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Networks, Relations, Cyborgs: on the Social Study of Technology

John Law

Introduction: Partial Identities and Mobilities

How to speak, and speak well, about the 'sociological study of technology'? I find this very difficult. Partly this is because there is not a *single* sociological study of technology at all. As you appreciate, sociologists work in many ways, reflecting many different approaches, concerns and political commitments. And sociologists who work on technology are no different. In addition, it isn't clear whether the social analysis of technology is distinctively *sociological*. The field of technology studies, if it is a field, is also interdisciplinary. As it happens I was indeed trained as a sociologist, but I also work with people who started life in psychology, philosophy, feminism, computer science, cultural studies, education, anthropology, and engineering. So I take it – this is received wisdom – that we live in a post-disciplinary era. That whatever the merits of disciplinary training, it is important for social science endeavours to look beyond disciplinary boundaries. The social analysis of technology is no exception.(1)

So we need to ask about the *issues* and the *tools* in the social study of technology. But we also need to think about *identities*: about who we *are* when we study the technical, where if anywhere we *belong*, and whether indeed we have or need *stable* identities. A post-disciplinary answer beckons: it is that we might make ourselves *mobile*; make heterogeneous alliances; and patch together friendships, projects, and insights, tools for thinking from a variety of changing sources. Such, at any rate, is my own vision. I take it that we live, and

should live, in a relational world of displacement and mobility and this can be reflected in our intellectual tasks. We can and should, I take it, be partially mobile. Somewhat nomadic, intellectually.

To talk in this way is pick up a widespread trope in contemporary social theory and practice. There is endless concern with the uncertainties of identity and belonging which crops up in a whole range of academic and non-academic writing, and in a whole range of lived realities (2). A few more or less random examples. Anthropologist Marilyn Strathern, drawing on Donna Haraway, talks about 'partial connections', about the inability and inappropriateness of trying to pull identities and knowledges together (3). Then, and somewhat differently, there are libraries of books which talk about global movements of capital and the fluidities, instabilities, and insecurities that these cause (4). There are further large literatures which tell us that we live in an information era (alternatively a great excitement or a terrible menace) in which people are removed, at least in part, from where their bodies happen to be and inserted into quite other contexts (5). There is writing on some of the inclusions and exclusions which result: for instance, around issues of gender (6). And there is a sadly limited literature – perhaps no more than a small bookcase in a back and underfunded wing of the social science library – on post-colonial inclusions and exclusions (7).

So the efforts to understand technologies in their movements, displacements, partial stabilities, their relation to fractured or nomadic identities, knowledges in tension, and instabilities, all of these then, are very variable, very uneven, and there are horrible gaps. But overall, in these and many other ways, the message is that we live in a world that is simultaneously smaller and better linked, and at the same time more fluid, less certain, more risky, less foundational, and more excluding, than may have been the case in the past.

Relationality, or all that is solid …

So what to make of this absence of foundations? Of the fact, as Marx and Engels put it in *The Communist Manifesto*, that 'all that is solid melts into air'? (8) And what in particular might we make of technologies and the social in such a mobile and fluid world? Their dynamics?

My first point is quite simple. It is, as I hope I have implied, that there no single answer, no single grand narrative. For the world is, the worlds we live in are, messier than that. There are many possible narratives. This means that any way of imagining technologies is partial, not simply in a technical sense, (though it is certainly, and also, a technical point) but also politically: we have what Donna Haraway describes as the *privilege of partial perspective* (9). This, then, is one of my themes, a *leitmotif*. That there *is* no single answer. But that, instead, there are *partial* answers. *Partial possibilities*. Indeed, to pick up a trope developed by STS philosopher Annemarie Mol, there are *multiple* and partial possibilities (10). I will return to this point below. But I will start by talking about *relations*. And in particular, I will talk about *systems* and *networks*. Let's bring this down to earth.

