Heterogeneities_{DOT}net

(logo text, rendered:) **Heterogeneities**_{DOT}**net**

Notes on Materiality and Sociality

John Law and Annemarie Mol

In this paper it is argued that materiality and sociality are produced together. In order to explore the implications of this suggestion, three metaphors are developed through a series of note-like stories. The first is that of semiotics. This suggests that materials are relational effects. The second is that of strategy. Here it is suggested that strategy is recursively and reflexively implicated in the performance of materiality. And the third is that of the patchwork. This is a way of exploring the possibility that though material and social relations might be matters of local performance, they may not 'add up' to form an overall pattern or structure.

Introduction

What is materiality? What is sociality?

Perhaps these are two different questions. Perhaps materiality is a matter of solid matter. And sociality has to do with interactive practices. Perhaps, then, sociology departs from matter. Perhaps it "departs" from it in two different senses: perhaps it both rests upon it; and it goes beyond it. To say this would be to hold on to materialism. And to idealism. Together. It would be to hold on to a traffic between the two. An interchange.

Perhaps. But perhaps not. Perhaps materiality and sociality produce themselves together. Perhaps association is not just a matter for social beings, but also one to do with materials. Perhaps, then, when we look at the social, we are also looking at the production of materiality. And when we look at materials, we are witnessing the production of the social. That, at any rate, is a possibility. The possibility that we here explore.

We're after brevity, so we write in note form. And in these notes we tell stories that are simultaneously about sociality and materiality. These are stories that have to do with the stability of social-material production. Or, as it turns out, its lack of stability. And we use our stories to explore three theory-metaphors for sociality-materiality.

The first is semiotic. Our semiotics suggests that sociology and materiology go together; and that materials are relational effects. It also suggests that social stability is linked to material distinction.

The second is that of strategy. Strategy, or so we suggest, is also a matter of material distinction: recursive and reflexive material distinction. Strategy then, both performs distinction and derives from it. But instead of helping us to understand social stability, strategy is about social change. About material inflation and the social shifts with which it is linked.

The third theory-metaphor is that of the patchwork. It depends on a sensitivity to difference, here and now. Or rather, it depends on a sensitivity to the possibility that social and material relations don't add up. Or hang together as a whole. Semioticially, or strategically. Which means that they are like a patchwork. That all entities are local. And that what we thought were stabilities are - unstable. What we thought had direction - shakes and quivers.

Metaphor number one: materiality and semiotics

Material Heterogeneity

Story 1: Primatologists tell stories about baboon society. Some emphasise the power of clever old females.[1] But Michel Callon and Bruno Latour[2] are interested in the character of baboon patriarchy. Its somatic character. In their story there is hierarchy in baboon society. At the top there is a large male baboon in his physical and sexual prime. But it's pretty tough-going at the top, because nothing stays in place for very long. Sure, the head baboon can intimidate the smaller male baboons in face-to-face interaction. And he may convince the females that they should mate with him. But the moment his back is turned his dominance is under threat. For he has few extrasomatic

resources with which to secure his position. There are no prison walls, bayonets, files, or secret policemen. Grass and sticks and rocks perhaps. But in general he has, as the jargon puts it, few resources for time-space distanciation. All that he has is his intimidating physical presence. And what happens to be around, there and then.

Are baboons capable of paranoia? We have no idea. All we can be sure of is that in this account the head baboon sustains the pyramid by means of personal interaction. But (this is the point of the story) people aren't like baboons. They deal in both social <u>and</u> technical relations; they produce (and simultaneously shape) scientific knowledge, economies, industrial structures, and technologies. They are, as the jargon puts it, heterogeneous engineers[3], or engineer-sociologists[4].

Story 2: Michel Callon[5] tells how the French power utility, Électricité de France, decided to create and sell an electric vehicle. It's a story about heterogeneous engineering on a grand scale, to do with ordering, and indeed creating, all sorts of different bits and pieces. For they couldn't create an electric vehicle without a society fit for this to live in. And this was complicated. Électricité de France needed to: shepherd electrons into novel kinds of accumulators and fuel cells; organise the efforts of scientists into laboratories; break up rival companies and reorganise them to produce vehicle bodies instead of petrol engines; coerce local authorities into a post-industrial world favourable to electrically powered public transport; and retrain consumers to think of vehicles as a practical way of moving from A to B rather than a mode of conspicuous consumption.

