

LIVING IN THE MATERIAL WORLD

andrew pickering

a.r.pickering@exeter.ac.uk

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My topic is materiality and how ideas on materiality from my field—STS, science and technology studies—might cross over into management and organisation studies.

'Sociomateriality' (Orlikowski and Scott 2008) is already an important topic in management and organisations, but I will try to widen the frame. We can start with technologies of the self, then turn to industry and technoscience, and finally explore an odd form of management which builds in the perspective I want to develop. The overall idea is to multiply our sense of the many different ways in which matter is intertwined with us.

First we should get clear on what the problem is. The problem, as I see it, is that since Descartes, western philosophy, social science and even commonsense have taken for granted a dualist ontology of people and things. We are different in kind from animals, machines and nature, inasmuch as we have something special that the rest of creation lacks: souls, reason, knowledge, language. And this difference is also an asymmetry. We are the only genuine agents in history. We have will, intention, goals and plans, whereas the nonhumans are machine-like, predictable, passive, waiting for the imposition of our will. We call the shots. This sort of human exceptionalism, as I call it, is nonsense, but it is the key to understanding the form that the human sciences take today (Pickering 2008). Sociology since Durkheim has generated a fabulous range of resources for thinking about autonomous active human beings as if they were masters of a passive universe.

Challenging this picture is not as simple as one might hope. In my experience, it entails a paradigm shift, in Thomas Kuhn's sense. The trick, I would say, is to change our conception of agency in a way that enables us to come at the world from a new angle. We should stop thinking about agency in terms of will, intention, calculation and representation, and start thinking about it in terms of performance, in terms of doing things, things that are

consequential in the world. Performance is the place we should start from, not reason, language, representations, symbols. And the key point is that if one starts from performance, Cartesian dualism collapses. We humans are performative agents—we do things in the world—but so do rocks and stones, cats and TV sets, stars and machine tools. At the level of performance, we are the same as everything else; we are not different in kind. And furthermore, at the level of performance, we are constitutively engaged with our environment: we do consequential things to it, and it does things back to us, on and on forever in what I like to call an open-ended dance of agency (Pickering 1995a). We are stuck, so to speak, in the thick of things—we can never step outside and take command as traditional sociology likes to imagine.

So the paradigm shift I have in mind moves in a non-dualist direction by emphasising performance rather than will and representation and cognition, and by recognising that performance densely and constitutively enmeshes us in the world rather than splitting us off from it. To throw in some more words, the dualist social sciences are ‘humanist’ in the sense that they find their explanatory variables exclusively in the human and social world, while the perspective that I associate with STS is instead ‘posthumanist,’ decentring the human and foregrounding instead nondualist couplings of people and things.

If you want an image to hang onto, look at the jade sculpture shown in fig. 1. At the bottom right you can see some small figures, and in other places you can see traces of human constructions—an archway in the middle; a stairway towards the top. But these are minor parts of the overall composition, not the key elements of it: the trees, mountains and clouds are much more powerful and striking, and the people nestle amongst them. The vision here is of humanity as just a part of a larger world, and this sort of vision is, I would say, a necessary condition for finding questions of materiality and space, the concrete substrate of our being, interesting. And then we can note that this little sculpture is not Western. It is Chinese; it exemplifies what I think of as a Taoist ontology, not a Cartesian one.

FIGURE 1: JADE MOUNTAIN, 1700-1725 AD. *Source:* Oriental Museum, Durham University

And to stay with the East, for a small but perspicuous example of *how* we are plugged into the larger social world, we could think about bonsai trees (fig. 2). In an obvious sense, keeping a bonsai tree is itself a decentred dance of agency, between the tree—a nonhuman agent—which continually grows new shoots in unpredictable places and directions, and a human

agent who reacts to that, trimming the shoots here and there in pursuit of an emergent aesthetic, and so on, back and forth between the human and the nonhuman. Bonsai, then, can be a model for how we exist in the world in general, and this points us in one direction to the posthumanist analysis of a dense performative engagement with the world, and in the other to Taoism again, with its nonmodern understanding of the world as endless decentred flows, transformations and becomings.

