SSK and Law/Science Encounters Involving Controversial Science and Technology: A Brief Critical Overview

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Abstract

The following paper offers a brief critical overview of SSK studies which have explored the law/science relationship. Nine main headings are identified to help capture recurrent themes and issues warranting further research: (1) Particulars of the legal-regulatory setting; (2) Particulars of a given scientific controversy and links with broader social problems settings; (3) Important parallelisms between professional ('boundary-working') rhetorics of 'legalism' and 'scientism'; (4) Resilience of appeals to naïve realist/positivist epistemology; (5) Law/science encounters typically offer opportunities for the legal deconstruction of science (but what is meant by deconstruction needs to be carefully considered); (6) In longer standing law science encounters, such as 'toxic torts', opposing cases frequently engage in increasingly elaborate 'efforts' to establish models of scientific standards (scientific method discourses) which are required to help 'stabilise' and aid the circulation of particular sets of knowledge claims in response to shifting social landscapes and opposing arguments; (7) Scientific method discourses can also reflect institutional identities and promote political claims beyond the instant case; (8) Importance of role of 'science brokers', 'hyphenated scientists' and 'hybrid' institutional entities; (9) Reified images of interactions of science and law can act as surrogates for wider political visions making limited contact with the actual practices being criticised. Discussion concludes by outlining a number of implications for policy.

Introduction

The following discussion paper provides a brief sketch of some generalisations that can be drawn from studies which have investigated law/science interactions from a Sociology of Scientific Knowledge (SSK) perspective and notes some of the policy ramifications of such studies. Before I provide this sketch I must address two smaller questions: What do I mean by an SSK perspective? And: What case studies have been

done using SSK inspired approaches to investigate the relationship between law and science?

The first question can be answered by noting that SSK approaches can be characterised by their analytical concern with linking the content of scientific knowledge and the practices of scientists to the social contexts in which scientific knowledge claims are produced and evaluated and the rejection of the idea that science is something that can be defined by its unique method and social norms (Mulkay 1979; Collins and Pinch 1993; Lynch and Bogen 1997).

The second question can be answered by noting there have been case studies on a wide variety of topics, including:

- Nuclear power (Wynne 1982)
- 'Insanity laws' (Smith 1985)
- 'Toxic torts' (Edmond and Mercer 1997a, 1998b, 2000; Jasanoff 1995, 1998)
- 'Creation science' (Geiryn, Bevins and Zehr 1985; Edmond and Mercer 1999a)
- Juries (Edmond and Mercer 1997b)
- Rules for admissibility of expert evidence (Jasanoff 1995; Solomon and Hacket 1996; Edmond and Mercer 1997a, 1999b)
- Forensic science (Smith 1988, 1989; Edmond 1998, 1999, 2000; Lynch and Jasanoff, eds. 1998)
- Environmental inquiries (Yearley 1989)
- Patent laws (Cambrosio, Keating and McKenzie 1990)
- Legal and regulatory culture(s) more generally (Nichols 1979; Smith and Wynne eds. 1989; Jasanoff 1993, 1997; Golan 1999).

The brief overview I will provide below is intended to be suggestive of further areas of inquiry rather than be exhaustive. It is also important to acknowledge that most SSK/law studies have focussed on controversial areas of science and law and relied on analysis of judicial inquiries and common law settings in Anglophone countries. More work is needed to

draw comparisons with other legal systems and systematically analyse more 'routine' law and science interactions.

I have organised my discussion around consideration of nine overlapping themes that have emerged from SSK orientated studies of law and science. In my conclusion I will indicate in point form how my earlier discussion may contribute to policy.

