AFTER DUALISM

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Prepared for discussion at a conference sponsored by the Gulbenkian Foundation on Challenges to Dominant Modes of Knowledge: Dualism*, SUNY Binghamton, 3-4 November 2006.*

I'm honoured by the invitation to write a paper for discussion at this conference. I can't present a measured review of the literature on dualism and challenges to dualism; what follows are basically my own thoughts from my own field, science and technology studies (STS).[1] Though they originate in a specific field, I think they have wider relevance, across the disciplines and beyond. I have not aimed at a linear exposition; what follows is a series of chunks which interconnect. The important thing, I suppose, is to set up some topics for discussion.

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Modernity has been characterised in terms of its operation of all sorts of dualisms, so to begin we need to think about just which dualism is being challenged. The classic modern dualism is the Cartesian split between mind (soul) and body, but this is not the one that is directly challenged in STS (though it could be). Instead it is a related *dualism of people and things*, of the human and the nonhuman, and this is what I will focus on. The basic idea is that not only do we (moderns) distinguish between people and things but that we further seek to understand them *separately* as two realms different in kind. The natural sciences take as their referent a world of things from which people are notably absent. Physics and chemistry would be paradigmatic examples of this,

[1] More specifically, what follows draws inspiration from what I call the posthumanist wing of STS, for example Latour (1987, 1993), Haraway (2003, 2004), Pickering (1995a). For the initial break between humanist and posthumanist STS, see Pickering (1992), and for an overview of posthumanist studies, Pickering (forthcoming a).

and not much more needs to be said about them. The social sciences and humanities take as their object a world of people in which things are marginalised, to say the least. I think here of Durkheim's construction of sociology as a discipline, though much the same could be said of a much wider range of approaches.[2] Durkheim defined the proper object of sociology as 'the social,' understood as irreducible to the proper objects of any other discipline (psychology, economics, physics, whatever), and he also insisted that like causes like: in this case, that social effects have social causes. Here we have a prescription for talking only about people and never about things. Of course, apparently non-social things are not as elegantly avoidable in the social sciences as social ones are in the natural sciences, but they are easily defanged by an insistence that we have no access to things in themselves but only to their *meanings* for us—themselves securely within the realm of the social. Hence a classical sociology of the supernatural (religion), of the natural (science) and of knowledge in general.

This duality of people and things is manifest in disciplinary and departmental identities across the university and goes deeply into modern commonsense. In STS it was manifest in the early sociology of science developed by Robert Merton et al, which focussed on the social norms of scientific conduct rather than, say, the substance of scientific knowledge and practice. A similar disciplinary allegiance was evident in the sociology of scientific knowledge as it developed in the 1970s.[3] While dismissing the Mertonian approach as a 'sociology of scientists' which failed to address the substance of science, still SSK offered a distinctly dualist account centred on the *social causes* of scientific beliefs. Nevertheless, this bifurcation between people and things was the key dualism to be challenged in STS from the mid-1980s onwards. More on this below, but I can say now that the challenge centres on the interface between these putatively different realms—a zone whose existence is implicitly denied by the modern disciplines. It began with a focus on *practice*, the place where the human and nonhuman engage one another on a more or less symmetric footing (Pickering 1992, 1995a).

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[2] In a North American context one has only to skim the leading social science journals to be convinced of this and conversation with a wide variety of academics persuades me of it. This is not to say that one cannot find approaches that do not follow the Durkheimian blueprint, including, of course, the posthumanist variants of STS that concern me here.

[3] See the canonical texts of Barry Barnes, David Bloor, Harry Collins and Steven Shapin.

Bruno Latour (1993) offers an unusual insight into modernity which connects it directly to the history of science and technology. He associates modernity with precisely the dualism of people and things, and asserts almost paradoxically that 'we have never been modern.' I want to explore this idea, which I think is important. What does it mean? Latour's own exegesis is, I would say, ontological.[4] His idea is that the building blocks of the world are themselves non-dualist *hybrids* of the human and the nonhuman—global warming, say, grasped not as an unequivocal fact (or not) about the world, but as an assemblage of human and social concerns, of scientific instruments, observations, experiments and computer simulations, of the almost unprecedented heat in Berlin as I write (July 2006), and so on. The world always has been and always will be populated by such hybrids, evolving and churning together (Callon and Latour 1981). From this perspective, what characterises modernity is that we learned how not to see this, that the academic disciplines found ways to *purify* themselves and their objects, each taking bits of either the human or the nonhuman as their subject matter, but never both. We learned, as I would say, to read the world *against the grain*—to conceptualise it, not as it appears, but in a quite non-intuitive way in terms of a reality behind the scenes. Of course, over the centuries our intuitions have changed, so that what was once bold, radical and refreshing has turned into the dead weight of commonsense and departmental labels.

This all sounds right to me, to a first approximation. But there are two points I would like to add. First, dualism is not simply an ideology; it is not simply a redescription of what will always be the case. It has practical consequences. Taking dualism to heart has meant both thinking and acting differently in the world. Latour argues that our modern dualist way of thinking speeds up the proliferation of hybrids—if we cannot get the coupling of people and things into focus we won't worry all the time about the social or spiritual aspects of major civil engineering projects, say. We can just get on with building some enormous dam in the Third World, and allow ourselves to be surprised (yet again) when some social catastrophe later becomes apparent. But more is at stake in modernity than simple acceleration. Physics and chemistry are not alchemy redescribed; they are very different sciences, incommensurable with their premodern cognates. And their incommensurability resides precisely at the level of their different ontological visions: modern physics speaks of things (quarks or whatever), while alchemy explicitly dwelt on an entanglement of the material, social and spiritual aspects of the alchemical work: in purifying matter the alchemist at once purified himself spiritually and vice versa. In Kuhn's famous phrase,

[4] I read Latour's work this way, though at key points he and the other actor-network theorists tend to speak instead of semiotics (see Pickering 1995a, ch 1).

the alchemists and modern physicists lived or live in *different worlds*, and I want to suggest that this has consequences for how we act. *Ontology makes a difference*.

Second, not all sciences in fact display and elaborate a dualist ontology. In the shadows of the modern one can always find the nonmodern. There are still alchemists, for example, and, as another example, the post-1960s New Age movement rejects any clean separation of the human and the nonhuman (or of the body, mind and spirit). I find it significant that, just like alchemy in the Scientific Revolution, in academic circles today New Age is almost universally reviled, ridiculed and walled-off—to speak of it without irony is to invite strange looks and expressions of contempt. And this is just one symptom of a much wider phenomenon, a more or less moralised dismissal of the non-modern by the modern. So if the dualism of the human and the nonhuman has not absolutely taken over our life-worlds—it is, indeed, still possible to question it—still, it exerts some sort of a *hegemony* over not only the practice but also the imaginations of many of us. My recent research has led me to an interest in the wilder fringes of 60s culture as another explicitly nonmodern, nondualist, formation. But try talking about explorations of consciousness and LSD trips to a scholarly audience without feeling that you are beyond the pale of polite society.

That is why it might be strategic to focus on more respectable non-dualist formations closer to science and engineering and the heartlands of modernity. These exist, too. In studying macro-transformations of science, technology and society around WWII I became very interested in what I called cyborg sciences and cyborg objects (Pickering 1995b). The former are sciences that don't share the ontological purity of the modern sciences. Operations research (OR), for example, originated as a science of the conjoint performance of men and weapons systems. The paradigmatic cyborg science, cybernetics, emerged as a science of the brain based on lively and adaptive electromechanical systems—cyborg objects that blurred the boundaries between the animate and the inanimate, the human and the nonhuman, mind and body. Cybernetics is visibly the precursor of some of the most interesting work in contemporary robotics, brain science and complexity theory. It is much less easy to dismiss than New Age—though still people do so, on the basis of a few dimly remembered historical cliches.

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I should slow down. I have been elaborating Latour's idea that we have never been modern, but how did STS arrive at this position? The answer is: in its explorations in the heart of modernity and its discovery that a dualist perspective does not work even for modern science itself. To see how this goes, we need an example to think about, which is not so easy to provide since a proper discussion would require much more documentation, technical background and analysis than is possible here. Instead, let me just point to some key features from one of my own studies, of Donald Glaser's Nobel Prize winning development of the bubble chamber as a key instrument in the detection of elementary particles (Pickering 1993, 1995, ch 2).

The key notion here is that of *modelling*. In the early 1950s, Glaser conceived the plan of building a new instrument that was modelled on an existing one, the cloud chamber—meaning a device that was somehow like the cloud chamber but differed from it in some way that was not determined in advance. This is the sense I need of modelling: an *open-ended* extension of that which already exists, along a vector which only gets fixed in future practice. For Glaser, this meant trying out all sorts of variants of the cloud chamber, all of which failed except one which worked. This was a small glass container, filled not with a saturated vapour (the cloud chamber) but with a liquid at the point of boiling—this was his prototypical bubble chamber.

This was by no means the end of the bubble-chamber story but I can note first that in this instance Glaser's practice amounted to a trial-and-error search through a space of material performance and agency, *finding out* what different set-ups would *do*. I can remark, second, that here he was dealing with *emergent properties* of matter in a fundamental and irreducible sense. There was no way of knowing in advance which set-up would succeed and which would fail, nothing in advance of his practice determined or caused or explained the success of his prototype bubble chambers. Of course, some *knowledge* of bubble-formation was intrinsic to Glaser's practice, but one can document the fact that this knowledge was itself revisable in practice; in fact, at a key point Glaser completely changed his mathematical model of bubble-formation in the light of what his chamber turned out to do. His knowledge of bubbles can thus be seen as modelled on earlier knowledge, but again in an open-ended fashion, and the particular vector of evolution of this modelling was structured by its intersection with the particular vector along which Glaser's chambers and their material performances evolved. We could say that the material and conceptual strata of the culture of physics evolved together here, and this is already a non-dualist point if we think of knowledge as distinctly human and the formation of bubbles (as particle tracks) as nonhuman.