As many of you will know, historian Thomas P. Hughes wrote a book called *Networks of Power* which charted the growth and the organisation of the electricity industry – its production and the organisation of its supply (11). He attended to the work of entrepreneurs such as Thomas Edison, who electrified New York – and the analogues of Edison in other US and European cities. Hughes referred to these entrepreneurs as *system builders*. And he attended, in particular, to the ways in which in system-building they patched together not only the technical elements necessary to make a functioning city-wide electricity system, but also a series of equally necessary economic, legal and political components. So the technical was indeed important – the creation, for instance, of the incandescent light bulb, or the calculations necessary to determine the optimal local and later regional voltages for transmitting and distributing electricity. But the technical was always and also juxtaposed – or better, inextricably mixed up – with political deals with city halls (for instance to win battles against gas suppliers), with legal arrangements about the location of supply cables and generating stations, and economic calculations about how far (and at what voltages) it was profitable to transmit power before losses became unsustainable.

Hughes' beautiful historical studies document the work of these system-builders. They also reveal that people like Edison barely distinguished in practice between people, technologies, money, politics, and legal institutions. Hughes is scarcely an admirer of Marx: his quite

different view is that capitalism is a creative and innovative system, and that in the absence of excessive state control the great system-builders are special people, heroes indeed, who break down the pre-established distinctions between the technical, the economic and the social, and do so in a way that reveals their creative genius. But for all the differences in their political agendas, Hughes' writing is nevertheless a fine exemplification of Marx' suggestion that in modern times all that is solid (indeed) melts into air.

Lets fix on this for a moment. There is corrosion of that which is, yes, fixed. There is erosion of the idea that there are foundations and distinctions given in the order of things that can be taken for granted. All of which means that, at least in the context of a social analysis of technology, there is also dissolution, partial or total, happily or unhappily, of the distinction between the human and the non-human. This erosion of fixity is implied in a logic of networks or systems. It is a logic which seems to travel everywhere and infiltrate itself into all the nooks and crannies of the human world – a process explored, albeit in other terms, in the work of Michel Foucault in his explorations of the modern episteme (12). And again, of course, by Karl Marx.

Another empirical example. If you look at 'defence procurement' – that is, the design and construction of military technologies – it turns out that the notion of the 'weapons system' was widespread at least fifty years ago. In the 1950s defence planners and policymakers were saying that it isn't good enough to buy an aircraft and then to bolt some weapons onto that aircraft as an afterthought. Instead you need to conceive of the whole arrangement as a system – yes, as a weapons system – in which all the different parts interact together to produce something that cannot be reduced to the behaviour of its component parts. This means that you can't design the aircraft without at the same time designing its weapons, and trying to understand how they will all interact together. It also means, in another application, that it is no very important to think about the safety of individual aircraft (or pilots) but rather of the overall effectiveness (including cost-effectiveness) of air power as a whole. *Individual* losses don't matter so much any more. What's important is 'bangs per buck'. Some comments.

First, it tells us many developments in the sociology of technology are *not particularly original*. I was struck very forcibly by this, when I started in the 1980s to work on military technologies. It was a revelation to discover that my (or our) version of the sociology of technology trailed behind that of the engineers and the system-builders. We were talking of 'heterogeneous engineering' (referring to the idea that when technical systems are constructed they involve the 'engineering' of people too) (13). But our work revealed, in the way that I have just suggested, that the engineers and the system builders (not to mention Karl Marx) already knew about this. They knew that in the face of a systems logic, yes, all that is solid melts into air. Humans and non-humans, technical and social, content and context, macro and micro – all of these were tending to dissolve in the logic of weapons procurement (or capitalist accumulation. Nothing was standing still. *Nothing could be counted on as a firm foundation*. And in the social study of technology we were often simply rediscovering, or re-articulating, what was already clear in the practice, and not infrequently in the talk, of engineers and systems builders. (14)

Second, it poses a question: what we should *make* of this similarity? And, as a part of this, how do or should we react to the *dissolution of fixed categories*? Do we feel comfortable with the idea that in the new logics of the sociotechnical, the distinction between (for instance) the human and the non-human gets dissolved, or at least eroded to the point where they are rendered into functional and practical matters rather than resting in morality, politics, ethics or theology? This, of course, is a big issue, and it is one which also goes to the heart of the social analysis of technology in a variety of ways, but in particular in the debates between the social construction of reality on the one hand, and actor-network theory on the other. A few words on each