Nine overlapping themes

(1) Particulars of the legal-regulatory setting

Whilst many commentators have noted that there are frequently differences between legal and scientific settings in relation to time constraints, burdens of proof, notions of fact finding, rhetorical registers, and the identity of who controls interpretive spaces, SSK/law studies have not taken these differences as warrant for interpreting 'law' and 'science' as discreet epistemologically definable entities (Jasanoff 1995). Following from this, analytical concerns have been directed at the ways the particulars of any given legal and regulatory setting may shape the way the meaning and significance of scientific knowledge claims are determined. Inquiry has been directed at questions such as: Is the setting adversarial or inquisitorial? Is cross examination to be used? Will recourse be made to things like expert panels? This hasn't mitigated against some generalisations about the law/science relationship being made, but it has normally been assumed that these will be made on the basis of empirical evidence and not because of the putative epistemologically essential qualities of each domain.

(2) Particulars of a given scientific controversy and links with broader social problems settings

SSK/law approaches have also normally proceeded by considering the importance of specific features of any given scientific debate that is entering into and being shaped by legal settings. Some controversies may be long standing. For example, 'toxic torts' (civil litigation nor-

mally involving multiple plaintiff's seeking compensation for damage linked to allegedly hazardous substances) often involve clusters of cases or 'case congregations' where scientific argument and legal rules are mutually refined over time (Edmond and Mercer 2000). In contrast, many (but not all) disputes involving forensic evidence are much more immediate.

Different scientific controversies may also involve different relationships between experts and 'publics' (Wynne 1991). In some controversies the dispute may be more internal to expert communities whilst in others expert disagreement may be strongly linked to broader political interests. In 'toxic tort' cases, for instance, questions of financial liabilities, costs of future regulation, moral accountability and judicial fatigue may shape both legal and scientific perceptions of standards of scientific proof required for decision making (see 6 and 7). It is also important to consider that in some instances, a legal setting may be drawing on pre-existing scientific disagreement, yet, in others there may be special features of the legal setting itself which are contributing to the disagreement in question.

(3) Important parallelisms between professional ('boundary-working') rhetorics of 'legalism' and 'scientism'

A repeated theme in SSK and law discourse has been the exploration of the implications of the similarities between the professional 'boundary working' rhetorics (Geiryn 1999) of lawyers and scientists, especially in their use of images of rationality and empiricism. Brain Wynne (1982) has developed this theme to critique the various ways 'idealized' artificial images of legal and scientific rationality foreclose a better understanding of law-science relationships. He proposes that one of the reasons the practical reasoning, uncertainties and more craft-based aspects of science are not openly acknowledged in legal contexts is that legal systems boost their own social authority by nurturing a self-image of legal practice similar to the ideal image of science. The ideal self-images of legal thought and practice emphasise the possibility that the legal system can transcend political and personal biases to ensure the optimal rational

outcomes in conflict resolution, given the constraints of formal law, via the objective discovery of facts and impersonal application of rules. This image has notable similarities to that of defining science according to its possession of ideal behavioural 'norms' and the application of a universal objective scientific method (Mulkay 1979). Recognition that legal forms of knowledge and assessment, like science, rely on various tacit and contingent judgments could weaken legal claims for social authority. It is, in a sense, structurally difficult for each body of practice/discourse to acknowledge the more localised features relevant to the framing and negotiation of both scientific and legal knowledge. The tensions involved in maintaining scientistic and legalistic images, in practice, is one of the factors that I will return to in the context of debates about 'legal deconstruction' of science under heading (5).

(4) Resilience of appeals to naïve realist/positivist epistemology

Despite claims made by popular commentators, such as Huber (1991) and Levitt (1999), that there has been a recent growth in anti-science sentiments in public, academic (humanities) and legal/regulatory cultures, most SSK orientated studies have suggested that appeals to naïve realist and positivist images of science are still extremely resilient in legal settings; two examples are provided below.

The Daubert 'Revolution'

In 1993 the US Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals*, embarked upon what has been described as a 'revolutionary' shift in the admission of scientific expert opinion evidence *Daubert's* interpretation of the US *Federal Rules of Evidence* 1975 replaced the so called *Frye* 'general acceptance' test for the admissibility of scientific evidence. 'General acceptance' came to mean that for admission, novel expert opinion evidence should conform to methods, principles and conclusions which had received widespread 'acceptance' in particular 'fields'. The *Daubert* judgment produced 'new' criteria for the admissibility of scientific evidence. It provided four flexible and non-exhaustive

criteria for judges to employ when assessing the validity of purportedly scientific evidence. Criteria to be used in creating court legitimated science include: whether the claims can and have been tested (falsificationism); whether the theory or technique has been subjected to peer review and publication; the known or potential rate of error and whether there has been 'general acceptance' of the 'claim' within a relevant scientific community.

