

7

Actor Network Theory and Material Semiotics

JOHN LAW

INTRODUCTION

Actor network theory is a disparate family of material-semiotic tools, sensibilities, and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations. Its studies explore and characterize the webs and the practices that carry them. Like other material-semiotic approaches, the actor network approach thus describes the enactment of materially and discursively heterogeneous relations that produce and reshuffle all kinds of actors including objects, subjects, human beings, machines, animals, “nature,” ideas, organizations, inequalities, scale and sizes, and geographical arrangements.

In this chapter I explore this definition, expand upon, and qualify it. I start with four qualifications.

First, it is *possible* to describe actor network theory in the abstract. I’ve just done so, and this is often done in textbooks. But this misses the point because it is not abstract but is grounded in empirical case studies. We can only understand the approach if we have a sense of those case studies and how these work in practice. Some other parts of social theory (for instance symbolic interactionism) work in the same way, and arguably that’s how natural science is too: theory is embedded and extended in empirical practice, and practice itself is necessarily theoretical. This means that if this chapter is not to betray the actor network approach it needs to subvert the definition above by translating it into a set of empirically grounded practices.

Second, the actor network approach is not a theory. Theories usually try to explain why something happens, but actor network theory is descriptive rather than foundational in explanatory terms, which means that it is a disappointment for those seeking strong accounts. Instead it tells stories about “how” relations assemble or don’t. As a form, one of several, of material semiotics, it is better understood as

a toolkit for telling interesting stories about, and interfering in, those relations. More profoundly, it is a sensibility to the messy practices of relationality and materiality of the world. Along with this sensibility comes a wariness of the large-scale claims common in social theory: these usually seem too simple.

Three, I've talked of "it," an actor network theory, but there is no "it." Rather it is a diaspora that overlaps with other intellectual traditions. As I have already hinted, it is better to talk of "material semiotics" rather than "actor network theory." This better catches the openness, uncertainty, revisability, and diversity of the most interesting work. Thus the actor network successor projects are located in many different case studies, practices, and locations done in many different ways, and draw on a range of theoretical resources. How much those studies relate to one another is chronically uncertain, but this is better read as a sign of the strength of material semiotic sensibilities than as a weakness. In short, actor network theory is not a creed or a dogma and at its best a degree of humility is one of its intellectual leitmotifs.

Fourth, if all the world is relational, then so too are texts. They come from somewhere and tell particular stories about particular relations. This implies the need for a health warning. You should beware of this chapter. I hope that it works and is useful, but it comes from somewhere, rather than everywhere or nowhere. It treats the actor network approach and material semiotics in a particular way. It proposes and seeks to enact a particular version of this animal. Beware, then, of this chapter, but beware even more of any text about actor network theory that pretends to the objectivity of an overall view.

In what follows first I offer a particular account of the intellectual origins of the actor network approach. Second, I characterize what I call "actor network theory 1990." This is the version, with all its strengths and weaknesses, that tends to find its way into textbooks. Then I briefly comment on reactions and responses to this animal. And fourth, I explore aspects of its diasporic creativity since 1995.

ORIGIN STORIES

If the actor network approach started at a particular time and place then this was in Paris between 1978 and 1982. The term, devised by Michel Callon, appeared around 1982, but the approach is itself a network that extends out in time and place, so stories of its origins are necessarily in part arbitrary. They lay claim to and include a particular version of the past created for particular purposes. In this section I tell four stories about its origins. My contention is that much of actor network theory 1990 can be understood as a product of their intersection.

Engineers, managers, and systems

It is obvious to most engineers that systems are made not simply of technical bits and pieces but also include people. Managers know this too, and those who study engineers and managers not infrequently end up thinking similarly. All are "system-sensitive" with a strong sense of relationality. An example.

In the late 1970s and early 1980s Thomas Hughes, historian of technology, wrote about Thomas Edison, engineer and manager, and his new New York electricity supply network. Hughes showed that this was an artful combination of transmission lines, generators, coal supplies, voltages, incandescent filaments, legal maneuvers, laboratory calculations, political muscle, financial instruments, technicians, laboratory assistants, and salesmen. In short, it was a system, and it worked because Edison engineered the bits and pieces together. Hughes emphasizes that the *architecture* of the system was the key. Its individual elements, people or objects, were subordinate to the logic of that architecture, created or reshaped in that system (Hughes 1983).

Edison was successful, but the world of engineering is also filled with failures. In 1980 Michel Callon wrote about one of these: the “electric vehicle.” The French electricity monopoly utility, EDF, concluded that the age of hydrocarbons was ending and proposed an electric vehicle powered by accumulators or fuel cells. EDF would make the motor, Renault the car body, and consumers would adapt their lifestyles. In fact the electric vehicle was never produced. The catalysts in the fuel cells got contaminated and failed. Renault didn’t fancy the technical and economic demotion implied by the plan. And the town councils didn’t want to buy the electric-powered buses that were supposed to popularize the new technology. Callon’s problem, which was to become the key problem for actor network theory 1990, was: how can we describe socially and materially heterogeneous systems in all their fragility and obduracy (Callon 1980)? This is the first context for actor network theory.

Exemplars and laboratory practices

Long before this Thomas Kuhn’s *The Structure of Scientific Revolutions* (Kuhn 1962) was the focus of fierce debate about the character of science. Did scientists use “paradigms,” pragmatic sets of intellectual and practical tools for scientific puzzle-solving? This was Kuhn’s view. Or was scientific knowledge a representation of reality produced by a special scientific method? Such was the view of epistemology. In the late 1960s sociologists read Kuhn and created a sociology of scientific knowledge. A paradigm can be understood, they said, as a *culture*. Scientists acquire this culture and use it to guide their puzzle-solving practices. Successful puzzle-solving extends the culture, which thus reflects both physical reality and social practices. But success is a practical matter: the issue is, does the paradigm work or not? In this way of thinking the absolute truth of a theory is irrelevant. Indeed, there is no independent way of knowing it. This led to a methodological dictum, the so-called “principle of symmetry”: true and false knowledge, it was said, need to be explained in the same terms (Bloor 1976).

