practices and daily decision-making that go into making science (Lynch 1985) or the ways in which scientific evidence is used in the courts (Lynch and Cole 2005). Still others have examined the cultures of scientific fields (Knorr-Cetina 1999; Traweek 1988). Jasanoff (2005), Thompson (2013), and others have studied the

governance of science in different countries. Others have studied how scientists build tools and infrastructures to help build their sciences, and how even those tools and infrastructures are always already constrained by social assumptions (Bowker and Star 2000; Fujimura and Rajagopalan 2011; Rajagopalan and Fujimura 2018). Still others have studied how scientific fields and disciplines have grown, what fueled the growth and development, without beginning with the idea that those fields were providing "right answers" (e.g. Fujimura 1996). STSers have also investigated how emerging neuroscientific technologies are reshaping health, illness, and disability (Halpin 2016; Pickersgill 2011; Pitts-Taylor 2016). Technology researchers like Suchman (1987) have examined how scientists often produce technologies that "work" according to idealized notions of how humans think, while Turkle (2011) and Ito (2012) studied how people associate with technologies like robots, smart phones, and video games. Still others who examined the subfield race and genomics wanted scientists to take on more responsibility for how their sciences were/are produced and for how they were/are used by politicians, corporations, and white supremacists (Rajagopalan et al. 2016).

Postcolonial studies of science have examined the co-production of identities, technologies and cultural formations in an emerging global order. "A postcolonial perspective suggests fresh ways to study the changing political economies of capitalism and science, the mutual reorganization of the global and the local, the increasing transnational traffic of people, practices, technologies, and contemporary contests over "'intellectual property' [to] reveal more fully the patterns of local transactions that give rise to global, or universalist, claims" (Anderson 2002: 642). This work includes research by historians (Anderson 2002), anthropologists (Fischer 20012; Fortun 2001; Fortun 2008; Ong 2016), philosophers (Harding 1998; Verran 2001), and sociologists (Alatout 2009; Aneesh 2006; Prasad 2014).

More recently, "disaster studies" and "toxicity studies" have been frameworks organized by STSers who work collaboratively with practicing scientists to collect, collate, and analyze data to attempt to deal with the dire state of the planet. For example, PECE's (Platform for Experimental Collaborative Ethnography) experimental collaborative ethnography aims to build platforms that allow work across multiple sites to examine multiple scales and levels of phenomena. They argue for an "especially complex accounting and accountability –often beyond what established systems can support… to reach for new knowledge practices, expressions and circulations because we study phenomena that call for this with deep urgency" (Fortun et al. 2018: 5).[7]

There are many more STS references and studies we cannot include in this short piece, including many studies being produced by excellent younger scholars. But these references show the vital work that remains to be done. Our point here in pointing out the diversity of perspectives in STS is to argue that even debates amongst STSers are important for science consumers to read. Many STSers are experts who have studied science, the production of science, and the uses of science, and they are building systems of information to provide readers what they need to make their decisions. This work has to go on.

Conclusion

In the last decade, skepticism and cynicism about science and scientific expertise have been gaining attention. In the last thirty years STS researchers played an important role in showing that scientific knowledge is socially constructed in historical and cultural places and

[7] See also a special issue of *Social Studies of Science* (Calvillo, Liboiron and Tironi 2018) on "toxic politics."

spaces. This paper addresses the question: How should STS deal with the current resistance to scientific expert knowledge? While the focus and content of STS research will continue to evolve, analyses based on observations of scientific practice, institutional contexts, social influences, and governance can provide a portrayal of science that is neither too accepting of unrealistic ideals nor too dismissive of the value and potential of science. By continuing to analyze and critique science, STS research can help keep science anchored, while preventing it from being buried in "post-truth" rhetoric.

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