FIGURE 2: BONSAI TREE. *Credit: Jane Flaxington*

But isn't Taoism one of those premodern philosophies that the Scientific Revolution and the Enlightenment were supposed to have demolished? This turn to the East, which I want to take seriously, is a marker of the price to be paid for throwing in your lot with posthumanist STS. I think the Taoists got it right about how the world is, and we modern Cartesians have got it wrong.¹

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More than images and philosophies, we need examples of what is at stake in the shift to the posthumanist paradigm. Most directly, it is interesting and important to explore and appreciate the ways in which management and organisational forms are emergently mangled alongside the introduction of new technologies (and vice versa), but rather than enter into the existing literature on this (see, for example, Orlikowski and Scott 2008, Jones and Rose 2005, Barrett et al 2011, Lynchnell 2011) I aim here, as I said, to widen the frame, and I want to begin with technologies of the self.

The dualist conception of the self is that of a stable, reliable centre of the action, autonomous, calculating and rational that one can appeal to as an explanatory variable. The great achievement of Michel Foucault was to show that this distinctly modern self, if it exists at all, is a historical creation, not the essence of humanity. In *Discipline and Punish* (1979), Foucault showed how the materialities of architecture, partitioning space and organising lines of sight, can function to transform inner states, making men docile, engineering a certain

¹ On traditional Chinese philosophy and its resonance with posthumanist STS, see Li (2012). The crossover centres on the common focus on practice and performance (rather than cognition and epistemology), a decentring of humanity and the recognition of change as a fundamental ontological category. There is also a mismatch, inasmuch as traditional Chinese philosophy adds to this basic picture notions of Yin and Yang and a series of pictures, the finite series of trigrams and hexagrams of the *I Ching* used in the interpretation of change (Blofeld 1991). These additional elements are themselves integral to traditional Chinese thought, though I am unable to find a place for them in my own analysis.

version of the modern self. The central insight of the book is that specific human selves are made in specific human/nonhuman assemblages. The phrase ‘technologies of the self’ comes from Foucault’s later work (1988) in which he explored ways in which people have worked on themselves to systematically transform their inner being. Often these have entailed purely mental disciplines—the Stoics, for example, tried to imagine themselves in the worst possible situations, so that they could face up to them with equanimity if they ever really happened. But we can still think of this in terms of performativity. The self is multiple, and technologies of the self set up inner automatisms or machines that act as a check on other automatisms.

I take the idea of technologies of the self more literally and materially than Foucault. The counterculture of the 1960s, for example, deployed all sorts of material technologies in what we used to call ‘explorations of consciousness.’ Sensory deprivation tanks, biofeedback set-ups, stroboscopes, dream machines and psychedelic drugs all figured as doorways to altered states. Very strikingly here, new selves and subject-positions emerged in performative interactions with material set-ups. In *The Doors of Perception*, Aldous Huxley described and explored a new relation to the world and his own inner being that went with his first experience of mescaline, and in his follow-up essay, *Heaven and Hell*, he argued that all mystical experience of unity with the divine depends on some such material technology, including, for instance, fasting, flagellation, chanting and meditation, as well as strobes (Huxley 1956; see also Lilly 1972, Geiger 2003, Pickering 2010).

Examples like these help us to see that far from being a stable given, the human self is itself materially produced and engineered. But one qualification is important. Technologies of the self are not causal in a linear sense. LSD elicits bad trips as well as good ones; the same molecules but very different effects. Emilie Gomart and Antoine Hennion (1999) once did a fascinating study of the ways in which drug users and music lovers construct specific set-ups—which they called *dispositifs*, following Francois Jullien (1999)—to optimise their experiences, tuning themselves, one could say, materially and socially, into an open-ended space of possibilities. When should you take this drug, in the morning or the evening? Alone or in company with other people? Alone or in the company of other drugs? And what should you do while taking it? Gomart and Hennion have a lovely quote from someone saying ‘I steal so naturally’ when on some drug I can’t remember.

Natalie Dow Schull’s (2005) study of digital gambling goes along the same lines. She explores the ways in which gamblers find their way into ‘the zone’—a space of mindless detachment from the mundane world, characterised by a feeling of seamless flow. This is, of

course, a sort of dualist separation from the world, but it depends, nevertheless, on all sorts of non-dualist material couplings. The gambling machine itself—an automated slot machine—is crucial. Nothing would happen without it. But many more levels of tuning are also involved. The gamblers learn to put paper cups on adjacent seats to keep other human beings away, and stick tooth-picks in the mechanism so that one gambling episode follows automatically from another. And from the other side, engineers endlessly tinker with the hardware and software to help the gamblers entrain themselves to the machines more effectively. The machines are equipped to make possible drink orders and cash withdrawals without human intervention; the software becomes adaptive, speeding up or slowing down play in response to the revealed preferences of the gambler.