Though actor network theory is very different, it borrows from Kuhn and the sociologists of scientific knowledge. I’ll return to the principle of symmetry shortly. First a comment on Kuhn. He said that scientists work through cases, exemplars. Knowing the formalisms isn’t enough. You need to know what they mean in practice. Kuhn’s book, a set of exemplary case studies, exemplifies this. The sociologists of science worked through exemplary case studies too. And the nascent actor network writers, also within the sociology of science and technology,

did the same. This is the basic methodological and philosophical principle that I mentioned in the introduction: knowledge lies in exemplars and words are never enough.

The sociologists of science studied scientists' meanings and their exemplary practices. They practiced a version of interpretive sociology: creative actors, they said, use scientific culture to solve puzzles. But there are other ways of thinking about scientific practice. When Bruno Latour went to the Salk Institute in the mid-1970s his preoccupations were different. Drawing on the work of A. J. Greimas and ethnomethodology, he explored the semiotics of the practices that lead to scientific truth-claims. He noted that in the laboratory most claims about the world are vague and promiscuously mix the social and the natural. "Jones told me that his PhD student saw this blip on the graph, and he suspects it might be a sign that . . ." says a post-doc over coffee. A tiny handful of these suggestions subsequently get transmuted into the much harder statements about nature that circulate in scientific papers ("the figures in the table show . . ."). Latour observed that by the time this has happened the social has disappeared, along with almost everything to do with how the new truth was produced. With most of the messy relations gone we are left with nature, a textual account of nature, and a set of more or less formulaic statements about method that purport to explain why the latter reflects the former. The intermediate and heterogeneous relations of production are deleted to generate two quite distinct and separate domains: reality on the one hand and knowledge of reality on the other (Latour 1993; Latour and Woolgar 1986). It is a system of purification that depends on a heterogeneous web of relations that is subsequently effaced.

Latour does not talk of actor network theory here, but many of its elements are present: materially heterogeneous relations analyzed with semiotic tools; a symmetrical indifference to the truth or otherwise of what it is looking at; concern with the productivity of practice; an interest in circulation; and the predisposition to exemplary case studies; all of these are signatures of actor network theory.

Translation, order, and disorder

So how might we study relationality and its productivity? Latour used Greimas, but he and Michel Callon also drew on philosopher of science Michel Serres. Serres writes about order and disorder. In his world there are patches of order in a sea of disorder. The most interesting places lie on the boundaries between order and disorder, or where different orders rub up against one another. Serres generates endless metaphors for imagining the uncertain messengers that pass between different orders or between order and disorder. Angels, parasites, Hermes, the North-West Passage, all of these make precarious links between places that do not belong to the same world. The notion of *translation* is another of his metaphors (Serres 1974).

To translate is to make two words equivalent. But since no two words *are* equivalent, translation also implies betrayal: *traduction*, *trahison*. So translation is both about making equivalent, and about shifting. It is about moving terms around, about linking and changing them. Michel Callon articulated this in his study of the electric vehicle and his subsequent work on the scallops of St. Briec Bay. The latter is another exemplary actor network case study. It is also notorious because Callon

analyzes people and scallops in the same terms. His “generalized symmetry” applies not, as in the sociology of science, to truth and falsity, to epistemology, but to ontology, to the different kinds of actors in the world.

Callon describes how a science of scallops is created with its own researchers, a science that leads to an experimental technology for rearing young scallops. He shows that, as a necessary part of the experiment, fishermen are tamed too: they agree not to trawl near the larvae collectors. This, then, is a web of relations that makes and remakes its components. Fishermen, scallops, and scientists are all being domesticated in a process of translation that relates, defines, and orders objects, human and otherwise. Callon adds that they hold themselves together but they do so precariously. All it takes is for one translation to fail and the whole web of reality unravels. And indeed this is what happens. One winter night the fishermen invade the protected areas, trawl the larval grounds, and destroy the collectors (Callon 1986). In short, translation is always insecure, a process susceptible to failure. Disorder – or other orders – are only precariously kept at bay.

Poststructuralist relationality

Precarious relations, the making of the bits and pieces in those relations, a logic of translation, a concern with materials of different kinds, with how it is that everything hangs together if it does, such are the intellectual concerns of the actor network tradition. However, this is a combination of concerns also found in parts of poststructuralism. My final contextual suggestion is that actor network theory can also be understood as an empirical version of poststructuralism. For instance, “actor networks” can be seen as scaled-down versions of Michel Foucault’s discourses or epistemes. Foucault asks us to attend to the productively strategic and relational character of epochal epistemes (Foucault 1979). The actor network approach asks us to explore the strategic, relational, and productive character of particular, smaller-scale, heterogeneous actor networks. We’ve seen this for the Salk laboratory and for the scallops. Here’s another example: Latour’s account of the Pasteurization of France.

Pasteur, a hero of French science, is said to have revolutionized French agriculture. For instance, he discovered the cause of anthrax and created a vaccine for the disease. But how did this happen? Was he, as Hughes claimed of Edison, a great man? Latour rejects this because in a material-semiotic world all actions, including those of great men, are relational effects. To show this he charts how a network of domesticated farms, technicians, laboratories, veterinarians, statistics, and bacilli was generated. He describes how they were shaped (in some cases created) in this network. And he shows how the result was generative. Farms were turned into laboratories, vaccines made from attenuated bacteria, cattle stopped dying of anthrax, and Pasteur became a great man (Latour 1988b). All of which were the effects of a set of materially heterogeneous relations.