Most commentators, including the US Supreme Court, emphasised the importance and primacy of Popper's doctrine of falsification in distinguishing science from other forms of inquiry:

> Ordinarily, a key question to be answered in determining whether a theory or technique is scientific knowledge that will assist the trier of fact will be whether it can be (and has been) tested. 'Scientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry.' Green, at 645. See also C. Hempel, Philosophy of Natural Science 49 (1966) ('[T]he statements constituting a scientific explanation must be capable of empirical test'); K. Popper, Conjectures and Refutations: The Growth of Scientific Knowledge 37 (5th ed. 1989) ('[T]he criterion of the scientific status of a theory is its falsifiability, or refutability, or testability'). [4809]

Despite practical difficulties (Edmond and Mercer 1997a; Edmond 2000), Daubert's encouragement of the use of Popperian 'Method' and fairly simplistic realist/empiricist images of science (Schwartz 1997), as tools for dealing with controversial science, has predominantly been well received in Anglophone legal discourse (Foster and Huber 1997; Edmond and Mercer 1999b).

Re-appropriation of SSK writings in legal discourse

In a survey (Edmond and Mercer 1998a) of the way SSK and STS literature was being put to use in Anglophone legal discourse (which focused on the work of influential SSK law science commentator Sheila Jasanoff) it was noted that whilst Jasanoff was commonly cited it was not necessarily for the SSK/STS insights one would expect.

A representative example of this can be drawn from an influential

discussion focusing on improving judicial scientific literacy, by Miller, Rein and Bailey (1994). According to Miller *et al.*, the 'sociology of science', represented by Jasanoff's 'What Judges Should Know About the Sociology of Science' (1992), demands that judges be conversant with 'the scientific method':

> At a minimum, judges will have to become conversant with the 'sociology of science', with emphasis on such concepts as 'the scientific method' to understand at least the rudiments of statistics and probability theory; to obtain some appreciation of error factors and the implicit limitations of oft-used means of scientific observations, measurement, and detection; and to become familiar with the federal judicial Centre's forthcoming reference guides intended to provide the basis for intelligent judicial inquiry of proffered experts in fields such as epidemiology or toxicology. [254]

Miller, Rein and Bailey appear to be unaware of the syncretism of placing SSK represented by Jasanoff (which proceeds with a general critique of a universal scientific method) alongside the need for judges to be conversant with 'the scientific method'!

(5) Law/science encounters typically offer opportunities for the legal deconstruction of science (but what is meant by deconstruction needs to be carefully considered)

Many SSK studies have noted the way the slippage between ideal images of science and the messy realities of scientific practice provide a particularly fertile source for the legal 'deconstruction' of science—especially in adversarial settings (Smith and Wynne 1989; Fuchs and Ward 1994; Lynch 1998). In such contexts, the work of scientists and their knowledge claims can be measured against standards of conduct and proof provided by ideal images of scientific norms and method. By juxtaposing these idealised images against revelations of the inevitably more craft-based nature of scientific work, as well as the socially contingent status of scientific knowledge claims, an interpretative space is created for the deconstruction of scientific authority: 'Scientists are constantly at risk of being hoist by their own positivist petard'.

A widely quoted example of these processes can be found in the work of Oteri, Weinberg, and Pinales (1982) on the cross-examination of chemists in drug cases. Oteri *et al.* outline a number of ways the expert's authority (e.g. chemists in their example) can be thrown into doubt. They note that the lawyer may: challenge whether or not the qualifications of the chemist neatly match the practical issue at stake; highlight the variations between the methods used in various drug tests; or introduce evidence whether the chemist relied on hearsay from other researchers rather than personally testing the specific substance at hand. Furthermore, some tests may be performed which have a strong empirical background, but an absence of deeper theoretical basis for the underlying processes involved. Such tests may be widely accepted by convention, even though they rely on numerous taken-for-granted assumptions. Additional considerations might be that the tests are not the most accurate, but rather have been chosen because they are cheaper, quicker, or easier to perform.