I can make two observations on this example and then we can move on. One is that gambling machines have a dual function: they are the pathway for gamblers into the zone, and, at the same time, they plug the gamblers into the circuits of capital. This inner/outer connection is probably always a feature of technologies of the self. The Stoic's inner stability goes with the role of ruler of the outer, political, state. Inner calm and non-violent political protest hang together with meditation as the pivot. Explorations of consciousness were integral to the counterculture as a distinctive form of life. So matter here can be seen as helping to constitute both specific selves and the specific social structures with which they hang together.

Second, the gambling example (like bonsai) points to the concept of emergence. As I said, the machine causes nothing; it is not the explanation of the gambler's behaviour. Instead, the gambler has to find out how to use the machine in practice, how to tune themselves into it. Likewise, the machines, and the engineers behind them, have to find out how to use the gambler. Nothing in this trajectory of coupled findings-out is given in advance. It is emergent in the brutal sense of not being predictable or even explicable in terms of independent variables. And just like the coupling of people and things, emergence is something which is hard for the western imagination to take in. The shadow of the Cartesian machine still hangs over the social sciences. To find any inspiration for thinking about such processes you would have to look elsewhere: to biological notions of co-evolution, say, or further afield, to eastern philosophy—the Taoist image, again, of the world as a place of endless decentred becomings.

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We can leave the self behind and move from the micro to the macro and think about technoscience, the coupling of science, industry and the economy that we take for granted

today and that seems to be the last hope of the west. As is well known, one of the first important examples of technoscience dates back to the second half of the 19th century and the dye industry: a whole series of synthetic dyes were discovered which were the foundation of a new industry and a new sort of chemistry, and the new industry and the new science grew together as a new sort of scientific/industrial assemblage (Pickering 2005, forthcoming). The story is too rich to get into here, but I do want to suggest that it is, in a way, isomorphic with what I just said about technologies of the self.

We can start by noting the obvious. As Thomas Pynchon wrote in *Gravity's Rainbow* (1975), 'If you want to know the truth, you have to look into the heart of certain molecules'; the synthetic dye industry was absolutely dependent on emergent properties of matter, on how matter turned out to perform. The key event was the discovery of the dye called mauve, by William Henry Perkin in London in 1849, and the key point to note is that Perkin was not trying to produce a dye at all. He wanted to synthesise the antimalarial drug quinine, and it just so happened that when he mixed certain chemicals and processed them in a certain way he arrived at a substance that could dye cloth a pretty colour. Here again then we find brutal emergence in the domain of matter, something completely unpredictable in advance that was immensely consequential for human history. And similar emergent material phenomena marked the whole history of this industry. It was important, for example, that mauve was not alone. Experimenting with different chemicals, chemists succeeded in synthesising an ever-expanding list of coloured substances that could serve as dyes. Emergent material phenomena here were absolutely central to the emergence of the world we live in now.

At the same time, it is important to think how these substances were drawn into the human world, and especially how they were transplanted from the laboratory into chemical factories. Scaling up their production proved to be non-trivial. Attempts to do so were dogged by explosions and the destruction of lives and property. Again, we would have to say that it just so happened that Perkin and others found ways to more or less safely scale up the process, cooling the reactants to prevent explosive boiling. They could have failed in this negotiation with the emergent properties of matter, and technoscientific dye production might never have happened. This is a point that has interested me a lot recently. A century and a half after Perkin, chemical factories still explode. So we have this paradoxical situation in which the social sciences resist seeing that matter has agency, while, out there in the real world, the typical problem is to contain material agency, to keep it in check and channel it, to shield ourselves from it. Disastrous failures like Deepwater Horizon and Fukushima can serve to bring this point home. And much human labour is, in fact, devoted to maintenance schedules

and the like which would make no sense without a recognition of the performative agency of matter that they try to keep in check, an attempt which necessarily, I would say, fails from time to time. Our entire world is built on this sort of chancy engagement with the material world. We live on performative islands of stability (Pickering 2011a). The social sciences need to be able to get that into focus.

But what about science? We are taught to think that we have science to thank for technoscience, as if the science comes first and makes industry and the modern economy possible. A performative perspective suggests that this is a mistake. Perkin had no idea what he was doing when he synthesised mauve—or, at least, only a mistaken idea. And the blossoming of the dye industry was integral, in fact, to a transformation of chemists' understandings of matter. Chemical theory struggled to keep up, trying to rationalise what had already been accomplished, and a good theory was one that could do that, and also help in some way in moving forward to new processes and syntheses. Kekulé's benzene ring theory, which I fell in love with at school, was the outcome of this competition, not the cause of anything.