The story goes on. Glaser wanted to use his new detector in cosmic-ray physics and again he explored a space of material performance, once more transforming his prototype chamber in an open-ended fashion, trying in various ways to trigger the chamber on the passage of cosmic-ray showers. None of these worked, and Glaser revised his goal, deciding to try to insert his device into accelerator-based rather than cosmic-ray physics. This entailed further searches in the space of material agency and also, interestingly, a transformation of the social contours of Glaser's practice. Originally working in a classical small-science mode (with the assistance of a single graduate student), Glaser drifted towards big science, ending up as the leader of a fourteen-man team. This was an entirely unintended outcome (as was the move into accelerator physics—Glaser didn't *like* to collaborate), and we can again think of an open-ended extension of the social relations of scientific research, with the contours of Glaser's human organisation evolving alongside and in relation to the performances of his chambers.

We thus arrive at a picture of the open-ended becoming of the material, social and conceptual strata of Glaser's project, with each stratum growing out of its earlier form along vectors that were not given in terms of any pure inner dynamics but in relation to the becoming of other strata. The material, social and conceptual aspects of the project eventually and temporarily hung together and *interactively stabilised* one another in the utility of Glaser's quenched xenon chamber (one of the first chambers of practical use in elementary-particle research).

This is a simple and straightforward historical story—some possibly more gripping ones follow—that serves to bring home the idea that we have never been modern. Modern physics is constituted as a modern discourse that presumes and elaborates a duality of people and things, yet the practice of physics itself challenges any dualist analysis (as I defined it earlier). To understand the social transformations around Glaser's project—the displacement of his goals, changes of scale in the social structure of his group—it is no use appealing to the Durkheimian idea that like causes like. One has instead to look to the unlike and heterogeneous: the becoming of the social was here coupled to the becoming of a machine and its powers (and vice versa). This is the basic sense in which studies in STS present challenges to the modern dualism of the human and the nonhuman.

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There is more to be said: we could think about dualism from another angle here, having to do with products rather than practices. I have described Glaser's practice in bubble-chamber development as a *dance of human and nonhuman agency* which appeared symmetrically as an alternation betweeen *activity* and *passivity* (Fleck 1979). If we begin with Glaser, we could say that in his work on the bubble chamber, he was often an active agent, disposing elements in a passive material world as he thought fit. But it is important to note that once he had configured his latest chamber set-up he became passive, standing back to watch what this set-up would *do* (literally, with a high-speed movie camera in his hand). He had to find out how each set-up would perform, and he would then revise his plans for the next set-up, and so on. We could thus say that human and nonhuman agency *intertwined* in a *decentred* fashion in constituting the history of the bubble chamber, but I want to dwell on a different point now.[5]

To speak of this alternation of activity and passivity between the human and the nonhuman is to point to an important characteristic of modern science and engineering. The important thing about the bubble chamber, like the cloud chamber before it, was that it should perform *independently of its creator*. Glaser put the pieces together, but the chamber had to produce particle tracks on its own without any human intervention from Glaser or anyone else.[6] And something rather general surfaces here, I suspect. So many of the instruments and machines that inhabit and emanate from modern science and engineering have this property of acting independently of us (unless they are 'broken'). The great thing about a car or a TV set is that it moves us around or shows us pictures with no effort on our part. I think of this as a *practical dualism* of people and things—a separation in practice between human agents having certain powers and *free-standing machines* having different ones.

I said above that dualism was more than an ideology, and I suggested that it was instead consequential for the kinds of knowledge we produce and the overall ontological vision in which that knowledge is set. But now we can see a particular *material* consequentiality, too. Modern scientific and engineering practice is organised around the production of free-standing machines as a dualist *telos*. It continually refigures and populates the material world with products—

[5] One can imagine all sorts of modes of decentring of the human. More often discussed is a decentring of the individual in language and discourse, so it might be worth emphasising that the latter is different from the one that interests me here. It remains, to my way of thinking, within the humanist/dualist orbit.
[6] This observation connects directly to Daston and Galison's (1992) analysis of the history of a machine-dependent form of scientific objectivity.

devices, gadgets, machines—that function as a sort of *ontological theatre*, staging before our very eyes a separation of the human and the nonhuman.

What should we make of this? First, we should be impressed. Our ability to remake the material world in this dualist fashion, only really evident since the Industrial Revolution, is truly amazing. We need to take this seriously. Second, we should not be over-impressed. What I just called 'our ability' is distinctly finite; many unintended products of our dualist 'mastery' of nature are coming back to haunt us—as discussed further below. But third, the point I wish to emphasise now: most of us now live most of our lives in a fabricated environment that is saturated with the products of dualist science and engineering. Our material worlds stage for us this practical duality of people and things over and over again, and this must have a lot to do with the hegemony of dualism over our imaginations more generally. I rely on the uncanny and very nonhuman powers of this computer in front of me to write this essay, to get bits of information I need for it quickly, to keep in touch with the organisers of this meeting. The town I live in is built on a Cartesian grid. When I travel, I just sit uncomfortably in a plane which moves me through empty and featureless Cartesian space to another airport. Time is linearised and standardised. In a material world like this, it is not surprising that dualism is the natural ontological attitude.

If one were serious about challenging dualism, them, one would have to think about re-engineering the built environment and staging new forms of ontological theatre. Writing papers would probably not be enough.

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I want to return to questions of ontology. The bubble chamber story suggests that more is at stake than the question of dualism. I have deliberately been speaking about cultural *evolution* in describing Glaser's practice. If one stays with the visible, the picture that emerges is literally an evolutionary one, populated by entities—material technology, bodies of knowledge, social relations and structures—that sport and mutate just like biological species, along historical trajectories marked by relations to other entities that are themselves mutating and becoming. This *quasi-organic ontology*, where open-ended change and search in a space of *multiplicity* is the norm, is one of the key upshots of science and technology studies.[7] I understand the challenge to

[7] In philosophy, one thinks here of the work of William James, Alfred North Whitehead and Gilles Deleuze, and the more recent work of Isabelle Stengers.

dualism, for example, as just one corollary of it, arising in instances whenever the co-evolving elements span the human/nonhuman divide. Such instances obviously come up often when science and technology are at stake, but formally they have no special quality to distinguish them from instances in which the elements belong to some homogeneous set (eg my discussion of Hamilton's mathematics: Pickering 1995a, ch 4). Another contrast with the modern disciplines thus surfaces here, inasmuch as the disciplines characteristically speak a language of fixed and regular— 'mechanical' or 'dead'—entities and relations (quarks, quantum field theory).[8]

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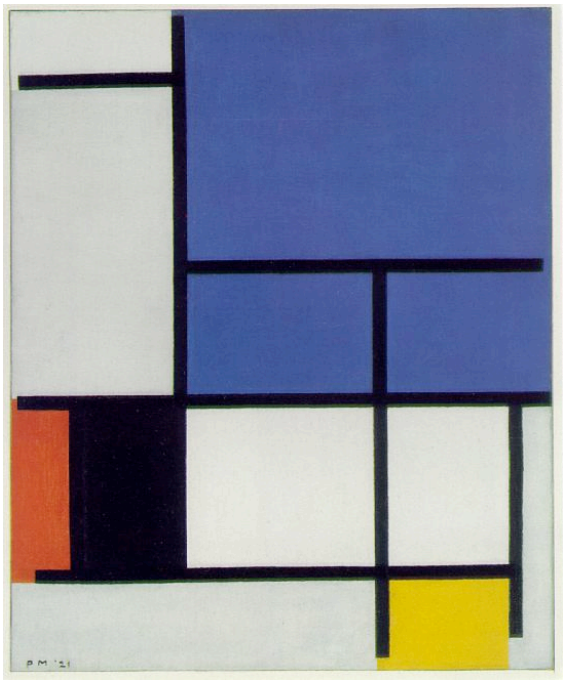

MONDRIAN

[8] These remarks on multiplicity and emergence link the present essay directly to the topics of the first two meetings in this series, reductionism and determinism. Evidently the topics of all three meetings interconnect. Canguilhem (2005) notes the different ontologies espoused by scientists and historians of science—one fixed, the other fluid—but does not develop this observation, treating it as simply a fact about the two camps. I thank Hans-Jörg Rheinberger for bringing this essay to my attention.

DE KOONING

I want to go back to the question of how our material environment either reinforces or challenges our dualist prejudices, and I find it useful here to contrast the works of two of the 20th century's great painters, Piet Mondrian and Willem de Kooning. I want to align Mondrian with a dualist modernity and de Kooning with a nondualist nonmodernity. There are complications here if one explores these artists' intentions, but I want to focus on their material artworks understood as ontological theatre in the sense used above.

First, I want to say that Mondrian's most famous images stage a version of a dualist ontology, though a strongly asymmetric one, different in that respect from Glaser's bubble chambers. Glaser's chambers elide the decentred dance of agency from which they emerged in the autonomous quality of their own performance, and they thus encourage us not to think about the human steps in the dance. Mondrian's paintings instead conjure up an ontology in which humans are the only genuine agents. Looking at his paintings, it is easy to imagine Mondrian projecting a preconceived image onto the canvas as a purely passive substrate—the black lines go here and here on a Cartesian grid; the flat primary colours fill in this space or that. All that intervenes between the image in the artist's mind and the finished picture is a source of error—smudges have to painted over. There is also no sense of time and change to be gained from Mondrian, no sense of evolution and becoming, no sense that it mattered whether he filled in the red, yellow or blue areas first, say.

When we turn to de Kooning the picture changes, literally. One cannot imagine de Kooning planning out in advance images like that shown above and then materialising them on a passive substrate of paint and canvas. We have to see his paintings as a decentred joint product of the artist, the paints and the canvas, emerging in an essentially temporal process, a back and forth, a dance of agency, between the artist and his materials. de Kooning messed about with his paints to see what would turn up, in an open-ended search for beauty, with no predetermined end-point.

I want to see these paintings, then, as ontological icons, echoing back to us very different ontologies. Like the knowledge and machines of modern science and engineering, Mondrian's paintings conjure up a static, and in this case, asymmetric duality of people and things, where all the agency lies with the former. de Kooning's paintings instead evoke a symmetric and decentred non-dualist world of becoming in a space of multiplicity; they thematise process without any given telos. On a material plane, any real challenge to dualism would, I think, entail populating our world with more de Koonings and fewer Mondrians.

