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Performing Technology's Stories*

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Introduction: On Social Constructivism, Performance, and Performativity

Ed Constant's recent piece, 'Reliable Knowledge and Unreliable Stuff' is an attractive, graceful and more than occasionally witty description of the growth of rational engineering belief[1]. In particular, it offers an account for the fact that we tend to have confidence in relevant scientific and technological theory rather than the apparently disconfirming instances endlessly thrown up in everyday practice. His argument is that rational belief in generalisable knowledge is a feature of engineering, technology, and science, and he offers a Bayesian account of how such knowledge spreads across engineering time and space. His account is positive in tone. His interest is in the reliability of engineering and scientific knowledge. At the same time, as he notes, it is not consistent with certain historical and sociological approaches to engineering, technology, and in particular with 'social constructivism'.

Ed observes that much has been learned from social constructivism. On the other hand its deconstructive micro-studies tend to emphasise the contingency and uncertainty of technology and lose sight of the fact that most of the time engineering knowledge works – and indeed tends to extend itself. This means that social constructivism tends towards relativism, which in turn means that it cannot offer rational political criticism of science and technology.

Social constructivism is a tricky target. As Ed notes, it comes in many shapes and forms. Somewhat arbitrarily it may be useful to distinguish four of these.

1. The sociology of scientific knowledge (SSK) is a version of constructivism that would, we judge, have little difficulty with Ed's Bayesianism. Indeed, it developed a similar Bayesian approach in the 1970s when it argued that scientific (and technological) practice and knowledge reflect not only the natural world, but also social influences – for instance from professional position, social class or gender. It is these two together – natural and social factors – which give knowledge its shape, an insight which has been explored in many empirical contexts[2].
2. Second, and in contrast with this, some versions of SCOT (the social construction of technology) have argued that the natural world has no role in shaping technological practice and belief, which are taken to be a function of social forces alone. SCOT-like studies greatly vary[3], but some focus on the social alone, with consequences that are much closer to the relativist constructivism questioned by Ed.
3. Actor-network theory (ANT) differently assumes that new hybrid social-and-material practices are constrained and enabled by equally hybrid pre-existing practices. This means that new practices imply theories and versions of the social and the material world that may differ from those that existed before. Nevertheless, because of the backdrop of existing practice such differences tend to be limited and the world is sensed – indeed is constituted – as solid and obdurate. ANT is not relativist, but neither is it realist. Deconstruction is always possible, but given the backdrop of existing practice also very difficult. Social and technological knowledge, the social world, and its material context are all obdurate – indeed translocal, since they carry from place to place in the textures of practice[4].
4. Feminist technoscience studies vary but some, like actor-network theory, assume that social and material practices recursively generate new social and material practices, technoscientific knowledges, and versions of the social and material world. It is, however, more political in its concerns, attending centrally to the way in which such practices carry (for instance) gender, ethnic, class and military agendas. It also insists that there is no neutral place outside society, and that every description of the world also participates in social and material agenda-setting[5]. Finally, and crucially, it insists that when one writes one also intervenes: writing may either support or erode current technoscience agendas[6].

Social constructivism is, indeed, 'a veritable and prolific zoo of theoretical perspectives' (325), but its differences are important in several ways. For instance ANT and feminism wouldn't call themselves 'social constructivist' because hybrid material-and-social performances explain change and stability, not social factors alone. But our particular reason for distinguishing between them has to do with performance. The point we want to make is that in recent social constructivism (as in a number of other fields) there has been *a* shift towards performance. To a first approximation SSK and SCOT proceed by assuming that they are able to offer pragmatically adequate descriptions of technological and scientific practice. They choose, often knowingly, to ignore the performative consequences of their own descriptions. By contrast, ANT and to a greater extent feminist technoscience studies, choose to wrestle with the fact that they (and therefore their own accounts) are socially located, non-innocent and therefore political performances. This suggests that they don't offer simple descriptions, but instead they make a difference.

This is our own position. We take it that to tell technoscience stories is, in some measure or other, to perform technoscience realities. This is true for our own writing – as it is for Ed's. This means that we don't want to suggest that what he argues is empirically wrong. Rather what we want to say is that it is a particular and located enactment or performance of technological knowledge and practice that does equally particular kinds of work. It also means that we perform alternative and different understandings of the character of technological knowledge and technological artefacts in our writing. The object of this note, then, is to highlight via empirical examples, one from John's work and one from Vicky, some of the differences between Ed's enactment of technoscience and ours. This implies, and we apologise to readers for this, that there are large parts of his argument which we do not treat with at all.