So again we have the image of co-evolution, now of matter and knowledge, with fields of emergent material properties and scientific representations growing together, like biological species constituting environments for one another or like gamblers and gambling machines, or humans and bonsai trees. And I should, of course, throw in the social here, too. One way into this is to ask about the role of capitalism in this whole story. Certainly the mauve synthesis only counted as an emergent property of matter in a world where textiles and textile-dyeing were already major industries, so could we not say that capital was the cause of all that followed? In a way, I think we could. But not in the sense that capital was a cause that somehow contained subsequent events within itself (as the collision of two snooker balls determines their later trajectories). Nothing was predictable here. Just as Perkin had to find out how to scale up the mauve synthesis, so capital had to find out how to latch onto it, in a process that emergently transformed the social landscape and capital itself. New links had to be set up between producers of raw materials (coal miners instead of farmers) to dyers. In the 1880s, science was itself built into capital for the first time, in the shape of a new social institution, the industrial research laboratory, now enfolded within the body of industry (on organisational 'enfolding' see also Pickering 1995b). New career paths appeared for academically trained chemists; universities changed form to foster these, especially in Germany. Patent law was also renegotiated to turn chemical syntheses into revenue streams, and so on.

So, if capital was a cause, it was also at stake and emergently transformed here, mutating like the evolutionary becoming of a strange plant or animal in history in its entanglements with the powers of nature and our knowledge of them—not any sort of independent exogenous controller of events. Capital lives and becomes in the thick of things, just like digital gamblers and academic scientists.

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I have so far been offering a sort of detached analysis of technologies of the self and of technoscientific production, exploring ways that materiality intertwines with the human and the social. This is a standard academic project, the kind of thing that most of us do most of the time. But my last example goes in a different direction. Once we have recognised the constituent role of material agency in human affairs: so what? Could it point us towards doing things differently? I think the answer is yes and that the change involved would be for the better. My third example concerns styles of management.

The dominant form of management today is reflexive to the sort of dualist social science we want to get away from. This style of management aims to instal a small class of elite managers as classical human agents in control of an organisation (including its human components) which has been turned into a predictable machine. That is certainly how my university, for example, is run, and English universities in general. The question now is: could we imagine a style of management that is reflexive instead to posthumanist STS, that somehow foregrounds performance and emergent dances of agency? Could posthumanist theory be a constructive resource in management and organisations as well as an analytic tool?

In fact, not much imagination is needed to answer these questions. We need only look into the margins of our own traditions to find examples of what I have in mind, and I now want to discuss a field I have been interested in for a long time: cybernetics (Pickering 2010).

What was, or is, cybernetics? The name comes from *kybernetes*, the Greek word for steersman, and you could think of cybernetics as the science of steering. But we can go a step further. Cybernetics is about steering something like a sailboat, and the art of sailing is a performative one, of getting along with the wind, currents and the way water flows round the hull, by leaning one way or the other, putting on more or less sail, tightening the rigging or

loosening it a bit, and so on. So cybernetics understands steering as a continual decentred, performative, emergent dance of agency, as I would say, between the human and the nonhuman, the sailor, the boat, the wind and the sea. It thus shares the Taoist and posthumanist ontology that I have been talking about all along. More importantly, however, the cyberneticians put this vision to work in real-world projects.

The man who did most to translate the basic cybernetic image into management was Stafford Beer (1926-2002), the founder of what he called management cybernetics (Beer 1959). And Beer's central objective was precisely to transform management to thematise and foreground dances of agency—dense, performative, open-ended interactions—between the internal elements of an organisation and between the organisation and its environment. The cybernetic organisation would continually find out how the environment reacted to it (buying more or less of its products, say) and then react to that, adapting itself to whatever emerged, and so on and so on, back and forth. And this was what led Beer and his friend Gordon Pask to an interest in biological computing, as it was called (Pickering 2009a).

Beer's project in the late 1950s was to take the automation of the factory beyond production and into management. Especially he wanted to automate the dances of agency that he understood to be crucial to management. The idea was to construct adaptive systems to take the place of managers in running organisations. Beer thought first of using computers, but rejected them as insufficiently lively. A computer does what it is programmed to do; it cannot radically reconfigure itself to identify and respond to truly emergent phenomena. In contrast, living biological systems are lively by definition, and nature is full of adaptive systems that engage in open-ended dances of agency with their surroundings. Beer's thought was that it might be possible to couple one of these into the factory in place of conventional management.