Relational Materiality

The first two stories together suggest that <u>the social isn't purely social</u>; and that if it were then it wouldn't hang together for very long[6]. It suggests that stability resides in material heterogeneity. But notice something else. In these stories the bits and pieces achieve significance <u>in relation to others</u>: the electric vehicle <u>is</u> a

set of relations between electrons, accumulators, fuel cells, laboratories, industrial companies, municipalities, and consumers; <u>it is nothing more</u>. Sometimes it's useful to talk about "the electric vehicle" without deconstructing all the other nodes-that-are-really-networks. But in principle this could be done, for the latter are also sets of more or less precarious relational effects: city councils, industrial companies, consumers, electrons, electrodes, laboratories - none can be said to exist in and of themselves. All are interactive products.

So the metaphor behind Callon's story is semiotic: the bits and pieces don't exist in and of themselves. They are constituted in the networks of which they form a part. Objects, entities, actors, processes - all are semiotic effects: network nodes are sets of relations; or they are sets of relations between relations. Press the logic one step further: <u>materials</u> are interactively constituted; outside their interactions they have no existence, no reality. Machines, people, social institutions, the natural world, the divine - all are effects or products. Which is why we speak of <u>relational materialism</u>.[7]

Story 3: Bruno Latour[8] describes how Louis Pasteur created a network of bits and pieces in the process of developing, testing, and securing acceptance of the immunisation of cattle against anthrax. Bacteria, cultures, microscopes, laboratories, laboratory assistants, farms and farmers, cows, diseases, vaccines - all of these and many more were assembled together[9]. So the story is one of scientific enterprise. But it also tells about Pasteur "himself". So who, or what, was he? Well, this is complicated. There are many answers. He was a physical body, an organism, a French citizen, a science-politician, a laboratory-scientist, a family member, a failed politician. It depends upon where and how one looks. This, then, is the point: Pasteur "the successful scientist" is an ordered network[10], a relational effect. And also, under other circumstances, a <u>point</u> in a network.

The conclusion: human actors are no different. This semiotic relational materialism is non-humanist: like inanimate objects, human actors are not primitive components or atoms. Humans may, but need not be, actors; and actors may, but need not be, humans[11].

Monism

If there are no fundamental distinctions in principle between different classes of entities then everything is or might be, the same in kind. Everything is, or might be, assembled in a network. And everything is, or might be, dissolved. So we've learned - or reminded ourselves - that semiotics is monist. But we've also reminded ourselves that it's all about the formation of <u>material distinction</u>. Distinction which may achieve qualitative significance. But this is a contingent matter. For there is no order of things made for once and all. Which means that semiotics adds fuel to the bonfire of the dualisms. Divisions between the natural and the social, mind and body, truth and knowledge, science and politics, structure and agency, or male and female - all can be deconstructed[12].

Here's an example. Some say that humans are distinct from machines because they can talk. But in semiotic terms this makes no <u>general</u> sense, because it is to take a single possible distinction between people and machines, and insist upon it as the measure of last resort. Why should we do this?

Story 4: Sherry Turkle tells about children talking about computers. And about whether these are alive:

"Elvira, four, says that [the computer] Speak and Spell is alive "because it has a talking voice in it." Ingrid at five: "It's alive - it talks." Randall, an eight-year-old, says with an air of confidence and authority, "Things that talk are alive." Kelley, six, gives an answer with a different twist. She looks closely at the seven-by-ten-inch Speak and Spell and pronounces, "It's alive - there's a man inside who can talk." But eight-year-old Adam ... [says] "Okay, so it talks, but it's not really thinking of what it's saying. It's not alive.""[13]The "experts" have similar arguments about artificial intelligence.

Sherry Turkle's stories suggest that the dividing line between people and machines is negotiable. And that sometimes it is difficult to draw a line at all. So that what we see is heterogeneous. Think of that heterogeneity. People have dental fillings, spectacles, drugs, heart pacemakers, condoms, alarm clocks,

dresses, telephones, shopping bags, money, books, identity cards, bus passes and ball-point pens. And machines have drivers, pilots, users, service-people, designers, victims, onlookers, lookouts, cleaners, bricoleurs, adapters, admirers and abusers.

Gradients of Durability

So baboons live without most of the objects that stabilise human relations. While humans cannot be clearly distinguished from the materialities they live with. In the last instance there are no stable ontological differences between entities. This is what the semiotic metaphor suggests. But in the first instance, and indeed in the second and the third, there <u>are</u> differences. Question: what should we make of these?

Story 5: A few miles outside Utrecht the fields are filled with large blocks of concrete and heavily armoured bunkers. These are part of a line of defence built by slaves for the Nazis during World War Two. The object was to preserve the Thousand Year Reich. Happily, though the concrete blocks remain, they didn't work. Like the elaborate nineteenth century system of flooding the polders which failed to saved Netherlands from the Nazis in 1940, the blocks didn't stop the Allied advance in 1945.

So some differences in durability maintain themselves, for longer than others. The concrete bunkers still stand there, in the Dutch fields. Nearly fifty years of cold wet European winters have not undone all the work of those who built them. This is why concrete is so beloved of generals, architects, and road-builders. It often keeps on going. Is often durable.