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I can extend the discussion of Mondrian and de Kooning in another direction. In his famous essay 'The Question Concerning Technology,' Martin Heidegger (1976) characterised modernity as a project of *enframing* the world, dominating it and turning it into 'standing reserve' for human projects. One of his examples was a power station straddling the Rhine, reducing this historically charged geography to a simple source of electricity for factories. Enframing clearly hangs together with the asymmetric dualist ontology staged by Mondrian's paintings, and we could take them in turn as icons that remind us of enframing more generally—bending a passive world, here of canvas and paints, to our will, to our preconceived projects. de Kooning's paintings would then serve as icons for a different ontology, and a different stance in the world, not of enframing but what one could call *revealing*, characterised not by an imposition of human plans and goals, but by an *openness to what the world has to offer us* (for better or for worse).

I think this contrast between stances of enframing and revealing is important. Dualism does not necessarily imply domination, but when coupled with an asymmetric attribution of agency to the human and the nonhuman, the two terms go together nicely. Part of the hegemony of dualism in the present is that enframing seems to have become our natural ontological attitude in our

dealings with the material and social worlds. de Kooning's paintings can serve as reminders that we do not have to approach nature in this mode.[9]

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My discussion of Glaser and the bubble chamber was intended to exemplify the idea that we have never been modern, even in physics, the heartland of modern science. Now I want to extend the exemplification to a field of greater worldly significance, engineering. My example here is one I've talked about before—struggles to control the Mississippi River—though it has a new ending since last summer. My principle source is John McPhee's wonderful book, *The Control of Nature* (1989).

The Mississippi is one of the world's great rivers. All of the rain that falls in the midwest of the US drains through it into the Gulf of Mexico. Prior to European settlement, the lower reaches of the Mississippi were marked by natural embankments of sediment about three feet high—levees—deposited on either side of the waterway. The levees usually served to contain the river, though sometimes it would overflow them and inundate an enormous floodplain. It appears that the human inhabitants of the area, nomadic Indians, could live with that. But then came the European settlers, who began to establish fixed towns—most notably New Orleans as the river's major seaport. With the growth of these towns, the containment of the river became a matter of increasing importance, one aspect of which was an artificial raising of the levees to confine the river within its banks. What interests me most about this strategy is that it never quite worked.

The theory was that containing the river would make it flow faster, causing it to cut into the riverbed and thus to sink relative to the surrounding land. Instead, as the levees rose, the river rose as well; flooding continued; the levees had to be raised further, and so on, back and forth. In the end New Orleans became a walled city, surrounded by a ring of earthworks thirty feet high. McPhee compared it to the walled cities of the Middle Ages, though the enemy now was water, not the humans beyond the walls.

[9] Note that one should not see Glaser's work on the bubble chamber simply as enframing nature. Much of scientific and engineering research has more the character of revealing, albeit a peculiar form of revealing structured by the telos of separating the human from the nonhuman and the retrospective veiling of the emergence of novelty.

For the past century and a half, responsibility for controlling the river has been assigned to the US Army Corps of Engineers, the ACE, which describes its work as a *battle* with the Mississippi—a battle in which the levees are central and whose outcome is far from certain. It turns out that the Mississippi wants to move. It is now, for example, thirty feet above one of the lesser rivers it feeds into, the Atchafalaya. Left to itself, the entire Mississippi would spill into the Atchafalaya, reaching the Gulf a couple of hundred miles west of its present destination, and leaving the existing lower reaches of the Mississippi a mere trickle. But cities like New Orleans rely on the river water in all sorts of ways, and the Army has accordingly been fighting the Atchafalaya for decades, reengineering its intersection with the Mississippi.

In 1963 a massive 250,000 ton sill or weir became operational, designed to control the runoff from the Mississippi into the Atchafalaya and to prevent it exceeding its prior rate of around 30%. In the floods of 1972 and 1973, the control structure held, just. If it had failed, the Mississippi would have changed course irrevocably. After the flood, inspections revealed that the structure had suffered massive damage. Part of it had just gone: turbulent flows had excavated holes as big as football stadiums around it. Despite massive repairs, it would never meet its design specifications again. The original control project had cost $86M; after 1973, a new Auxiliary Structure was added at a cost of $300M, consisting of six gates, each 62 feet wide and together weighing 2,600 tons. McPhee quotes an engineer on the new project as saying at the time ‘I hope it works’ (52).

Now, of course, we know that it didn’t work, though it wasn’t a flood coming down from the midwest that defeated the ACE in 2005, it was hurricane Katrina. The control structures are still there; the levees broke instead. New Orleans experienced a massive flood, enormous amounts of property were destroyed, many people died, hundreds of thousands remain homeless—nomads, one might say, like the Indians before them, but involuntary ones this time.

How should we think about this story? First, it challenges dualist understandings in much the same way as did the story of Glaser and the bubble chamber, but on more obviously important and less rarefied terrain. The story of our struggles with the Mississippi is another example of the decentred dance of agency that STS found first in the scientific laboratory—an active/passive open-ended back and forth between the river and the engineers. Second, also as before, the story shows that dualism has real-world consequences; it should not be understood as mere ideology. The ACE’s struggle was precisely to *impose* a modernist and dualist spine on the dance of

agency, to bend the river to human will, to enframe it—to keep it to its existing course, to stop it overflowing its banks, to allow New Orleans to exist without change. The fantasy that this is possible goes with the sort of asymmetric dualism I just associated with Mondrian's paintings, which is why this history of engineering can be described as distinctly modern and dualist. But third, something new appears here.

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I want to make the obvious point: New Orleans and Katrina stage for us the fact that the other side and probably a necessary corollary of enframing is catastrophic failure and disaster. In one sense, this is obvious. Wolfgang Schivelbusch (1986) talks about the increase in 'falling height' that accompanied the development of railway travel in the 19th century: so much energy was bound up in a fast moving train that railway smash-ups were so much more devastating than stage-coach crashes in the pre-rail era.[10] We all know that. And yet . . .

I first began thinking about the Mississippi, New Orleans and the ACE around 2001. I could see that the historical story exemplified an emergent dance of agency, but that it was orchestrated around an asymmetrically dualist attempt to enframe the river—the idea that the river could indeed be dominated. And one sunny afternoon in Urbana, I asked myself so what? What follows from seeing things this way? And the answer that popped into my mind was: we don't need to enframe the river; no-one says we have to; we should let New Orleans go. More precisely, we should at least let its residents have an easy option of moving out of the city at a time of calm when water-levels were low (instead of when they were creeping inexorably up the levees). And three points are worth making here. First, I laughed out loud when this thought came to me—just because it was so crazy and surprising; it was a quite singular thought for me. Second, for once in my life I was right. Third, despite the destruction of New Orleans, I have yet to find any evidence for anyone else seeing the point. In the US, the principal reactions to Katrina have been (a) to blame the ACE for failing to enframe the river, and (b) to move the population back into New Orleans as fast as possible.

So, if my point about disaster as the other side of enframing seems trite in the abstract, in this particular instance it has nevertheless eluded the population of America—including, I should

[10] I thank Schivelbusch for a brief but enlightening on the present topic. He told me that 'falling height' is just a bad translation from the German for 'potential energy,' but this odd phrase has stuck in my mind.

emphasise, academics and scholars: the natural scientists and engineers have concerned themselves with questions of what went wrong with the levees and how the river can be enframed better in the future; social scientists have focussed more on what Katrina can tell us about race relations in the US. Even massive death and destruction, then, have failed to dent an asymmetric dualism, an image of a dominatable nature entirely lacking in any conception of becoming and the dance of agency. This is a striking instance, I think, of both the spectacular hegemony of dualism over our practices and imagination and of the baneful consequences of that.

How can we think our way out of a grim, desperate, joyless, nail-biting, repetitive, boring and fabulously expensive attempt to keep New Orleans the same? On the one hand, we could enrich our imaginations. If our ontology was the quasi-organic, non-dualist one that has grown out of science and technology studies, enframing the Mississippi would appear much less plausible than it presently does. On the other hand, it might help to recognise that, if the ACE's approach to managing the environment is distinctively modern, well, as always, there are also non-modern engineering approaches to that field too, approaches that adopt a stance more of revealing than enframing. In the US, for example, there is a field called adaptive environmental management, that Lisa Asplen (forthcoming) has written about very nicely. If the ACE acts in a command-and-control mode, as Asplen calls it, adaptive management tries instead *to pay attention to what rivers want to do*. Its stance towards nature is *experimental.* Asplen gives the example of experimental floods staged on the Colorado River, in which scientists monitor the ecological transformations that occur when large quantities of water are released from an upstream dam—as a way of exploring the possibilities for environmental management, rather than simply trying to dictate to nature what it will look like. I want to say that adaptive management exemplifies a stance of revealing rather than enframing—it is alert to unexpected possibilities as well as dangers—and it stages a nonmodern ontology for us. It shows us what a recognition of our ontological condition might look like as engineering; and, in comparison with the works of the ACE, it demonstrates that *ontology makes a difference*: real world projects look very different depending on whether they stage a modern or a nonmodern ontology. I could also add that adaptive management promises to be *robust*, relative to the obvious *fragility* of modern command and control; the scope for massive failure of the latter just isn't there in an experimental relation to nature.[11]

[11] There is a subtlety that needs to be thought through here, since experiment is clearly central to the modern sciences themselves. We can see these sciences as operating a *detour* away from and back to the world as found, isolating specific segments of the world and producing knowledge of them in small-scale laboratory experiments which can then be transferred back to the world in the fashion of enframing, Latour's (1983) old essay on Pasteur and anthrax remains the canonical study of this manoeuvre. Latour

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I want to say that there is something *political* at stake in the contrast between enframing and revealing, though perhaps sub-political might be a better word. Whether to adopt one stance or another is a choice about how we live our lives. One acts out a stance of dualist domination which is more and more haunted by quite justified fears of disaster; the other recognises that we are not at the centre of history and always expects the unexpected, without expecting the unexpected to be necessarily bad. If we seriously realised that we have this choice, I don't think the choice itself would be difficult.

