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Enacting Naturecultures: a Note from STS¹

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Thinking about nature.

How far apart are the disciplines? No doubt there are differences, but I suspect the differences within the disciplines are greater than the differences between them. So what I need to say about the varieties of STS is going to ring bells in sociology, anthropology and geography at least. No apologies.

¹ I am grateful to Ingunn Moser, Vicky Singleton and Helen Verran for discussion and support, and especially to Annemarie Mol who also read and commented on an earlier version of this note.



Imagining a History: SSK

STS, the discipline, at least at its origins, tells stories about science and technology, and how they relate to nature. I offer you my version of it. This means that I'm not going to talk about the Radical Science Journal, or the important cultural/critical Marxist branch of STS. I'm going to start, instead, with Thomas Kuhn's Structure of Scientific Revolutions.²

Possibly what Kuhn intended to say was not what he was read as saying, but at the beginning of what we then called 'science studies' this book was taken as a warrant for the idea that the content of scientific knowledge is shaped by the social. For those who are not science-warriors this idea is by now mundane, not to say banal. But in 1970 it wasn't. In any case this is the first position we need to know about if we are to understand how STS thinks about nature. It runs something like this.

Scientific knowledge is a form of culture.³ And culture is a resource for making sense of a pretty complex, let's say an unknowably complex, world. It is a shared interpretive resource. So scientists in their communities solve the puzzles thrown up by nature, by the world, by using and extending their cultural resources, their knowledge or, if you like, their paradigms. Culture is not just in the head. It's embedded in instruments and bodily habits as well. It shapes perceptual propensities and provides for classification.

Philosophically, this is a form of pragmatism. What is true about nature is what works, at least for the moment. In due course this is likely to change, but at any given moment we are where we are.

So there are different scientific theories of nature? Of course! This is given in the pragmatism. If knowing nature is all about solving the puzzles that it throws up, then different puzzles will present themselves in different ways to different social groups, and different outcomes will count as solutions. So the puzzles are varied, but so too are the social locations: different economic, political, and professional interests are at work. This means that much of this 'sociology of scientific knowledge' is also an 'interests sociology'.⁴ In one version different interests shape different bodies of expertise about nature, different perceptions of nature, and different theories. In another version different styles of interest shape different explanatory styles: for instance (this comes from Mary Douglas' anthropology and Imre Lakatos' philosophy of science), monster-barring or tolerance of disorder.⁵

SSK is close to versions of Marxism, but it isn't Marxist. This is because social interests of one kind or another are not only necessary to knowledge, but the notion of distortion, distorting interests and inherently flawed knowledge, doesn't really come to life in SSK. Notes on this.

² See Kuhn (1970).

³ This is developed in three important books: Barry Barnes' Interests and the Growth of Knowledge (1977), David Bloor's Knowledge and Social Imagery (1976), and Harry Collins' Changing Order: Replication and Induction in Scientific Practice (1985).

⁴ See, for instance, Donald MacKenzie's study of British statistics (1981).

⁵ See Mary Douglas (1975), Imre Lakatos (1976), and David Bloor (1982).



One: SSK assumes a distinction between the world, and our knowledge of the world. Different theories of the world, versions of nature are to be expected. That is, it is perspectivalist.

Two, it is at least methodologically relativist. There are no general, outside-of-context reasons for preferring one paradigm over another. We are always 'in context', cannot get out of it.⁶

Three, it is politically variable. Sometimes, often, as I've just suggested, it doesn't take sides. It merely notes that different interests produce different accounts of nature. Sometimes it does. And it does so by raising questions (for instance) about the British Nuclear Fuels version of the THORP plant. Is this so 'interested' that it is questionable?⁷

But fourth, since the differences between esoteric knowledge, science, and common sense culture are only pragmatic, not differences in kind, it takes what some of my colleagues call 'lay experts' very seriously. People, all people in all contexts, are active puzzle-solvers, not cultural dopes. In this way it tends to a kind of cultural levelling in which lay people's versions of nature are taken as seriously as those of expert experts. The public interprets science, it does not misunderstand it. Truth does not trickle down from on high.⁸