'Projectness' and Collusion

> The TSR2 was the British answer to the American F111. As a tactical strike aircraft, it could carry both conventional and nuclear weapons. And as a reconnaissance aircraft, it could carry a whole range of sensing and photographic equipment. It also had a large mission radius and short take off and landing capabilities.
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> The project was conceived about 1955, commissioned in 1957, and went through various stages of development, prototyping and testing. These became somewhat drawn out as a result of various technical and political problems. Finally, with a change of government, cost escalation, and changes in British world status, it was cancelled amidst much acrimony in 1965[7].

This account is highly selective, a selectivity emphasised by our present need to limit it to two paragraphs! But it is also, or so we are arguing, a performance. So what does it perform? One answer is that it frames technology, and technological stories, around the notion of the project. It does not (as does Ed when he writes of the turbojet) focus on a specific technology, or (say) the evolution of British air strategy, or a labour-process account of working in the aerospace factories, or the gendering of the patriarchal defence and procurement world, or a technological controversy. In the abstract there is nothing wrong with focusing on the project, and this is precisely how John Law started out: with a study of the 'TSR2 project'. But our point is that this is not an innocent description. It is a performance. We are not simply describing a technological project, but also performing a particular notion of the nature of technological organisation, and with this a particular version of technology and its organisation, tout court. In other words, as we tell a story about a 'project' we tend to breath life into a whole set of assumptions which we might think of as 'projectness'.

So what might this imply? Here are some possibilities. That:

- technologies (in part) evolve under centralised control.
- they need to be managed.
- if they are fragmented then this is likely to be a problem.
- they involve co-ordinated puzzle-solving.
- they benefit from a co-ordinated perspective.
- they indeed move through stages, have a chronology.
- they may have setbacks which need to be overcome.
- how they evolve is a function of background 'macro-social' factors of one kind or another as well as other relatively stable conditions in the real world.
- that there is more technological knowledge around at the end than at the beginning.

None of this is unreasonable. Much of it is either assumed or explicit in Ed's – and many other technological – stories. It isn't unreasonable because that's how many technologies develop – within projects or large technical systems. But this is the point we want to press: technologies are like that because that is how they are performed. For much of the work of making technologies – much of the growth of technological knowledge – arises within projects, project-work, and the telling of project-related stories. Stories which then get enacted into reality. And our argument is that the difference between telling stories and acting realities isn't so large. It's a continuum, not a great divide. Which means that our stories aren't simply innocent descriptions. They may make a difference, introduce changes. Or, alternatively, bring aid and succour to the existing performances of technological reality. While it could be otherwise. Technologies could be enacted in other ways. Imagined and enacted.[8]

Of course, the stories told by historians or sociologists of technology are not particularly powerful. Even so, if we mimic the assumptions that are performed in projects in our own writing projects we collude with a particular version of technology, what we might call the 'project of projectness'. We . And this, indeed, is what happened in John's TSR2 study. For instance, this involved interviewing senior people – air force officers, civil servants, engineers, politicians. But such people had their own agendas: they wanted to set the record straight and

contribute to what they thought of as the definitive story; and then they thought that if we could understand what had gone wrong then we would be able to apply those lessons to current projects. To cut a long story short, they wanted the sociologist to feed his stories back into current military aircraft projects, where they might help to reproduce a more effective version of 'projectness'. Implicitly, then, John was being asked to perform a study that was collusive with 'military aircraft projectness'.[9]

So our argument is that technological storytelling makes a difference, and it is important to understand how this happens, how our descriptions interfere with other performances of technoscience to prop these up, extend them, undermine them, celebrate them, or some combination of these. The problem, then, is both analytical and political. It is to try to work out – to make decisions about – how to interfere. Or, at the very least, to be conscious of the fact that descriptions are performances – and that no description is ever entirely innocent. To understand that the stories we tell work to reinforce (extend, undermine, celebrate) arrangements that are explicitly political (for instance to do with national security, or gender, or the proper organisation of technological effort) or implicitly so (for instance to do with the rights and duties of humans and non-humans, or indeed the very distinction between humans and non humans).