We are offered an historical account of particular translations through time rather than a diagnosis of an epochal epistemic syntax. Even so the logic is not far removed from Foucault’s. It can also be understood as an empirical version of Gilles Deleuze’s nomadic philosophy (Deleuze and Guattari 1988). Latour has observed that we might talk of “actant rhizomes” rather than “actor networks,” and John

Law has argued that there is little difference between Deleuze's *agencement* (awkwardly translated as "assemblage" in English) and the term "actor network" (Law 2004). Both refer to the provisional assembly of productive, heterogeneous, and (this is the crucial point) quite limited forms of ordering located in no larger overall order. This is why it is helpful to see actor network theory as a particular empirical translation of poststructuralism.

ACTOR NETWORK THEORY 1990

Material-semiotic relationality

The date is arbitrary, it could be 1986 or 1994, but I'm trying to catch a moment when actor network theory achieved recognizable form as a distinctive approach to social theory. A moment when the web of different origins described above had been woven together to craft a workable set of tools carried in a persuasive and well-documented set of case studies. A moment when an agenda, a vocabulary, and a set of ambitions became current. So what *was* "actor network theory 1990"? Here is another exemplary case study.

How did the Portuguese reach India? How did they maintain their imperial control? Conventional histories talk of spices, trade, wealth, military power, and Christianity. With some exceptions they treat technology as an essential but ultimately uninteresting infrastructure. Maritime history talks of innovations in ship-building and navigation, but is usually little concerned with the politics or economics of imperialism. In 1986 Law brought the two narratives together. He asked how the Portuguese generated a network that allowed them to control half the world. His answer was that ships, sails, mariners, navigators, stores, spices, winds, currents, astrolabes, stars, guns, ephemerides, gifts, merchants' drafts were all translated into a web. That web, precarious though it was, gave each component a particular shape or form that was to hold together for 150 years. He added that result was a structure of asymmetry. Like Pasteur's lab in Paris, Lisbon became an obligatory point of passage for a whole set of tributaries. Law also argued, following Latour, that the ships became "immutable mobiles" circulating to and fro in space whilst holding their form and shape constant. This, he said was crucial to the success of the system (Law 1986).

This study displays all the ingredients of actor network theory 1990. There is *semiotic relationality* (it's a network whose elements define and shape one another), *heterogeneity* (there are different kinds of actors, human and otherwise), and *materiality* (stuff is there aplenty, not just "the social"). There is an insistence on *process* and its *precariousness* (all elements need to play their part moment by moment or it all comes unstuck). There is attention to *power* as an effect (it is a function of network configuration and in particular the creation of immutable mobiles), to *space* and to *scale* (how it is that networks extend themselves and translate distant actors). New for actor network theory, there is an interest in large-scale political history. And, crucially, it is a study of *how* the Portuguese network worked: how it held together; how it shaped its components; how it made a center and peripheries; in short, of how differences were generated in a semiotic relational logic.

The erosion of foundations

The single-minded commitment to relationality makes it possible to explore strange and heterogeneous links and follow surprising actors to equally surprising places: ships, bacilli, scallops, and scientific texts (Latour 1987). It highlights practices off-limits or uninteresting to non-semiotic approaches: navigational innovations, biological bench work, the habits of larvae, the practices of farmers, food (Mol and Mesman 1996). It does this by eroding distinctions in kind, ontological distinctions. In short, the toolkit can be understood as a powerful set of devices for leveling divisions usually taken to be foundational. These are demoted and treated as the effect of translations. Human and non-human, meaning and materiality, big and small, macro and micro, social and technical, nature and culture – these are just some of the dualisms undone by this relationality. Obviously this posthumanism is intellectually radical and often controversial. Let me, then, talk of some of these disappearing dualisms.

In actor network webs the distinction between *human* and *nonhuman* is of little initial analytical importance: people are relational effects that include both the human and the nonhuman (think, for instance, of “Pasteur”) while object webs conversely include people (ephemerades). Particular networks may end up being labeled “human” or “nonhuman” but this is a secondary matter. Here then, as with Foucault, there is a powerful if controversial nonhumanist relational and semiotic logic at work quite unlike that of humanist sociology. It is obnoxious to those who take people to be morally special, and intellectually flawed for those who frame the social in terms of meaning and intersubjectivity (Collins and Yearley 1992). For the latter a relational semiotics misses out on what it is that constitutes the social. More generally, humanists simply find it difficult to grasp the intellectual single-mindedness of this logic of relationality. Sometimes, for instance, they misunderstand its empirical studies as examples of foundational sociology, assuming that social categories are being used as an explanatory resource. But in the material semiotics of actor network theory the social is also being reworked (Latour 2005).

Again, the distinction between *big* and *small* is a relational effect. Callon and Latour (1981: 229) observe that “[i]t is no more difficult to send tanks into Kabul than to dial 999.” Their point is that the same relational logics apply at any scale. Whether we are “big” or “small,” the largest part of the webs we draw on and allow us to act are hidden. An actor is always a network of elements that it does not fully recognize or know: simplification or “black boxing” is a necessary part of agency. This implies that the notion of “level” is also a relational effect. To put it differently, and following the Deleuzian logic mentioned above, there is no overall social, natural, or conceptual framework or scale within which events take place: as webs grow they tend to grow their own metrics. But then, without a foundational macro and micro the distinction between macro- and micro-sociologies similarly makes little sense except as a performative effect of those sociologies (Law 2000): class, nation-state, patriarchy become effects rather than explanatory foundations. This is not to say that they are not real – they may indeed be *made* real in practice – but they offer no framework for explanation.

Some of the other disappearing dualisms are less contentious. We have seen that the *social* and the *technical* are embedded in each other. This means that it simply

isn't possible to explore the social without at the same time studying the hows of relational materiality. Sociologists sometimes experience this as a diversion from serious social analysis. Why, they wonder, does actor network theory obsess over material minutiae? Why doesn't it look at what is important? The response to this is the counter-complaint that many sociologies have little sense of how the social is done or holds together. They ignore the material practices that generate the social: ships, sailors, currents. They simply move too quickly to a non-material version of the social.