To say it very (indeed far too) quickly, the approach called *the social construction of technology* (or SCOT) distinguishes in its presuppositions and its metaphysical roots, between people and societies on the one hand, and the world of artefacts (and the natural world too) on the other. In this way of thinking, people don't carry souls, or even necessarily ethics, but they certainly carry language and they carry meanings. This means that the social is distinguishable, in principle, from the technical. We always already know before we start

that there is doing to be a division in kind between the two. So it is necessarily important to distinguish people from artefacts, including even the most intelligent machines, which don't have linguistic abilities, at least not in a human-like form. Instead such objects are understood as being shaped by humans. And in turn they produce a context, a geography or an architecture which enables and/or constrains subsequent human projects. This means that within SCOT people and objects interact and they certainly do so in ways that are complex. But it also means that they are always different, entirely different in kind. Such is the bottom line. All that is solid does not dissolve into air. Humans are humans and non-humans are non-humans, even if they live together. (15)

Distinguish this dualism with the approach called *actor network theory* or ANT (though I think in the present context any comments about this would apply just as well to the feminist technoscience studies of writers such as Donna Haraway). The first thing to say is that ANT is a *semiotics*. That is, it is a method (or better, a sensibility) that has to do with and explores relations, relationality. In de Saussure's synchronic linguistics (which is where it started) terms achieved their significance in relation to contrasts with other terms: man, women; father, son, daughter, grandparent, and so on. ANT (and other post-structuralist semiotics of materiality such as that developed by Michel Foucault) extends this beyond language to all entities. All entities, it says, achieve their significance by being in relation to other entities. This means that in ANT entities, things, people, are not fixed. Nothing that enters into relations has fixed significance or attributes in and of itself. Instead, the attributes of any particular element in the system, any particular node in the network, are entirely defined in relation to other elements in the system, to other nodes in the network. And it is the analyst's job, at least in part, to explore how those relations – and so the entities that they constitute – are brought into being (16).

The implication of this apparently simple move, a move to what we might call *radical relationality*, is that we arrive at a logic which dissolves fixed categories. Elements have no significance except in relation to their neighbours, or the structure of the system as a whole. In this respect, then, ANT is like Hughes' (or any other) system-builders. All that is solid does indeed melt into air. Humans and non-humans, technical and social, all the rest. If differences exist it is because they are generated in the relations that produce them. Not because they exist, as it were, in the order of things.

So there are two positions in the social analysis of technology: a SCOT-like position which proposes and grows out of certain essential distinctions and divisions – for instance between human and non-human. And a semiotic (here ANT-like) position which doesn't start out with those premises but instead starts with a playing field in which all entities are initially (only initially) equal and indeterminate. So what should we make of this difference? – a difference over which so much ink has been spilled (17).

One response is that the question – or the difference – is straightforwardly metaphysical and so lies beyond debate and discussion, embedded as it is in different and contrasting ethical, spiritual and political commitments. This means that the debates about (say) humans and non-humans mobilise those metaphysical commitments in a more or less technical guise. If we accept this – and it is surely correct – then we have two possibilities. On the one hand we can treat it as an irreducible impasse. Or, on the other, we can explore the empirical and theoretical implications of one or the other position. Which is, indeed, my concern. This is because I am not unduly disturbed by the dissolution of the human as a foundational category. But also because I take it to be a vital challenge to imagine 'humane', progressive and creative forms of politics, ethics, aesthetics and enchantments that do not rest on essential distinctions between the human and the non human but are instead relational. Though if we are to do this – and this is the task that I set myself – we need to consider how best we might erode those essential distinctions. And this is what I want to do for (actor) networks. I want to ask: what is wrong, and what is (possibly) right about network understandings of the world.