Imagining a History: Constructing Worlds

That is the first version of STS that I need to mention. SSK. But then, like other disciplines, STS also does its own version of the turn to the ontological. This is the second part of the trilogy, and it comes in two major variants, ANT, and feminist technoscience studies. They've been in dialogue for fifteen years and have much in common, but it is useful to distinguish them. And indeed they are also distinct.⁹

Here as elsewhere, the turn to the construction of worlds implies an ontology of relationality. Here is the root argument. The world is a web of relations. Continuous, discontinuous, configured, ragged. And those relations have no status, no shape, no reality, outside their continued production. This means that the concern is with process. It is with how particular realities get made and remade. And then how they sometimes, possibly often, get themselves embedded so that they become obdurate and resistant. So sure, various

⁶ It was David Bloor who most clearly insists on what he calls methodological symmetry. See his (1976),.

⁷ See Brian Wynne (1982) for an exploration of the Sellafield THORP inquiry.

⁸ See, for instance, Brian Wynne (1988; 1996), and, in a different mode to which I return below, Rebecca Ellis and Claire Waterton (2005).

⁹ Both ANT and feminist technoscience studies have generated large literatures. In ANT important studies of nature have included Callon's (1986) work on scallops, Latour's (1988) work on the Pasteurisation of French agriculture, and his general work on 'non-modernity' (1993), which has now been developed into an explicit analysis of nature (1999). Important work in feminist technoscience studies has come, in particular, from Donna Haraway. See her (1989; 1991; 1997) and (2003). Other related work includes that of Ian Hacking (1992), Andrew Pickering (1995), and Hans-Jorg Rheinberger (1997).



realities might be possible, but making them differently is not a trivial task, here and now.

What, then, is nature? The contrast with the perspectivalism of SSK is stark. Perspectivalism postulates an environment, a context, 'out there'. We know it partially, and sometimes badly. But nature exists. Alongside nature there are cultural interpretations of nature. Perhaps these simply serve different interests. Perhaps, normatively and politically, some are better than others. But by and large, in this perspectivalism reality is reality. (I say by and large because it is understood that humans may work on their environments in some degree and re-engineer them in what critical realists call 'transitivity').¹⁰

In relational production this no longer works. Reality is not a fixed thing out there. Instead it pushes us to what Annemarie Mol calls an 'ontological politics'¹¹ and Isabelle Stengers and Bruno Latour call 'ontopolitics'¹². The natural, the real, is not a gold standard. It can, at least in principle, be unmade and reconstructed otherwise. And if it can be remade, then within the clinging stickiness of the constructed web of relations, it is possible to ask what kind of reality, what kind of nature, might be both possible and better. Here truth and politics, two versions of the good, are blended together. Inseparably. There is no gold standard.

The variations are interesting. Bruno Latour proposes what he calls a 'parliament of things'¹³. He imagines this as a provisional constitutional settlement. This is his way of thinking about two major problems of political philosophy: one, what gets rights to representation. And, two, how do those things with rights arrange relations between themselves in order to live well together. This is a classic formulation, but the 'what gets rights' question is being transformed here. Usually a question of defining humans or human groups, it now broadens from the province of politics to become, in addition, a 'scientific' matter. This is ontological politics, and it is like this. Since the reality of things is always constructed in their relations, they are always coming into or going out of being in the process of becoming realer or less real. This is Latour's argument, though we need to settle on the nature of things for a time in order to work out how real things might live well together. Then, every so often, that reality needs to be tested to discover what is real and what is not. How the realities have moved on. What deserves to be represented. Nothing, then, is ever excluded definitively, and for ever. The argument is Karl Schmidt-like: there must be space for not-quite-real protestors to say that they are really real. Nature is never second nature. It is only fixed for a time.

Note, in passing, and this is perhaps what is most distinctive about the STS version of construction, that for Latour (but Callon too, in a quieter way) it is

¹⁰ For an account of critical realism see Ted Benton and Ian Craib (2001).

¹¹ See Annemarie Mol (1999).

¹² See Bruno Latour's introduction in Isabelle Stengers (1997). The term 'ontopolitics' has recently been picked up and developed by Steve Hinchliffe and his co-authors in their (2005).