Does this fit with a semiotics of materiality? If we thought of concrete as a "thing in itself" we'd have to say no. But suppose we imagine that concrete is <u>not</u> a thing in itself. Suppose we say, instead, that it is a set of relations: relations (for instance) with the weather; the molecular forces that make it up; and the reinforcing rods that run through it. Then we can guess that it will take 1,000 years for the Dutch weather to dissolve the Nazi bunkers, to break the chemical bonds, to rust the reinforcements. (Though, of course, under different circumstances, the forces released in an atomic explosion might do the job in a

microsecond). So a material semiotics asks how things measure up to one another to generate relative durabilities. It doesn't deny durabilities themselves.

Story 5 (cont): The object-networks which were supposed to obstruct allied tanks did not stand in their way. The soldiers are gone, and when the rain drives across the flat Dutch landscape the concrete blocks shelte r cows. So the concrete is still there. But it isn't an element in a Nazi network any more. That network was less durable than some of its concrete elements.

Metaphor number two: materiality and strategy

Strategy and Durability

Perhaps it's best to think of semiotics as a way of clearing the ground. Perhaps it's a way of helping us to imagine that sociality and materiality go together. That they form themselves together. That socials and materials come together, as a package. And that stability or durability have something to do with material heterogeneity. But where do we go next?

Story 6: Let's talk about the bridges over the Long Island Parkway. For these are very low. But why? Langdon Winner tells it so:

"Robert Moses ... built his overpasses according to specifications that would discourage the presence of buses on his parkways. ... the reasons reflect Moses' social class bias and racial prejudice. Automobile-owning whites ... would be free to use the parkways for recreation and commuting. Poor people and blacks, who normally used public transit, were kept off the roads because the twelve-foot tall buses could not handle the overpasses."[14] And they were, accordingly, kept away from the public park at Jones' Beach.

Like the Nazi bunkers, Robert Moses' bridges over the Long Island Parkway are still there. They suggest, as Winner puts it, that "artifacts have politics". They witness how artifacts may be

strategically designed to have politics. Bridges may be built to maintain the distribution between rich and poor or white and black. They embody "social relations" in materials more durable than those of face-to-face interaction. This, then, is a hurtful move away from baboon-land.

Story 6 (cont): But it isn't so simple. Nowadays many blacks in the United States have cars, and those who do can cruise the Long Island Parkway. So we are reminded again that durability is a relational effect. Though the bridges haven't gone (despite their continuing combat with the New York winters) most of the buses have: the bridges have lost some of their strategic significance.

But there's another point here. How did the bridges come into being in the first place? Answer: they were designed. Robert Moses drew them, on paper. So this is the point: strategy resides in differences in material durability, manipulability, and scale. Indeed, strategy is inconceivable without re-presentation; without relations in which one material signifies another.

Let's look at this more closely:

Story 7: In the design office of Bristol Engines in the middle 1950s they sat down and started to design a new jet engine. A few designers scratched their heads, and played with equations about pressure, temperature, and combustion efficiency. They used pencils and sheets of paper. The object was to invent a schematic plan of an engine with an efficient combustion cycle. Let's say that this was a conceptual engine. Certainly it was simple: a few symbols and line drawings.

The designer's cross-section was passed the drawing office. Here the question was: could it be converted into a set of engineering drawings? Could the conceptual engine be translated into a drawn engine? Could it be persuaded to hang together physically and mechanically? Were the right materials available? To answer these questions, a large number of draftspeople, engineers and materials scientists produced a "real" design, a drawn engine, a huge number of

drawings and instructions to machinists about how to cut metal. This was complex: that is, it was complex by comparison with the conceptual engine. Though not when compared with the "real engine" to be installed in an aircraft.

Then the drawn engine went to the workshop to be converted into a <u>wooden engine</u>, and then a <u>metal engine</u>. Why a wooden engine? Answer: sometimes paper engines don't work in three dimensions; things don't fit. But at the same time specialist machinists tried (though not always with success for sometimes the demands were impossible) to translate their instructions into metal: to create a <u>metal engine</u>.

This story is all about strategy and materiality: again it suggests that strategy resides in material distinction. For without these it is inconceivable. Literally. Let's emphasise this. It is not possible to conceive of what might be unless it can be re-presented. Imagined. Or (this is the point of strategy, what makes it possible) to represent and imagine it in materials that are relatively simple, relatively malleable, and relatively tractable. So strategy is also the (attempted) performance of material distinction. Of certain kinds of material relations. Of relations in which one set of materials comes to stand for others. In sum: <u>strategy both organises and produces material distinction</u>.