Hegemony, Collusion and Functionality

What is right with networks, if one starts from where I start, is that they are indeed a way of talking about and exploring radical relationality. But what *is* wrong with them? No doubt the answer is: many things (18). But let me mention three. The first has to do with hegemony –

the already mentioned dominance of the network metaphor in contemporary discourse. The second has to do with collusion and performativity – the idea that when we describe networks we also help to bring them into being. And the third brings the first two points together to suggest that the performative character of many but not all network analyses in the social study of technology is not innocent, but contributes to a functional version of the networks (and persons) in technology which is politically difficult if not obnoxious, and would certainly be better avoided. But I start with the argument about hegemony.

1. Networks as Hegemonic

I've said that in our studies of technology we trail along behind the engineers and the politicians. This suggests, as I've also noted, that we're not particularly original. But, more seriously, it also suggests that we are being caught up in a *hegemonic* way of representing and (we will shortly need to add) performing the world.

Perhaps the term 'system' has had its day: it sounds 1950ish or 1960ish, something to do with self-regulation, cybernetics and autopoesis. But if people are no longer so keen to talk about systems, then the term 'network' is on everyone's lips. A series of political and business gurus from Al Gore through Bill Gates down to the local computer retailer, tell us that informatics will 'network' us and transform our economic and social relations. A series of academic luminaries – the most recent of whom is Manual Castells – tell us that we live in a 'network society' which is ordered quite differently from its predecessors (19). In a related way we are repeatedly told that we live in a world in which global flows (I touched on this at the beginning) circulate through new and ever more complex networks (20). We've reached the point where every man, woman, child and dog seems to be talking of networks.

Much of this talk is notable primarily for its superficiality. Further, superficial or otherwise, much of it isn't radically relational: it works in relatively foundational terms, for instance distinguishing in principle between the economic, the social and the technical, and arguing from premises that turn out to be (for instance) technological determinist. But whatever the differences in the arguments in terms of content and quality, the word 'network' is certainly notable for its ubiquity. And this, or so I suggest, should set the alarm bells ringing. If we too find that we are talking of (systems or) networks, then what are we *actually* doing? What are we up to? Perhaps there are two possibilities here.

The first is that we are simply discovering something important about the structures of the sociotechnical – even if it is a bit late in the day, and the engineers and the Marxists have been there for quite some time. Such is one possibility, the possibility implied in the work by Hughes and at least some of the ANT authors who were writing in the 1980s and early 1990s. And it is a possibility that is quite comforting. It is that we are simply in the business of discovering the truth about society and its technologies, no more, no less. Our job is to represent the world as it is. End of story.

The second possibility is less comforting. It is that we are in the process of *uncritically reproducing some kind of dominant ideology*. We are reproducing the ways in which the current orderings of the world like to represent themselves. Which, if it is the case, is certainly a less than appealing thought. And it immediately poses the question: what has happened to social criticism?

2. Collusion and Performativity

That's the first problem. The second is an extension of the first. If we talk of 'networks' might it not be that we are representing the world in a way that is not simply uncritical, but more strongly, in a way that *colludes and helps to reproduce* the way in which the world is already being made?

Let me point to some of the issues here by drawing on my own experience. For me the issue of collusion came into focus in the context of the study of military technology that I mentioned above. I was writing about a technological project – in fact an ultimately unsuccessful British attempt to build a nuclear tactical strike and reconnaissance aircraft. I was exploring this aircraft project, its design, its development, and its ultimate failure, as a 'weapons system'. As a part of my study I interviewed various senior people – top members of the British Royal Air Force, successful politicians, high executives and engineers in the aerospace industry, senior

civil servants. Most of these people (almost all men) were attractive and thoughtful, and they were all certainly very smart. But as I interviewed them I found that two things were happening. First, they wanted someone to *document* what had gone so wrong with the project. Second, they hoped that my historical study would be useful in *drawing lessons for the future*. The idea, of course, was that if we could learn from our mistakes, future projects would be more successful.