To that end, he experimented with a whole range of systems to find out what might work best, including colonies of insects and mice, and he even got his own children to play a game that found solutions to coupled mathematical equations performatively rather than cognitively. Much of this work focussed on pond ecosystems. Pull the humans out of the factory, plug in a pond instead, was the idea, and the pond, the factory and the business environment could engage in dances of agency, sometimes finding situations of relatively stable equilibrium, but also capable of transforming the factory itself and its products into a new and better adapted form.

I have three comments on this work. First, I just want to say that biological computing is one of the most imaginative and visionary projects I have ever come across in the history of science, technology and organisations—so wild! Second, we should note that it depends on taking matter and its agency very seriously; you would never imagine such a project unless you had the sense of steering a ship in a world that performs in unpredictable ways.

Cybernetic management and biological computing were, then, reflexive to posthumanist STS—they played out a posthumanist ontology; they were in the same paradigmatic space—in much the same way as the management of English universities, with their fantasy of collecting power in a few individuals, is reflexive to standard, humanist social theory. This is the important general point here. As well as opening up new perspectives on existing forms of organisation and management, posthumanism helps us to see that radically different forms are possible and interesting; it can function as a radically transformative resource within organisations as well as offering a new and distinctive angle from which to examine them.

My third comment is, of course, that, sadly, biological computing never quite worked. Organisations today are not managed by ponds or colonies of mice. Beer's project ended in the early 60s. But not, I want to stress, on any point of principle; rather, on the practical difficulty of getting biological systems to care about us. In one experiment, for example, Beer induced pond insects, *Daphnia*, to ingest iron filings, so that applied magnetic fields representing key industrial variables would constitute the environment to which they adapted. The *Daphnia*, however, just excreted the iron, creating a rusty brown medium impervious to the fields—this mode of coupling just did not work. The crowning achievement of the biological computing project was to grow a body of electrochemical threads that developed a new sense—namely, an ability to respond to specific sounds: an ear! (Cariani 1993)—that had not been designed into it, again an amazing and magical accomplishment from the perspective of conventional computing. But in 1962 Beer more or less gave up, lamenting the lack of support for this research, which he had been conducting in his spare time (while leading the Operations Research Group of a major steel company in his working hours).

From the 1960s onwards Beer went in a new direction, developing what he called the Viable System Model of adaptive organisation, the VSM (Beer 1981). Instead of incorporating real biological material into the organisation, Beer's idea was now to model information flows within the organisation on the most adaptive biological system he could think of: the human brain and nervous system. The organisation itself was to become a giant adaptive cyborg, partly human and partly nonhuman (figs 3, 4).

FIGURE 3: CONTROL SYSTEMS IN (A) THE HUMAN BODY, (B) THE FIRM.

Source: Beer (1981, 131, figs 22 and 23).

FIGURE 4: THE VSM DIAGRAM. *Source:* Beer (1985, 136, fig 37).

The VSM diagram became Beer's trademark, and it shows information pathways between five levels of the organisation modelled on their biological equivalents, running between production units at level 1 and the board of directors at level 5 through various intermediary levels and the firm's environment. Much of Beer's attention focussed on level 3, which housed a set of operations research models of the organisation, and level 4, home for a big computer model of the firm's world, the wider economy. And these models deserve some further thought before we move on. If biological computing was a purely performative project, these models were instead representational. So how should we think about them?

Beer was scathing about traditional management. In 1973 he published an essay with the great title, 'The Surrogate World We Manage' (1973), analysing the way in which managers become bewitched by paper representations of their organisations and entirely lose contact with the things in themselves. Beer's take on representations and models was that they could be helpful, but we should not trust them. We should continually monitor the performance of the organisation and regularly revise our models in the light of this. So the models themselves should be explicitly in the plane of practice, we could say, bound up with performance and dances of agency, not external criteria to be imposed on them. With the VSM, then, we are still in the world of performance, but now including representational elements as themselves mangled, growing open-endedly and organically in their engagement with performance—much as, in fact, chemical theory was bound up with the development of the dye industry. This is a further sense in which cybernetic management is reflexive to posthumanist theory.

The VSM was the basis for all of Beer's consultancy work and has many followers in management today, but I can note that the most ambitious application of it was forty years ago now, to the entire Chilean economy under the socialist regime of Salvador Allende in the early 70s. Project Cybersyn, as it was called, went a long way in a couple of years before it was cut off by the Pinochet coup.

