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### *ABSTRACT*

*Law and regulation increasingly interact with science, technology, and medicine in contemporary society. Law and social science (LSS) analyses can therefore benefit from rigorous, nuanced social scientific accounts of the nature of scientific knowledge and practice. Over the past two decades, LSS scholars have increasingly turned for such accounts to the field known as science and technology studies (STS). This essay reviews the LSS literature that draws on STS. Our discussion is divided into two primary sections. We first discuss LSS literature that draws on STS because it deals with issues in which law and science interact. We then discuss literature that draws on STS because it sees law as analogous to science as a knowledge-producing institution amenable to social science analysis. We suggest that through both these avenues STS can encourage a newly critical view within LSS scholarship.*

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## **INTRODUCTION**

In promoting the case method and professional development that form the cornerstones of American legal education today, jurist and legal scholar Christopher Columbus Langdell declared that law must be regarded as nothing less than a science, that the library was to be the lawyer’s laboratory: “all that the laboratories of the university are to the chemists and the physicists, the museum of natural history to the zoologists, the botanical garden to the botanists.” Indeed, Langdell cautioned, “[i]f law be not a science, a university will best consult its own dignity in declining to teach it” (Langdell 1887, p. 124). This was more than poetry; it was an attempt to elevate law by placing it on par with what was then an almost-universally accepted paradigm of objective truth: science (Schweber 1999).

Although law today does not always reflect Langdell’s scientizing program, it has not been banished from universities, nor has it relinquished its claims to produce a form of truth: factual truths about individual cases, rather than science’s more general truths. Indeed, many have observed that law and science may be the two most powerful truth-producing institutions in contemporary society. This presumption has generated interest in the interaction between these two institutions, prompting inquiry into instances when they clash and when they cooperate. Historically, many discussions of the interaction between law and science have echoed Langdell’s admiration for natural scientists, scientific knowledge, and

institutions. Alongside this favorable idea of science remains a critique of lawyers' purported misunderstanding—even misuse—of science.

Scientists' misunderstanding of law seems to be less of a concern, discussed perhaps only for diplomatic reasons. Thus, one way for the Law and Social Science (LSS) scholar to explore this intersection is to seek edification from natural scientists, scientific knowledge, and scientific institutions. Through such an approach, law can be critiqued for its poor understanding of scientific information. In such formulations, scientific knowledge generally is treated as stable and unambiguous; the problem lies in law's use of it. These arguments rest upon an assumption that "correct" scientific information can be discerned and accessed. Such assumptions rest, in turn, on claims about scientific method or scientific authority that purportedly can be used to easily sort "real" science from pseudo-science (e.g., Faigman 1999, Foster & Huber 1999). Some useful work has come out of this approach, for example in exposing the failure of courts to regulate forensic science (Saks & Faigman 2008).

However, another way for the LSS scholar to explore the interaction between law and science is to engage with fellow social scientists who study science, technology, or medicine, as the LSS scholar studies law. Over the past two decades or so, some LSS scholars have become cognizant of the existence of a community of social scientists, much like themselves, who are dedicated to the study of science and technology as social phenomena, much in the way that LSS approaches law as a social phenomenon. This focus on sociality challenges traditional conceptions of law and science as confined to institutions, isolated from the norms and values that

motivate most of human interaction. Science-in-action (Latour 1987), like law-in-action, has become a popular buzzword, and signals an approach to the study of science and technology that takes into account not only science and its impact *on* society, but also the communities of people and things that comprise and enact science itself.

We refer to the community of social scientists who study science and technology and society as “STS.” This is an intentionally ambiguous acronym that can usefully distinguish a particular school of social scientific approaches to science and technology (for an introduction, see Sismondo 2004) from the full panoply of approaches, including, for example, plenty of excellent scholarly work on the nature of scientific knowledge that would disavow the STS label, notably much philosophy of science (Haack 2003). Our topic in this essay is specifically the impact of the particular school of scholarship labeled STS on LSS.

Engagement with STS will take the LSS scholar down a different path than the traditional law-and-science approach described above. Rather than seeing science as clear and unproblematic, STS suggests that the LSS scholar should expect to find science messy, unclear, and unresolved. Indeed, we suggest that it is difficult, if not impossible, to find occasions where the law can apprehend science as a stable, uncontested entity. Instead, the LSS scholar will have to treat science as just as unstable and contested as law. Indeed, STS scholars would question the very premise of Langdell’s vision discussed above. They would challenge “the possibility, and desirability, of law becoming ‘more scientific’ or being made more

‘authoritative’ through incorporating scientific claims or mimicking its epistemic norms” (Cloatre & Pickersgill 2015, p. 3).

## **STS**

While STS, like any other academic field, encompasses a wide range of ideas and approaches, the acronym may reasonably be interpreted to refer broadly to a social scientific approach to studying science that arose in the 1970s and continues to thrive today. It can claim the customary trappings of those academic fields, like LSS itself, whose status rests somewhere between a topic, movement, school, and discipline—what may be described as a “semi-autonomous social field” (Moore 1973) or, simply, a “site” for the study of social action (Seron & Silbey 2004). Like LSS, STS claims disciplinary societies (e.g., the Society for Social Studies of Science and the European Association for the Study of Science and Technology), journals (e.g., *Social Studies of Science* and *Science, Technology & Human Values*), and so on. It has had less success in establishing itself institutionally as a discipline in universities. In most universities, it tends to exist more on the level of a program than a department.

STS broadly derived from a number of converging intellectual threads, including Fleck (1979) and Kuhn’s (1962) history of science, Wittgenstein’s (1953) philosophy, Berger and Luckmann’s (1966) social constructivism, ethnomethodology (Lynch 2001), Mannheim’s (1936) sociology, cultural anthropology (Franklin 1995), and others. It defined itself in opposition to what it perceived as old and outmoded approaches to science and technology. STS distinguished itself from these “older” approaches by claiming to study science

empirically as it actually was, as opposed, perhaps most notably, to philosophers' interest in what science ought to be, i.e., epistemology. Some early STS scholars used qualitative social science tools, including ethnography, to try to capture the actual making of scientific knowledge. Again, this observation of science "in action," rather than in the literature may be seen as parallel to similar moves in LSS to distinguish "real" law from law-in-books.

STS initially defined itself broadly as constructivist, by which it meant that scientific knowledge and technological artifacts and systems were at some level made by human social actors. STS scholars such as Shapin and Schaffer (1985) and Collins (1981) distilled this interest into a methodological principle by which STS scholarship committed to explaining scientific knowledge as a purely social phenomenon. One could not explain scientific belief merely by saying it was true; scientific belief could only come about socially through sets of well coordinated, if tacit, professionally developed habits of interaction and discourse.

This was consistent with a broad strand of social constructivism across academia, and STS may be seen as one facet of the broader movement to apply relativism and constructivism to more or less anything. However, because this approach was applied to what is undoubtedly the most epistemically privileged social institution—science—STS may be seen as, in some sense, the most radical strand of these movements. The claim that scientific knowledge was socially constructed provoked antagonism from practicing natural scientists, realist philosophers, and others who caricatured the social construction of scientific knowledge as a claim that one could even choose to defy gravity (e.g., Sokal &



Bricmont 1998). Because STS, like LSS, engages in “studying up” (Nader 1972)—inverting the common social science tendency to study the disenfranchised and powerless (e.g., deviants for sociologists, indigenous peoples for anthropologists) to instead encourage the social scientist to study people and institutions more powerful than herself—these “science wars” (Ross 1996) were potentially detrimental to the field’s health. Yet STS has flourished, and its commitment to investigating the sociality of science launched a number of programmatic research efforts, some of which are still associated with STS today: the sociology of scientific knowledge (SSK), the strong programme, and the Edinburgh School (Bloor 1991); the Bath School (Callon & Latour 1992, Collins & Yearley 1992), the Empirical Program in Relativism (EPOR) (Collins 1981), the social construction of technology (SCOT) (Bijker et al 1987), and so on.

A more modest reading of STS may be that it denotes simply a preference for studying the role that social relations play in the construction of scientific knowledge over studying the impact of science and technology on society. This preference is significant because the very phrase “science, technology and society” had until the 1970s referred to precisely these sorts of “impact” inquiries, which could be treated as matters for ethics, policy, and so on.

STS found law before LSS found STS. Early STS researchers studied interactions between science and law. By the 1990s, there was enough STS work on law to make it a canonical STS topic. Although Jasanoff (2008) covers STS work on law, we endeavor to cover LSS work that draws on STS. Interested readers should

also note Silbey’s (2008a, 2008b) collection of reprints of LSS scholarship on science.