Story 7 (cont): Which is why the engineers <u>drew</u> engines. And worked with mathematical symbols. The latter were more tractable: more easily changed. And yet they stood - or were supposed to stand - for the "real thing"[15]. For if this were not the case, then perhaps we could all build aeroengines in our back yards at weekends.

So strategy is the performance of teleology embedded in variations of scale, manipulability, and durability. <u>It depends on and enacts material diversity</u>. It is a way of defining re-presentation: the links between related materials with differing degrees of tractability. And it is a form of linking, a set of relations, that is full of hazards. For the malleable representative may turn out to be a poor representative. Is the representative legitimate? That is the question.

Story 7 (cont): The metal engine was tested, and it failed. It was tested again, and it failed again. And again. And again. Only after many failures did it begin to behave like the conceptual engine, and the drawn engine[16].

New Material Forms

So strategy <u>implies</u> materiality. It's a metaphor for thinking about the organisation of materiality. For imagining relatively stable distinctions between materials. Though - a caution here - it doesn't depend on the idea that there's a human strategist lurking behind every material object. For strategies, stategic loci, and indeed "intentions" are like the layers in a silicon chip. They're recursive effects produced in a place where materials differing in durability and manipulability join together. They're an effect generated by workable translation or exchange between the more and the less durable[17]. They aren't people.

We don't want to invent cybernetic myths about the origins of strategy. But perhaps we can say something about it once it's under way. For the possibility of simulating the more durable in materials that are less durable, or at any rate more manipulable, entails the possibility of <u>representative advantage</u>. If (but only if) the logic is one of strategic competition, there may be pressure to create new kinds of materials, materials that are more manipulable, materials which represent more and more in less and less. So strategic performance may lead to <u>new material forms</u>; indeed, perhaps to material escalation and inflation. And so to a certain kind of material instability.

This is the reasoning: what is manipulable one day (like the scroll and the quill pen) is less so the next with the invention of the book and the fountain pen. That is, it becomes <u>relatively</u> less manipulable: it may be easier to write with a fountain pen than its quill equivalent. But the process goes on. For the pen is followed by the typewriter and carbon paper. And these are followed by the word processor, its floppy discs, and the database with its electronic networks. If the logic is one of competition and control there is pressure towards material inflation, material instability. Which is, roughly speaking, one way of talking of the history of the West since the early-modern period - and also explains the (overblown) promises made about every "information revolution".

Story 8 This was the logic of organisation of the aeroengine office: the generation of representative ephemera. Algebra is relatively quick and easy: mistakes or algebraic non-starters don't really matter if they are quickly discovered. But the discovery that drawings do not adequately "represent reality" is much more costly. For by this stage there is an army of people, all drawing. And a whole lot of specialist equipment. And time. And money. Even so it's better to uncover problems in the drawing office than on the test rigs. And much, much, better to discover them on test rigs than once the engine inside an aircraft.

Nowadays things are different: designs are simulated, both conceptually and spatially, with computer-aided design. In theory, at any rate, the translation between the computer screen and the finished product is more secure. So this is material inflation - the creation of new, strategically relevant, material forms.

Multiple Strategies, Multiple Materialities

Story 9: The electrodes in the batteries they made for the electric vehicle misbehaved. When they got polluted they didn't make electricity. Renault was supposed to make bodies for electric vehicles, but it didn't fancy this. Instead it mounted a campaign for conventional cars and against the electric vehicle. French consumers didn't fancy their new role either, as "mature" and "ecologically responsible" members of a post industrial society. Instead they went on seeking social distinction by buying convential cars. And the local authorities refused to favour public transport and restrict private petrol-driven cars. The result: the electric vehicle came unstuck. It never came into being.

Here the problem of legitimate representation wasn't resolved. The imagined world, the simulated world, of Électricité de France wasn't successfully translated into other material forms: the junction of translation broke down. But this is a chronic problem, not one specific to Électricité de France. For the translation between materials that represent and those that are repre-

sented is always uncertain. It may turn out that what is manipulable is actually tellling stories only of itself. So material distinctions performed in strategy are always insecure. Stability may be achieved, but it may not. For there are no dualisms or ultimate divisions. The stable and the transient are never separated for ever after. And any <u>particular</u> strategy is also insecure.

But this has an important consequence. It means that the "best" strategy is usually impure. It's <u>a mix of different strategies</u>. Not one alone.[18]

Story 10: We're in a large laboratory and we're listening to its managers. They're talking the Librarian's request for money to sort the archives out:

<u>Andrew</u>: "What archives? I didn't know that we had any. Where are they?

<u>Tim</u>: "In the basement ... It is full of them, box after box, that people have put down there when they ran out of space in their offices."

<u>Andrew</u>: "What's the problem with just chucking them out?"