¹³ See Latour (1993).



the laboratory that is the great source of new realities¹⁴. For it is in technoscience that new combinations of relations are brewed up. New putative natures are created. And it is in the laboratory that some of them, a very few, are made to hold together for long enough to become naturalised. To make it into the parliament of things. As is well known Latour argues that the secret of modernity is not its purity, its dualist distinction between 'nature' and 'culture' (or 'science' and 'society'). Rather it is its insistence on this distinction and its purity while, at the same time, making endless hybrids, putative naturecultures that may or may not make it into relative stability. So much for Latour. Donna Haraway is less impressed by constitutional settlements, overall if temporary assessments about who or what exists and might be allowed to speak. Less republican and more feminist, she's much more interested in interferences: with how to interfere in what counts as nature, the real, to make a difference¹⁵. How to make arrangements of the real more politically acceptable, less exploitative. So, though the similarity with ANT is clear enough, here we need to imagine a contested gradient of realness. Some things are endlessly produced and are very real. Others are not. Interference takes the form of enacting realities, tropes in speech and action, that will make a difference in the configurations of the real. (Well, this happens all the time. There is no choice). So that we might make non-sexist, non-military cyborgs rather than, for instance, the sexist, militarist versions that have been brought into being and sustained since the 1960s.¹⁶

Like Latour, Haraway is concerned with Otherness, that which is not assimilated. But how these two writers tackle this feels very different. For Latour the constitutional settlement is provisional. That which has been Othered will get another go at the time of the next constitutional settlement. It will either be admitted, or not. Haraway, less impressed by the totalising aspirations of constitutions, argues that what is real is also Other. This is one of the points of her Companion Species Manifesto.¹⁷ Dogs, she says, are partially connected with humans. The two have co-evolved together at a variety of levels of scale and time. But they are also irreducible to one another, only partially connected. Dogs are not furry children (and neither, in my experience, are children furless dogs). They have their own partially alien specificities, and those specificities deserve respect. Natures, then, are partially connected to humans: they are partly being made together. But their specificities are not human. Their relations also extend, and are performed, elsewhere. This is surely a post-structuralist sentiment. The same and the Other are linked. The Other is other, but also within. The Other cannot be very well known. But it is real, it is consequential, it is in relation to the Same, and it

¹⁴ 'Give me a Laboratory and I will Raise the World' is the title of one of Latour's early articles on Pasteur (1983). But a similar argument is to be found in Callon, Lascoumes and Barthe (2001).

¹⁵ Amongst the many metaphors with which she plays, one that is important is that of optical diffraction and interference. See, in particular, her (1997).

¹⁶ See Haraway (1991).

¹⁷ See Haraway (2003).



deserves respect. Natures are irreducible but they are relationally produced. Partial connections.

Imagining a History: Enacting Multiplicities

I think it's useful to say that we're dealing here, in the STS turn to ontic construction, with a kind of material post-structuralism. The sentiments, relationality, incompleteness, the trace, deferral, are all here, and they are all post-structuralist in inspiration. But along the way something profoundly important has happened to the text. It has become materially heterogeneous. It is written in and on the body, and it is written in and on the instruments and the practices of everyday life. I think that this is why Latour insists that he is not a post-structuralist. He is too concerned with the mundanities of material practice to be caught up, alone, in (what we might straightforwardly think of as) the text.

But I'll put this on hold for a moment because I want to turn to the third version of STS and nature. A moment ago I wrote: 'Natures are irreducible but they are relationally produced.' Natures, plural.

Question. When we are caught up in making the real, in making nature, what are we doing? One answer, implicit in parts of STS, is that we're involved in building particular and provisionally stable versions of this hybrid real, natureculturetechnics. First wave ANT tends to this view. It is about construction. Early in the process of building a world there may be a series of equi-probable reals, but as the web of constraints grows, so, too, does a kind of path dependency. The other realities, the things that don't quite make it, become less and less real and fade into the endless limbo of the might-have-beens. It simply becomes too expensive to make other realities, other natures. Until something is upset there is convergence. Latour's wonderful work on the Pasteurization of France reveals the logic¹⁸. Microbes, inoculations, the Institut Louis Pasteur in Paris, and a set of farmers, all become ordered into a particular version of natureculturetechnics. The assumption is that the web that has been constructed is more or less coherent, more or less stabilised, rather obdurate.