By the time of the period under discussion in this essay—approximately 1994 through the present—STS had moved well beyond the project of demonstrating the social construction of scientific knowledge. Although many natural scientists doubtless remain unconvinced, the constructed nature of scientific knowledge long has been taken for granted within STS and is no longer questioned or even considered interesting. The field has since moved in a dizzying array of different directions—thick ethnography, politics, literary theory, activist intervention, design, and art (to name just a few)—and in this way has undoubtedly lost a certain degree of coherence. Despite this (or perhaps because of it), STS has acquired a certain cachet in the academy. Scholars across a wide variety of disciplines now draw on, or mention, STS. It was in this context that LSS found STS.

Levi and Valverde (2008, p. 812) claim that Riles’s (2000) “pioneering application of actor-network tools to analyze human rights activism is, to our knowledge, the first major sociolegal work to use” actor-network theory (ANT), a popular approach within STS, although Riles (2016, p. 259) herself dates her exposure to STS earlier, to around 1994 [for more on actor-network theory, see below]. Valverde (2005, p. 420) explicitly dates the convergence of STS and LSS to two panels at the 2003 Law and Society Association (LSA) conference in Vancouver. One participant in those panels (Silbey 2013, p. 28) dates her engagement with STS to around 1999 when she decided to undertake the study of law in scientific laboratories. In any case, it seems reasonable to treat 1994 through the present as a

period of “developing synergies between scholarship in socio-legal studies (SLS) and science and technology studies (STS)” (Faulkner et al 2012, p. 2).

There are a number of ways in which LSS scholars have found STS useful to them. In what follows, we explain those ways. Our explanation necessarily excludes two rich areas of convergence between LSS and STS that already have been covered elsewhere in this journal: First, scholars who study law and race commend STS for having “refuted the opposition of science and power that views science either as a mere product of politics or as an apolitical instrument capable of destroying false ideologies like racism” (Roberts 2013, p. 159). Second, those who study environmental regulation have found STS useful because it “focus[es] keenly on the manner in which actors go about promoting, organizing, regulating, and reacting to the generation of knowledge” (Boyd et al 2012, p. 184).

### **STS Impact on LSS**

There are two primary avenues by which LSS scholars find STS, which we label “interaction” and “analogy.” By “interaction,” we mean cases in which the LSS scholar examines an area in which there actually is interaction between law and science. Because it is a truism that the proportion of scientific issues in legal disputes is rapidly increasing, there is no shortage of areas in which this approach may be fruitful. In seeking insight into the scientific issues in question, it makes sense to the LSS scholar to draw on the latest social scientific accounts of scientific knowledge and practice. STS consciously presents itself—and is characterized by others in many contexts—as “the latest” in this sense. It thus appeals to those

seeking to incorporate a sophisticated, rather than naïve understanding of the relevant science into an LSS analysis.

By “analogy,” we mean cases in which the LSS researcher may be interested in the LSS project of understanding law as a social phenomenon without any explicit interactions with science. For this scholar, STS is an appealing tool in the social science toolkit. Such a scholar might turn naturally to STS because of the plausible analogy between law and science as social institutions. Both science and law are powerful social institutions that make knowledge—albeit in quite different ways—and have great epistemic authority (Jasanoff 2008, p. 761, Silbey 2013, p. 27). The social analysis of both institutions comprises the vaunted social science practice of “studying up.”

Despite these similarities, the analogy is imperfect at best. Even today, the claim that scientific knowledge is socially constructed is still provocative in a way that the claim that law is a social creation is not. The relationship of STS and LSS to their research subjects is different as well. Many LSS scholars are institutionally located in law schools. While law professors are not necessarily practicing lawyers, many LSS scholars are nonetheless institutionally located in the very institution that produces the knowledge they study. STS scholars are far more likely to be located outside of the primary institutional producers of the scientific knowledge they study—that is, in places other than universities’ natural science departments.

Thus, in the analog approach, the relationship between LSS and STS is that of an exchange of “tools, methods and concepts, in order to study their respective objects of inquiry” (Jacob 2015, p. 139) (see also Valverde 2005, p. 421). Some

scholars see the relationship less as an exchange and more as a conquest of LSS by an expansionist STS, suggesting that law should be yet another “‘expansion’ of the remit of STS” resulting in a new field perhaps called “social studies of law” (Cloatre & Pickersgill 2015, p. 4, quoting MacKenzie in part) (see also Foster 2014, Murphy & Cuinn 2013). The expansionist impulse derives from a belief that STS in fact constitutes a better way of studying everything, not just science. But this belief is not universally held even within STS itself, where even claims that STS constitutes a theory are contested.

## **INTERACTION**

Positivist notions of science remain dominant in contemporary culture and large swaths of academia as well. These notions may be found in much LSS work, especially when the LSS scholar, intent on analyzing the dynamism in law, finds it helpful to treat science as unambiguous and stable. One way in which STS can inform LSS is when the LSS scholar exploring a problem that involves science *in law* adopts instead a more nuanced, STS-inflected understanding of scientific knowledge. We provide examples of this below.

### **Law in the Laboratory**

The influence of STS is evident in at least two ways in Silbey and Ewick’s (2003) study of the role of law in university science laboratories. First, having a deep understanding of the history of the science laboratory from the scientific revolution through the present enables them to see the contemporary university laboratory as neither static nor inevitable, but rather as a particular formation of

contemporary society, in which the laboratory is public, standardized, and, in their view, essentially uninhabited. Second, STS's focus on the role of the social in scientific knowledge draws them to study the role of law in shaping scientific knowledge and what Shapin (2008) calls "the scientific life." From this perspective, legal regulation—health and safety regulations, animal protection, and so on—"shaped the spaces" of university science laboratories "and thereby altered the professional lives, consciousness, and passions of scientists" (p. 102; see also Huising & Silbey 2011, Silbey 2006, Silbey 2009).

### **Intellectual Property**

STS scholars have long been fascinated by intellectual property. The patent itself—as a univocal, unambiguous, and uncontested narrative of a scientific discovery or invention—has long seemed a fertile site for STS scholars to reveal the constructed nature of this narrative and more complex stories that could be told. Some LSS scholars thus draw on STS to challenge simplistic notions of discovery, invention, and authorship, novelty, and patentability (e.g., Biagioli 2011, Cohen 2012, Coombe 2011, Fish 2006, Hayden 2003, Kelty 2011, Murray 2011, Parthasarathy 2007, Silbey 2014, Swanson 2007, Swanson 2011). Kahn's (2013) study of the clinical testing and marketing of the congestive heart failure drug BiDil draws on the STS tradition of intensive questioning of scientific claims. He shows that the vendor's claims that the drug was particularly effective among African-Americans, which made it the first drug approved by Food and Drug Administration for use in a specific race, were not only tenuous products of questionable interpretations of data that relied upon artificial constructions of "race," but also

were intended to extend the life of the IP owner’s patent. Burk’s (2013, p. 95) discussion of the fraught question of gene patenting evinces an STS sensibility by drawing attention to the essentially arbitrary construction of the gene itself, an entity commonly presumed to be entirely self-evident. Burk argues that science alone cannot unequivocally answer even the question: “what is a gene”? He questions the “products of nature” doctrine in U.S. patent law by pointing out that the “gene” itself does not exist in nature; it is one of many possible human conceptual designations for delineating some parts of biological organisms.

### **Controversy**

STS scholars view scientific controversies as breaches in the established social order of science, and thus strategic research sites from which to observe scientific knowledge in the making. LSS scholars have begun drawing attention to “hybrid” (Lynch et al 2008, p. 43) controversies that are both scientific and legal (e.g., Alder 2007, Freudenburg 2005, Freudenburg 2008, Rees 2015, van Brakel & De Hert 2011). Lynch *et al.*’s (2008) study of the controversy over forensic DNA profiling begins from an STS approach in which the explanation for reaching closure—that is, general agreement in a “core set,” a relatively small group of individuals whose expertise lies closest to the subject matter—is social rather than purely natural. They then draw on Edmond’s (2001) work extending the notion of the core set into the “law-set,” a core set composed of both scientific and legal actors, to which Lynch *et al.* add a “literary set” of legal scholars, science journalists, and social scientists like themselves. They approach the DNA controversy as “a techno-legal controversy,” arguing that “[c]losure was as much a legal and

administrative matter as it was a technical or scientific issue” (Lynch et al 2008, pp. 45-46) (see also Aronson 2007).

Aronson and Cole (2009, Cole & Aronson 2009) bring an STS perspective to the use of science as a rhetorical resource in debates over the death penalty in the United States. Through a series of three case studies—the use of DNA profiling to show that factually innocent people are sentenced to death, the appeal to psychological knowledge to support the argument that the juvenile brain is not fully formed and therefore should be considered less culpable, and the use of medical knowledge in debates over whether lethal injection execution causes undue pain—they show that the appealing notion of invoking science in these controversies also invites peril. Scientific knowledge should be expected to change, and even the same scientific data may be subject to alternative explanations.

Ottinger’s (2013) study of environmental justice uses STS to challenge cherished procedural justice notions like informed consent and informed participation. A common theme in her work, as well as in controversy studies more generally, is the point that since scientific knowledge is dynamic, it becomes difficult to hold it temporally stable enough to determine legal questions like whether there is such a thing as a DNA “match,” or whether legally actionable scarcity exists (see also Alarout 2007), or whether consent was “informed.”