Along with notions of politics go ideas of *power*. The asymmetric dualism I have been focussing on goes with a linear notion of power—command-and-control, as I just called it. A chain of command in which commands are always obeyed and nothing ever travels back up the hierarchy. I doubt whether any real instance of this kind of power has ever be seen, but like the basic dualism with which we began, the very idea is consequential—all sorts of engineering and social systems attempt to instantiate it and make it come true. A nonmodern ontology of open-ended becoming, in contrast, points to a surrender of dreams of that sort of power which, in fact, we can never have. It points towards a very extended sense of *democracy*, of a necessary interest in and respect for an uncontrollable other, human or nonhuman. This is what Donna Haraway (2003) means by *love* in her recent book on relations between people and dogs.

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I should take stock again of where we have got to. I have been meditating on Latour's idea that we have never been modern, where modernity is defined as operating a dualism of people and things. Against that dualism, I have proposed a different binary classification. I think we can crudely carve up the world into two blocs of practices and products. One is itself modern and plays out a dualist ontology before our eyes. My examples have been from physics (Glaser and the bubble chamber) and engineering (the ACE and the Mississippi), and I have also read Mondrian's paintings as icons of duality from the artworld. The other is nonmodern, staging a

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does not, however, discuss the fact that sometimes this tactic works and sometimes it fails (as in the Katrina example). The sense of 'experiment' I need in the above paragraph is that of experimenting on the thing itself (here the Colorado River) without any detour through the laboratory—experiment as revealing rather than a step towards enframing.

non-dualist ontology—exemplified thus far by adaptive environmental management and in de Kooning's paintings.[12]

One sense in which we have never been modern is this complicated one: the discovery that modernist formations, like physics or civil engineering, fail to exemplify their own ontology. It turns out that they themselves grow in a nonmodern, quasi-organic fashion. But it also turns out that their modernity is nevertheless consequential. They are organised around the production of dualist artefacts: bodies of knowledge that speak to us of a clean split and essential difference between people and things; free-standing machines that evoke a notion of nonhuman agency quite independent of us. The modern sciences and engineering aim, at least, at *making* the world more dual than when they found it. We could say that this dualism is less a reflection on the world than a particular strategy for transforming it.

The second sense in which we have never been modern is the simple observation that there are and always have been nonmodern cultural strata of the kind just mentioned—ways of going on that quite literally have never been modern.

If I had to produce a crude cultural map, it would feature a small circle. Within it, we would find the modern, dualist, practices and artefacts; outside it, and stretching off as far as the eye could see, would be the nonmodern. The eruption of modernity into this small circle must have once been a wonderful and liberating thing. But we live in a time when it seems increasingly difficult to recognise anything outside the circle. Even more so than fifty years ago, say, the nonmodern is reviled, trivialised, condemned or, of course, simply ignored, rendered non-existent, negated, nullified.

Politics again. So what? I think that much of the grimness of the early 21st century hangs together with the domination of our imaginations by a dead dualism. I can easily imagine a world I would rather live in, that would hang together with the nonmodern ontology I have been contrasting with it. Is the political prescription then to stamp out dualism, to eradicate modernity, to erase that small circle in the middle of the map? I don't think so. Modernity was wonderful once and it

[12] My objection to the dualism of the human and the nonhuman centres on the modern practice of theorising them separately. In contrast, I have no interest in offering different accounts of the modern and the nonmodern. I'm sure we could offer isomorphous accounts of the evolution of, say, Mondrian and de Kooning's painting styles, or of cybernetics and modern physics. One can also easily populate a confused middle ground between modern and nonmodern practices and products. My instinct, however, is that to break the spell of human/nonhuman duality it is best to look at examples that are as far from it as possible.

could be again. What we need to do though is to contest its hegemony so that we can see clearly and immediately that we have other options than, iconically, fighting the Mississippi forever in the name of New Orleans. What we need, I think, is a gestalt switch, one of those figure/ground reversals, so that we can take the nonmodern, as well as the modern, seriously, while shrinking the modern back to the size it really is—a small circle, not necessarily in the middle of the map, and not necessarily the best judge of what lies outside it. Enframing as a desperate gambit, not the only option. Revealing as possible.

How is the gestalt switch to be accomplished? I know of no magic recipe. Norwood Russell Hansen (1958, ch 1) once offered a nice description of this process in relation to the gestalt figures beloved of experimental psychologists, the duck/rabbit, the old woman/young girl. If people just can't see one or the other of the images, you can only gesture around them, pointing at splodges that are meaningless in one gestalt but significant in the other, explaining how these splodges fit together and what they are in relation to the whole picture. In the end, people either get it or they don't.[13] I want to attempt something along those lines now, trying to assemble a range of instances as elements of a wider non-dualist gestalt that one could take seriously and live, and along the way I want to point out some important contrasts between this and the modern dualist gestalt, especially along the enframing/revealing axis. Most of the examples, I could say, derive from my studies of the history of cybernetics (Pickering forthcoming b).

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Mathematics, physics, biology . . .

We can start with science itself. If modern physics, say, conjures up for us a knowable, calculable and, in principle, predictable and enframable world, the sciences of complexity evoke a different vision, of a world of systems which we cannot control and will always surprise us in their behaviour. I can briefly sketch out a couple of examples.

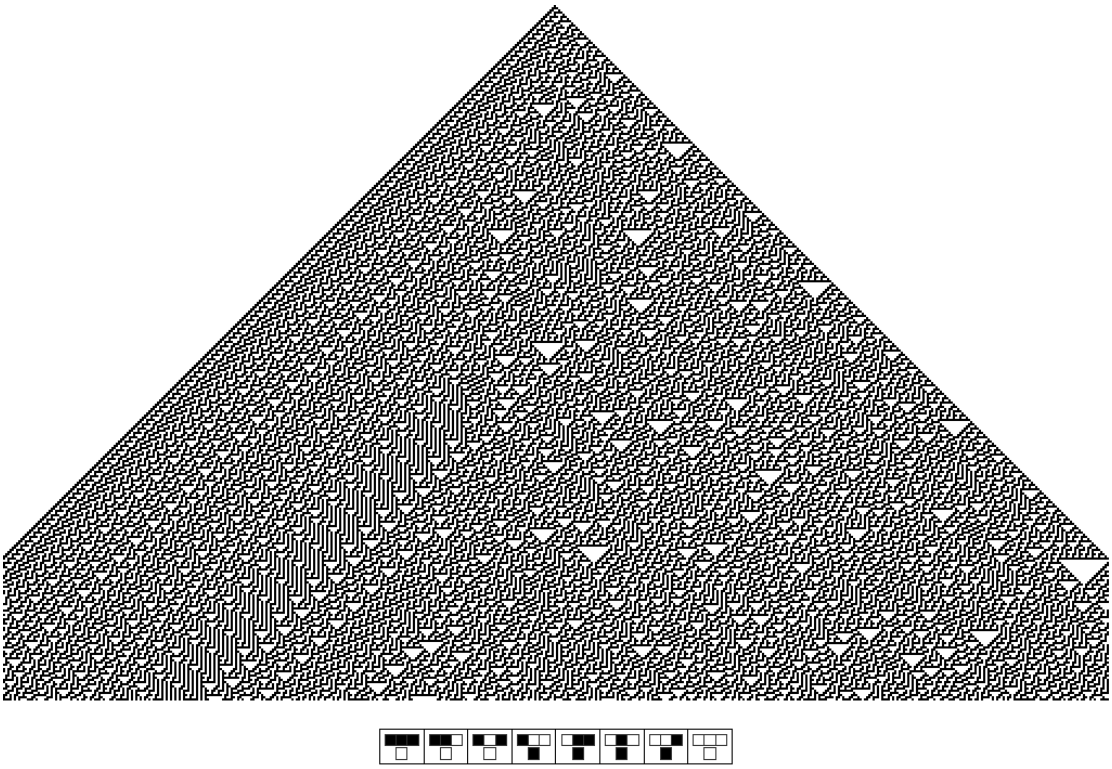
Cellular automata are mathematical systems. A one-dimensional CA is a sequence of points on a line, where each point can be assigned a value of 0 or 1. One thinks of the system as evolving in a series of discrete time-steps, with a transformation rule giving the value at any point in terms of

[13] Hanson's most memorable example is a picture that almost everyone first sees as a random collection of black splodges on a white ground. Hanson's caption instructs one to try to see specific splodges as the shadow of an ear, a beard, and so on. Soon enough the head and shoulders of Christ become clearly apparent.

its value at the previous step and those of its neighbours. Stephen Wolfram (2002) argues that such systems show that even the simplest of rules can generate endless complexity in the behaviour of the system over time. His Principle of Computational Irreducibility states that for some of these systems there are no scientific 'short cuts'—if one wants to know how they evolve over time, there is no better method than to simply iterate the transformation rule over and over again and find out.

We could think of these CAs as nonmodern ontological icons, in the spirit of de Kooning's paintings. Though they do not speak directly to questions of dualism, they are simple models of what I have been calling *becoming*. One never knows what they will do next in advance of them actually doing it. Wolfram himself ontologises this picture, arguing that the world is built from CA-like systems (rather than the predictable entities of which mainstream physics speaks): even space, time and causality emerge from discrete systems that themselves lack these qualities.

If we followed Wolfram in imagining the world as built from such entities, projects of enframing would appear as implausible in the extreme. One cannot command a system that continually changes in unpredictable ways. One can only get along with and adapt to it as best one can. The stance that I called revealing, in contrast, would be entirely appropriate—an alertness to what the system might offer us.



RULE 30 CELLULAR AUTOMATON

The tranformation rule is shown at the bottom. The value assigned to any point is a function of its value and those of its two nearest neighbours at the previous time-step.