<u>Tim</u>: "The law says that we can't destroy them. We have to keep our organizational records."

<u>Andrew</u>: "I didn't know anything about this! When I finished my last job I just threw out six filing cabinets of papers. You've no idea what a relief it was - like a great weight off my shoulders!

<u>John</u>: "If you want my opinion, we should just put a match to them!"

<u>Terry</u>: "But it's worrying if we're supposed to be keeping them."

<u>Andrew</u>: "Listen, this is quite a lot of money they are asking for.... What's to stop us drawing a line in history at 1990 and deciding on what we should be doing from now on, and doing that? Meanwhile we'll say "no" to their [request for money] for sorting out the archives that are already there. Okay?"[19]

There's a humanist reading of this story. It says that these people, the managers, are "deciding" what to do next. But that's not the way we want to read it. For instead of talking about men with strategies we want to say that this talk is a product of strategic material distinction. Indeed, of multiply-ordered material distinction. For we want to suggest that there are at least three distinct strategic logics here. The first makes us think of Weber. Let's call this administration. At any rate, it has to do with legality, rationality and due process. It's voiced by Tim who talks of the legal requirement to keep records. The second is iconoclastic. There isn't much to go on here - only John's single comment. But other data makes us think that this iconoclasm is an expression of scientific charisma and grace, a semiotics of vision. So it's Weber again, this time in romantic mode. And the third logic? Running through Andrew's talk there's a line of pragmatism and opportunism, so perhaps it's a strategic semiotics of enterprise. In which case Andrew's closing judgement is one which artfully juxtaposes administration and enterprise. He tells that while the rules of administration will be obeyed in the future, it's too expensive to sort out past archives - and never mind the law.[20]

The argument is that there is narrative and strategic heterogeneity. Which means that there is also material heterogeneity, for each strategic logic performs material relations in its own distinctive way. For instannce, papers move from irrelevance (in vision) via a necessary nuisance (in enterprise) to legal records (in administration).

So the co-existence of multiple strategic semiotics implies the co-existence of multiple forms of materiality. Which means that the world is a kind of kaleidoscope in which materiality is continually being organised and reorganised. Perhaps at times these materialities compete. But this isn't necessarily the case, for a mix of strategies may be stronger than one alone[21]. Agents, papers, machines - all are being redrawn. Kaleidescopically. Multi-strategically:

Story 11: A scientist working in the same laboratory says: "... you've got to understand what you are doing. Otherwise [the instrument] is just a black box where you put in this sample and get data out. All the commands in [this computer program] are quite simple, and will allow you to process the data. But

you have to have some knowledge about x-ray diffraction.
So the philosophy is that you should have some idea about
x-ray diffraction and what you can <u>do</u> with it."

This talk describes a further strategy. And another kind of material distinction. Perhaps it's a matter of <u>vocation</u>. At any rate humans are told and performed as responsible and thoughtful puzzle-solvers, and machines are turned into tools or aids that have to be guided. Which can be contrasted with, for instance, administration, in which responsibility is taken away from humans and given to machines:

Story 12: "[In order to ensure radiation safety] we need a new
hardware arrangement which removes the need for
written protocols. Protocols can [work] but your advice is
that [we shouldn't use them] for a long time. Sooner or
later people slip up on procedures. So in a reasonable time
the hardware should be modified."

Here the skilful people who "master" machines have disappeared. Suddenly people are untrustworthy. Hardware is needed to replace them. Which means that the boundary between humans and machines isn't settled but shifts, being drawn in one way here and another there. Which means that materialities (and actions and organisations[22] too) are multi-strategic and kaleidescopic. It means that they're decentred.

Metaphor number three: patchwork

Materiality is decentred: so suggest our stories about strategies. Better, <u>materialities</u> are decentered. There are multiple materialities performing themselves in manifold ways. So another question follows. Do these different materialities fit together? How do they relate?

It seems that sometimes materialities <u>do</u> fit together. For instance, they may fit together within strategies. For strategy is a narrative method for pulling material differences together into a single kind of story. But what happens if materialities are local arrangements? Local and decentred? What can we tell of these

if it turns out to be difficult to gather them together? What happens if there isn't a single field to unravel? What happens if there are no interrelated strategies? The answer, or so we want to suggest, leads us to the logic - the multiple logic - of the patchwork, in which we move from one place to another, looking for local connections, without the expectation of pattern "as a whole".

Story 13: He's a surgeon. He's in his consulting room. A patient comes in. They talk for a few minutes. Then the patient takes his trousers off and lies down on the examination table. The surgeon puts some gel on the patient's ankle. And then picks up the probe of an instrument and rests it on the patient's skin, just above a blood vessel. "Pshew, pshew", the apparatus says. The surgeon listens to the pitch of this sound. Why the pitch? What does it signify? Here's the answer: it tells something about the velocity of the bloodstream. The higher the pitch the faster the blood flow. And the faster the blood flow the greater the obstruction in the arteries of the leg. The greater the extent of arteriosclerosis.