## **Expertise**

One area where science in law becomes particularly visible lies in the necessity of adjudicating the legal admissibility of scientific (or expert) evidence. Law, in some jurisdictions at some times, has seen this necessity as a call for



“demarcation”—that is, distinguishing true science from pseudo-science and other pretenders (Golan 2004).

One particularly well-studied example of demarcation is the United States Supreme Court opinion *Daubert v. Merrell Dow Pharmaceuticals* (1993). Although *Daubert* did cite some STS work, it generally approached admissibility from a perspective informed by Popperian philosophy of science, which holds that the proper goal is demarcation and the proper tool with which to do it is a philosophical principle called “falsification.” *Daubert* thus results in a crude binary framework in which purported scientific knowledge claims are sorted into two categories: “true science” and “junk.” Witnesses representing true science are then given free reign to make pretty much any statements they want, while witnesses representing junk science are not permitted to say anything, no matter how epistemologically humble (Cole 2007).

STS scholars have critiqued *Daubert* for its mythologized notions of a unitary science that can be fully accounted for by falsification, as well as its hubristic claim of an objective standpoint from which to engage in demarcation (Edmond & Mercer 1998a, Edmond & Mercer 1998b, Edmond & Mercer 2002, Edmond & Mercer 2004, for a contrary view, see Jasanoff 1995, p. 63). STS scholars’ efforts to articulate what an STS-inflected legal standard for evaluating expert evidence would look like illustrates the differences between STS and approaches like falsification. Such a standard, they suggest, would be ethnographic, contextual, critically reflective, non-idealized, and non-romantic (Caudill 2002a, Caudill 2002b, Caudill & LaRue 2003,

Caudill & LaRue 2006, Caudill & Redding 2000, Edmond & Roach 2011, LaRue & Caudill 2004).

Jasanoff (2005, 2006), however, argues that scholars may be asking the wrong question. Rather than ask how to properly evaluate science, she argues that the question should be approached pragmatically: how best can law do justice under conditions of scientific uncertainty? Indeed, while STS has been criticized as an undifferentiated debunking of all knowledge claims (e.g., Wolpert 1993, p. 110), much recent STS work has engaged the question of how to move forward with technical decision-making in a world in which the insights of STS are taken for granted. It asks: Without either leveling all knowledge claims as equal, on the one hand, or uncritically privileging certain knowledge claims on the other, how can social groups make technical decisions in a world of scientific uncertainty (e.g., Collins & Evans 2007, Jasanoff 2003, Rip 2003, Wynne 2003)?

Forensic science turns out to be an area in which STS scholars have engaged this problem (e.g., Cole 2010, Dioso - Villa 2016, Mnookin 2008). In Risinger's (2007, p. 688) sympathetic reading, STS-influenced scholars discovered that many knowledge claims in the realm generally known as "forensic science" were "insupportable not merely in the same sense that . . . science studies . . . may assume that all claims are ultimately insupportable, but insupportable in a more fundamental and important way."

### **Legal Knowledge**

Another set of analyses examines the role of law in generating what is taken to be scientific knowledge. Cole's (2004) debunking of the assumed fact of the

absolute accuracy of fingerprint identification also notes the role that law itself played in constructing this “fact.” Cunliffe (2011, p. 199) finds similar invoking of law in support of medical facts about infant death and, further, that legal cases sometimes drove medical research in this area. Lawless (2012) makes a similar argument about a possibly novel—the very issue of novelty was subject to intense debate—application of DNA profiling: low-template DNA profiling (LT-DNA). Mnookin (1998) shows that the seemingly unproblematic claim that photographs constituted faithful representations of reality were not simply accepted by courts, but had to be tamed and fitted into familiar legal doctrine.

This making of scientific knowledge by law is only one usage of the rather flexible and ambiguous term “legal knowledge.” Other researchers study the making of legal knowledge, by which they mean “those multiple, collective, medico-administrative and managerial decisions about knowledge itself that precede official legal decisions,” and also, like much STS scholarship, “the various uses people make of a law’s perceived set of tools, forms, idioms and styles of reasoning” (Jacob 2011, pp. 245-46). Focusing on this latter form, Riles (2011) offers an ethnographic study of the Bank of Japan. Looking carefully at the collateral that acts as security for a loan, Riles examines what she calls “collateral knowledge”: a knowledge that practitioners view “as of no particular consequence or worry” but which Riles sees as instrumental in bringing new forms of governance into being. She emphasizes the importance of legal reasoning in the financial markets and transactions—reasoning that helped to transform collateral from “just a technique” to something that took on a “cultural reality” of its own (pp. 173-74). Similarly, Kawar (2014) emphasizes the

importance of material practices, such as charts, questionnaires, and “split paragraphs”—dividing paragraphs of legal documents into smaller parts that can be negotiated and treated differentially—in the making of rights for domestic workers in international law. Jain (2006) notes that the archive she mined for her study of the short-handled hoe, and even the artifact of the hoe itself, were in some sense created by law. Scheffer (2010, p. 623), in his study of psychologist experts, argues that such experts expand their authority through performances of borrowing and sharing diverse knowledge from others—establishing their role not through knowing everything but, instead, through the “modest acts” of claiming not to know some things.

### **Common Knowledge**

Some LSS scholars apply these approaches to knowledge that is not necessarily scientific in a conventional sense. For example, in their study of liquor licensing and drunk driving, Levi and Valverde (2001) approach police science much in the way STS approaches scientific knowledge. Their comparison of “common” versus professional knowledge mirrors STS work on the expert knowledge of non-professionals, such as farmers or AIDS patients—an approach applied to several other “common” and “hybrid” knowledges in Valverde (2003)— which essentially takes an STS approach to “*nonscientific* knowledges in legal contexts” (3, emphasis added) (see also Allen 2004).

### **Co-Production**

The focus on the interaction of scientific and legal knowledge can be pushed further through the notion of “co-production” (Jasanoff 1995, p. xv, Jasanoff 2011, p. 3). Those ascribing to the notion of co-production hold that it would be fruitless to try to isolate the effect of law on scientific knowledge or the effect of science on legal knowledge; it is better to analyze the process through which they produce one another.

Mnookin (2001, p. 114), for example, notes that most legal evidence scholars, despite other differences, tend to “share a belief that scientific reliability is generated entirely outside of law, rather than partly constituted through legal determinations.” In her study of handwriting evidence, she shows that law, in the form of judicial opinions, played an important role in constructing the supposed scientific reliability of handwriting analysis. Moreover, the law’s conception of what was meant by “scientific reliability” shaped handwriting analysts’ conception of their own expertise. Thus, “[t]he reliability of expert evidence in handwriting was co-produced by judges and experts in tandem” (pp. 121-22) (see also Balmer 2015, M’charek 2008, Toom 2012).

In addition to its applications to forensic science, co-production is particularly attractive to scholars studying regulation (e.g., Kirkland 2016), perhaps because the field has historically treated law and science as so clearly separate: law regulating science. Bora (2008, pp. 68-69) notes that the field of “science advice” has historically been treated as the opposite binary: science advising law (or, more generally, government). He argues that both could benefit from a co-productionist

approach. Winickoff (2015, pp. 174-75) applies co-production to regulation, arguing that regulatory science can even co-produce a new “jurisdictional architecture.”

## **ANALOGY**

Legal scholars long have questioned whether law exists as an autonomous discipline (Holmes 2009, Posner 1987), but such skepticism says little about what law is. The act of defining law, it turns out, “is surprisingly tricky business” (Calavita 2010, p. 24). Some try to avoid this definitional quagmire altogether. Rather than defining law, they analogize it; and science is the most frequent comparison they invoke (Langdell 1887, Latour 2010). Indeed, as Horwitz (1980) notes, the idea of law as science “has dominated American legal thought” for much of the last two centuries. For those LSS scholars who see law as science, STS provides a convenient toolkit for studying law and its implementation (Davis et al 2012), but the comparison to science need not be explicit. Often, LSS scholars cite STS as a significant influence, but offer little elaboration of either STS or how it has influenced their work (e.g., Braverman 2008, Guzik 2013, Suchman 2003, Tejani 2016). Still other scholars borrow STS concerns and concepts and directly apply them to their studies of law. We examine these applications below.

## **Actor-Network Theory**

Actor-network theory (ANT), generally credited to Callon (1984), Law (1987), and Latour (1987), is by far the best-known STS concept outside of the field of STS, and it is the most frequent STS concept imported into LSS. Indeed, many LSS scholars equate STS with ANT, and more specifically with a single scholar, Bruno

Latour. ANT is an end-product of—or an unfortunate distraction from—the social constructivist project in science. Within STS, ANT was arguably a product of the same “theoretical exhaustion” that LSS encountered after showing that law and culture, or law and society, were mutually and socially constructed (Maurer 2004); but within LSS, some see ANT as promising something distinct and new.