If Wolfram's CAs can enrich our imagination of a world of becoming, Stuart Kauffman's (1995, 2002) idealised networks of genes in theoretical biology can enrich our notions of control and power along a similarly nonmodern axis. In the mid-1960s, Kauffman began experimenting with computer simulations of such networks which were also, in effect, CAs. Sites on a lattice could again take on the values of 0 or 1, and some simple rules determined the evolution of the array of these values in discrete time-steps. Kauffman found that if each site was connected to just two others by the rule, then such systems had very interesting emergent properties, independent of the details of the rule. It would appear a priori that such systems might behave in an astronomical number of different ways, depending on the initial conditions. In fact, Kauffman's simulations settled down quickly to running through some small number of repetitive cycles. More interestingly here, Kauffman experimented with interfering with these cycles—flipping the value at some site from 0 to 1 or vice versa at a given time-step and seeing what would happen. He

found that often this interference had no effect—the system would return to its existing cycle—but occasionally the upshot would be to tip the whole system into another of its cycles.

We can read Kauffman's simulations as ontological theatre, too. They stage for us a nonmodern world, with which one can interfere—flipping site values—but without any necessarily determinate and predictable effect: Kauffman had no way of knowing in advance what the upshot of his interference would be, whether the system would return to its initial cycle or, if not, which new cycle it would move into. Here again we have a mathematical model of a world in which command-and-control simply makes no sense; a world of entities that, again, one would have to learn to adapt to and get along with. Kauffman's simulations, like Wolfram's CAs, help boost an ontological vision of a world in which revealing and symmetric adaptation rather than enframing would be the natural ontological attitude.

We can note also some of the tensions that surround these nonmodern sciences, as we could call them. Wise and Brock (1998, 386) quote remarks on complexity from orthodox physicists at a meeting at Princeton University in 1996: 'One really can't help feeling childish fascination looking at this picture of different beautiful systems. But switching to my adult mode, I start thinking about what I can really do as a theorist apart from going to my kitchen and trying to repeat these experiments;' 'It seems to me that you are viewing the patterns in non-equilibrium systems like a zoo, where we view one animal at a time, admire it and describe it, and then go on to the next animal.' The opposition between 'adult' and the string child-kitchen-zoo is interesting many ways but, at least, it registers the difficulty that modern scientists have in taking seriously what lies outside the modern circle, and functions as a warning to others not to venture beyond it—if they do so, they stand a good chance of losing credibility in mainstream science. This is a small token of the hegemony of the modern over our imaginations within science and how it is maintained.

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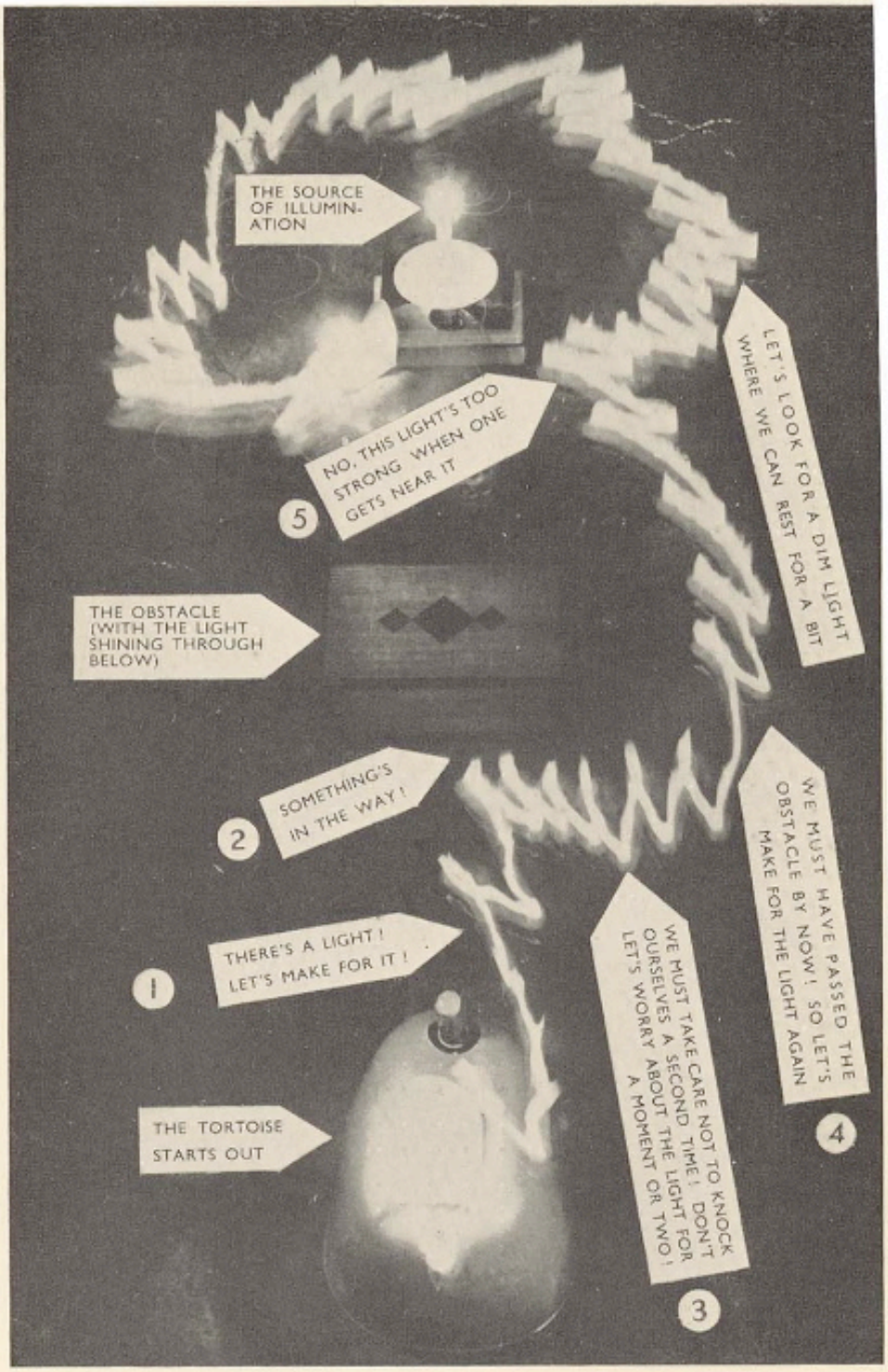
Brain science, robotics, engineering

From the 1960s to the 1980s engineering attempts to model the brain were dominated by an approach often referred to as symbolic AI. The emphasis was on representing the environment and planning ways to achieve particular goals in the space of such representations. An AI robot might seek to compute a path across a room that would avoid obstacles, or how to rearrange

geometrical blocks, for example. Inasmuch as the technical emphasis was on the manipulation of symbols as a model of human cognition and as the necessary precursor to action, symbolic AI staged a modern and asymmetrically dualist ontology. Agency was located inside the model brain, while the world was treated as a passive environment in which the brain's goals were to be accomplished, a place to be enframed. We could also see symbolic AI as staging a primitive version of the modern and dualist *self*, the unitary, autonomous, rational, calculating, purposive individual.

Before the 60s and after the 80s, a different approach to the brain and robotics has been visible that we could call situated or cybernetic robotics. Cybernetics emerged in and after World War II as a science of psychiatry (especially in Britain), focussed on an interest in the brain as a performative and adaptive (rather than cognitive) organ, and centred on the construction of electromechanical models. I can just mention two, both built in 1948 (Pickering 2002, 2004a).

Grey Walter's robot 'tortoises,' in contrast to AI robots. modelled the performative and adaptive rather than the cognitive brain. The machine's two 'neurons' (each consisting of an electronic valve, a capacitor and a relay) acted as a switchyard between sensory inputs (a photocell attached to the front forks and a contact switch on the body) which enabled the machine to lock onto and pursue light sources while navigating around obstacles, without, I should emphasise, the construction and manipulation of any centralised representation of the environment.



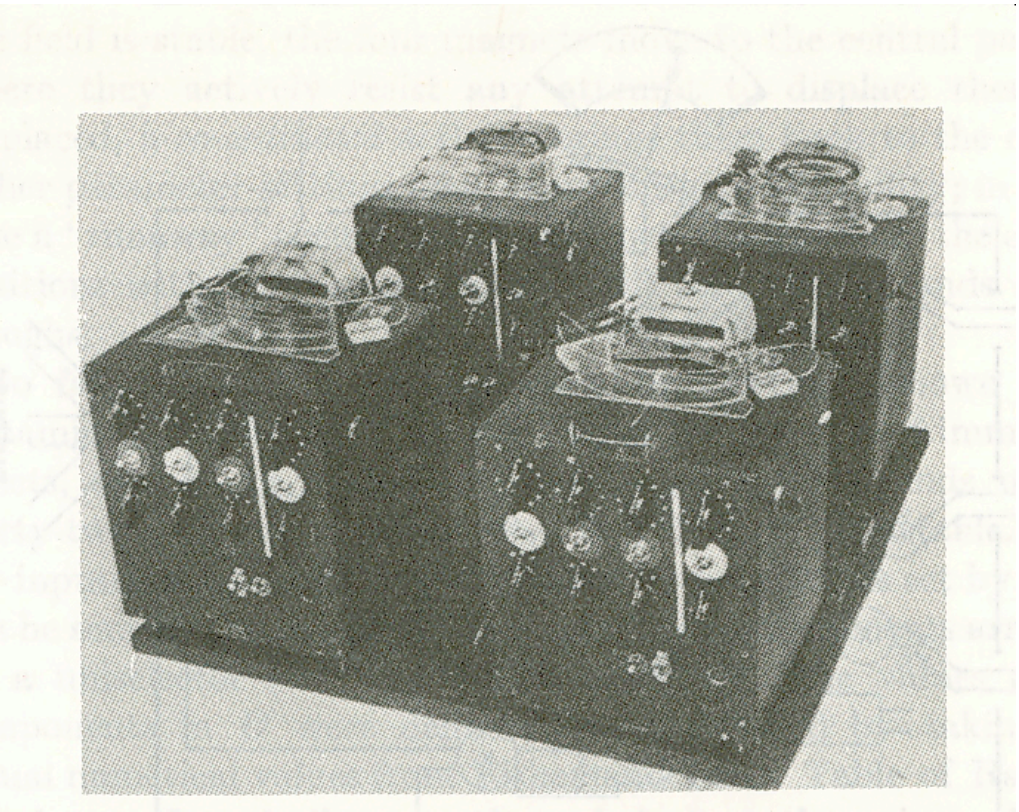
TWO MINUTES OF ELSIE'S LIFE

The photograph records the comings and goings of the electronic tortoise Elsie during a period of two minutes. Elsie had a lighted candle attached to her which produced a luminous trail. She is seeking out the source of illumination of another lighted candle. (*Photo "Time-Life".*)

The tortoise, one could say, explored its environment in the mode of revealing, responding to whatever it found there. If AI robotics, then, stages for us a dualist vision of a brain that stands apart from matter, Walter's tortoises thematised instead a nondualist vision of the brain as integrally engaged with the body and its environment—in the thick of things, one might say, and just one part of the action, rather than a detached controller.