This leads back to another distinction mentioned above. Sociology is usually interested in the *whys* of the social. It grounds its explanations in somewhat stable agents or frameworks. Actor network's material semiotics explore the *hows*. In this non-foundational world nothing is sacred and nothing is necessarily fixed. But this in turn represents a challenge: what might replace the foundations that have been so cheerfully undone? Is it possible to say anything about network-stabilizing regularities, or are we simply left with describing cases, case by case? Actor network theory 1990 responded to this challenge in the only non-foundational way it could, by exploring the logics of network architecture and looking for configurations that might lead to relative stability. Arguably it did this in three different though overlapping ways.

Durability after foundations

Material durability. There is a straightforward way in which some materials last longer than others. It is easier to imprison people if there are prison walls while, unlike traffic patrols, sleeping policemen are never off duty (Callon and Latour 1992). So the first argument is that social arrangements delegated into non-bodily physical form tend to hold their shape better than those that simply depend on face-to-face interaction. But note the caveat, "tend to": everything is a relational effect. Prison walls work better if they are part of a network including guards and penal bureaucracies, while knotted bedsheets or the sheer passage of time will subvert them. As with Bentham's panopticon, in the end it is the configuration of the web that produces durability. Stability does not inhere in materials themselves.

Strategic durability. Think again of the Portuguese maritime network. Over a long period the Portuguese experimented with novel designs for vessels suitable for exploration and exploitation. They also, and as a matter of explicit royal policy, created a system of celestial navigation. These were deliberate strategies to create a durable network. Equally important for network stability was the translation of strategies developed in other networks. Examples include the art of growing spices, and the desire of Arab mariners to avoid lethal confrontations. Such strategically durable configurations were translated whole and "black boxed" into the Portuguese web. How they worked was of little direct interest, though mostly indeed they were durable and reliable.

Do these options exhaust the strategic possibilities? The answer is, arguably not. In practice the actor network conception of strategy can be understood more broadly to include teleologically ordered patterns of relations indifferent to human intentions. For the Portuguese examples include the actions of the currents and the winds in the South Atlantic that, year after year, more or less reliably pursued their

own telos on an annual pattern. Again, with this third form of durability, the actor network position resonates with that of Foucault, who tells us that strategy is not necessarily located in human deliberation. In short, for a material semiotics teleology may not reside in human intentions.

Discursive stability. Another case study. How does an organization hold itself together? This was Law's question in 1990 in his ethnography of a large scientific laboratory. He concluded that the managers worked in a series of different logics, four in number. Sometimes they were entrepreneurs, sometimes bureaucrats, sometimes Kuhnian puzzle-solvers, and sometimes they dabbled in charisma. Law argued that this was not a matter of individual character but of different modes of ordering that extended through people to include technologies and organizational arrangements. Enterprise, for instance, generated self-reliant individualism and demands for performance, organizational cost centers, and management accountancy systems. Bureaucracy, quite differently, generated a Weberian respect for administrative due process, organization as a set of competent offices, and an accounting system designed to prevent fraud (Law 1994).

Law was borrowing from Foucault: the modes of ordering are mini-discourses. But what has this to do with stability? The answer comes in two parts. First, as Foucault insists, discourses define conditions of possibility, making some ways of ordering webs of relations easier and others difficult or impossible. In the UK in 1990 "enterprise" and "bureaucracy" were standard ordering strategies easy to enact both because they were known to managers and because they were standard ways of interacting with other organizations. Second, the fact that they are different also contributes to stability. This is because every discourse sets limits to its conditions of possibility so it cannot recognize certain kinds of realities. But those realities exist and they have to be handled. For instance, the laboratory needed bureaucracy but would have been strangled by red tape if this had been the only ordering mode. It likewise depended on enterprise, but would have run the risk of illegality if it had ordered itself in this way alone. It was the multi-discursive ordering of the laboratory that secured its relative stability. When one mode of ordering became problematic others might be more effective. And this was the third non-foundational way for understanding configurational stability developed within actor network 1990, and it foreshadows the move away from centering that characterizes much subsequent material-semiotic work.

RESPONSES AND REACTIONS

I've suggested that actor network theory's refusal of essential foundations was unacceptable to many. Since this, and especially the issue of humanism and nonhumanism, is primarily a metaphysical quarrel perhaps all we can do is to note the difference and move on. But there are other critical stories about actor network 1990. Here are three. First, it was argued that its studies were often centered, managerialist, and even military in character, attending to the powerful, sometimes in functionalist and masculinist mode (Star 1991). Second, it was suggested that the approach effaced whatever could not be translated into network terms, so failing to recognize its own role as an intellectual technology of Othering (Lee and Brown

1994). And third, it was argued that it was not very aware of its own politics, and in particular of the political agendas of its own stories (Haraway 1997).

In response it is possible to offer counter-narratives. First, Latour's work on Pasteur shows the latter to be a network effect rather than a shaping genius. Law's managers are similarly treated not as heroes but products of multiple and decentered discourses. In both studies the authors are trying to deconstruct power by "studying up" rather than down. Second, Latour's laboratory ethnography is an explicit attempt to reject the Othering of French colonial anthropology by applying its techniques (which he originally applied in the classrooms of the Côte d'Ivoire) to high-status scientific knowledge. More studying up rather than down. If there is a difference between the West and the Rest it is, Latour tells us, not because the Rest is radically Other, but because the West has accumulated a series of small and practical techniques that generate cumulative advantage (Latour 1990). Third, it is too simple to say that actor network has no interest in the origins and construction of its own accounts. Steve Woolgar, who cannot quite be claimed for actor network theory though he co-authored the Salk laboratory study (Latour and Woolgar 1979), raised questions of reflexivity for science studies (Woolgar 1991). Amongst others Latour and Law took up his challenge and wrote in reflexive mode (Latour 1988c: 1996; Law 1994), thus exploring what science studies writing does, what it helps to bring into being – a continuing preoccupation to which I return below.