ANT argues for doing away with the nature-society divide entirely, for analytically treating everything as an actor—rechristened “actant” to signal the inclusion of non-human participants—without being distracted by the “outmoded” question of whether the “thing” is natural or social (Latour 1987, p. 84). Famously, this leads to the treating of machines, bureaucracies, documents, and even scallops and microbes as actants. Hence, ANT is sometimes summarized as “scallops have agency.” Rather than attending to the nature-society divide, the social scientist is advised to study the networks between actants that see—or make—the world in a consistent way. In the language of ANT, “scientific facts,” “action,” or “reality” are in a sense “made” by actants who “enroll” or mobilize the strongest networks. This emphasis on strength, rather than, say, truth, invites the common characterization of ANT as Machiavellian.

ANT is (or was) one of those trendy academic ideas that gets new adherents excited and irritates skeptics. Even within STS, ANT is controversial; many, including some of its own founders, have questioned its claim to being a theory and suggest that it may have outlived its usefulness (e.g., Latour 2004, Law & Hassard 1999). In LSS, ANT has been adopted mostly as a method: a way of following the disparate people and materials that comprise law. It is regarded as a “tool,” not a

theory: a hoped-for means of “stimulat[ing] methodological innovation through analyses that ask not about the content of claims but about *process* and *flow*—about how actors pick through documents or discourses and cobble together new governing machines that recycle old bits in new ways” (Valverde 2005, pp. 420-21).

One curious feature of efforts to apply ANT to LSS is that such efforts have in some sense been upstaged by one of the founders of ANT himself. Latour’s (2002) book, *La Fabrique du Droit* [*The Making of Law*] studies law by focusing on its most visible manifestations: “the wonderfully kitsch frescoes . . . the fattening of files in grey or yellow folders . . . the hesitations, the winding path, the meanders of reflexivity [in the counsellors’ discussions]” (1, 69, 151). For Latour, law is “a practice, a situated material practice that ties a whole range of heterogeneous phenomena in a certain specific way” (x). The cases that present themselves at the Conseil d’Etat offer an opportunity for the counsellors to identify and describe the “way” of law.

*The Making of Law* was, however, unavailable in English for eight years. During this interregnum, Levi and Valverde (2008) raised awareness of ANT for “non-French-reading” LSS scholars with an essay that summarized *La Fabrique du Droit*’s methodological and theoretical implications for LSS research. They saw its principal values as: first, its rejection of the duality of law and society in favor of an ANT approach that “treats law as a network of people and of things in which legality is not a field to be studied independently, but is instead a way in which the world is assembled” (806); and, consequently, its rigorous commitment to ethnographic empiricism in order to generate “specific, concrete analyses that attempt to be as



dynamic and as sensitive to contingency as the processes being analyzed” (812). They suggest that “the revival of a pragmatist tradition through ANT can provide analytic insights to complement existing theoretical and methodological tools” (822).

ANT’s adherents thus celebrate it as a way to study law dynamically, drawing attention to law as a practice enacted by people and things, rather than as a power that controls those people and things (Cloatre 2008, Cloatre & Wright 2012). Thus, for example, Lange’s (2005) study of legal regulation uses ANT to move beyond obsession with disentangling the relative contributions of agency and structure, and instead treats everything, including technology and material objects, as agents. When ANT is used in LSS, then, it is not to record perceptions of law or analyze law’s effects; it often skips over these classic sociolegal preoccupations. Instead, ANT-inspired studies more closely resemble mapping projects: they follow the process and flow of actants to plot who and what is involved in the making of laws and regulations (e.g., Rooke et al 2012). Cowan and Carr (2008) make this point explicitly in their study of legal challenges mounted by landlord associations in Ireland. They extol ANT for allowing them to eschew the perceived binaries of power and resistance, governable and ungovernable. Instead, using an ANT-inspired methodology, they follow the networks established within and by the associations, highlighting concerns that might otherwise have seemed marginal. Acknowledging that it becomes difficult to know where to cut the network, Cowan and Carr (2008, p. 166) conclude that following the network ultimately is a “methodological limitation[] as well as strength[]” of ANT.

Following the network is, as Latour puts it, a quest for the ontology of law, the search for law’s “essence” (x), its “mode of existence” (274), or, more to the point, its “*libido judicandi*” (204). Law is defined as strategically positioned networks, allying human and non-human *actants*, and extending well beyond the confines of formal institutions. These networks connect and bind disparate and seemingly unrelated things, documents, and people. Latour characterizes this as formatting; “the law,” he pronounces, “formats” (268). For connoisseurs of law, this is a marvelous observation: Law coheres; it does not impose. This conclusion also reveals the limits of ANT in law, for this sort of mapping exercise does little to navigate one through the theoretical thickets of legitimacy, obeisance, and power that are the “standard fare of sociolegal research” (Levi and Valverde 2008, 822). After tracing the paths of law, then what?

### **Ethnography**

For many scholars, this unanswered—possibly unanswerable—question poses a source of frustration and cause for spurning ANT. Even for these scholars, however, Latour’s contribution to the study of law remains a source of inspiration, particularly in his “revival of a pragmatist tradition,” which encourages scholars to study law through a “deeply empiricist” ethnography—one that discusses not law that has been made but, rather, “law in the making” (Levi & Valverde 2008, p. 822). While LSS embraced ethnography prior to discovering STS, researchers who combine ethnographic and STS perspectives offer special insight into the technology—not just the effects—of law.

The commitment to ethnography as a means to study law as and through practice—albeit not always explicitly following Latour—has influenced a growing number of studies of law and legal regulation. Thus, for example, Van Hoyweghen et al. (2007, p. 181) aim to discover the “practical effects” of Belgian insurance law by studying the effects of such law through ethnographic fieldwork “from the inside” of Belgian insurance companies. They conceptualize the legislation through the STS concept of “socio-technique,” by which they mean that science and society (including legislation) are co-produced (181). Through ethnographic detail, their work draws attention to the mechanics, as well as the effects, of this co-production.

Ethnographic methods and analysis are especially useful for producing interpretive accounts of legal practice, and for illuminating the dynamics of legal knowledge (e.g., Gundhus 2012, Ottinger 2013, Riles 2011, Valverde et al 2003). Riles (1998) uses ethnography to examine the legal agreements negotiated at a United Nations sponsored international conference and asks how legal norms are made visible to participants (and to the anthropologist who studies them). Borrowing a page from STS, Riles answers this question by focusing on the material manifestations of legal negotiation: the changes made and negotiated in written documents. She implies that, like scientific knowledge, legal knowledge may be ascertained through observation of the practices and instruments of those who might be said to be “doing” law. Bertenthal uses ethnographic research and analysis of meetings between unrepresented litigants and attorneys offering advice in a legal self-help clinic to examine the production of legal literacy—specifically, the process through which legal understanding is developed and articulated through the reading

and writing of legal documents. Kruse (2016) also uses documents to trace the “social life of forensic evidence” backwards from the courtroom through the forensic laboratory to its origin at the crime scene.

### **Materiality**

The materiality of law is an especially pervasive theme in studies of law that draw inspiration from STS. The focus on law’s matter does not, of course, draw exclusively from STS; but, as a field that “increasingly recognize[s] materiality as pertinent to social inquiry” (DeSoucey & Schleifer 2010), STS makes available several analytic tools to LSS scholars interested in the materiality in and of law. Among the insights LSS scholars have borrowed from STS is the recognition that objects do not merely exist as things in the world, but must be understood—and perhaps even redefined—according to what they *do* within the world (see Madison 2005) as residues of legal action that “lead[] forward as well as into the past” (Merry & Coutin 2014, p. 3). Such redefinition is necessary, Riles (2011) suggests, because objects in law are not simply neutral and agnostic tools, but, rather, potent vehicles for the implementation of law in society, with potentially profound distributive consequences. Thus, Hunter (2015) proposes studying things within law as “socio-legal objects” to emphasize the imbrication of objects, legal processes, and social relationships. In tracing disputes over solar leases in the United Kingdom, she urges closer attention to the written lease as a particular kind of object that creates a particular social reality through its existence, use, and action within law.

Other scholars have looked more closely at the contours of what Hunter calls “socio-legal realities” (154), and, especially, the import of objects in constructing

these realities. Many LSS scholars treat law as a “regime of enunciation” (Pottage 2012), which should be studied through attention to specific language and rhetoric. By calling attention to the role of things, however, the STS approach extends the LSS inquiry beyond discourse, drawing attention to the role of machines (Pottage 2011), regulations (Faulkner 2012), physical landscapes (Levi 2009), and regulated entities such as food products (DeSoucey & Schleifer 2010) in the enactment of law.