One can, of course, detect a residual dualism in Walter's work. The tortoises were active agents while their environments were a fixed and passive array of lights and obstacles. Ross Ashby's early brain models effaced that asymmetry. His homeostat was a device that converted electrical inputs to electrical outputs. Inert in isolation, Ashby worked with multi-homeostat set-ups in which four units, say, were interconnected with one another. The homeostat's key feature was that it was capable of randomly reconfiguring its internal circuitry if its output current went beyond some limit. In multi-unit set-ups, therefore, a given unit might reconfigure itself repeatedly until it came into equilibrium with the others—meaning that its output current went to zero and returned there under perturbation. The homeostat could thus find a way to adapt and come into a kind of dynamic equilibrium with novel environments (mimicking biological homeostasis, hence its name), and this was the sense in which it functioned as a brain-analogue for Ashby.

What interests me most here is that Ashby used his homeostats to model both the brain and its world. In such a configuration, one unit could be said to stand for the brain, while the other three stood for its environment. Ashby's homeostats were thus nondualist in the sense that, first, a perfect symmetry obtained between brain- and world-models—both were lively agents—and that, second, the inner dynamics of each was structured (not determined) by the other, much like Kauffman's simulations of gene networks 20 years later. Again, a multi-homeostat set-up can function as a nondualist ontological icon, helping us imagine more generally a nondualist world populated by a co-evolving multiplicity of lively and unpredictable entities and agents. AI echoes modernity back to us; the homeostat echoes instead the nonmodern.



FOUR-HOMEOSTAT SET-UP

I could add a couple of comments. Ashby's work around the homeostat as model brain foreshadowed the later work on complexity discussed above. Likewise Walter's robots were models for the situated robotics that has come to the fore in computer science since the 1980s, for example in Rodney Brooks' work at MIT (Brooks 1999; Brooks read Walter's popular 1953 book, *The Living Brain*, when he was a schoolboy). We should take Ashby and Walter seriously. Nevertheless the tortoises and homeostats were built more or less on an amateur, hobbyist, basis, outside Walter and Ashby's professional work in EEG research and psychiatry. This again speaks of a hegemony of the modern. The contemporary resurgence of situated robotics within the universities and elsewhere shows that that hegemony is not unbreakable. Complexity, however, still sits uneasily within the academic world, often finding its home in unusual places like the Santa Fe Institute and Wolfram's company, Wolfram Research (which produces the *Mathematica* software system).

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Psychiatry

I mentioned the connection between cybernetics and psychiatry above, and early cybernetic psychiatry was distinguished by its conception of the brain as a performative rather than representational organ, where its role in performance was in bodily adaptation to novel environments. Again, then, this conception of the brain was a non-dualist one, emphasising the coupling of the brain to the body and its environment (including other people) rather than its special inner properties.[14] And a certain view of madness followed from this: madness as failed adaptation. The model here was Pavlov's experiments on cross-conditioning in dogs—when dogs were conditioned to respond to different stimuli in contradictory ways, they would display many of the symptoms of human mental pathology. Grey Walter was able to elicit similar behaviour in his robot tortoises, and Gregory Bateson extended this idea in his famous notion of *double binds* in schizophrenic communication patterns (Bateson et al 1956). A double bind is a situation in which there is no satisfactory routine way to go on: the mother who verbally insists on demonstrations of love from her child but physically rejects them, was Bateson's group's first example.

Placed repeatedly in a double bind there is no satisfactory way to proceed, and Bateson suggested that the bizarre behaviour of schizophrenics is a response to this. Inspired by the phenomenon of spontaneous remission he further hypothesised the existence of a higher level of mental adaptation than those exhibited by the tortoise and the homeostat, and that psychotic episodes could, in some instances at least, be understood as 'inner voyages' from which sufferers might emerge with a better undertsanding of themselves and the world than when they departed.

There were several different ways in which Bateson's ideas could be put into practice—family therapy is perhaps the best known today. But they also fed into radical developments in psychiatry in the 60s (often misleadingly labelled 'anti-psychiatry'). In Britain, a distinctly Batesonian approach to schizophrenia was developed by the group led by the Glaswegian psychiatrist R. D. Laing, at Kingsley Hall in London. At Kingsley Hall, schizophrenics and psychiatrists (and artists, dancers and others) lived together in a communal fashion, designed to support inner voyages and allow them to reach their conclusion—in contrast to the orthodox therapies of electroshock and psycho-active drugs which, from this perspective, had the effect of stopping inner voyages in their tracks and leaving patients stuck in their double binds

[14] So here we touch on the classical mind/body dualism.

What strikes me again is the contrast in practice—in life—between the nondualist psychiatry of Kingsley Hall and orthodox psychiatry, and one aspect of this contrast can be caught up in the notion of power. Unlike Kingsley Hall, which aimed at a fully democratic symmetry between the mad and the sane in the organisation of communal life, with the possibility of reciprocal revealing and transformation, the canonical mental hospital is a place of dualist enframing, a hierarchical institution in which the doctors are the only genuine agents, prescribing therapies (drugs, ECT) to patients understood as literally that, passive and subject to the doctor's will.[15] This is, in fact, the same contrast as that between the ACE's stance re nature and adaptive environmental management's, but now between people and people rather than people and things, and in an psychiatric rather than engineering register. Again we see that non/dualism makes a big difference in practice, in how we go on in the world.

Selves and spirituality

In his first schizophrenia paper (1956) Bateson made a connection between madness and spirituality that echoed through the 60s (see also Huxley 1954, 1956, of course, and before him Walter 1953). He pointed to the formal identity of the double bind with the contradictory instructions given by a Zen master to his pupil. In both cases the result was a disintegration of the self, but one route led to madness while the other led to enlightenment, The difference lay in the fact that enlightenment was the explicit goal of Zen practice and the master could help the pupil along the way, while double binds were unintended and, according to Bateson, a key feature was that the parties were somehow forbidden to mention them. The schizophrenic thus experienced an incipient disintegration of the self without any context in which to recognise this, and the unbearable inner experience of schizophrenia could thus be understood in terms of an inner struggle to hang onto the modern form—the modern, autonomous self-contained self.

Several points interest me about this analysis. One is that it takes us back to the earlier stages of this essay. There I argued that dualism was consequential for how we go on in science and engineering—we engage in projects like dominating the Mississippi which aim to affirm and intensify a practical dualism of people and things. Bateson's analysis of schizophrenia encourages us to think along the same lines about selves: the modern autonomous self not as given in nature, but as something created and maintained with difficulty—and, again, at the price of potential catastrophe—madness as the Hurricane Katrina of the soul.

[15] Laing later recalled that in his early days working in mental hospitals doctors were forbidden to converse with schizophrenics, for fear of encouraging them in their delusions.

Second, this story invites us to think about what is, in fact, a much broader phenomenon—the association one finds very often, if not always, between non-dualist projects and Eastern spirituality. Here Buddhism offers a non-dualist analysis of the self that proved entirely congenial to the non-dualism of cybernetic psychiatry, but also supplemented it with a vision of the world as a more wonderful place than modernity can articulate (enlightenment, the inner voyage). It served, one might say, to glamorise, in a non-pejorative sense, the unknown world to which the brain continually adapts. Another side of this is what I think of as the *hylozoism* of cybernetics, a spiritually-charged awe at the endless liveliness and performativity of matter itself, though I will let that thread go for now. I should simply note that in building up this non-dualist assemblage, certain forms of spirituality can find an integral place (unlike, as Latour puts it, the Crossed-Out God of modernity, indefinitely distant from the mundane world).