But does it have to be that way? One response is: no it doesn't. Why not? Answer: the practices of technoscience – never mind everything else – are not as consolidated as this picture of constructed convergence makes them sound. Instead they are rather ramshackle. The argument is that there isn't one set of practices. Instead there are lots of them. And those practices, this is the really crucial shift, are all enacting and re-enacting putative realities. This move to enactment is connected to the work of Latour and especially Haraway who talks of the 'current state of disorder', but it takes us unto a subtly different space. Because in a world of endless enactments and uncertain consolidations the following issue immediately presents itself: how do the enacting practices and their realities relate? And the answer is that this is uncertain. Fitting practices together (or not) is an open ended process. But this means that fitting realities, natures, together is also an open ended process. This is what Annemarie Mol in her book The Body Multiple (a key

¹⁸ See Latour (1988).



text for any STS student of natureculturetechnics) calls 'the problem of multiplicity'. So there are lots of natureculturetechnics. And how they relate together is an empirical (but also a political) issue¹⁹.

This, then, is the third great version of STS, the turn to enactment. We are still in the realm of the real, the ontological. But now it appears that natures are enacted in the plural. This is the point of Mol's book. Atheroscleroses of the lower limb may be multiple, even in the same patient. More than one and less than many. Fractional natures. Fractional and enacted bodies. The webs in which they are enacted are partially other. Other, as it were in general, but also other to each other. And their relations are uncertain. Perhaps, sometimes, they fit together neatly. Perhaps they contradict one another. Perhaps they pass each other by without touching, like ships in the night. Perhaps they are included in one other. Perhaps they are added together to produce new natures. Perhaps they are deliberately kept apart because any encounter would be a collision. Or perhaps their relations are a mix of these: complementary, contradictory and mutually inclusive. At any event, in this way of thinking, natureculturetechnics are complex in the sense that they are multiply enacted in multiple practices and cannot be known anywhere in particular.

Concluding Thoughts

I started by saying that the divisions within STS are as large as the divisions between STS and the other disciplines represented at this meeting. I also noted that the disciplinary overlaps are important. The corollary is that little of what I have said will be news to anyone working on nature in any of the disciplines represented here today. So what is distinctive about STS?

I could write a book about this. (Actually I have just done so, but that is another story²⁰). But here I want to end by proposing that what we might particularly take from STS is its concern with the patterns of practice. And this is one way of saying it.

In their classic text Laboratory Life Latour and Woolgar talk of inscription devices²¹. An inscription device is a patterned set of arrangements for producing inscriptions or traces out of materials that have been made to take other forms. In the laboratory setting this often includes a machine (though it is not reducible to this). The focus is on the process of inscribing. Non-inscribed potential realities are, so to speak, being relationally engineered not only into greater reality but, and as a crucial part of this, into a set of traces or

¹⁹ See Annemarie Mol (2002). The argument is also developed for other examples in Charis Thompson's (Cussin's) work on IVF (1998), her work on elephants (2002), John Law's account of a technological object (2002), Tiago Moreira's exploration of surgery (2001), Ingunn Moser's exploration of disabled bodies and discourses (2000; 2003), and Vicky Singleton's work on public health programmes. (see, for instance, Singleton and Michael (1993), and Singleton (2005). In a somewhat difference idiom, Helen Verran explores the clotting of enacted numerical realities in Nigerian classrooms. See her (1999; 2001). Related work that attends more to formal politics includes Andrew Barry's (2001), and Kristin Asdal's (2003).

²⁰ See John Law (2004).

²¹ See Bruno Latour and Steve Woolgar (1979).



inscriptions. Then they become manipulable, and they also become mobile. Inserted into the right set of relations somewhere else (this may mean another laboratory) they point to and help to produce, the same reality

Inscription devices don't just exist in laboratories. They are to be found, in different modalities, in health care, accountancy, politics, or the criminal justice system – you name it, and you are likely to find inscription devices. They can be seen as technics for producing naturecultures.

Two points follow. One: we are dealing with practice, technics. We have to look at specificities. STS almost always works in specificities. Dourly perhaps, it is sceptical of flights of theoretical fancy that aren't grounded in explorations of material specificities and practices. This, then, is one point I'd like to leave you. It almost never does what my feminist friends call 'boy-theory'. But the second is somewhat less dour. It seems to me that inscription devices work in a very particular way. As I've just said, they make inscriptions. They enact realities that have become inscribed. This is fine. Indeed it's important. Inscriptions are being made in a great many places. But as we think about natureculture and its practices, the third version of STS that I have talked about above suggests that it is also unduly restricting. This is because natureculture is also being enacted in ways that don't produce inscriptions. Or (perhaps a very large class of practices) in which inscriptions are produced along the way, but this is not primarily what the practices are about.