The assumptions built into John's original TSR2 narrative (which we've listed above) are similar to those of most other of technology's story-tellers – including those offered by Ed. This is not necessarily wrong. Stories and performances of 'projectness' certainly seem less ambivalent for reservoir engineering than they do for the case of military aircraft. But they also perform work. They help to make the technological world.

Working, Multiplicity and the Translocal

They do work. For instance, they help to perform the idea that there is a single technical world filled with single technical objects which work, or don't, in more or less single ways.

> Vicky is looking for her son John. He's two and a half, he's on his grandparents' farm, and he's disappeared. His grandmother runs to look in the garden. Vicky goes to the 'big building' – a new super-efficient warehouse-like cattle building. The 'newish' red Massey Ferguson tractor with the red cab and the 'new' blue Ford with its sporty white and blue cab are here, but not John. Getting worried, Vicky runs back towards the house. The old wooden tractor shed is on her right, its door ajar, its floor impacted dirt. Old machinery is stored here, and the old blue little Fordson Dexter tractor. She looks in. John is sitting happily on its black torn plastic seat, arms stretched to their limit to maintain his hands in an effective driving position on the huge metal steering wheel. What a relief. He waves and shouts a greeting but doesn't move. A quarter of an hour passes. The sun shines. John is safe and busy, not to be disturbed. And Vicky watches him, remembering fragments of her childhood, driving this tractor.

This story is about working. What counts as working. Ed notes that the notion of "working" is problematic, adding that constructivists are especially attracted to things that don't work (330), problematising and indeed overcooking the idea that 'working' is socially constructed (footnote 21). Instead he notes that much of the time things (here he cites his son) 'kinda work' despite a 'noisome sense of contingency and unreliability'. Surely he is right: that sense of contingency is often with us. The Fordson Dexter sometimes breaks down. But our spin on this is a little different. It is to say that its working is just as noisome – or noisy – as its breakdowns. For something to work, it takes work. A performance. In this particular case all the materials and people which enter into the scene involving the boy and the tractor are doing work. They are performing. The combination of elements – the skill of the boy, the size of the tractor in relation to the boy, the fact that it's relatively robust, the way the shed door is open, the fact Vicky can keep an eye on him as he plays, all of these elements work together, perform. The tractor is working as a safe child's toy.

The classic way of thinking of performance is to say that people perform surrounded by material props.[10] The new performative approach tries to understand the role of everything in a performance, people and objects alike. Thus ANT says that humans and non humans perform together to produce effects – and the same idea can also be found in the feminist literature. The argument is that though some things are fairly consistent in the way in which

they act, at least in principle they could have acted otherwise, and then the whole performance might have come unstuck.[11]

> 'Little dexter' was an important feature in Vicky's childhood. Being the 'tractor driver' during the collection of the bales at annual hay time was an honour, a rite of passage to become a truly useful member of a hard-working team. It was a skilled job that required little physical strength but certainly the wisdom that arrives only on attaining the age of 10 years and is accompanied by enough physical height to reach the pedals and steering wheel. Vicky, learned to manoeuvre the 'little dexter' effectively around the fields pulling its trailer, successfully steadying its jerky gait.
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> A good tractor driver makes a difference. The job is crucial to the efficient loading of the bales of hay onto the trailer. Hay time was always a family affair, and always a sunny time of co-operative work. Her brothers, father, mother, sister and family friends drafted in especially for the occasion, worked together in a sense of urgency and purpose. The hay must be cut, dried, baled, transported and stored during a spell of good weather. Rain at any stage following the cutting can damage the hay and have severe consequences. The hay is the food for the cattle when they are in from the fields over the winter.

Here the tractor is performing in a certain way, as are other mechanical bits and pieces together with the people, not to mention the weather. But such performances are very specific. For instance, if the ten-year-old driver lost control the fact that the little dexter didn't have a cab was important because an adult could quickly come to the rescue – something difficult with the larger new red Ford with its cab. One might say, then, that every performance of working is different. Sometimes only a bit different – as between different haytimes, but sometimes not, as between haytime a generation ago and a small child playing in an old shed now. And we want to develop this point. Philosopher Annemarie Mol has shown that multiple performances produce multiple realities. Or in this case multiple versions of working. So there are lots of different enactments of working.[12] These are some of them. Little dexter is a safe toy in one enactment. A load carrier in a second. A moment of solidarity and pride in a third – to do with the enactment of memory and the family as a hard-working bonded unit.