Latour’s interest in “immutable mobiles,” which can move objects across time and space while keeping them stable, is discernable in Lezaun’s (2012, p. 21) ethnography of the European Institute for Reference Materials and Measurements, “the agency tasked by European authorities with the fabrication of dependably constant versions of the entities mentioned in EU legislation.” The Institute is a sort “curiosity cabinet” consisting of “entities mentioned, somewhat casually, in European laws and regulations, but which the law would be unable to find in the world if it were not for the availability of an official, stable version of the material in question.” In studying law, one should focus on materials before speech, Lezaun argues, for “the law does not speak of the world . . . unless worldly stuff can be classified on the basis of legal criteria” (p. 38). Material intermediaries have the power to transform legal criteria from mere pronouncement to something that is in fact “a part of the world.” This process of coming to matter, as Lezaun puts it, does not operate in a vacuum but must be looked at in conjunction with other actants in the legal system, whose use, interpretation of, and interaction with objects forms the basis of a unique legal vision (van Oorschot 2014). Legal materials, in other words,

are not just objects of study; they are an important component of the technology that grounds law and enables it to do what it does.

### **Science Communication**

Science communication (sometimes called “public understanding of science”) is another semi-autonomous field oriented around the eponymous problem. Science communication overlaps somewhat with the problem of expertise (see above)—because it raises the question of public scientific competence—but the field is broader, encompassing “consumption” of science for purposes other than technical decision-making, such as education and entertainment. The definitional project serves as an important tool in establishing what knowledge counts, why it counts, and for whom it counts. It is a field in which positivist and constructivist perspectives maintain an uneasy coexistence, and STS-inflected work occupies the constructivist end of this continuum.

STS work understands itself in opposition to what is derisively known as the “deficit model,” which holds that the “problem” is a lack of scientific knowledge on the part of laypersons (which often includes, for example, legal actors or policymakers). In contrast, STS work begins from the premise that scientific knowledge is itself unstable, ambiguous, and contested, and thus cannot simply be poured into laypersons’ minds. STS work tends to valorize various forms of lay knowledge and to call for public participation and engagement in scientific knowledge-making and technical decision-making. This work challenges the influential view that knowledge is made by experts, and it presents some pathways

through which those far removed from the center can also stake a claim to scientific understanding.

Tracking and evaluating public understandings of law comprises an important part of LSS work as well. The bulk of this scholarship uses a model of meaning-making—commonly referred to as legal consciousness (Ewick & Silbey 1998, Silbey 2005)—consistent with conventional understandings of “a thinker, a cognitive self” (Engel 1998, p. 111) who adopts individual or cultural forms of knowledge “through which legal understandings, expectations, aspirations, strategies, and choices are developed” (McCann 2006, p. xii). Like STS, LSS work valorizes some forms of lay understanding of the law, and, especially, the mobilization of that understanding as social action (Silverstein 1996).

For those LSS scholars who see law as analogous to science, STS provides a convenient toolkit for studying law and its implementation, including the ways law is communicated and understood by the public (e.g., Caudill 2011, Davis et al 2012, Flear & Pfister 2014). Some STS work on science communication gravitated toward normative advocacy of “public participation” in science: e.g., stakeholder consensus conferences, citizen science. Flear and Pickersgill (2013) draw from STS work on public participation in their study of the EU’s regulation of nanotechnology. They ask how citizens can participate in such regulation in the absence of certain scientific knowledge, but also, what such participation might do. They observe that “public participation is a key site where debate around futures is played out” since those futures “can literally be talked into existence” (p. 13). This public discursive interaction creates, among other things, new configurations of science/citizen

relations, fundamentally affecting the ways in which people and things both regulate and are regulated by law. In characteristic fashion, however, STS quickly turned its critical eye on such enterprises for offering only faux participation and serving entrenched interests. LSS might benefit from a similarly skeptical perspective, subjecting even well-intended public participation programs to analysis and critique.

### **Reflexivity**

“Reflexivity,” the notion that STS’s social understanding of scientific knowledge must be applied to STS itself, is considered by many to be a core principle of STS; it is indeed one of the four principles of the famous “strong programme in sociology of scientific knowledge” (Bloor 1991). The principle makes sense, of course, but it has been criticized even within STS, in part for being perhaps impossible to enact (Ashmore 1989).

Reflexivity has relevance for LSS, which, like STS, has aspirations to producing social scientific knowledge at the same time that it studies truth-makers of other kinds. It echoes earlier interventions into law and society, especially Teubner’s (1983) call for a more reflexive law. In some ways, Teubner’s concept of reflexive law echoes the strong programme. Reflexivity is meant to be a restraining mechanism on law, requiring “the legal system to view itself as a system-in-an-environment and to take account of the limits of its own capacity as it attempts to regulate the functions and performances of other social subsystems” (p. 280, citations omitted). Yet, unlike the strong programme, Teubner’s concept of reflexivity was concerned with the subject of knowledge—law—rather than the



making of that knowledge. STS would propose reflexivity in the study of law and society, not only reflexivity in the legal system itself.

Even as some LSS scholars have absorbed STS, LSS remains influenced by strong strains of what STS would consider un-reflexive scientism and positivism. Some argue that “scientism,” which has been defined as “a matter of putting too high a value on natural science in comparison with other branches of learning or culture” (Sorell 1991, p. i), invites social scientists to try to imitate the certitude that they imagine the natural sciences can command (see, e.g., Calavita 2002).

LSS has always produced its own social scientific facts, of varying types and accompanied by varying degrees of rhetorical conviction, and the present is no different. Indeed, given the growing presence of social science methods and training in the legal academy, we should expect to see increased knowledge-making in LSS. STS shouldn't necessarily teach LSS never to make such claims, but it might teach LSS to at least think about the principle of reflexivity when they are made. It is not so much that LSS scholars need to think about whether the claims are true. Rather, STS would urge them to think about their own knowledge claims as they would those of others, as contingent and socially produced. Likewise, STS would encourage them ask the same questions about their own knowledge claims as they would ask about others' claims: What social forces went into the making of these claims? Whose interests does it serve to make them facts, and how did that happen? Why does this claim have purchase in this particular place and time? And, above all, how to respond to these questions following the STS directive that they cannot be answered: “because it's true”?

It is often argued that truly reflexive scholarship leads to scholarly paralysis. But STS has been able to move forward by remaining modestly, if not fully, reflexive. STS has had vigorous debates over the issue of intervening in the scientific controversies it studies, and persuasive arguments have been made for various purist positions (e.g., STS scholars should never take sides; should take the side of politico-moral underdogs; should take the side of epistemological losers; etc.). For many STS scholars, however, the challenge is precisely how to intervene while maintaining some degree of reflexivity.

Reflexivity also may be found in some LSS work. One example is Valverde's reflections on her work as an expert witness on the social construction of sexuality. She describes conforming to legal requirements about how she presented herself and her knowledge; trying to balance "intellectual integrity" with the urge to present "the kind of social science I instinctively knew the law wanted" (Valverde 1996, p. 208); making "problematic move[s]" (Valverde 2003, p. 115); and ending up becoming a purveyor of precisely the sort of "common knowledge" she herself studies (p. 135) (see also Cole 2009, Lynch 2009, Lynch & Cole 2005).

## **CONCLUSION**

STS is sometimes portrayed as a theoretical intervention into LSS. Our review of the literature paints a somewhat different picture. Rather than a theory, STS seems to function more like an anti-theory for LSS. Rather than constituting a new theory, the overall thrust for most LSS scholars who "listen to STS" seems to be to focus even greater attention on the contingent details of specific legal and

scientific practices in specific places at specific times, at the expense of abstract theorizing. For example, STS calls for paying attention to and questioning the details behind scientific “facts” and technological systems and artifacts. It calls for increased attention to the materiality of law, the papers, objects, and places that compose it. It endorses ethnography and thick description. Even actor-network “theory” seems to be less a theory than a call to carefully reconstruct, trace, and analyze socio-technical-legal networks.

As noted, there are many versions, and visions, of STS. But among the more compelling is an emphasis on the importance of a thorough understanding of the details behind the making of scientific facts and technological artifacts—opening “black-boxes,” tracing networks, studying controversies, and so on. STS at its best has this character, and perhaps STS can lend more such character to LSS, not least by dissuading scholars from treating at least one aspect of the landscape in which law operates—science and technology—as something that can be summarily accounted for without being carefully engaged, considered, and questioned.

A longstanding STS argument has been that even if science does not conform to its romantic idealizations, it can still be both powerful and interesting to study. Likewise, we need not accept law as a science in the Langdellian sense to recognize that it still remains a potent form of knowledge and well worth studying: both in its interactions with, and comparisons to, science.