Now how to think about this? I can tell you that I began to feel deeply uncomfortable. Perhaps my politics were confused, but one thing was clear: I certainly didn't want to add to the British capacity for building nuclear bombers. As a result I began to understand that what I was at risk of doing was *colluding* in the process of military procurement in two different ways. First, and straightforwardly, if my study was actually to teach the military anything useful (which was probably unlikely), then it would, presumably, make it easier to build better military aircraft in the future. But, second, there was another more subtle form of collusion involved. This was because *the terms used by those working on, in and around the project, were more or less the same that I was using to analyse it*. I have already made this point: I was using an actor-network approach to describe something that was typically being imagined by its participants in terms of systems and relations. Both approaches tended (I put it no higher than 'tended' because there are subtleties here) to make similar analytical and lived assumptions about the proper and perhaps the necessary ways of practising technology. For instance, that the latter is *centred, strategically ordered, and more or less controlled in one place*. That it is a set of relations between entities which are thereby created and shaped (against various resistances) to contribute towards *a single strategic goal*. And that there are *few important foundational differences between entities* – between, for instance, humans and non-humans. It imagines, in short, that the latter are effects produced in project-relevant relations: as network consequences. (21)

There is a lot more that might be said. However, the bottom line is that when we talk about a sociotechnical project what we are doing can *either* be understood as a description of the way things are (for instance, that technologies are often organised in terms of projects). *Or* it can be seen both as presupposing a set of assumptions about how relations are organised and networked and then (and crucially) *as adding power, strength, plausibility and lustre to those assumptions* (including, for instance, the idea – and the reality – that there are no essential differences between humans and non-humans.)

This is a point that is both pretty subtle, and pretty devastating. This is because if we're simply *describing* the world, then our activity is innocent enough. We might be right or we might be wrong in our descriptions, but that is another matter. The world and its relations – its differences, metaphysical or otherwise – is already in being, waiting to be described more or less accurately and workably. If, on the other hand, when we tell stories about the world we also tend to help to *perform* it as we are describing it, then it follows that *no description is ever innocent*. Every description is, as the philosophers put it, *performative*. Every description, however subtly, tends to help bring into being what it describes. So that as we write we are, as Donna Haraway might put it, interfering in one way or another with what we're describing (22). Tending to bring some relations into being, while pushing others out of being. We are always, then, in the business of making a difference – or, to put it differently and more negatively, we are always at risk of collusion.

3. Functional Networks

So networks are hegemonic. First point. And when we analyse in terms of networks, we help to perform networks into being. Second point. What happens if we bring these two observations together? The answer is that if we write as network analysts what we may be doing, what we're often doing, is *buying into and adding strength to a functional version of relationality*. One that is, to say it quickly, managerialist.

As I have already indicated, this is the position more or less explicitly adopted by Thomas Hughes (though he is more committed to the hero-entrepreneur than modern bureaucratic versions of technological enterprise). And it is implicit in a great many other studies of business organisation – one that comes to mind is Thomas Beniger's *The Control Revolution* (23). In works like these, all that is solid melts into air – as part of a logic of control, extension across time and space, and capital accumulation. But the same complaint can be levelled –

and has indeed been made – against at least some of the studies in actor-network theory. Leigh Star, in her celebrated paper on being allergic to onions, notes that if we are all heterogeneous engineers, then the heterogeneity for a white male manager in a senior position in an organisation is unlike that of a working class woman of colour. (24) Quite so. She's right. And Donna Haraway is not the only other writer who has made similar suggestions, preferring to talk of the messy activity of making cat's cradles than of the relatively centred networks (25). And indeed if we look at the actor network studies of the 1980s it isn't always very easy to see the difference between them and the work on large technical systems. These are studies, then, which tend to reproduce and help to perform a *functional understanding of the relations between entities*. And they tend to work out from, and back to, a centre, an obligatory point of passage. For an actor is, of course, also a network – and vice versa. That is what the whole thing is about. All that is solid – human and non-human – melts into air in the face of the need to create a coherent, ordering, and functioning heroic or bureaucratic actor.