And collecting bales, itself, involves different moments, different performances. The trailer needs to be attached to the tractor. The tractor needs to be able to pull the trailer. The tractor needs to be manoeuvrable. It needs to be driven to just the right distance from the bales. Then it needs to be driven at just the right speed so people can throw the bales onto the trailer. And smoothly too – or the person stacking the bales on the trailer gets thrown about and the bales fall off. Since the pile of bales may be 20 feet high, it needs to be driven with caution back to the barn, through the gates, round the worst of the bumps, and avoiding low branches. Finally it needs to reverse into the barn, pushing the trailer to just the right place for throwing the bales directly into their storage positions.

Different performances, multiple forms of working.

There are several issues here. One has to do with fragmentation. Clearly there are limits. One could fragment and make multiplicity till the cows came home. This is because the turn to performance fragments that which was previously seen as seamless and unitary – everything including working becomes a specific performance, which means that there are indefinitely many of them. But our reason for making a multiplicity out of 'working' is to suggest that this can be understood in non-Bayesian ways, and, in particular, that this always involves specific and local effort.

The stories about the little dexter are not design stories about the knowledge of professional technologies and engineers, so they don't directly address Ed's Bayesian model. Instead they make visible the effort needed to make anything work at all. The point is like the argument about collusion. It is that an engineering-centred Bayesian analysis of rational degrees of belief performs technology and knowledge in one way – one that tends to fit the narratives performed by technologists. This is fine. But it does not have to be that way. In particular, it tends to delete what then becomes the endless invisible work of keeping technologies working. We don't have to deconstruct the performances of the little dexter down to their component nanoseconds to make that point. Working, not just not-working, takes energy and effort. And it comes in many forms.[13]

> The mechanic who maintains the farm machinery has come to mend 'little dexter'. Though Vicky's father claims it has never let him down, over the years the mechanic has come to know it well. He laughs and brushes away the dusty oil from the engine. He normally works on new, state of the art, tractors and farm machinery. The little dexter is such a contrast. He smiles when he says that he does not understand why her father still bothers to "keep it going". "They don't make them like they used to" he says, and adds, jokingly "and it's a good job they don't". He says that The Fordson Dexter was a good tractor and says that 'little dexter' "has had a hard life" and that "it works well for its age". He points to the endless bits of 'little dexter' that are not part of a Fordson Dexter, additions to do a particular job which belong to different makes and ages of tractor or different vehicles altogether. For instance, a large specially made metal spike attached to its front in order to pick up the big round bales which didn't exist when it was first made.

Ed (331) notes that constructivists extend the notion of working from 'an absolutely commonplace, straightforward, simpleminded' sense to 'socially beneficial symbolic or rhetorical utility', and worries about this. In the present context all we can do is to note that the division between social and technical, which is fundamental to modern society, is itself a performance[14] – though one that is carefully ignored, for instance by Thomas Hughes' heterogeneous engineers for whom the social, the technical and the symbolic were all mixed up. 'Working', in this view, is heterogeneous: the distinction between symbolic and 'commonplace' working at best uncertain. But even if one excludes the social and the symbolic – Ed touches on this when he talks about the complexity of machines and their many component parts – 'working' even from an engineer's point of view is also a series of different performances. Does the engine actually start to run when the key is turned? Is it running smoothly? Are there noises that don't sound right? Will it go into gear and move? Will the different tools engage with the drive? Do they do what they are supposed to? Does something have to be patched together to do a new job? The mechanic isn't confronted with a working (or a non-working) tractor as a single entity. It's a multiplicity, a set of different and no-doubt interacting performances.