**LITERATURE CITED**

1993. *Daubert v. Merrell Dow Pharmaceuticals*. In *U.S.*, pp. 579: U.S.
- Alatout S. 2007. State-ing Natural Resources through Law: The Codification and Articulation of Water-Scarcity and Citizenship in Israel. *Arab World Geographer* 10: 16-37
- Alder K. 2007. *The Lie Detectors: The History of an American Obsession*. New York: Free Press.
- Allen BL. 2004. Shifting Boundary Work: Issues and Tensions in Environmental Health Science in the Case of Grand Bois, Louisiana. *Science as Culture* 13: 429-48
- Aronson JD. 2007. *Genetic Witness: Science, Law, and Controversy in the Making of DNA Profiling*. New Brunswick, N.J.: Rutgers University Press.
- Aronson JD, Cole SA. 2009. Science and the Death Penalty: DNA, Innocence, and the Debate over Capital Punishment in the United States. *Law & Social Inquiry* 34: 603-33
- Ashmore M. 1989. *The Reflexive Thesis: Wrioting the Sociology of Scientific Knowledge*. Chicago: University of Chicago Press.
- Balmer A. 2015. Telling Tales: Some Episodes from the Multiple Lives of the Polygraph Machine In *Knowledge, Technology and Law*, ed. E Cloatre, M Pickersgill, pp. 104-18. Abingdon: Routledge
- Berger PL, Luckmann T. 1966. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York: Anchor.
- Bertenthal A. The 'Right Paper': Developing Legal Literacy in a Legal Self-Help Clinic. *Law & Social Inquiry*: In press
- Biagioli M. 2011. Patent Specification and Political Representation: How Patents Became Rights In *Making and Unmaking Intellectual Property*, ed. M Biagioli, P Jaszi, M Woodmansee, pp. 25-39. Chicago: University of Chicago Press
- Bijker WE, Hughes TP, Pinch T, eds. 1987. *The Social Construction of Technological Systems*. Cambridge: MIT Press.
- Bloor D. 1991. *Knowledge and Social Imagery*. Chicago: University of Chicago Press.
- Bora A. 2008. Scientific Norms, Legal Facts, and the Politics of Knowledge In *Who Owns Knowledge? Knowledge and the Law*, ed. N Stehr, B Weiler, pp. 67-86. New Brunswick: Transaction
- Boyd W, Kysar DA, Rachlinski JJ. 2012. Law, Environment, and the 'Nondismal' Social Sciences. *Annu. Rev. Law Soc. Sci.* 8: 183-211
- Braverman I. 2008. The Tree Is the Enemy Soldier: A Sociolegal Making of War Landscapes in the Occupied West Bank. *Law & Society Review* 42: 449-82
- Burk DL. 2013. Edifying Thoughts of a Patent Watcher: The Nature of DNA. *UCLA L. Rev. Disc.* 60: 92-102
- Calavita K. 2002. Engaged Research, "Goose Bumps," and the Role of the Public Intellectual. *Law & Society Review* 36: 5-20
- Calavita K. 2010. *Invitation to Law and Society: An Introduction to the Study of Real Law*. Chicago: University of Chicago Press.
- Callon M. 1984. Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay. *Sociological Review* 32: 196-233

- Callon M, Latour B. 1992. Don't Throw the Baby out with the Bath School! A reply to Collins and Yearley In *Science as practice and culture*, ed. A Pickering, pp. 343-68. Chicago: University of Chicago Press
- Caudill DS. 2002a. Ethnography and the Idealized Accounts of Science in Law. *San Diego Law Review* 39: 269-305
- Caudill DS. 2002b. Give Me a Line in a U.S. Supreme Court Opinion or in Official Commentary to the Rule of Evidence for Admissibility of Experts in Court and I Will Move the [Legal] World. *Hous. L. Rev.* 39: 437-46
- Caudill DS. 2011. *Stories about Science in Law: Literary and Historical Images of Acquired Expertise*. Burlington: Ashgate.
- Caudill DS, LaRue LH. 2003. Why Judges Applying the Daubert Trilogy Need to Know about the Social, Institutional, and Rhetorical--And Not Just the Methodological--Aspects of Science. *B.C. L. Rev.* 45: 1-53
- Caudill DS, LaRue LH. 2006. *No Magic Wand: The Idealization of Science in Law*. Lanham, Mary.: Rowman and Littlefield.
- Caudill DS, Redding RE. 2000. Junk *Philosophy* of Science?: The Paradox of Expertise and Interdisciplinarity in Federal Courts. *Washington and Lee Law Review* 57: 685-766
- Cloatre E. 2008. Trips and Pharmaceutical Patents in Djibouti: An ANT Analysis of Socio-Legal Objects. *Social and Legal Studies* 17: 263-81
- Cloatre E, Pickersgill M. 2015. Introduction In *Knowledge, Technology and Law*, ed. E Cloatre, M Pickersgill, pp. 1-14. Abingdon: Routledge
- Cloatre E, Wright N. 2012. A Socio-legal Analysis of an Actor-world: The Case of Carbon Trading and the Clean Development Mechanism. *Journal of Law and Society* 39: 76-92
- Cohen JE. 2012. *Configuring the Networked Self: Law, Code, and the Play of Everyday Practice*. New Haven: Yale University Press.
- Cole SA. 2004. Grandfathering Evidence: Fingerprint Admissibility Ruling from *Jennings to Llera Plaza* and Back Again. *Am. Crim. L. Rev.* 41: 1189-276
- Cole SA. 2007. Where the Rubber Meets the Road: Thinking About Expert Evidence as Expert Testimony. *Villanova Law Review* 52: 803-42
- Cole SA. 2009. A Cautionary Tale About Cautionary Tales About Intervention. *Organization* 16: 121-41
- Cole SA. 2010. Who Speaks for Science? A Response to the National Academy of Sciences Report on Forensic Science. *Law, Probability and Risk* 9: 25-46
- Cole SA, Aronson JD. 2009. Blinded by Science on the Road to Abolition? In *The Road to Abolition*, ed. CJ Ogletree, Jr., A Sarat, pp. 46-71. New York: New York University Press
- Collins H, Evans R. 2007. *Rethinking Expertise*. Chicago: University of Chicago Press.
- Collins HM. 1981. Stages in the Empirical Program of Relativism. *Social Studies of Science* 11: 3-10
- Collins HM, Yearley S. 1992. Epistemological Chicken In *Science as Practice and Culture*, ed. A Pickering, pp. 301-26. Chicago: University of Chicago Press
- Coombe RJ. 2011. Cultural Agencies: The Legal Construction of Community Subjects and Their Properties In *Making and Unmaking Intellectual Property*,

- ed. M Biagioli, P Jaszi, M Woodmansee, pp. 79-98. Chicago: University of Chicago Press
- Cowan D, Carr H. 2008. Actor-Network Theory, Implementation, and the Private Landlord. *Journal of Law and Society* 35: 149-66
- Cunliffe E. 2011. *Murder, Medicine and Motherhood*. Oxford: Hart.
- Davis KE, Kingsbury B, Merry SE. 2012. Indicators as a Technology of Global Governance. *Law & Society Review* 46: 71-104
- DeSoucey M, Schleifer D. 2010. Technique and Technology in the Kitchen: Comparing Resistance to Municipal *Trans Fat* and *Fois Gras* Bans. *Studies in Law, Politics and Society* 51: 185-218
- Dioso - Villa R. 2016. Is the Expert Admissibility Game Fixed?: Judicial Gatekeeping of Fire and Arson Evidence. *Law & Policy* 38: 54-80
- Edmond G. 2001. The Law-Set: The Legal-Scientific Production of Medical Propriety. *Science, Technology, and Human Values* 26: 191-226
- Edmond G, Mercer D. 1998a. Representing the Sociology of Scientific Knowledge and Law. *Science Communication* 19: 307-27
- Edmond G, Mercer D. 1998b. Trashing "Junk Science". *Stan. Tech. L. Rev.* 1998: 3
- Edmond G, Mercer D. 2002. Conjectures and Exhumations: Citations of History, Philosophy and Sociology of Science in US Federal Courts. *Law and Literature* 14: 309-66
- Edmond G, Mercer D. 2004. The Invisible Branch: The *Authority* of Science Studies in Expert Evidence Jurisprudence In *Expertise in Regulation and Law*, ed. G Edmond, pp. 197-241. Aldershot, U.K.: Ashgate
- Edmond G, Roach K. 2011. A Contextual Approach to the Admissibility of the State's Forensic Science. *U. Toronto L.J.* 61: 343-409
- Engel DM. 1998. How Does Law Matter in the Constitution of Legal Consciousness In *How Does Law Matter?*, ed. BG Garth, A Sarat, pp. 109-44. Evanston: Northwestern University Press
- Ewick P, Silbey SS. 1998. *The Common Place of Law: Stories from Everyday Life*. Chicago: University of Chicago Press.
- Faigman DL. 1999. *Legal Alchemy: The Use and Misuse of Science in the Law*. New York: W.H. Freeman.
- Faulkner A. 2012. Law's Performativities: Shaping the Emergence of Regenerative Medicine through European Union Legislation. *Social Studies of Science* 42: 753-74
- Faulkner A, Lange B, Lawless C. 2012. Material Worlds: Intersections of Law, Science, Technology and Society. *Journal of Law and Society* 39: 1-19
- Fish A. 2006. The Commodification and Exchange of Knowledge in the Case of Transnational Commercial Yoga. *International Journal of Cultural Property* 13: 189-206
- Flear ML, Pfister T. 2014. Contingent Participation In *Knowledge, Technology, and Law*, ed. E Cloatre, M Pickersgill, pp. 33-49. Abingdon: Routledge
- Flear ML, Pickersgill M. 2013. Regulatory or Regulating Publics? The European Union's Regulation of Emerging Health Technologies and Citizen Participation. *Medical Law Review* 21: 39-70