After Networks

Though many of its studies are, indeed, managerialist in tone, the actor-network sensibility is perhaps more open to Otherness than this quick analysis might suggest (26). For instance, built into its vocabulary is the idea of translation – and the idea that translation (the attempt to render equivalent) is also betrayal. But in the present context I'm not particularly interested in trying to save actor-network theory. It itself is a mobile betrayal, and if we are to respond well to the fluidities and mobilities which I talked about at the beginning, then defending strong points is in any case of little interest. Rather, it is the questions, the issues, the interventions and the politics, that require attention. For instance, the issues to do with collusion and otherwise.

What I have said about actor-network theory and its relatives indicates one of the directions in which we might go if we want to get a grip on this issue. It suggests that if we are thinking about relations, and trying to do so in a manner that is not foundational, we should at the same time try to *avoid falling into functionalism*. This is because, as I've tried to suggest, studies of technologies which offer analyses of how things are put together in a strategically problem-solving idiom reproduce that functionalism and perform it into being. Every technical system becomes a more or less (un)successful functional arrangement. Every component in that system is understood as a part of that functional arrangement. All that is solid – including human and non-human distinctions – melts into air in a specific way that subjugates that dissolution to a logic of function, and often enough, of capital accumulation. *But it does not have to be that way*.

It does not have to be that way. Meaning? Meaning that *the non-foundational logics of semiotic analysis do not have to hitch their wagons to functionalism*. It is possible to imagine relational orderings which perform other logics, logics which produce different kinds of politics, and different kinds of persons. Persons that are no less relational than their functionally-defined relatives. But persons that are not subjugated to those logics of means and ends, projects and goals, which come to us from what one might think of as the *first and functional wave of relationality*.

The best-known attempt to work within a relationality of semiotics in a mode that is refuses functionalism is no doubt that of Donna Haraway. As is again well known, she tells stories about cyborgs. Cyborgs are combinations of the human and the non-human (which therefore in some sense dissolve the boundary between the two). The concept – and the reality – was created originally within the strategic logic of (partially militarised) space travel where it was imagined that altered human bodies would better sustain interplanetary or (in its more ambitious forms) interstellar travel. And this cybernetic reality is one that, God help us, has seized the popular imagination in all sorts of ways that tend to celebrate extreme (and gendered) forms of violence. Haraway, however, reworks the metaphor to produce a feminist cyborg which is not only a mixture of human and non-human, but is also politically radical. So this new creature is a hybrid in at least three ways. First it is a fleshy-machinic hybrid. Second, it is also a hybrid, a set of partial connections, between what is real and what might perhaps be performed into being – a feminist, non-racist, and non-violent technoscience. It is, in short, a hybrid which lies between science fact and science fiction. And third, it is a

metaphor, too, for something quite other to functionalism. This is because it is not primarily to do with drawing things together and ordering them into a single vision, order, or goal-related network. But rather because it imagines the performance of technologies, of worlds, and of persons where *vision is split*. Where there is heterogeneous but necessary multiplicity. Where, to coin a phrase, there is room for the *fractionality* of that which is separate but which is also joined (27). The cyborg, then, in its third manifestation, is *more than one but less than many*.

The hope, then, is for a non-foundational but material relationality that is not functionalist. That does not distinguish between the political (which is a given defined outside the system) and the technical (contained within it). That does not presuppose a metaphysical distinction between the human and the non-human. But rather one which opens up possibilities for thinking about and performing alternative realities, alternative versions of the good, and alternative sensibilities to Otherness. One that is sensitive, like the cyborg, to the creative possibilities of a world in which what we used to think of as 'systems', or 'networks', or 'projects', or 'people', or 'rules' are not necessarily rigidly consistent, centred, and mono-vocal, but rather perform, reflect and enable fractional and shifting coherences. Such that the failure of an entity (a person, a technical arrangement, a set of rules) to cohere in a single and functional manner is neither treated nor experienced as a failure but, instead, as an analytical and experiential reality – and one with possibly liberatory consequences. And so it is that everywhere I look, though no doubt I look selectively, I find work on technologies and societies and person which seeks to articulate these mobilities, fluidities and partialities – partialities which become so intriguing once we remove the requirement for a single form of coherence.