Story 14: She's a midwife. She's in her consulting room. A pregnant woman comes in. They talk for a few minutes. Then she takes of her sweater and lies on the examination table. The midwife puts some gel on the pregnant belly. And then she puts a probe on the tight skin, just above the place where the foetus is likely to be. "Pshew, pshew," the apparatus says. The midwife listens. She listens to the frequency of the sound. So why does she do this? Why the frequency? The answer is that it says something about the heartbeat of the unborn child. If the sound is fast and regular then the baby is doing okay. If not, there may be a problem.

Story 15: He's a technician. He's working on an apparatus. He replaces a component. And then places the probe belonging to the apparatus on his wrist and listens. He frowns. There's nothing to be heard. He fiddles with the apparatus some more. Puts the probe back on his wrist and listens again. Suddenly

there is a sound. "Pshew, pshew" it goes. He smiles. Why does he smile? The answer is that the sound says something about the apparatus. It tells him that the probe is emitting ultrasound again, and picking up its reflections. It tells him that the apparatus is working.

Three stories. But how are they related? How are their materialities related? What kind of stories could we tell about those relations? About the link between them?

Option one. We could say: each of these stories is about the same machine; each is about an apparatus called "Doppler"; and about what happens to "Doppler" in different contexts. The apparatus is a piece of ultrasound technology. And the contexts are to be found in various parts of health care. There's nothing to stop us telling a story in this way. It's the kind of story they often tell in the sociology of technology. But there's a problem: it is that it assumes a lot about materiality; and in particular, it assumes that there is <u>material continuity</u>. Which means that it stops us asking questions about materiality. The social <u>departs</u> from pre-existing matter. Or it shapes it. That is: the objects may be manipulated, but their identities are relatively stable. In this case: the object manipulated is "the" Doppler apparatus.

Option two would be to say that the links between our stories are of no importance, and instead to stress their <u>differences</u>. It would be to say: each of these stories is about a different strategy. That is, it's about another way in which materiality is distributed, in a specific place, according to a specific logic. This would lead us to say that different "Dopplers" are being performed. Thus in the first story "Doppler" is instrumental in diagnosing clogged vessels, in the second it helps to assess the health of an unborn child, while in the third it itself has been turned into the object of diagnosis and assessment. But it's not just that different Dopplers do diffeent things. The elements that make them up differ too - as for instance in the case of the Doppler sound. First it is "the stenosis"; second, it represents "the heartbeat"; and third, it stands for "the soundness of the apparatus". This is a nice kind of story, for it dissolves the idea that there is a stable object, Doppler, that stays the same from one place to another. An object in which durability resides. An object with which the social can interact.

But there's a third option. This is to go neither for overall links, nor to move to closed off, isolated and fragmented worlds. Instead, it is to ask about the possibility that there are <u>partial connections</u>. Partial and varied connections between sites, situations, and stories.[23] This, then, is the patchwork option. It's to imagine that materials and social - and stories too - are like bits of cloth that have been sewn together. It's to imagine that there are many ways of sewing. It's to imagine that there are many kinds of thread. It's to attend to the specifics of the sewing and the thread. It's to attend to the local links. And it's to remember that a heap of pieces of cloth can be turned into a whole variety of patchworks. By dint of local sewing. It's just a matter of making them.

Story 16. Like the midwife, the surgeon puts gel on the skin. On the place where he will put the Doppler probe. The technician doesn't bother, for he's not interested in detail.

Like the surgeon, the technician works in the hospital. Here the midwife is different. Her office is in an old house in town which she shares with several others.

Sometimes when a vascular patient hears the Doppler he asks the surgeon: "Is that my heartbeat, doctor?" "Yeah," replies the doctor. And if it's fast he may add: "Are you nervous?"

But the midwife tells the pregnant women that the heartbeat of her unborn baby is twice as fast as that of an adult. "Don't worry, this sounds fine, this is as it should be." (So both are talking about heartbearts and nerves. But different kinds of heartbeats and different sorts of nerves).

The technician only sees the apparatus because someone sent him a form to complain about it. And the surgical patients come to the surgeon's office with complaints, too. "Doctor, it hurts, my leg does, when I walk. I hardly get to walking any more these days." But it's different for the midwife. She uses her Doppler apparatus regularly in routine check-ups for pregnant women. There's no need for the woman or her baby to complain. It happens anyway.