I could go on: there are rebuttals to each of these counter-narratives. But let me ask what we are *doing* if we write like this. One response is that we are assuming that something called "actor network theory" deserves criticism or defense. But do we want to add succor to this assumption? I have argued that the approach is not a single entity but a multiplicity. I have also argued that it is embedded in case studies. If this is right, then general criticisms or defenses of "the approach" are likely to mistranslate its epistemic and practical import. A second answer takes the form of a question. How useful it is to live in an intellectual world defined by criticism, defense, and the desire to "win" arguments? This is a complicated question, but one way of translating it is to ask whether we really think that there is a single intellectual and political space to be "won." Perhaps if we wash away this assumption we might conceive of theoretical intersections differently: as a set of possibly generative partial connections. And this is how I will proceed. My interest is in how the material-semiotic traditions have interfered with one another to articulate new intellectual tools, sensibilities, questions, and versions of politics. The metaphor here is intellectually and politically polytheistic rather than monotheistic: there are, I assume, various truths and various politics. In the final diasporic section of this chapter I articulate a small number of these. Many others, for instance to do with bodies, passions, and spatialities, I exclude purely for reasons of space (Gomart 2002; Gomart and Hennion 1999; Hennion 2001; Law and Mol 2001).

DIASPORA

Enactment

Crucial to the new material semiotics is performativity. It is helpful to start with another case study.

How are strawberries bought and sold? Is it possible to drive out inefficiencies and create a perfect market? In Fontaine-en-Sologne in France in 1981 the answer to these questions takes physical and organizational form. In a two-storey building the ground floor is for those selling strawberries, and the first floor for those buying them. Crucial is the fact that buyers and sellers cannot see one another. Equally important is the fact that everyone in both rooms is attending to a single market transaction. This takes the material form of a large electronic display visible to all, which describes the lot being sold, and the level of the current bid. Both buyers and sellers can also see the auctioneer as he sits in his cabin. The prices start high and fall until the lot in question finds a buyer and the price is fixed. If it falls too low the seller can withdraw his strawberries. To repeat, buyers and sellers don't talk with one another directly. They aren't supposed to fix deals in private. The market is intended to be unified and transparent. In short, it is supposed to reproduce the conditions of perfect competition (Garcia 1986; Garcia-Parpet 2007).

This study doesn't belong to actor network: its author was a student of Pierre Bourdieu's. However, it has been assimilated to material semiotics by Callon. Understood in actor network terms it tells of the creation of a heterogeneous, material-semiotic reality that enacts an approximation to a perfect market (Callon 1998a, 2007). This is instructive for a number of reasons: it tells us that "the market" should not be regarded as a state of nature; it suggests, like economic anthropology, that markets will take different forms in different places (Callon 1998b); and, most important for my story, it tells us that neoclassical economics is not real until it is *enacted into being* (MacKenzie, Muniesa, and Siu 2007). In short, we are in the realm of performativity. Economics in theory is all very well, but economics in practice is different. And theory is only translated into practice if it is enacted – in practice. We saw this in the Salk laboratory and for the Pasteurization of France. Now we see it for economics. To understand markets we need to trace how the webs of heterogeneous material and social practices produce them. It is *these* that are performative, that generate realities.

Something seismic is happening here. A vital metaphorical and explanatory shift is taking place. We are no longer dealing with *construction*, social or otherwise: there is no stable prime mover, social or individual, to construct anything, no builder, no puppeteer. Pasteur, we have seen, is an effect rather than a cause. Rather we are dealing with *enactment* or *performance*. In this heterogeneous world everything plays its part, relationally. The shift is easily misunderstood, but it is crucial. The metaphor of construction – and social construction – will no longer serve. Buyers, sellers, noticeboards, strawberries, spatial arrangements, economic theories, and rules of conduct – all of these assemble and together enact a set of practices that make a more or less precarious reality.

Multiplicity

The move to performativity has strange consequences. Here is another case study.

Annemarie Mol's book, *The Body Multiple*, describes diagnostic and treatment practices for lower limb atherosclerosis. The condition turns up in different forms in different places: in the surgery it presents as pain on walking; in radiography as appears as an X-ray photo of narrowed or blocked blood vessels; in the ultrasound

department it takes the form of Doppler readings which detect increases in blood speeds at narrowed sections of vessels; and in the operating theater it manifests itself as a white paste scraped out of blood vessels by the surgeon (Mol 2002). It is tempting to say that these are different perspectives on a single disease. This, however, is precisely what Mol rejects. In material-semiotic mode, she argues that each practice generates its *own* material reality. This means that for atherosclerosis there are four actor networks or realities rather than one. Then she says that how these relate together, if they do so at all, is itself a practical matter. Sometimes, and for a time, they may be coordinated into a single reality, but often this does not happen. So Mol's claim is simple but counterintuitive. In theory the body may be *single* but in practice it is *multiple* because there are many body practices and therefore many bodies.

We have seen how the studies of actor network theory 1990 describe the more or less precarious generation of realities. Mol has pushed this logic one step further by washing away a single crucial assumption: that successful translation generates a single coordinated network and a single coherent reality. Any such coherence, if it happens at all, is a momentary achievement. The logic is Serres-like: most of the time and for most purposes practices produce chronic multiplicity. They *may* dovetail together, but equally they may be held apart, contradict, or include one another in complex ways.

How do different realities relate together? How might we think of these partial connections (Strathern 1991)? And then, a new question, how might this patchwork of realities be enacted in better ways? These are the questions that arise if we combine the insistence that realities are enacted with the discovery that they are enacted differently in different places. First the issue of how realities relate.

Fluidity

The answer is: in complex ways. We have encountered this question already in Law's account of the laboratory managers. Is the laboratory organized in a single way? No, says Law: there are multiple modes of ordering, multiple realities, and it works precisely because these are irreducible to one another (see also Law 2002). The idea there are different logics is basic, too, to Latour who has written of different regimes of enunciation including religion (Latour 1999), science, and the law. It takes feminist form in the work of Vicky Singleton on ambivalence in public health programs (Singleton 1998; Singleton and Michael 1993). So this is one way of thinking about it. Realities hold solid by relating though discontinuity, or by Othering one another (Law and Singleton 2005). But perhaps they also hold together because they flow into one another. Madeleine Akrich hints at this in her work on technology transfer: rigid technologies don't translate successfully from the North to the South (Akrich 1992). Another case study builds on her work by exploring a fluid technology.