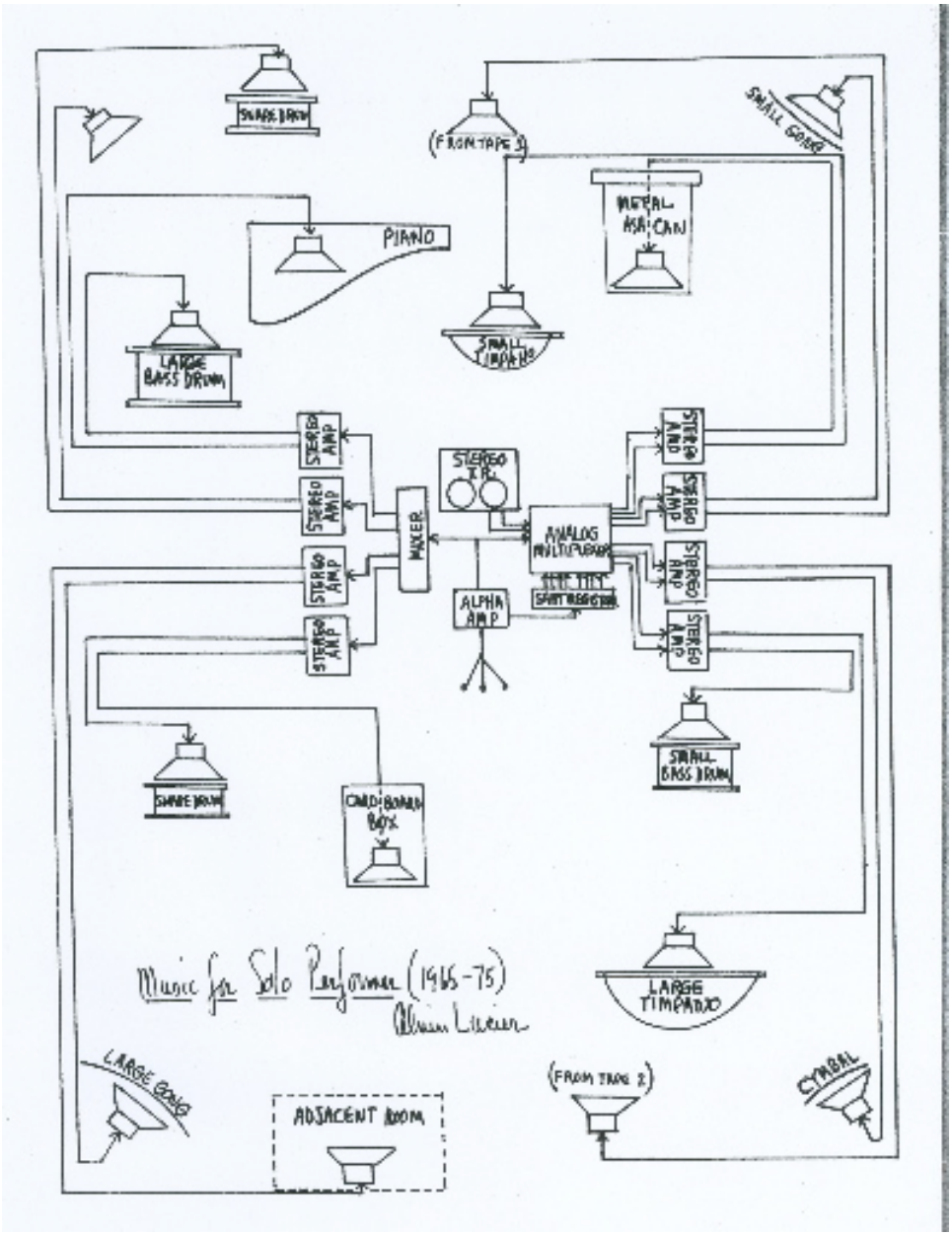
Third, the Foucauldian echoes of the above are evident. One thinks of his notion of *technologies of the self*: specific personal and social disciplines and practices that go into the production of specific kinds of free-standing, autonomous agents (Foucault 1988). I can just remark here that one can take this notion of technology very literally, though the technologies we need to think about aimed at the dissolution rather than the creation of autonomous selves. Aldous Huxley's *Heaven and Hell*, for example, is a veritable catalogue of consciousness-altering technologies, many of them chemical (mescaline, LSD), but also including starvation, chanting, flagellation and what have you. These technologies all point both to a decentred, nondualist, nonautomous conception of the self—a self that is out of control—and to the production of the same in union with a material other.[16]

One such technology of the self, *flicker*, interests me especially as emerging from a cybernetic matrix (Geiger 2003). It turns out that if one gazes with eyes closed into a stroboscope flickering at a rate near the alpha frequency of the brain one sees fascinating geometrical patterns of moving coloured lights, and some people (not including me, alas) see visions. Grey Walter investigated the connection between flicker and EEG readings at considerable length in the 1940s and 1950s, and the phenomenon gained the attention of William Burroughs and the Beat writers and artists via Walter's 1953 book, *The Living Brain*. The Beats understood flicker as a drug-free route to

[16] We could put Huxley et al on a trajectory running from William James (1902), *The Varieties of Religious Experience* up to *The Future of the Body* (Murphy 1992) as a continuation into New Age. For a fascinating scholarly study of drugs and music as technologies of the self, see Gomart and Hennion (1999) and Gomart (2002).

altered states, and one of them, Brion Gysin, actually sought to market Dream Machines, as he called them, as an alternative to the living-room TV. Evidently he didn't succeed, but what interests me here is the contrast between a Dream Machine and a TV. Potential marketers just couldn't decide what a Dream Machine *was*—just what category should it fit into, what should they sell it as? This clash with the demarcations of modern popular culture once more emphasises the strangeness of non-dualist artefacts, and once more one can think in terms of ontological theatre. If the TV stages for us a dualist image of people and things (with people now as passive consumers of whatever the TV has to offer), then the Dream Machine stages for us instead a nondualist coupling: visions as the joint product of the engaged brain and the machine.

This line of thought can continue for a long way. Walter's technical interest in flicker began in his research on epilepsy. A colleague devised a feedback device that made it possible to couple the flicker frequency to the specific alpha frequencies induced in the subject's brain—a beautifully decentred and non-dualist set-up in which the brain controlled the light which controlled the brain and so on round the loop. This device made it possible to induce epileptic symptoms in more than 50% of the subjects it was tried on. On a less horrifying note, EEG feedback got swept up into the 1960s as *biofeedback*: a means for subjects to monitor their own brain states and train themselves to produce alpha waves, which by then had become associated with transcendental inner states. Besides giving the alpha frequencies a bad reputation in the years that followed, this led in turn to the development of biofeedback music, which used an EEG readout to control various sound-generating devices, the output of which helped the performer maintain a transcendental alpha-state, and so on—a beautiful and hylozoist conception of what music is, very different from modern notions of composition by the sovereign artist.



BIOFEEDBACK MUSIC SET-UP: note the 'alpha amp' at the centre.

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The arts

Heidegger thought that only artists stood much chance of rescuing us from the perils of enframing. I am not too optimistic about that, which is why I have concentrated elsewhere until now. But still, the arts and entertainment are important, and I can say a bit about them now. My

impression is that a great deal of contemporary artwork has a non-dualist and even hylozoist character, but I am just going to mention a couple of examples that have come up in my research on the history of cybernetics. I have already mentioned de Kooning's paintings and biofeedback music (which continues to this day, but with much less visibility than in the 60s); now I want to concentrate on the British cybernetician Gordon Pask (Pickering 2006).

Pask built his first cybernetic machine as an undergraduate at Cambridge in the early 1950s. This was the Musicolour machine, a synaesthetic device that used the sound of a musical performance (converted into an electronic signal) to control a lightshow. The machine was sensitive to frequencies and rhythms, and, to simplify, one might imagine that the lowest notes controlled the blue lights and so on up the spectrum. But the defining feature of Musicolour was that it got bored, as Pask put it. Thresholds for firing given lights would rise as certain notes or rhythms were repeated and eventually the machine would cease to respond to them, thus encouraging the performer to try something new. We could go back to the topic of power here: if a skilled performer can in some sense dominate a conventional musical instrument and bend it to his or her will, this was not a possibility with Musicolour. With Musicolour the performer had to adapt to the machine, which was in turn adapting to whatever the performer had done so far. A Musicolour sound-and-light show was thus a symmetrical and emergent joint product of the human performer and the machine—something that neither of them could have achieved alone—a beautiful piece of non-dualist ontological theatre, a revealing machine.

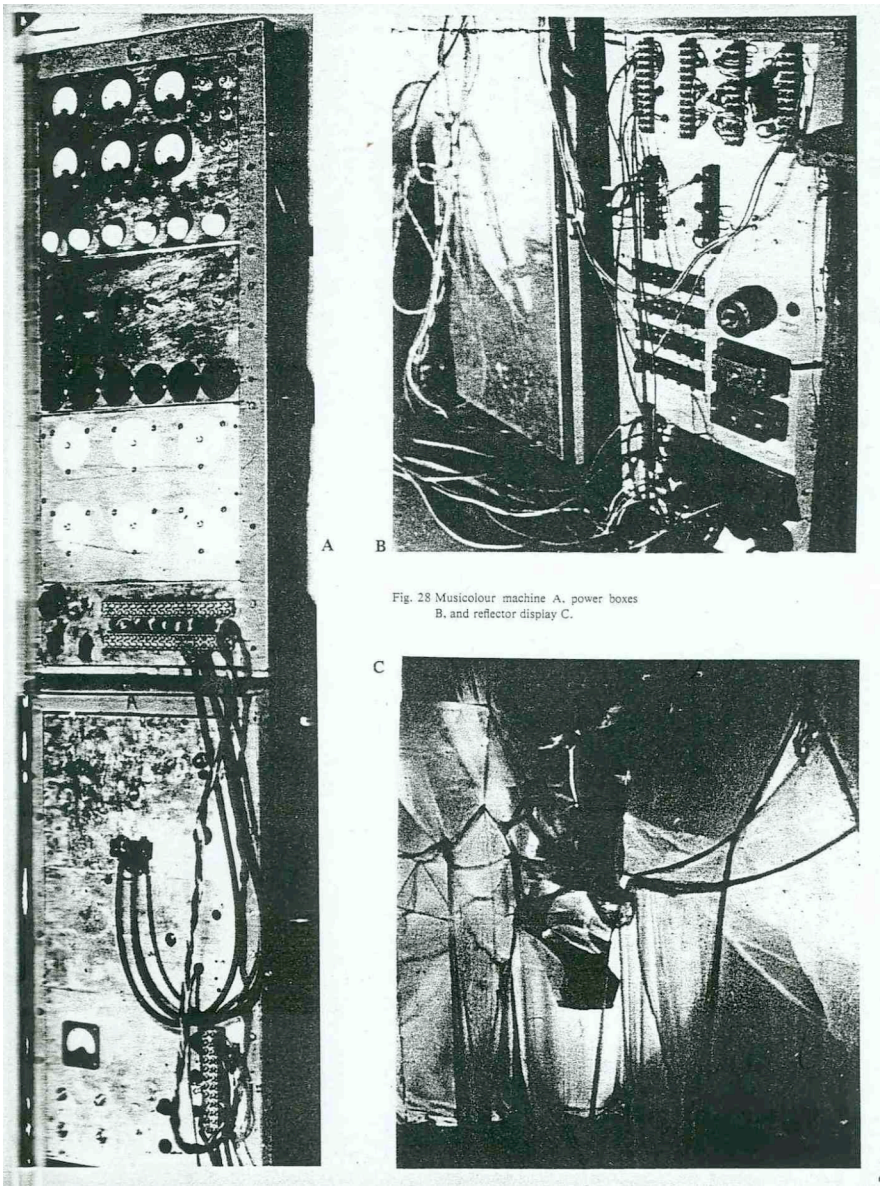
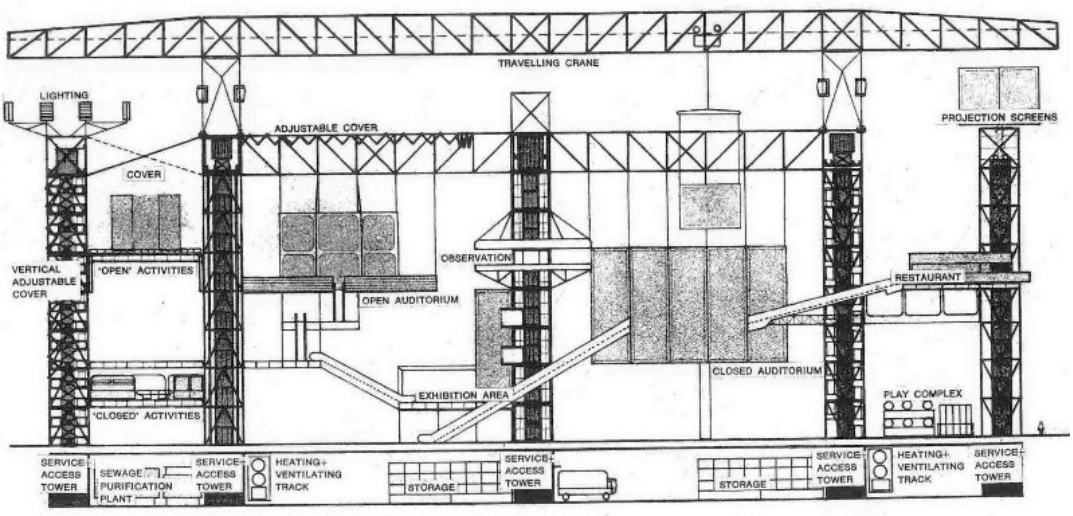