No, this isn't <u>a story</u>: it's bits and pieces from a whole list of possible stories. We could go on and on. There are endless stories to tell. Endless stories about practices. About interactions. About designs. About coincidences. About sequences. About logics. About inclusions and exclusions. Endless stories about the kaleidescope of materialities. Some of those stories sometimes make it possible to say that these Dopplers are single entities being <u>used</u> in "different ways". And other stories make it possible to say that we're dealing here with "different entities"; they suggest that there is material <u>multiplicity</u>. And then there are stories of a third kind. Stories which explore the possibility that these Dopplers are different. And the same. And different. And the same. Depending on where and when and how you tell your story.[24] Gel is a link between the probes - though not in all cases. The hospital is a link between Dopplers - though not every time. Heartbeats form a partial connection between the sounds of Doppler - though they are different heartbeats. Doppler is a part of the problem-solving process - but this isn't always so, for sometimes it goes and looks for problems.

Go and look. Trace connections. Partial connections. Here. There. Somewhere else again. Relational materialism doesn't just reside in objects. <u>It's also a way of telling stories</u>.

Story 17: When a dominant male baboon looks away, his society collapses. But what of human society?

> Isn't the answer this? The moment a human turns his - or even her - head and looks away, the world may start to change. Sometimes, perhaps, there are networks. Sometimes, again, there are strategies. Sometimes those strategies brace themselves, one against another, and hold together. But sometimes what we find is partiality. Partial connections. Patchwork. Which means that materialities may shift. Socialities may move. And this may happen even if we concentrate and try to observe their multiple realities. For matter isn't as solid and durable as it sometimes appears. And if does hold together? Well this is an astonishing achievement.

Acknowledgements

Notes

[1] See Haraway (1990).

[2] See Callon and Latour (1981).

[3] See Law (1987: 113).

[4] See Callon (1987).

[5] See Callon (1980).

[6] See also Latour (1987a, 1987b) and Law (1991b).

[7] Note that semiotics, in its classical form, insists that the sign is arbitrary with respect to nature. This is not assumed here.

[8] See Latour (1983; 1984)

[9] "Science", says Latour, in a memorable parody of Clausewitz' famous phrase, "is politics pursued by other means." (Latour :1983:168)

[10] In practice any kind of Pasteur may be treated as a script, a relational effect, or the ordering of a network: his body; his "personal" life; his character as a political actor; and so on. For the notion of script developed in this semiotic manner, see Akrich (1992).

[11] Indeed, in some statements of the theory, the term "actant" is used in preference to "actor". See, for instance, Irréductions in Latour (1984).

[12] On the latter, in related mode, see Mol (1991).

[13] Turkle (1984:45). See also Woolgar (1991).

[14] See Winner (1986a); the quotation is drawn from page 23.

[15] For a development of the argument about the character of representation see Latour (1990).

[16] The story of the OL 320 engine is described in Law (1992).

[17] Cooper (1992) calls this distinction a "semio-technical hierarchy". On the relation between subjectivity and strategy see Foucault (1981:95).

[18] Boltanksi and Thévenot (1987) argue the opposite. They say about mixtures between different justifications are less stable than those which are pure .

[19] We are grateful to the Editors of The Sociological Review, and the managers concerned for permission to print this exchange.

[20] This argument is spelled out more fully in Law (1993).

[21] For this point developed in a somewhat different way, see Latour (1991).

[22] For the notion of the production of organisation, see Cooper and Burrell (1988).

[23] The notion of partial connections is explored in an intriguing and inspiring manner by Marilyn Strathern (1991).

[24] For further detail on the Doppler case, see Annemarie Mol (1992).

References

Akrich, Madeleine (1992), "The De-Scription of Technical Objects", in Bijker and Law (1992), pages 205-224.

Bijker, Wiebe E., Thomas P. Hughes and Trevor J. Pinch (eds) (1987), <u>The Social Construction of Technical Systems: New Directions in the Sociology and History of Technology</u>, Cambridge, Mass., MIT Press.

Bijker, Wiebe E. and John Law (eds) (1992), <u>Shaping Technology/Building Society: Studies in Sociotechnical Change</u>, Cambridge, Mass., and London, MIT Press.

Boltanski, Luc and Laurent Thévenot (1987), <u>Les Économies de la Grandeur</u>, <u>Cahiers de Centres d'Études de l'Emploi</u>, 31, Paris, PUF

Callon, Michel (1980), "Struggles and Negotiations to Define What is Problematic and What is Not: the Sociology of Translation", in Knorr, Krohn and Whitley (1980), pages 197-219.

Callon, Michel (1987), "Society in the Making: the Study of Technology as a Tool for Sociological Analysis", in Bijker, Hughes and Pinch (1987), pages 83-103.