- Fleck L. 1979. *Genesis and Development of a Scientific Fact*. Chicago: University of Chicago Press.
- Foster KR, Huber PW. 1999. *Judging Science: Scientific Knowledge and the Federal Courts*. Cambridge: MIT Press.
- Foster L. 2014. Critical Cultural Translation: A Socio-Legal Framework for Regulatory Orders. *Indiana Journal of Global Legal Studies* 21: 79-105
- Franklin S. 1995. Science as Culture, Cultures of Science. *Annual Review of Anthropology* 24: 163-84
- Freudenburg WR. 2005. Seeding Science, Courting Conclusions: Reexamining the Intersection of Science, Corporate Cash, and the Law. *Sociological Forum* 20: 3-33
- Freudenburg WR. 2008. Rethinking the Threats to Scientific Balance in Contexts of Litigation and Regulation. *Environmental Health Perspectives* 116: 142-47
- Golan T. 2004. *Laws of Men and Laws of Nature*. Cambridge: Harvard University Press.
- Gundhus HI. 2012. Experience or Knowledge? Perspectives on New Knowledge Regimes and Control of Police Professionalism. *Policing* 7: 176-92
- Guzik K. 2013. Taking Hold of the Wheel: Automobility, Social Order, and the Law in Mexico's Public Registry of Vehicles (REPUVE). *Law & Society Review* 47: 523-54
- Haack S. 2003. *Defending Science -- Within Reason: Between Scientism and Cynicism*. Amherst, N.Y.: Prometheus.
- Hayden C. 2003. *When Nature Goes Public: The Making and Unmaking of Bioprospecting in Mexico*. Princeton: Princeton University Press.
- Holmes OW. 2009. *The Common Law*. Cambridge: Harvard University Press.
- Horwitz MJ. 1980. Law and Economics: Science or Politics? *Hofstra Law Review* 8: 2-8
- Huising R, Silbey SS. 2011. Governing the Gap: Forging Safe Science through Relational Regulation. *Regulation & Governance* 5: 14-42
- Hunter C. 2015. Solar Panels, Homeowners and Leases: The Lease as a Socio-legal Object In *Exploring the 'Legal' in Socio-Legal Studies*, ed. D Cowan, D Wincott, pp. 137-56. London: Palgrave
- Jacob M-A. 2011. Knowledge Games, Truthfulness and Organ Transplants Regulation. *BioSocieties* 6: 243-61
- Jacob M-A. 2015. Misconduct Hunting: Research Integrity via Law, Science and Technology In *Knowledge, Technology and Law*, ed. E Cloatre, M Pickersgill, pp. 137-53. Abingdon: Routledge
- Jain SSL. 2006. *Injury: The Politics of Product Design and Safety Law in the United States*. Princeton: Princeton University Press.
- Jasanoff S. 1995. *Science at the Bar: Law, Science, and Technology in America*. Cambridge, MA: Harvard University Press.
- Jasanoff S. 2003. Breaking the Waves in Science Studies: Comment on H.M. Collins and Robert Evans, "The Third Wave of Science Studies". *Social Studies of Science* 33: 389-400
- Jasanoff S. 2005. Law's Knowledge: Science for Justice in Legal Settings. *Am. J. Pub. Health* 95: S49-S58

- Jasanoff S. 2006. Just Evidence: The Limits of Science in the Legal Process. *J.L. Med. & Ethics* 34: 328-41
- Jasanoff S. 2008. Making Order: Law and Science in Action In *The Handbook of Science and Technology Studies*, ed. EJ Hackett, O Amsterdamska, M Lynch, J Wacjman, pp. 761-86. Cambridge: MIT Press
- Jasanoff S. 2011. *Reframing Rights: Bioconstitutionalism in the Genetic Age*. Cambridge: MIT Press.
- Kahn J. 2013. *Race in a Bottle: The Story of BiDiI and Racialized Medicine in a Post-Genomic Age*. New York: Columbia University Press.
- Kawar L. 2014. Making the Machine Work: Technocratic Engineering of Rights for Domestic Workers at the International Labour Organization. *Indiana Journal of Global Legal Studies* 21: 483-511
- Kelty C. 2011. Inventing Copyleft In *Making and Unmaking Intellectual Property*, ed. M Biagioli, P Jaszi, M Woodmansee, pp. 133-48. Chicago: University of Chicago Press
- Kirkland A. 2016. *Vaccine Court: The Law and Politics of Injury*. New York: New York University Press.
- Kruse C. 2016. *The Social Life of Forensic Evidence*. Oakland: University of California Press.
- Kuhn TS. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Langdell CC. 1887. Address to Harvard Law School Association at the Quarter-Millennial Celebration of Harvard University. *Law Quarterly Review* 3: 118-25
- Lange B. 2005. Social Dynamics of Regulatory Interactions: An Exploration of Three Sociological Perspectives In *Law and Sociology: Current Legal Issues*, ed. M Freeman, pp. 141-64. Oxford: Oxford University Press
- LaRue LH, Caudill DS. 2004. A Non-Romantic View on Expert Testimony. *Seton Hall Law Review* 35: 1-45
- Latour B. 1987. *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge: Harvard University Press.
- Latour B. 2002. *La Fabrique du Driot: Une Ethnographie du Conseil d'État*. Paris: La Découverte.
- Latour B. 2004. Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern. *Critical Inquiry* 30: 225-48
- Latour B. 2010. *The Making of Law: An Ethnography of the Conseil D'Etat*. Cambridge: Polity.
- Law J. 1987. Technology and Heterogeneous Engineering: The Case of Portuguese Expansion In *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, ed. WE Bijker, TP Hughes, T Pinch, pp. 111-34. Cambridge: MIT Press
- Law J, Hassard J. 1999. *Actor Network Theory and After*. Oxford: Blackwell.
- Lawless C. 2012. The Low Template DNA Profiling Controversy: Biolegality and Boundary Work Among Forensic Scientists. *Social Studies of Science* 43: 191-214
- Levi R. 2009. Gated Communities in Law's Gaze: Material Forms and the Production of a Social Body in Legal Adjudication. *Law & Social Inquiry* 34: 635-69



- Levi R, Valverde M. 2001. Knowledge on Tap: Police Science and Common Knowledge in the Legal Regulation of Drunkenness. *Law and Social Inquiry* 26: 819-46
- Levi R, Valverde M. 2008. Studying Law by Association: Bruno Latour Goes to the Conseil d'Etat. *Law & Social Inquiry* 33: 805-25
- Lezaun J. 2012. The Pragmatic Sanction of Materials: Notes for an Ethnography of Legal Substances. *Journal of Law and Society* 39: 20-38
- Lynch M. 2001. Science and Technology Studies: Ethnomethodology. In *International Encyclopedia of the Social & Behavioral Sciences*, ed. NJ Smelser, PB Baltes, pp. 13644-47
- Lynch M. 2009. Science as Vacation: Deficits, Surfeits, PUSS, and Doing Your Own Job. *Organization* 16: 101-19
- Lynch M, Cole SA. 2005. STS on Trial: Dilemmas of Expertise. *Social Studies of Science* 35: 269-311
- Lynch M, Cole SA, McNally R, Jordan K. 2008. *Truth Machine: The Contentious History of DNA Fingerprinting*. Chicago: University of Chicago Press.
- M'charek A. 2008. Silent Witness, Articulate Collective: DNA Evidence and the Inference of Visible Traits. *Bioethics* 22: 519-28
- Madison MJ. 2005. Law as Design: Objects, Concepts, and Digital Things. *Case W. Res. L. Rev.* 56: 381-478
- Mannheim K. 1936. *Ideology and Utopia*. New York: Harvest.
- Maurer B. 2004. The Cultural Power of Law? Conjunctive Readings. *Law & Society Review* 38: 843-49
- McCann M. 2006. On Legal Rights Consciousness: A Challenging Analytical Tradition In *The New Civil Rights Research: A Constitutive Approach*, ed. B Fleury-Steiner, LB Nielsen, pp. ix-xxx. Burlington: Ashgate
- Merry SE, Coutin SB. 2014. Technologies of Truth in the Anthropology of Conflict. *American Ethnologist* 41: 1-16
- Mnookin JL. 1998. The Image of Truth: Photographic Evidence and the Power of Analogy. *Yale Journal of Law and the Humanities* 10: 1-74
- Mnookin JL. 2001. Scripting Expertise: The History of Handwriting Identification Evidence and the Judicial Construction of Reliability. *Va. L. Rev.* 87: 102-226
- Mnookin JL. 2008. Of Black Boxes, Instruments, and Experts: Testing the Validity of Forensic Science. *Episteme* 5: 343-58
- Moore SF. 1973. Law and Social Change: The Semi-autonomous Social Field as an Appropriate Subject of Study. *Law & Society Review* 7: 719-46
- Murphy T, Cuinn GO. 2013. Taking Technology Seriously: STS as a Human Rights Method In *European Law and New Health Technologies*, ed. ML Flear, A-M Farrell, TK Hervey, T Murphy, pp. 285-308. Oxford: Oxford University Press
- Murray F. 2011. Patenting Life: How the Oncomouse Patent Changes the Lives of Mice and Men In *Making and Unmaking Intellectual Property*, ed. M Biagioli, P Jaszi, M Woodmansee, pp. 399-411. Chicago: University of Chicago Press
- Nader L. 1972. Up the Anthropologist: Perspectives Gained from Studying Up In *Reinventing Anthropology*, ed. D Hymes, pp. 284-311. New York: Pantheon Books