Some SSK writers have focused on 'legal deconstruction' as offering possibilities to make both law and science more publicly transparent. Jasanoff describes this as 'civic education' (1995). The implicit value orientations and social processes involved in the construction of science and expertise become more transparent as actual expert practices and knowledge claims are held up against unobtainable ideals of such practices in public fora.

Whilst specific scientific claims are being deconstructed in such settings, these processes may not necessarily involve a deconstruction of expertise and science more generally. Legal and regulatory settings nearly always rely on an ultimate reconstruction of 'the science' rather than a non-scientific justification for a conclusion (see discussion above 3-4). This means legal deconstruction can be one sided, specific, or, to use SSK jargon, asymmetrical, it is not science in general, or expertise, being exposed but a specific body of knowledge, or individual, being exposed as lacking in a specific context. Many actual case studies of legal deconstruction show the intricacy of these processes. A good example is the controversy over DNA typing in the O.J. Simpson trial (Jasanoff 1995; Jasanoff and Lynch 1998). Because of an absence of standards and protocols DNA typing in the first instance seemed vulnerable to 'deconstruc-

tion', but this *deconstruction* was followed by an ultimate *reconstruction* of DNA typing. This occurred through efforts by scientific authorities external to courts to encourage legal standardisation to overcome 'legal deconstruction'. This showed how 'legal deconstruction' might play a role in the actual construction of scientific knowledge, and the learning processes of institutions. Whilst 'legal deconstruction' may enhance the public accountability of institutions creating and using scientific knowledge the O.J. Simpson example suggests that these processes may, at best, be rather indirect (Edmond and Mercer 1996; Edmond 1998).

(6) In longer standing law science encounters, such as 'toxic torts', opposing cases frequently engage in increasingly elaborate 'efforts' to establish models of scientific standards (scientific method discourses) which are required to help 'stabilise' and aid the circulation of particular sets of knowledge claims in response to shifting social landscapes and opposing arguments

The tendency in Anglophone contexts for law-science knowledge-making in 'toxic torts' and public health inquiries to deliberate on causation in the specific, as well as define what counts as evidence for causation more generally, makes those deliberations an exercise in decision-making extending beyond specific pieces of scientific knowledge to include the negotiation of tacit but transferable models of science and the scientific method (Edmond and Mercer 2000). Law/science encounters become fruitful sites for the operation of folk and practical epistemology of science, or what could be described as 'scientific method discourses' (Schuster and Yeo 1986; Richards 1991). This can involve the construction of very general models of scientific method such as in Daubert (4.1 above) and also more specific and intricate stipulations of what should count as appropriate scientific standards. This capacity for law/science encounters to, in a sense, generate scientific knowledge and standards for what should count as science, is well illustrated by the history of the litigation involving the alleged hazards of the morning sickness medication Bendectin. I have summarised this history and the points relevant to my discussion below.

Case study: Bendectin litigation and the emergence of the 'favor epidemiology rule' (Edmond and Mercer 2000)