In the villages of Zimbabwe pure water is a problem. But one kind of effective pump is widely distributed and used in rural areas. Quite simple, it is manufactured in Harare and sold in kit form to village collectives. Before they install it villagers need to drill a borehole with a surrounding concrete apron. Then they attach the base of the pump to the apron and lower the most important working part of the

pump, its piston, levers, and plunger, down the borehole on the end of a long rod. Then a handle is attached to the head, and the pump is ready for use (de Laet and Mol 2000).

The pump is a success. It is widespread, and the water that it pumps is cleaner than water from alternative sources. But it is also successful for two further reasons. First, it is very simple. Years of experience have gone into paring it down to a minimum. Second, and more important for my story, it is malleable. When the seals in the pistons fail the leather may be replaced bits of rubber tire. If the rods going down the well are too heavy, they can be replaced with lighter alternatives. If the bolts come loose it is surprisingly tolerant: often it just keeps on working. Mechanically it is malleable. And its success as a source of clean water is malleable too. Sometimes this is measured in bacteria counts, but more often than not the indicator is disease – or relative lack of it.

This is a *fluid technology*. It doesn't work by insisting on rigidity and translating every village into a design created in Harare. Neither does it work by forcing villagers to visit Harare for spare parts. Instead it changes shape – it is a *mutable* mobile rather than the kind of immutable mobile described by Law when he talked of the Portuguese ships. So as we read the study, first we learn something about objects: these may reconfigure themselves. Second, we learn that different realities may be loosely rather than rigidly associated. And third, we learn that material semiotics does not have to imagine a single actor network: that we have moved on from the core preoccupations of actor network 1990. Webs may be partially associated in endless different ways but the need for a center has gone.

Realities and goods

What happens when different enacted realities overlap? Charis Cussins takes us to the Amboseli National Park in Kenya. This is the question: how should the elephants be handled, and how should people relate to them? One of the issues is overgrazing. There are too many elephants in the park. They need to be culled, or they need to be tolerated beyond the boundaries of the park. But beyond those boundaries they damage Maasai agriculture. What to do about this (Thompson 2002)?

There is controversy. On the one hand there are animal behaviorists. They've been studying elephants for a long time and think that these have rights that should be protected. They point to the international scientific journals where they publish their findings, and argue that that the Amboseli elephants are a unique scientific resource for animal behavior studies. They think that culling is appropriate for management purposes, and they also think that while local people should be compensated for damage they shouldn't be allowed to kill elephants in revenge. Indeed, they are generally distrustful of the local people, who they think will act in ways that undermine conservation. For the same reason they are distrustful of economic development: other than safari tourism, conservation and development coexist badly. In practice they want to keep most of the elephants in the park most of the time, but they also want to rent buffer zones to allow some degree of migration.

On the other hand there are conservation biologists. They think that elephants play a key role in conservation: at the right density, neither too high nor too low, they foster biodiversity. They are less interested in knowledge published in interna-

tional journals than in local ways of witnessing and authenticating links between elephant density and biodiversity. So, for instance, they drive visitors – scientists, tourists, wildlife managers, and locals – from site to site so that they can see the differences in tree density. Then they think that both elephants and local people are stakeholders. Both are actively involved in conservation in practice, and both *need* to be involved and indeed to coexist if long-term conservation is to be achieved. This will involve development and the creation of profitable forms of land use including tourism, some sustainable hunting, and the migration of elephants beyond the park.

This is material semiotics at work. Two realities are counterposed, and those realities are heterogeneous, combining and enacting the natural, the social, and the political. But Thompson breaks “the social” and “the natural” down further. There are *legal* issues to do with rights and responsibilities. There are *land use* questions. There are *economic* concerns about development. There are scientific or *epistemic* tensions about the nature of proper knowledge. And then, finally and most important for my story, there are normative or *moral* issues. How should elephants and the Maasai be treated? What *kinds* of beings are they?

We’ve seen that material semiotics explores the enactment of realities, the *ontological*. We’ve also seen that it describes the making of knowledge, the *epistemological*. With Thompson’s study this philosophical list grows again, for she shows that practices are also about the doing of *goods*. Goods (or bads), knowledges, and realities, all are being enacted together: this is one of the ways the material-semiotic sensibility leads us into the diaspora.

An ontological politics

There is nowhere to hide beyond the performativity of the webs. But since our own stories weave further webs, it is never the case that they simply describe. They too enact realities and versions of the better and the worse, the right and the wrong, the appealing and the unappealing. There is no innocence. The good is being done as well as the epistemological and the ontological.

Actor network 1990 knew this in theory (Latour 1988a) though it sometimes forgot it in practice. It was forcibly reminded of its non-innocence by Donna Haraway in her own much more explicitly political material semiotics (Haraway 1991a, 1991b). We make realities, she said. They only question is: what kind of difference do we want to make? Material-semiotic writers have responded to this question in different ways. Haraway uses tropes – most famously the cyborg – that interfere with and undermine politically and ethically obnoxious realities. Latour talks of “ontopolitics” (Hinchliffe et al. 2005; Stengers 1997) and of a “parliament of things” where what is real, and how these things might live together, are provisionally determined (Latour 1993, 2004a). Mol talks of “ontological politics” in the specific context of healthcare (Mol 1999). STS feminist writer Moser defends practice-based versions of dementia (Moser 2007). Postcolonial STS writer Helen Verran talks of the ontic softening that would help encounters between the realities of Western technoscience and indigenous knowledge systems (Verran 1998, 2001). And Law, resisting the idea that the different versions of the real can be brought together at a single site of representation, offers methodological tools for partial connection (Law 2004).