This is the point of Annemarie Mol's work and it is implied in the turn to enactment. Simply put, health care is not primarily about naming or inscribing. Often enough it involves these, but it is also about cutting, and eating, and walking or not-walking, and manipulating, and feeling, and digesting, and bathing, and dressing wounds, and swallowing pills. On and on. Some of these enactments involve inscriptions, but inscribing is not the primary object. The major aim is not to describe or tell. It is to make a difference in a body or in a life. And a whole set of practices is caught up in the various ramifying enactments of disease.

Here is another quite different example that comes from the work of Rebecca Ellis and Claire Waterton on amateur experts²². Amateur experts – bryologists or batologists – may locate and name species. They may be indeed be interested in biodiversity in much the same way as those, for instance at the Natural History Museum, who are responsible for creating biodiversity action plans. But this version of scientific inscription is only one possibility. Amateur experts may, instead, be primarily interested in quite other practices – for instance the embodied and aesthetic pleasures of fly fishing. But these practices are also an enactment of reality. If we look at it from the point of view of biodiversity we may say that fishermen 'know about' certain kinds of invertebrates. This isn't wrong. But inscription is pretty incidental to the practices of fly fishing. The reality of the trout is, so to speak, enacted in a particular way for the fly fisherman in the course of his or her practice, and inscriptions are only a small part of this.

This way of thinking leads me to want to make two suggestions.

²² See Rebecca Ellis and Claire Waterton (2005).



The first concerns STS itself. In the way I have tried to build it, this attends to the practices of enacted materiality. It is as much to do with ontology (what is), as with epistemology (the process of knowing reality, or knowing it well). But if this is the case, then perhaps science and technology can or should no longer be the focus of STS. It should be attending to more. To other practices. I say this because it appears to me that often the post-SSK versions of STS have been caught up in a collusion: they have participated in enacting science and technology as privileged sites for reality-production. 'Give me a laboratory', says Bruno Latour in a telling phrase, 'and I will build the world'. This is his assessment of the dynamics of the Pasteurisation of France. In this way of thinking technoscience is special. It makes new things. I can see reasons for saying this. But note that it is an agenda that resonates, and I fear all too well, with standard Euro-American accounts of the role of technology, not to mention Blairite discourses of modernisation, the traditions of Marxist analysis, and insidiously, the funding preferences of the ESRC. The question is, is this privileging of technoscientific innovation right? How far should we be attending to the 'innovative' at the expense of everything else? How far is the 'innovative' coterminous with technoscience anyway?

I'm not quite sure of the best response to these questions: perhaps technoscience enacts itself so powerfully that it has secured the privilege that it claims. But I tend to the alternative view that we shouldn't be privileging technoscientific enactments. I tend to think we shouldn't be colluding. And, most certainly, I take it that we should be attending to enactments of nature in practices that have little to do with science or technology. At which point, if we take the argument seriously, the enactment STS that I have been describing rejoins an SSK that explores what used, quaintly but insidiously, to be called 'the public understanding of science'. But does so in ontological rather than epistemological terms.

Let me conclude by spinning this suggestion in a slightly different way. Sure, we can agree that the technics of natureculture deserve study in their endless multiplicity. But (as I have tried to suggest) there is more to reality enactments than inscription devices. These may be important, but at best they are a subset of the practices of enactment. How far do we want to push the notion of 'inscription'? This we might debate. But as I have noted, my take is that inscription goes only so far. And if this is right then it seems that we should be trying to discover and characterise what we might think of as alternative enactment devices or modes of enacting.