One further aspect of the VSM is worth discussing here. As I said, Beer insisted that internal relations within the organisation should themselves have the form of a performative dance of agency. This is the significance of the reciprocating arrows linking systems 3 and 4 in fig 4.

The relation between levels was supposed to be a process of ‘reciprocal vetoing,’ of proposal and counterproposal, until some sort of equilibrium emerged which all of the parties could live with. This constructive give and take is precisely what the management of my university lacks, with its reporting chains only going upwards and a monological flow of orders travelling in the opposite direction.

But what should those reciprocating linkages look like? How should they be staged? What form should they take? When he was working in the steel industry in Sheffield, Beer improvised. He would try to grab members of higher management and union representatives after work on Friday afternoons and drag them into his office to drink whisky, just to see what would happen if they talked openly to one another—something which, again, would never happen in my university. As a consultant, Beer developed a more structured approach to decentred decision-making in a process he called Syntegration (Beer 1994). Syntegration is a complex process of many iterations, usually extended over several days, but the basic idea is to assign participants to the edges of a notional icosahedron, and to organise a process of sequential discussions between the parties whose edges end at a common vertex, alternating in steps between the vertices at the end of each edge. In this way arguments can progressively echo all around the icosahedron, eventually taking an emergent form controlled by no-one in particular.

Syntegrations have been performed on many topics, running from the reorganisation of the British OR Society (of which Beer was President) up to Israeli-Palestinian relations and world peace, and they continue to be held today. And one further observation is relevant here. Syntegration does depend on some simple material technologies—recording and circulating the outcomes of different phases of discussion—and also on the control of space—systematically putting groups of people together and keeping others apart. But the process is primarily representational and linguistic—it is talk. Nevertheless, it is talk which is performative. If Syntegration stages anything, it is open-ended, emergent and transformative dances of agency between the human participants. And my comment on this is that it reminds us of something that should probably be obvious, that posthumanism is not just about materiality; it is about understanding people differently too: not as carriers of fixed properties (interests, values, symbol systems, expertise, or whatever) but as malleable, mangle-able, always liable to become something new in interaction with each other as well as with things. The most powerful example I am familiar with is the 1960s antipsychiatry movement, in which the psychiatrists hoped to become something new themselves in their interaction with the mad (Pickering 2009b).

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I have tried to conjure up some ways in which materiality helps constitute our human world, at the microlevel of selves and the macrolevel of technoscience, and also to ask how a recognition of this might feed into new ways of conducting ourselves in the world. But I want to end with one last remark about Stafford Beer.

Much of Beer's writing took the usual technical form. His books on management are, for example, full of intimidating mathematics and complex diagrams like fig. 4. But he was disgusted with the modern west after the Pinochet coup, and in his later writings he increasingly revealed a less conventional side of his work and thought—the fact that his management cybernetics was, in fact, drenched in a sort of non-standard spirituality. The early work on biological computing points to what I call a hylozoist awe and wonder at the agency of matter—the idea that everything we need is already there in nature: why waste so much time and energy making silicon chips and computers when your local pond will run the factory for you? Beer wrote a poem, a sort of hymn of praise, about the computing power of the Irish Sea (Blohm, Beer and Suzuki 1986, 52).

Though I have not mentioned it before, the VSM has a recursive structure (fig 4), so that within any system 1, say, is nested a whole replica of the VSM, and this goes on up and down the scale forever. And Beer understood this in terms of a great chain of being stretching upwards from biological cells to the cosmos. Syntegration, in turn, was envisaged as giving rise to a genuine group mind, again located on a spectrum running from the yogic chakras up to a transcendental unity with the divine. And Beer himself lived out these understandings. After Chile, he spent half of each year in Toronto working as a management consultant and the other half living in a primitive stone cottage in Wales where he taught tantric yoga. In Beer's cybernetics, then, the mundane and the spiritual ran continuously into one another, rather than being assigned to separate ontological realms.

What can we say about this? I was surprised when I first found spiritual threads like these running all through the history of cybernetics. Now, I am not (Pickering 2011b). Once you start thinking about decentred dances of agency, where would you look for inspiration? Not modern science or philosophy. You would have to look backwards to alchemy, witchcraft and magic, or sideways, to India, China or wherever. The tantra for Beer; I have referred to Taoism here; the last sentence of my book, *The Mangle of Practice*, was 'The dance of

agency as the dance of Shiva.’ The gravitational pull of the East takes over. As I said before, taking materiality seriously involves a paradigm shift and some serious mental gymnastics, and things look very differently afterwards.

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