There are important differences in the scope and the character of these political visions, but most are specific. Such is what one would expect in the performative, multiple, and partially connected world of material semiotics: there are no general solutions. Latour's non-modern constitution is perhaps an exception, but Haraway's tropic bending leads us to specific Politics with a capital P, both with the cyborg and her subsequent writing on companion species (Haraway 2003). Mol's ontological politics is healthcare located. Walking therapy is cheaper than surgery and often more effective in treating lower limb atherosclerosis. (More recently she has defended "care" against individualist models for practicing diabetes control; Mol 2008). Moser's interventions in dementia are also specific, as are Verran's postcolonial visions which have to do with counting in Yoruba classrooms, and land use and ownership in Australia.

But if the differences between these visions are important, so too are the similarities. This new material semiotics insists that the stories of social theory are performative, not innocent. It also assumes that reality is not destiny. With great difficulty what is real may be remade. And it is with this thought, the possibility and the difficulty of living and doing the real, that I end. The relational semiotic diaspora insists that the good and the bad are embedded in the real, and the real in the good and the bad. To describe the real is always an ethically charged act. But, and this is the crucial point, the two are only partially connected: goods and reals cannot be reduced to each other. An act of political will can never, by itself, overturn the endless and partially connected webs that enact the real. Deconstruction is not enough. Indeed, it is trivial (Latour 2004b). The conclusion is inescapable: as we write we have a simultaneous responsibility both to the real and to the good. Such is the challenge faced by this diasporic material semiotics. To create and recreate ways of working in and on the real while simultaneously working well in and on the good.

Acknowledgment

I am grateful to Annemarie Mol, Ingunn Moser, and Vicky Singleton for sustained intellectual support.

Bibliography

- Akrich, M. (1992) "The De-Description of Technical Objects," in W. E. Bijker and J. Law (eds.), *Shaping Technology, Building Society: Studies in Sociotechnical Change*. Cambridge, MA: MIT Press.
- Bloor, D. (1976) *Knowledge and Social Imagery*. London: Routledge & Kegan Paul.
- Callon, M. (1980) "Struggles and Negotiations to Define What Is Problematic and What Is Not: The Sociology of Translation," in K. D. Knorr, R. Krohn, and R. D. Whitley (eds.), *The Social Process of Scientific Investigation: Sociology of the Sciences Yearbook*, 4. Dordrecht and Boston: Reidel.
- Callon, M. (1986) "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of Saint Brieuc Bay," in J. Law (ed.), *Power, Action and Belief: A New Sociology of Knowledge?* Sociological Review Monograph 32. London: Routledge & Kegan Paul.

- Callon, M. (1998a) "Introduction: the Embeddedness of Economic Markets in Economics," in M. Callon (ed.), *The Laws of the Markets*. Oxford: Blackwell; Keele: The Sociological Review.
- Callon, M. (ed.) (1998b) *The Laws of the Markets*. Oxford: Blackwell; Keele: The Sociological Review.
- Callon, M. (2007) "What Does It Mean to Say that Economics Is Performative?," in D. MacKenzie, F. Muniesa, and L. Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press.
- Callon, M., and Latour, B. (1981) "Unscrewing the Big Leviathan: How Actors Macrostructure Reality and How Sociologists Help Them To Do So," in K. D. Knorr-Cetina and A. V. Cicourel (eds.), *Advances in Social Theory and Methodology: Toward an Integration of Micro- and Macro-Sociologies*. Boston: Routledge & Kegan Paul.
- Callon, M., and Latour, B. (1992) "Don't Throw the Baby Out with the Bath School! A Reply to Collins and Yearley," in A. Pickering (ed.), *Science as Practice and Culture*. Chicago: Chicago University Press.
- Collins, H. M., and Yearley, S. (1992) "Epistemological Chicken," in A. Pickering (ed.), *Science as Practice and Culture*. Chicago: Chicago University Press.
- de Laet, M., and Mol, A. (2000) "The Zimbabwe Bush Pump: Mechanics of a Fluid Technology." *Social Studies of Science* 30(2): 225–63.
- Deleuze, G., and Guattari, F. (1988) *A Thousand Plateaus: Capitalism and Schizophrenia*. London: Athlone.
- Foucault, M. (1979) *Discipline and Punish: The Birth of the Prison*. Harmondsworth: Penguin.
- Garcia, M.-F. (1986) "La Construction sociale d'un marché parfait: Le Marché au cadran de Fontaines en Sologne." *Actes de la Recherche en Sciences Sociales* 65: 2–13.
- Garcia-Parpet, M.-F. (2007) "The Social Construction of a Perfect Market: The Strawberry Auction at Fontaines-en-Sologne," in D. MacKenzie, F. Muniesa, and L. Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press.
- Gomart, E. (2002) "Methadone: Six Effects in Search of a Substance." *Social Studies of Science* 32: 93–135.
- Gomart, E., and Hennion, A. (1999) "A Sociology of Attachment: Music Amateurs and Drug Addicts," in J. Law and J. Hassard (eds.), *Actor Network Theory and After*. Oxford: Blackwell; Keele: The Sociological Review.
- Haraway, D. J. (1991a) "A Cyborg Manifesto: Science, Technology and Socialist Feminism in the Late Twentieth Century," in D. Haraway (ed.), *Simians, Cyborgs and Women: The Reinvention of Nature*. London: Free Association Books.
- Haraway, D. J. (1991b) "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," in D. Haraway (ed.), *Simians, Cyborgs and Women: the Reinvention of Nature*. London: Free Association Books.
- Haraway, D. J. (1997) *Modest_Witness@Second_Millennium.Female_Man@_Meets_Oncomouse™: Feminism and Technoscience*. New York and London: Routledge.
- Haraway, D. J. (2003) *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press.
- Hennion, A. (2001) "Music Lovers: Taste as Performance." *Theory, Culture and Society* 18: 1–22.
- Hinchliffe, S., et al. (2005) "Urban Wild Things: A Cosmopolitical Experiment." *Society and Space* 23(5): 643–58.