So working is noisome, and noisy. Things 'kinda work'. The point also links with the translocal. Technical knowledge, as Ed reminds us, is translocal. We can't explore this fully, but we can suggest that like rationally held, translocal, non-foundational beliefs, the working little dexter may also be imagined as translocal – as a working tractor. And we make this suggestion because we want to argue that just as it takes materially heterogeneous effort to put on a specific performance of little dexter working, so it takes heterogeneous effort to join these specific performances together to produce a 'tractor that is working' – or even 'kinda' working. Vicky's father performs one of these joins when he describes little dexter as 'a good little tractor, a good worker'. But, we need to add, it takes various kinds of effort to make knowledge that works in lots of places. (Think of Thomas Hughes' system-builders). Our suggestion is that working – a working tractor, translocal knowledge – is a network of different performances joined in multiple and complex relations. The effect – knowledge, working – moves from place to place. Yet is also an effect of endless effort in particular localities.

Conclusion

Constructivism is many things – and some are only doubtfully constructivist. The turn to performance is sometimes seen as constructivist, but it has particular implications. In particular, it suggests that technologies, knowledges and working may be understood as the effects of materially, socially and conceptually hybrid performances. In these performances different elements assemble together and act in certain ways to produce specific consequences.

There are at least two ways in which performances don't exist in the abstract. First, they always take place in a context of other performances. This means that the success of any performance is uncertain and that anomalous performances tend to fail since they find that they cannot easily recruit the right actors. Thus new performances interact with enactments of older performances – to mimic and reaffirm them, or perhaps to interfere with them and suggest alternatives. In this note we've explored this issue by talking about the collusions of

'projectness' and the growing sense that what was a perfectly warrantable technoscience description reproduced a series of troubling analytical and political assumptions.

Second, performances don't exist in the abstract because, to state the obvious, they need to be enacted. Performances are material processes, practices, which take place day by day and minute by minute. Since performances are specific, this also leads to multiplicity, so that what appears to be one thing (an 'object', 'working', 'knowledge') may be understood as a set of related performances. More strongly, it suggests that abstraction (including abstract knowledge) is a performance, something enacted in specific locations which has to be re-enacted in other locations in further performances if it is to carry. This has all sorts of implications. One is that things don't come to rest in a single form once agreement or what is called 'closure' is achieved. They, as it were, rumble on and on, noisy and noisome.[15] We've tried to show this by showing that a working tractor may be understood as a set of interrelated performances – and with this the idea that 'working in general' is an effect of the extended work which produces particular performances, and the links between those performances. The general, we're suggesting, is made general locally.

We are grateful to Ed for his clarity. The strength of his Bayesian argument has made it possible for us to clarify parts of the performative alternative which arises out of recent actor-network and feminist technoscience writing, and to explore some of its implications. One of these is that Ed's account (like our own) is a performance which contributes to and helps to enact a particular version of technology and its knowledge. We hope that we have been able to show that the differences between these two performances are interesting and important.

References

[*] A number of friends and colleagues have helped us to think about performativity and politics. Important amongst these have been Claudia Castañeda, Anni Dugdale, Donna Haraway, Maureen McNeil, Annemarie Mol, Ingunn Moser and Helen Verran.

[1] See Edward W. Constant II, "Reliable Knowledge and Unreliable Stuff," Technology and Culture 40 (1999): 324-357.

[2] For a statement of the Edinburgh school position see Barry Barnes, T.S.Kuhn and Social Science (London, 1982) and David Bloor, Knowledge and Social Imagery (London, 1976). For Mary Hesse's development of the philosophy of science see Mary B. Hesse, The Structure of Scientific Inference (London, 1974). A fine empirical example of the genre is Donald MacKenzie, Inventing Accuracy: a Historical Sociology of Nuclear Missile Guidance (Cambridge, Mass., 1990).

[3] For an early collection, with a range of different positions, see Wiebe Bijker, Thomas P. Hughes and Trevor J. Pinch, eds, The Social Construction of Technological Systems (Cambridge, Mass., 1987).

[4] For accounts of the actor-network approach see Bruno Latour, Science in Action: How to Follow Scientists and Engineers Through Society (Milton Keynes, 1987) and John Law, "Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity," Systems Practice 5 (1992): 379-393. Exemplary empirical studies here include Latour's study of Louis Pasteur, Bruno Latour, The Pasteurization of France (Cambridge Mass. 1988) and John Law's exploration of the Portuguese maritime expansion, John Law, "On the Methods of Long Distance Control: Vessels, Navigation and the Portuguese Route to India," in Power, Action and Belief: a new Sociology of Knowledge? Sociological Review Monograph, 32, ed. John Law (London 1986).