- The litigation involved the allegation that ingestion of the anti-nausea (anti morning sickness) drug Bendectin in the first trimester of pregnancy led to birth defects. (In some ways the scientific controversy followed in the wake of Thalidomide).
- The litigation was effectively closed by the emergence of what could be described as the 'favor epidemiology rule'.
- Individual courts negotiated the specific evidence presented against broader considerations from past legal proceedings (such as the *Agent Orange* litigation and earlier Bendectin cases) and in anticipation of future policy and jurisprudential implications such as the so-called 'litigation explosion', 'insurance crisis', the seminal US Supreme Court *Daubert* decision (see 4.1) on the admissibility of scientific evidence, and concerns about the efficient use of 'scarce' judicial resources.
- During the course of the Bendectin litigation, a range of courts came to different conclusions and administered trials and appeals according to their evaluations of the behaviour, credibility and conclusions of individuals, disciplines and institutions. Judges explained their findings according to interpretations and representations of legal standards, scientific standards, and in some cases the broader social implications of the litigation.
- Drawing on Bendectin cases from 1983 to 1992 it is possible to gain an indication of how the evidentiary domain shifted and a Bendectin 'scientific method discourse' favouring particular types of epidemiology prevailed.
- *First*, the plaintiffs rarely relied upon the findings of published epidemiological studies. Instead, the plaintiffs' experts generally had undertaken re-analysis or meta-analysis using one or more of the published epidemiological studies.
- *Second*, the plaintiffs often based their case upon non-epidemiological evidence, particularly in vivo, in vitro and chemical structure comparisons between Bendectin and teratogenic substances.

- *Third*, the defendants relied predominantly upon published epidemiological evidence and once Bendectin had been withdrawn from sale, 'secular trend data' to ascertain if there were any differences in the net number of birth defects.
- Judges presiding over the earlier and relatively isolated Bendectin trials tended to admit a broad range of evidence. As the litigation escalated and cases were appealed, federal appellate courts began to restrict the types of evidence deemed admissible or sufficient to sustain the plaintiffs' allegations. Included in this more restrictive atmosphere were attempts to exclude all but the results of original published epidemiological studies ('favor epidemiology rule').
- Over time most of the appellate courts drawing on the authority of the evolving 'informal' 'favor epidemiology rule' determined that the plaintiffs' evidence was legally insufficient to prove that Merrell had caused their injuries specifically or was responsible for such injuries more generally.

(7) Scientific method discourses can also reflect institutional identities and promote political claims beyond the instant case

In the brief case study above the 'favor epidemiology rule' as a Bendectin law/science method discourse and the Daubert decision (4.1) emerged from wider political pressures to introduce more restrictive requirements for entry and evaluation of novel scientific evidence in 'toxic tort' cases. Setting informal legal/scientific precedents to give greater credit to certain types of evidence, can also involve de-facto decisions about what types of institutions are to be taken more seriously in decision making about science and technology. Wynne (1982) has noted some of these types of dynamics at play in his case study of the politics of decision making involving nuclear power in Britain's *Windscale Inquiry*. During the Inquiry, environmental groups frequently raised questions about future energy policies but experienced difficulties in having these arguments considered by the commissioner who gave preference to more quantifiable styles of evidence such as 'scientific risk estimates', which were a more familiar part of the nuclear industry advocates' technocratic vocabulary.

(8) Importance of role of 'science brokers', 'hyphenated scientists' and 'hybrid' institutional entities

In law/science encounters scientists are often called upon to answer problems that do not neatly mesh with any pre-defined body of scientific expertise, work with unfamiliar time constraints, and find that their knowledge claims will be reconstituted and strategically simplified (Hilgartner 1990) into legally tractable terms. These pressures have helped lead to the development of a significant number of areas where science and law have been brought together in 'hybrid' forms. Such hybrids often experience difficulty locating and legitimating their knowledge claims in terms of the traditional professional rhetorics of law and science. Examples of such law/science hybrids include forensic science, patent law, environmental regulation, and insanity laws. With increasing demands on governments to formulate authoritative public policy, certain branches of science and law have evolved together in close relationships. This integration of science and law often operates more deeply than merely the specific settings of given legal proceedings. In fact the very constitution of some types of scientific knowledge can be shown to be shaped by the demands of legal/quasi-legal settings. Smith and Wynne (1989) note that this integration appears at its most obvious when we consider fields of knowledge such as forensic pathology:

> [I]t is not only the court room interaction that socially shapes knowledges: the institutional integration of a particular expert profession into the legal process already achieves this. Indeed, for forensic science and pathology, the legal process itself has created their particular type of professional interaction and expert knowledge. The social integration of forensic expertise with the law is such that forensic experts have learnt to reconcile themselves to the regular adversarial skepticism of legal processes, while maintaining the normal consensual discourses of scientific expertise. Whereas other disciplines may manage this by defining the court-room[sic] interaction as 'unscientific', this is not so easily available to forensic experts, because the courtroom is their ultimate professional arena. [15]

The development of 'hybrids' reinforces the contention that understanding law-science interactions requires a finely grained empirical concern for the intricate ways science and law are brought together. It is far too

easy to claim that hybrids are inadequate on the basis of exposing their genesis in social, economic, or technical needs, and comparing this to artificial, ideal images of science as an activity totally insulated from social contexts.

(9) Reified images of interactions of science and law can act as surrogates for wider political visions making limited contact with the actual practices being criticised

One of the most important and persistent themes in scholarship which has investigated law/science encounters has been the notion that social pressures surrounding litigation have led to the development of 'junk science' (junk science supposedly being the science generated for the purposes of litigation but with little resemblance to 'real' scientific knowledge). As noted in point (4) 'junk science' has been identified by some commentators as residing at the centre of a broader 'social problem' involving a litigation explosion, insurance crisis, and public paranoia in relation to environmental damage and health risks (Huber 1991). It is suggested that without legal-political pressures the scientific community would be able to 'weed out' deviant junk science claims (Foster and Huber 1997; Edmond and Mercer 1999a).

Images of the problem of junk science have underpinned initiatives to limit the role of lay juries, institute expert panels and enact stricter requirements for the admissibility of scientific and expert evidence to courts (Edmond and Mercer 1997a).

The difficulty in actually defining simple legal rules for demarcating real science from junk science, (see Daubert, point (4)), and plausibly dismissing numerous scientific controversies and popular concerns with new science and technology as merely 'junk science' led paranoia, has been difficult to convert into sustainable policies. Implementing simple demarcation criteria between science and non-science has proved more difficult in practice than advocates have anticipated (Jasanoff 1995; Edmond and Mercer 1998a/b; Edmond 2000).

Whilst debates about 'junk science' have focussed on demands to reform the legal system much of the debate would appear to be a surro-

gate for broader concerns which intersect with, but do not have their origins in, the legal system. This would include concerns with such things as political control over technological decision making and questions of institutional responsibility for, and public acceptability of risks related to new technologies (Wynne 1982; Jasanoff 1995; Edmond and Mercer 1998b).

Conclusions and policy reflections (cross-referenced to earlier generalisations)

- *(Points 1 and 2)*: Avoid epistemological 'quick fixes' which attempt universal solutions based on returning law and science to their putatively separate epistemologically 'natural' states. Recognise that different legal settings and different areas of science may experience different problems requiring different solutions.
- *(Points 3 and 4)*: More work needs to be done in relation to exploring the challenges of legitimating legal decisions and setting criteria for the admissibility of expert evidence to courts without relying on simplistic positivist epistemology.
- *(Point 5)*: The democratising potential of 'legal deconstruction' of science should be acknowledged and investigated further, but such claims must be made in a measured way noting legal 'reconstruction' of science and limits to the degree science and expertise more generally are actually 'deconstructed' in legal settings.
- *(Point 6)*: Longer standing law/science encounters such as 'toxic tort' case congregations can be constitutive of science in politically important ways and warrant further study.
- *(Point 7)*: Adjudications in favour of one 'method discourse' over another can involve choices in favour of particular types of institutions and social orders. The implications of such choices should be made as transparent as possible.
- *(Point 8)*: The growth of law/science hybrid institutions reveal weaknesses in policy discussions based on strict law/science dichotomies

(see also points 1 and 2). More work is needed to map the dynamics and structure of law/science hybrid institutions, and determine their appropriate roles.

– *(Point 9)*: The 'junk science' debate indicates the need to improve and broaden public and policy discussion concerning law and science. Simplistic links between images of 'junk science' (legal distortion of science) and social and political problems often disguise broader political debates about control of new science and technology and disagreements over responsibility and acceptability of technological risks.

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