- Hughes, T. P. (1983) *Networks of Power: Electrification in Western Society, 1880–1930*. Baltimore: Johns Hopkins University Press.
- Kuhn, T. S. (1962) *The Structure of Scientific Revolutions*. Chicago: Chicago University Press.
- Latour, B. (1987) *Science in Action: How to Follow Scientists and Engineers through Society*. Milton Keynes: Open University Press.
- Latour, B. (1988a) *Irréductions*, published with *The Pasteurisation of France*. Cambridge, MA: Harvard University Press.
- Latour, B. (1988b) *The Pasteurization of France*. Cambridge, MA: Harvard University Press.
- Latour, B. (1988c) “The Politics of Explanation: An Alternative,” in S. Woolgar (ed.), *Knowledge and Reflexivity: New Frontiers in the Sociology of Knowledge*. London: Sage.
- Latour, B. (1990) “Drawing Things Together,” in M. Lynch and S. Woolgar (eds.), *Representation in Scientific Practice*. Cambridge, MA: MIT Press.
- Latour, B. (1993) *We Have Never Been Modern*. Brighton: Harvester Wheatsheaf.
- Latour, B. (1996) *Aramis, or the Love of Technology*. Cambridge, MA: MIT Press.
- Latour, B. (1999) “‘Thou Shalt Not Take the Lord’s Name in Vain’ – Being a Sort of Sermon on the Hesitations of Religious Speech.” *Res* 39: 215–34, also available at <www.bruno-latour.fr/articles/article/079.html>.
- Latour, B. (2004a) *Politics of Nature: How to Bring the Sciences into Democracy*, Cambridge, MA: Harvard University Press.
- Latour, B. (2004b) “Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern.” *Critical Inquiry* 30: 225–48; also available at <<http://www.ensmp.fr/~latour/articles/article/089.html>>.
- Latour, B. (2005) *Reassembling the Social: An Introduction to Actor network theory*. Oxford: Oxford University Press.
- Latour, B., and Woolgar, S. (1979) *Laboratory Life: The Social Construction of Scientific Facts*. Beverly Hills: Sage.
- Latour, B., and Woolgar, S. (1986) *Laboratory Life: The Construction of Scientific Facts*, 2nd edn. Princeton: Princeton University Press.
- Law, J. (1986) “On the Methods of Long Distance Control: Vessels, Navigation and the Portuguese Route to India,” in J. Law (ed.), *Power, Action and Belief: A New Sociology of Knowledge?* Sociological Review Monograph 32. London: Routledge & Kegan Paul.
- Law, J. (1994) *Organizing Modernity*. Oxford: Blackwell.
- Law, J. (2000) “Transitivities.” *Society and Space* 18: 133–48.
- Law, J. (2002) *Aircraft Stories: Decentering the Object in Technoscience*. Durham, NC: Duke University Press.
- Law, J. (2004) *After Method: Mess in Social Science Research*. London: Routledge.
- Law, J., and Mol, A. (2001) “Situating Technoscience: An Inquiry into Spatialities.” *Society and Space* 19: 609–21.
- Law, J., and Singleton, V. (2005) “Object Lessons.” *Organization* 12(3): 331–55.
- Lee, N., and Brown, S. D. (1994) “Otherness and the Actor Network: The Undiscovered Continent.” *American Behavioural Scientist* 36: 772–90.
- MacKenzie, D., Muniesa, F., and Siu, L. (eds.) (2007) *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press.
- Mol, A. (1999) “Ontological Politics: A Word and Some Questions,” in J. Law and J. Hassard (eds.), *Actor Network Theory and After*. Oxford: Blackwell; Keele: The Sociological Review.

- Mol, A. (2002) *The Body Multiple: Ontology in Medical Practice*. Durham, NC: Duke University Press.
- Mol, A. (2008) "The Logic of Care: Active Patients and the Limits of Choice." Under consideration.
- Mol, A., and Mesman, J. (1996) "Neonatal Food and the Politics of Theory: Some Questions of Method." *Social Studies of Science* 26: 419–44.
- Moser, I. (2007) "Making Alzheimer's Disease Matter: Enacting, Interfering and Doing Politics of Nature." *Geoforum*.
- Serres, M. (1974) *La Traduction: Hermes III*. Paris: Les Éditions de Minuit.
- Singleton, V. (1998) "Stabilizing Instabilities: The Role of the Laboratory in the United Kingdom Cervical Screening Programme," in M. Berg and A. Mol (eds.), *Differences in Medicine: Unravelling Practices, Techniques and Bodies*. Durham, NC: Duke University Press.
- Singleton, V., and Michael, M. (1993) "Actor-Networks and Ambivalence: General Practitioners in the UK Cervical Screening Programme." *Social Studies of Science* 23: 227–64.
- Star, S. L. (1991) "Power, Technologies and the Phenomenology of Conventions: On Being Allergic to Onions," in J. Law (ed.), *A Sociology of Monsters? Essays on Power, Technology and Domination*, Sociological Review Monograph 38, London: Routledge.
- Stengers, I. (1997) *Power and Invention: Situating Science*. Minneapolis: University of Minnesota Press.
- Strathern, M. (1991) *Partial Connections*. Savage, MD: Rowman & Littlefield.
- Thompson, C. (2002) "When Elephants Stand for Competing Models of Nature," in J. Law and Annemarie Mol (eds.), *Complexity in Science, Technology, and Medicine*. Durham, NC: Duke University Press.
- Verran, H. (1998) "Re-imagining Land Ownership in Australia." *Postcolonial Studies* 1(2): 237–54.
- Verran, H. (2001) *Science and an African Logic*. Chicago: Chicago University Press.
- Woolgar, S. (1991) "Configuring the User: The Case of Usability Trials," in J. Law (ed.), *A Sociology of Monsters? Essays on Power, Technology and Domination*, Sociological Review Monograph 38, London: Routledge.