Such an inquiry would, of course, be largely empirical. But if an enactment device or a mode of enacting is a patterned set of practices for producing naturecultures, then there are many straws in the wind. Work by Maggie Mort and her colleagues on foot and mouth – and my own work too – lead us, for instance, to so many foot-and-mouth-relevant enactments²³. Here are a few of them, a backdrop of enactments before the virus even arrives. The milking. The mucking out. The artificial insemination. The phone calls to the vet. The inoculations. The visits to market. The buying and the selling. The arrival of

²³ See Cathy Bailey *et al.* (2004), Ian Convery *et al.* (2004) Maggie Mort *et al.* (2004) and John Law and Vicky Singleton (2004).



the milk tanker. The fencing. The EU headage payments. The transactions about quotas. The nights of calving. The worries about debt. All of these and many more are enactments. They are enactments of people, of cows, of micro-organisms, of devices and machinery, of skills, of social relations, of landscapes, and of economic realities. And if they are patterned, if they repeat in their differences, then perhaps we may talk of enactment devices. Of enactment practices. Or of modes of enacting naturecultures. And then we may explore how they interfere with one another. This is the promise of the STS turn to enactment.

References

- Asdal, Kristin (2003), 'The Problematic Nature of Nature: The Post-Constructivist Challenge to Environmental History', History and Theory, 42: in the press.
- Bailey, Cathy *et al.* (2004), 'Narratives of trauma and on-going recovery: the 2001 foot and mouth disease epidemic', AutoBiography, in the press.
- Barnes, Barry (1977), Interests and the Growth of Knowledge, London: Routledge and Kegan Paul.
- Barry, Andrew (2001), Political Machines: Governing a Technological Society, London and New York: The Athlone Press.
- Benton, Ted, and Ian Craib (2001), The Philosophy of Social Science, Basingstoke: Palgrave.
- Bloor, David (1976), Knowledge and Social Imagery, London: Routledge and Kegan Paul.
- Bloor, David (1982), 'Polyhedra and the Abominations of Leviticus: Cognitive Style in Mathematics', pages 191-218 in Mary Douglas (ed.), Essays in the Sociology of Perception, London and Boston: Routledge and Kegan Paul.
- Callon, Michel (1986), 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of Saint Brieuc Bay', pages 196-233 in John Law (ed.), Power, Action and Belief: a new Sociology of Knowledge? Sociological Review Monograph, 32, London: Routledge and Kegan Paul.
- Callon, Michel, Pierre Lascoumes, and Yannick Barthe (2001), Agir dans un Monde Incertain: Essai sur la Démocratie Technique, Paris: Seuil.
- Collins, H. M. (1985), Changing Order: Replication and Induction in Scientific Practice, London: Sage.
- Convery, Ian *et al.* (2004), 'Emotional Geographies of the UK 2001 Foot and Mouth Epidemic', Journal of Rural Studies, forthcoming.
- Cussins, Charis (1998), 'Ontological Choreography: Agency for Women Patients in an Infertility Clinic', pages 166-201 in Marc Berg and Annemarie Mol (eds), Differences in Medicine: Unravelling Practices, Techniques and Bodies, Durham, N.Ca. and London: Duke University Press.
- Douglas, Mary (1975), Implicit Meanings: Essays in Anthropology, London: Routledge and Kegan Paul.
- Ellis, Rebecca, and Claire Waterton (2005), 'Caught Between the Cartographic and the Ethnographic Imagination: The Whereabouts of Amateurs, Professionals and Nature in Knowing Biodiversity', Environment and Planning D: Society and Space, forthcoming.
- Hacking, Ian (1992), 'The Self-Vindication of the Laboratory Sciences', pages 29-64 in Andrew Pickering (ed.), Science as Practice and Culture, Chicago and London: Chicago University Press.
- Haraway, Donna (1989), Primate Visions: Gender, Race and Nature in the World of Modern Science, London: Routledge and Chapman Hall.
- Haraway, Donna (1991), 'A Cyborg Manifesto: Science, Technology and Socialist Feminism in the Late Twentieth Century', pages 149-181 in Donna Haraway (ed.), Simians, Cyborgs and Women: the Reinvention of Nature, London: Free Association Books.
- Haraway, Donna J. (1997), Modest Witness@Second Millenium.Female Man@ Meets Oncomouse™: Feminism and Technoscience, New York and London: Routledge.
- Haraway, Donna J. (2003), The Companion Species Manifesto: Dogs, People, and Significant Otherness, Chicago: Prickly Paradigm Press.