- Ottinger G. 2013. Changing Knowledge, Local Knowledge, and Knowledge Gaps: STS Insights into Procedural Justice. *Science, Technology, and Human Values* 38: 250-70
- Parthasarathy S. 2007. *Building Genetic Medicine: Breast Cancer, Technology, and the Comparative Politics of Health Care*. Cambridge: MIT Press.
- Posner RA. 1987. The Decline of Law as an Autonomous Discipline, 1962-1987. *Harvard Law Review* 100: 761-80
- Pottage A. 2011. Law Machines: Scale Models, Forensic Materiality, and the Making of Modern Patent Law. *Social Studies of Science* 41: 621-43
- Pottage A. 2012. The Materiality of What? *Journal of Law and Society* 39: 167-83
- Rees G. 2015. Making the Colposcope 'Forensic': The Medico-Legal Management of a Controversial Visualization Device In *Knowledge, Technology and Law*, ed. E Cloatre, M Pickersgill, pp. 86-103. Abingdon: Routledge
- Riles A. 1998. Infinity Within the Brackets. *American Ethnologist* 25: 378-98
- Riles A. 2000. *The Network Inside Out*. Ann Arbor: University of Michigan Press.
- Riles A. 2011. *Collateral Knowledge: Legal Reasoning in the Global Financial Markets*. Chicago University of Chicago Press.
- Riles A. 2016. Afterword: A Method More Than a Subject In *Exploring the "Legal" in Socio-Legal Studies*, ed. D Cowan, D Wincott, pp. 257-64. London: Palgrave Macmillan
- Rip A. 2003. Constructing Expertise -- in a Third Wave of Science Studies? *Social Studies of Science* 33: 419-34
- Risinger DM. 2007. The Irrelevance and Central Relevance of the Boundary Between Science and Non-Science in the Evaluation of Expert Witness Reliability. *Villanova Law Review* 52: 679-722
- Roberts DE. 2013. Law, Race, and Biotechnology: Toward a Biopolitical and Transdisciplinary Paradigm. *Annu. Rev. Law Soc. Sci.* 9: 149-66
- Rooke C, Cloatre E, Dingwall R. 2012. The Regulation of Nicotine in the United Kingdom: How Nicotine Gum Came to Be a Medicine, but Not a Drug. *Journal of Law and Society* 39: 39-57
- Ross A. 1996. *Science Wars*. Durham: Duke University Press.
- Saks MJ, Faigman DL. 2008. Failed Forensics: How Forensic Science Lost Its Way and How It Might Yet Find It. *Annu. Rev. Law Soc. Sci.* 4: 149-71
- Scheffer T. 2010. Knowing How to Sleepwalk: Placing Expert Evidence in the Midst of an English Jury Trial. *Science, Technology, and Human Values* 35: 620-44
- Schweber H. 1999. Law and the Natural Sciences in Nineteenth-Century American Universities. *Science in Context* 12: 101-21
- Seron C, Silbey SS. 2004. Profession, Science, and Culture: An Emergent Canon of Law and Society Research In *Blackwell Companion to Law and Society*, ed. A Sarat, pp. 30-60. Oxford: Blackwell
- Shapin S. 2008. *The Scientific Life: A Moral History of a Late Modern Vocation*. Chicago: University of Chicago Press.
- Shapin S, Schaffer S. 1985. *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life*. Princeton: Princeton University Press.
- Silbey J. 2014. *The Eureka Myth: Creators, Innovators, and Everyday Intellectual Property*. . Stanford: Stanford University Press.

- Silbey SS. 2005. After legal consciousness. *Annu. Rev. Law Soc. Sci.* 1: 323-68
- Silbey SS. 2006. *Governing Green Laboratories*. Presented at University of California, Irvine
- Silbey SS, ed. 2008a. *Law and Science: Epistemological, Evidentiary, and Relational Engagements*, Vol. 1. Aldershot: Ashgate.
- Silbey SS, ed. 2008b. *Law and Science: Regulation of Property, Practices, and Products*, Vol. 2. Aldershot: Ashgate.
- Silbey SS. 2009. Taming Prometheus: Talk About Safety and Culture. *Ann. Rev. Sociol.* 35: 341-69
- Silbey SS. 2013. What Makes a Social Science of Law? Doubling the Social in Socio-Legal Studies In *Exploring the 'Socio' of Socio-Legal Studies*, ed. D Feenan, pp. 20-36. Houndmills: Palgrave Macmillan
- Silbey SS, Ewick P. 2003. The Architecture of Authority: The Place of Law in the Space of Science In *The Place of Law*, ed. A Sarat, L Douglas, M Umphrey, pp. 75-108. Ann Arbor: University of Michigan Press
- Silverstein H. 1996. *Unleashing Rights*. Ann Arbor: University of Michigan Press.
- Sismondo S. 2004. *An Introduction to Science and Technology Studies*. Malden, Mass.: Blackwell.
- Sokal A, Bricmont J. 1998. *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science*. New York: Picador.
- Sorell T. 1991. *Scientism: Philosophy and the Infatuation with Science*. London: Routledge.
- Suchman M. 2003. The Contract as Social Artifact. *Law & Society Review* 37: 91-142
- Swanson K. 2007. Biotech in Court: A Legal Lesson on the Unity of Science. *Social Studies of Science* 37: 357-84
- Swanson KA. 2011. Authoring an Invention: Patent Production in the Nineteenth-Century United States In *Making and Unmaking Intellectual Property*, ed. M Biagioli, P Jaszi, M Woodmansee, pp. 41-54. Chicago: University of Chicago Press
- Tejani R. 2016. Little Black Boxes: Legal Anthropology and the Politics of Autonomy in Tort Law. *University of New Hampshire Law Review* 11: 129-70
- Teubner G. 1983. Substantive and Reflexive Elements in Modern Law. *Law & Society Review* 17: 239-86
- Toom V. 2012. Bodies of Science and Law: Forensic DNA Profiling, Biological Bodies, and Biopower. *Journal of Law and Society* 39: 150-66
- Valverde M. 1996. Social Facticity and the Law: A Social Expert's Eyewitness Account of Law. *Social and Legal Studies* 5: 201-17
- Valverde M. 2003. *Law's Dream of a Common Knowledge*. Princeton: Princeton University Press.
- Valverde M. 2005. Authorizing the Production of Urban Moral Order: Appellate Courts and their Knowledge Games. *Law & Society Review* 39: 419-56
- Valverde M, Levi R, Moore D. 2003. Legal Knowledges of Risk, Law Commission of Canada
- van Brakel R, De Hert P. 2011. Policing, Surveillance and Law in a Pre-Crime Society: Understanding the Consequences of Technology Based Strategies. *Journal of Police Studies* 20: 163-92

- Van Hoyweghen I, Horstman K, Schepers R. 2007. Genetic 'Risk Carriers' and Lifestyle 'Risk Takers': Which Risks Deserve our Legal Protection in Insurance? *Health Care Analysis* 15: 179-93
- van Oorschot I. 2014. Seeing the Case Clearly: File-work, Material Mediation, and Visualizing Practices in a Dutch Criminal Court. *Symbolic Interaction* 37: 439-57
- Winickoff DE. 2015. Epistemic Jurisdictions: Science and Courts in Regulatory (De)centralisation In *Knowledge, Technology and Law*, ed. E Cloatre, M Pickersgill, pp. 173-88. Abingdon: Routledge
- Wittgenstein L. 1953. *Philosophical Investigations*. New York: Macmillan.
- Wolpert L. 1993. *The Unnatural Nature of Science*. Cambridge: Harvard University Press.
- Wynne B. 2003. Seasick on the Third Wave? Subverting the Hegemony of Proportionalism. *Social Studies of Science* 33