I think, for instance, of the work of Annemarie Mol on bodies. *The Multiple Body* (28) she calls her book. In this work she attends with great rigour to a serious but mundane disease – lower limb arteriosclerosis – and the multiple but interconnected ways in which this seemingly singular object is enacted and performed into being in different ways in the different departments of a hospital: the operating room; the pathology laboratory; the radiology department; the consulting room. This, then, becomes a disease that is fractional. Most of the time, whatever the textbooks say, in practice it is not a consistent condition. Rather it is more than one and less than many. This means that it is a disease which is, indeed, relational, but in a precisely cyborg-like manner. A multiple set of performances with their own less-than-centred coherences and interferences. The point, then, is not that the multiplicity of arterioscleroses represents some kind of failure – which is necessarily how would appear in the functional logic of the medical textbook (29). It is rather that multiplicity – or better fractionality – is *how in reality it actually is*. How this disease is performed in its different and shifting relations. How, indeed, it is necessarily performed, given the different locations, indications, tools, approaches, and all the rest. All of which means that it, the disease, cannot be understood as an object to be tamed in a simple and straightforwardly functional manner. Which suggests in turn that *even if our concerns are primarily functional* (in this case to cure, or at least provide palliative care for those suffering from the disease) it is important to find ways of entertaining split vision, the privilege of partial perspectives. Of the privilege which comes with moving and displacing. Of balancing and relating different visions, different realities, and different versions of the good – all of which intersect but cannot be reduced to one another. Facts and values – or if you prefer, science and politics – here are inextricable intertwined. This is Mol's argument, an argument that is not simply about the complexity of relations, but also about the ways in which these shift between locations – and the necessity of those displacements.

If bodies and their diseases are more than one and less than many, and they need fluid methodologies in order to understand the realities and the goods that they produce, then the same is true for *social rules*. In this context Anni Dugdale analyses the advice offered to women about the appropriate use of IUDs. And Vicky Singleton explores the rules disseminated in health education campaigns, for instance in advice intended to reduce sudden infant death syndrome, or 'cot death' (30). In part this advice tells parents that they should put the baby to sleep on its back. But what does this mean in practice? Vicky Singleton shows that something which appears to be a single and unambiguous rule is used and practised in endless, different and (this is the important move) *not necessarily inappropriate* ways. A rule and the business of following a rule well is not something that is

fixed, she argues. Rather it is, as she puts it, 'made on location' in the contexts where it intersects and interferes with other realities: a crying baby; a cold house; previous health-care advice; pressure from a partner. Once again, in practice there are different visions, different realities, different truths, different subjectivities and different versions of the good – and constant displacements between these. All of which suggests that health practices need, somehow or other, to move on from blaming mothers who don't follow prescriptive and context insensitive rules to something closer to an appreciation of mobile and materially-embedded subjectivities the ironies that embedded in the performance of split vision. Here, then, to be 'humane' is not straightforward. To be 'human' is to understand and appreciate the mobilities of split vision.

Diseases, rules, and so it is too, for technologies. Is an aircraft a single thing? Is it something, a single thing, that can be held together in a network, a system, or a project? Studies of technological projects, as I have tried to argue, have often assumed that this is possible – or if not possible, then at least a good, a goal, and something to be aimed for. But we can also imagine that devices are multiple and partially connected sets of relations. That, cyborg-like, they are not single networks, but rather fractionalities, more than one and less than many. That they too, like diseases and rules, are relationally specific, and relationally mobile. That they embody or are performed in different visions, realities, truths and versions of the good. At which point technological choices are no longer dominated by a single and functional vision which follows a dissolving relational logic to produce a single and inevitable outcome. Rather, they become, yes, precisely arguments about how to articulate the relations between different realities and different versions of the good.

I cannot develop these arguments further here. But what I have tried to do is to explore the character of radical relationality and show how it permeates through our intellectual tasks and tools, our intellectual identities, and, in reactions and resistances to it, in the form of debates in the social analysis of technology. I have tried to show that a metaphysics of radical relationality has often, perhaps usually, been linked to a form of functionalism that is analytically and politically unattractive. And then I have tried to suggest that a commitment to radical relationality, to the idea that all that is fluid melts into air, is not necessarily linked to a commitment to functionalism. That there are alternatives, and that those alternatives can, in some measure, be performed into being if we can avoid a commitment to functionalism.