- Hinchliffe, Steve *et al.* (2005), 'Urban Wild Things: a Cosmopolitical Experiment', Society and Space, (forthcoming).
- Kuhn, Thomas S (1970), The Structure of Scientific Revolutions, Chicago: Chicago University Press.
- Lakatos, Imre (1976), Proofs and Refutations, Cambridge: Cambridge University Press.
- Latour, Bruno (1983), 'Give Me a Laboratory and I will Raise the World', pages 141-170 in Karin D. Knorr-Cetina and Michael J. Mulkay (eds), Science Observed, Beverly Hills: Sage.
- Latour, Bruno (1988), The Pasteurization of France, Cambridge Mass.: Harvard.
- Latour, Bruno (1993), We Have Never Been Modern, Brighton: Harvester Wheatsheaf.
- Latour, Bruno (1999), Politiques de la Nature: Comment faire entrer les sciences en démocratie, Paris: la Découverte.
- Latour, Bruno, and Steve Woolgar (1979), Laboratory Life: the Social Construction of Scientific Facts, Beverly Hills and London: Sage.
- Law, John (2002), Aircraft Stories: Decentering the Object in Technoscience, Durham, N.Ca.: Duke University Press.
- Law, John (2004), After Method: Mess in Social Science Research, London: Routledge.
- Law, John, and Vicky Singleton (2004), 'A Further Species of Trouble? Disaster and Narrative', submitted.
- MacKenzie, Donald (1981), Statistics in Britain, 1865-1930: the Social Construction of Scientific Knowledge, Edinburgh: Edinburgh University Press.
- Mol, Annemarie (1999), 'Ontological Politics: a Word and Some Questions', pages 74-89 in John Law and John Hassard (eds), Actor Network Theory and After, Oxford and Keele: Blackwell and the Sociological Review.
- Mol, Annemarie (2002), The Body Multiple: Ontology in Medical Practice, Durham, N. Ca., and London: Duke University Press.
- Moreira, Tiago (2001), 'Involvement and Constraint in a Surgical Consultation Room', Bulletin Suisse de Linguistique Appliquée, 13-32.
- Mort, Maggie *et al.* (2004), 'And they wonder whether foot and mouth affects humans': researching the human health and social consequences of the 2001 UK Foot and Mouth Disease epidemic', Qualitative Health Research, submitted.
- Moser, Ingunn (2000), 'Against Normalisation: Subverting Norms of Ability and Disability', Science as Culture, 9: 201-240.
- Moser, Ingunn (2003), 'Living After Traffic Accidents: On the Ordering of Disabled Bodies', PhD, University of Oslo.
- Pickering, Andrew (1995), The Mangle of Practice: Time, Agency and Science, Chicago and London: University of Chicago Press.
- Rheinberger, Hans-Jorg (1997), Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube, Stanford: Stanford University Press.
- Singleton, Vicky (2005), 'The promise of public health: Vulnerable policy and lazy citizens', Society and Space, 23: forthcoming.
- Singleton, Vicky, and Mike Michael (1993), 'Actor-networks and Ambivalence: General Practitioners in the UK Cervical Screening Programme', Social Studies of Science, 23: 227-264.
- Stengers, Isabelle (1997), Power and Invention: Situating Science, Minneapolis and London: University of Minnesota Press.
- Thompson, Charis (2002), 'When Elephants Stand for Competing Models of Nature', pages 166-190 in John Law and Annemarie Mol (eds), Complexities: Social Studies of Knowledge Practices, Durham, N. Ca.: Duke University Press.
- Verran, Helen (1999), 'Staying True to the Laughter in Nigerian Classrooms', pages 136-155 in Actor Network and After, Oxford and Keele: Blackwell and the Sociological Review.
- Verran, Helen (2001), Science and an African Logic, Chicago and London: Chicago University Press.
- Wynne, Brian (1982), Rationality and Ritual: the Windscale Inquiry and Nuclear Decisions in Britain, Chalfont St Giles: The British Society for the History of Science.
- Wynne, Brian (1988), 'Unruly Technology: Practical Rules, Impractical Discourses, and Public Understanding', Social Studies of Science, 18: 147-167.
- Wynne, Brian (1996), 'May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide', pages 44-83 in Scott Lash, Bronislaw Szerszynski, and Brian Wynne



(eds), Risk, Environment and Modernity: Towards a New Ecology, London and Beverly Hills: Sage.