[5] This is implicit in actor-network theory, but has been less developed in that body of work.

[6] Donna Haraway's work is developed in several books, the most recent of which is Donna Haraway, Modest_Witness@Second_Millenium.Female_Man©_Meets_Oncomouse™: Feminism and Technoscience (New York and London 1997), but see particularly her essays on the cyborg manifesto and situated knowledges collected together with other writing in Donna Haraway, Simians, Cyborgs and Women: the Reinvention of Nature (London 1991).

[7] This is discussed at greater length in a number of locations. See, for instance, John Law, "The Anatomy of a Sociotechnical Struggle: the Design of the TSR2," in Technology and Social Process, ed. Brian Elliott, (Edinburgh 1988) and John Law, "The Olympus 320 Engine: a Case Study in Design, Development, and Organisational Control", Technology and Culture, 33 (1992) 409-440. The analysis of political performativity outlined in the present piece is explored in greater depth in John Law, Aircraft Stories: Decentering the Object in Technoscience, (Durham, N.Ca. 2001).

[8] 'To will the future (and not to desire it), to submit it to planning and projects, to wish to construct it, is to lock oneself into a devalorized present that is airless and unlivable, "The project," according to Bataille, "is the prison." To want to get out of the labyrinth, making this into a project, is to close it, to close oneself inside it.' This quotation come from page 61 of Denis Hollier Against Architecture: the Writings of Georges Bataille, (Cambridge, Mass. and London 1989).

[9] This is described more fully in John Law, "On the Subject of the Object: Narrative, Technology and Interpellation," Configurations 8 (2000), 1-29.

[10] See, for instance, Erving Goffman, Asylums: Essays on the Social Situation of Mental Patients and Other Inmates, Harmondsworth, (Mddx. 1968).

[11] The approach has been developed for the notion of the person in a variety of locations. See, for instance, Judith Butler, Gender Trouble: Feminism and the Subversion of Identity (New York and London 1990).

[12] Annemarie Mol has rigorously developed this position through a series of publications on medical performance. See, in particular Annemarie Mol (1998), "Missing Links, Making Links: the Performance of Some Artheroscleroses," in Differences in Medicine: Unravelling Practices, Techniques and Bodies, ed. Annemarie Mol and Marc Berg, (Durham, NCa. and London 1998), Annemarie Mol, "Ontological Politics: a Word and Some Questions," in Actor Network Theory and After, ed. John Law and John Hassard (Oxford and Keele, 1999) and Annemarie Mol, The Body Multiple: Ontology in Medical Practice (Durham, N.Ca. and London 2001).

[13] It resonates with one of the great tropes of feminist and other politically radical writing – namely that much scholarship renders the work of low-status groups invisible. Donna Haraway explores this for technology, as does Leigh Star. See Susan Leigh Star, "Power, Technologies and the Phenomenology of Conventions: on being Allergic to Onions," in A Sociology of Monsters? Essays on Power, Technology and Domination, Sociological Review Monograph, 38, ed. John Law (London 1991), and Susan Leigh Star, "The Sociology of the Invisible: the Primacy of Work in the Writings of Anselm Strauss," in Social Organization and Social Processes: Essays in Honor of Anselm Strauss, ed. David Maines (New York 1992).

[14] See Bruno Latour We Have Never Been Modern (Brighton 1993).

[15] This point has been made in slightly different idioms on the one hand by Vicky Singleton and Mike Michael, where the argument is that a working programme (the UK Cervical Screening Programme) is not a single structure, but rather contains inconsistencies and ambivalences. See Vicky Singleton and Mike Michael, "Actor-networks and Ambivalence: General Practitioners in the UK Cervical Screening Programme," Social Studies of Science, 23 (1993) 227-264 and Vicky Singleton, "Stabilizing Instabilities: the Role of the Laboratory in the United Kingdom Cervical Screening Programme," in Differences in Medicine: Unravelling Practices, Techniques and Bodies eds Marc Berg and Annemarie Mol (Durham, N.Ca. 1998). And on the other by Anni Dugdale in her exemplary exploration of Australian policymaking about the advice to accompany IUD contraception. See Anni Dugdale, "Materiality: Juggling Sameness and Difference," in Actor Network Theory and After eds John Law and John Hassard (Oxford 1999).