What might those performances by like? I have explored one kind of response to this question in the last part of this paper. This is a cyborg-like or fractional version of relationality, one that benefits from what Annemarie Mol calls multiplicity, and Donna Haraway the privilege of a cyborg-like split vision. This, then, is a post-human world. There are no essential humans. People-machines, cyborgs, these are produced in the shifts and displacements of relations. But neither is it a world that is inhumane. This is because it is functionalism which makes radical relationality so inhumane. Instead, as we perform different versions of the world which are also different versions of the good, the political and technical choices are brought together and made explicit. This, then, is why it is good to embrace mobilities and displacements. Mobilities and displacements in general, and not simply the disciplinary mobilities with which I started. If we can separate the dissolution of all that is solid from the singular logic of functionalism, a new version of analysis and politics opens before us. One that accepts responsibility for its participation in and performances of the world.

Notes

* This paper is dedicated to the interdisciplinary STS-Lancaster team which includes: Claudia Castañeda, Sarah Franklin, Maureen McNeil, Greg Myers, Elizabeth Shove, Vicky Singleton, Lucy Suchman and Brian Wynne. And also to my equally interdisciplinary STS friends beyond Lancaster including Michel Callon, Anni Dugdale, Kevin Hetherington, Annemarie Mol, Ivan da Costa Marques, Ingunn Moser and Helen Verran.

1 See, for instance, John Urry (2000).

2 The references are endless. For two very different examples, see Donna Haraway (1997) and David Harvey (1989).

3 See Marilyn Strathern (1991).

4 See, for instance, Anthony Giddens (1990), Scott Lash and John Urry (1994) and Nigel Thrift (1996).

5 See Manuel Castells (1996).

6 See Charis Cussins, (1998a; 1998b), Anni Dugdale (1999a; 1999b), Donna Haraway (1989; 1997), Ingunn Moser (2000), Vicky Singleton (1996; 1998; 1993), Leigh Star (1991), Lucy Suchman (2000), Sharon Traweek (1988; 1999), and Marja Vehvilaïnen (1998).

7 See, for instance, Claudia Castañeda (1999), David Turnbull (1993; 1996; 1999), and Helen Verran (1998; 1999).

8 Karl Marx and Friedrich Engels (1967).

9 Donna Haraway (1991).

10 Annemarie Mol (2001).

11 Thomas P. Hughes (1983).

12 Michel Foucault (1979).

13 John Law (1987).

14 John Law (2001).

15 Wiebe Bijker, Thomas P. Hughes and Trevor Pinch (1987).

16 For an introduction to actor-network theory, see John Law (1992). For examples of the approach at work, see Bruno Latour (1987) and Michel Callon (1986).

17 See, for instance, Harry Collins and Steven Yearley (1992) and Michel Callon and Bruno Latour (1992).

18 Marilyn Strathern, though resolutely non-foundationalist, notes that the term 'relation' carries a series of Euro-centric, kinship-related, assumptions that raise serious questions. See her (1996).

19 One example which I have already cited would be Castells (1996). But it is, perhaps, implicit even in a writer like Lyotard (1984).

20 Lash and Urry (1994).

21 This is developed more extensively in John Law (2001); see also John Law and Vicky Singleton (2000a).

22 See Donna Haraway (1991).

23 James Beniger(1986).

24 See Leigh Star (1991).

25 Donna Haraway (1994).

26 For discussion of the limits of ANT see Nick Lee and Steve Brown (1994). But for alternative 'after-ANT' approaches see the papers collected in John Law and John Hassard (1999).

27 See Donna Haraway (1991).

28 See Annemarie (Mol 2001), and also her (1998; 1999a; 1999b; 1996)

29 Sometimes, of course, things do fail to cohere in a way that poses serious practical and political problems. For a case in point, see John Law and Vicky Singleton (2000b).

30 See Anni Dugdale (1999b) and Vicky Singleton (2000).

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