Callon, Michel and Bruno Latour (1981), "Unscrewing the Big Leviathan: How Actors Macrostructure Reality, and How Sociologists Help them to Do So", in Knorr-Cetina and Cicourel (1981), pages 277-303.

Cooper, Robert (1992), "Formal Orgnization as Representation: Remote Control, Displacement and Abbreviation", in Reed and Hughes (1992), pages 254-272.

Cooper, Robert and Gibson Burrell (1988), "Modernism, Postmodernism and Organizational Analysis: an Introduction", <u>Organization Studies</u>, 9, 91-112.

Elliott, Brian (ed.) (1987), <u>Technology and Social Process</u>, Edinburgh, Edinburgh University Press.

Foucault, Michel (1981), <u>The History of Sexuality, Volume 1: an Introduction</u>, Harmondsworth, Penguin.

Haraway, Donna (1992), <u>Primate Visions: Gender, Race, and Nature in the World of Modern Science</u>, London, Verso.

Hermsen, Joke J. and Alkeline van Lenning (eds) (1991), <u>Sharing the Differences: Feminist Debates in Holland</u>, London and New York, Routledge.

Jameson, Frederic (1991), <u>Postmodernism, or, the Cultural Logic of late Capitalism</u>, London, Verso.

Knorr-Cetina, Karin D. and Aaron V. Cicourel (eds) (1981), <u>Advances in Social Theory and Methodology: Toward an Integration of Micro- and Macro-Sociologies</u>, Boston, Routledge and Kegan Paul.

Knorr-Cetina, Karin D. and Michael J. Mulkay (eds) (1983), <u>Science Observed: Perspectives on the Social Study of Science</u>, London, Sage.

Knorr, Karin D., Roger Krohn and Richard D. Whitley (eds) (1980), <u>The Social Processes of Scientific Investigation: Sociology of the Sciences Yearbook</u>, Vol. 4, Dordrecht and Boston, Reidel.

Latour, Bruno (1983), "Give Me a Laboratory and I Will Raise the World", in Knorr-Cetina and Mulkay (1983), pages 141-170.

Latour, Bruno (1984), Les Microbes, Guerre et Paix; suivi de Irréductions, Paris, Collection Pandore, A.M.Métailié; (translated as Bruno Latour, The Pasteurization of France, Cambridge, Mass., Harvard University Press, 1988.)

Latour, Bruno (1987a), Science in Action: How to Follow Scientists and Engineers Through Society, Milton Keynes, Open University Press.

Latour, Bruno (1987b), "The Prince for Machines as well as for Machinations", in Elliott (1987), pages 20-43.

Latour, Bruno (1990). "Drawing Things Together", in Lynch and Woolgar (1990), pages 19-68.

Latour, Bruno (1991), Nous N'avons Jamais Été Modernes, Paris, La Découverte.

Law, John (1987), "Technology and Heterogeneous Engineering: the Case of the Portuguese Expansion", in Bijker, Hughes and Pinch (1987), pages 111-134.

Law, John (ed.) (1991a), A Sociology of Monsters: Essays on Power, Technology, and Domination, Sociological Review Monograph 38, London, Routledge and Kegan Paul.

Law, John (1991b), "Monsters, Machines and Sociotechnical Relations", in Law (1991a), pages 1-23.

Law, John (1992), "The Olympus 320 Engine: a Case Study in Design, Autonomy and Organisational Control", Technology and Culture, 33, 409-440.

Law, John (1993), Organizing Modernity, Oxford, Blackwell.

Ilana Löwy (ed.) (1993), Medicine and Change: Historical and Sociological Studies of Medical Innovation, Paris, les Éditions Inserm.

Lynch, Michael and Steve Woolgar (1990), Representation in Scientific Practice, Cambridge, Mass., MIT Press.

Mol, Annemarie (1991), "Wombs, Pigmentation and Pyramids: Should Anti-Racists and Feminists Try to Confine 'Biology' To Its Proper Place?", in Hermsen and van Lenning (1991), pages 149-163.

Mol, Annemarie (1993), "What is New? Doppler and Its Others: an Empirical Philosophy of Innovations", in Löwy (1993), pages 107-125.

Reed, M. and M. Hughes (eds) (1992), Rethinking Orgnisation, London, Sage.

Strathern, Marilyn (1991), Partial Connections, Savage, Maryland, Rowman and Littlefield.

Turkle, Sherry (1984), The Second Self: Computers and the Human Spirit, New York, Simon and Schuster.

Winner, Langdon (1986a), "Do Artifacts Have Politics", in Winner (1986b), pages 19-39.

Winner, Langdon (1986b), The Whale and the Reactor: a Search for Limits in an Age of High Technology, Chicago, Chicago University Press.

Woolgar, Steve (1991), "Configuring the User: the Case of Usability Trials", in Law (1991a), pages 58-99.