Fig. 28 Musicolour machine A, power boxes B, and reflector display C.

MUSICOLOUR

Musicolour was the model for all of Pask's subsequent work which went, in one direction, into the construction of increasingly sophisticated teaching and learning systems (starting with the forerunner of today's Mavis Beacon typing trainer). Another direction was further into the arts. In 1968, for instance, Pask exhibited his *Colloquy of Mobiles*, an assemblage of robots designated male and female which adapted to one another in a decentred fashion in uncertain matings mediated by sounds and lights. In the early 1960s Pask also collaborated with the radical playwright and producer Joan Littlewood in the development of a cybernetic theatre in which

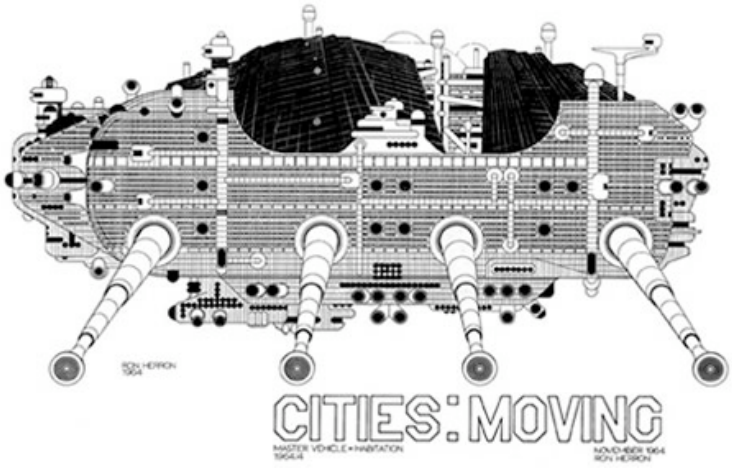
feedback from the sudience would help to steer and construct the action in the real time of performance. Collaboration with Littlewood also led Pask's career in an architectural direction, beginning with Littlewood's projected Fun Palace in the early 1960s. Littlewood conceived the Fun Palace as a new sort of place, where people would go to be entertained, informed and educated, as well as to play games, make their own art, and so on—a 'university of the streets' was one description. Pask became chair of the Fun Palace's cybernetics committee, where his distinctive contribution was to devise in detail how the building might be made adaptive—somehow reconfiguring itself in response to emergent patterns of use and encouraging new ones, again on the model of Musicolour. Adaptive architecture is a fascinating theme in itself, coupling the built environment to its human users in a symmetrical fashion: Littlewood and Pask's hope and expectation was that new human goals and desires would themselves emerge in the novel space of the Fun Palace.[17] The contrast with conventional architecture as a fixed representation of pre-given aesthetic norms or social functions is once again clear.[18] And I can't resist returning to New Orleans at this point. The city's vulnerability lay precisely in its inability to adapt to its environment. In the realm of fantasy, at least, Archigram's Walking City would not have had the same problem with Katrina.



[17] The historical context for the Fun Palace was the so-called leisure problem—the idea (now lost!) that automation would make human labour increasingly redundant and that new activities might emerge in places like the Fun Palace to fill the gap—new people might come into being there.

[18] On the history of adaptive architecture in Britain one should also think of the Archigram group and the Fun Palace's principal architect, Cedric Price (Sadler 2005). On US history, one would think of Nicholas Negroponte at MIT, a sometime colllaborator of Pask. The London Fun Palace was never built; the Pompidou Centre in Paris was a rather non-adaptive version of it.

THE FUN PALACE



ARCHIGRAM: THE WALKING CITY

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Organisation, management, politics

I said earlier that there is something political about non-dualist objects and practices, in the sense that they instantiate and more generally echo back to us different ways to grasp the world and organise our lives from those characteristic of modernity. It is appropriate, therefore, to end this survey with a brief discussion of non-dualist approaches that engage explicitly with questions of organisation and politics.[19] I have in mind here the work of Stafford Beer, another English cybernetician and the founder in the 1950s of a field that he called management cybernetics (Pickering 2004b).

The ruling preoccupation of Beer's work, in industry and later as an independent consultant, was how organisations could be coupled to their environments in an adaptive fashion, so that they could explore their worlds effectively and transform themselves accordingly. In the late 1950s and early 1960s this interest fed into Beer and Pask's amazing projects in biological computing which hinged on harnessing naturally occurring adaptive systems to human enterprises—ponds as factory-managers, for example. This was entirely a spare-time activity for Beer and Pask and led

[19] This is also a thread in posthumanist STS: see almost all of Haraway's writings, Latour (1993, 2004), Pickering (forthcoming a) as well as the present essay. But here I am trying to find inspiration outside the STS tradition.

nowhere at the time, though this approach has begun to re-emerge in recent years (Pickering forthcoming c).

In the late 1960s, Beer developed a different approach to adaptive organisation. His Viable System Model (VSM) modelled information flows and transformations within the organisation on current knowledge of a highly adaptive biological system: the human brain and nervous system—a model of the firm as a real cyborg, with humans and technological artefacts integrated on the plan of the brain, itself non-dualistically coupled to its environment. From a political angle, Beer claimed that the VSM was as democratic a form as possible, consistent with being able to speak of an integral organisation. The key point was that the different levels of the VSM, running from the upper levels of management (levels 4 and 5 below) to production units (level 1), were supposed to be coupled homeostatically—each level could veto proposals coming from other levels and experiment with different configurations in search of some mutual equilibrium, on the model of Ashby's multiple-homeostat set-ups. (This in contrast, of course, with the usual linear model of orders flowing down a chain of command, and nothing flowing back up.)

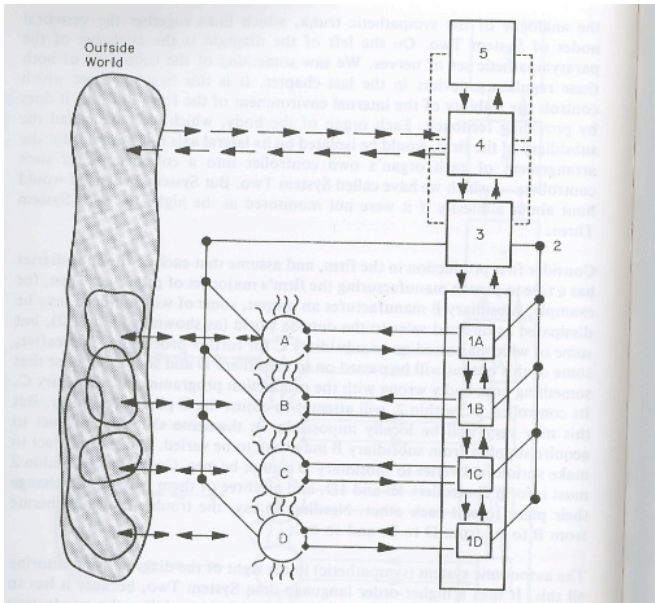

Figure 22. The automatic system of a firm having subsidiaries A, B, C, and D

risk. Productivity indices measuring the rate of production may rise above the

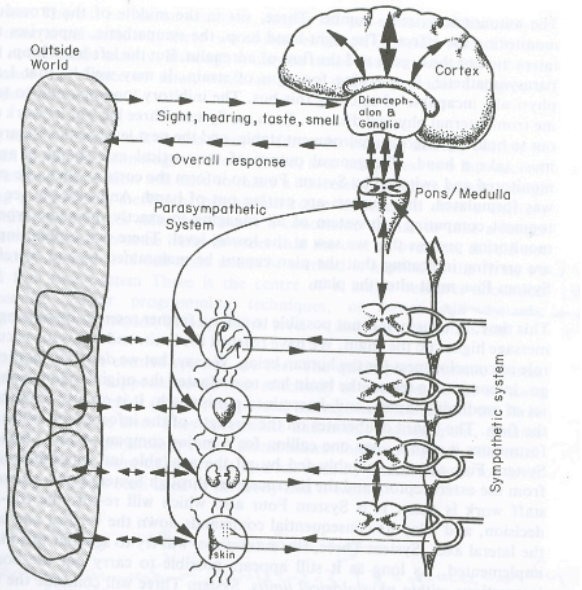

Figure 23. Two dimensions of neurophysiological control: the main vertical command system (somatic) and the sympathetic and parasympathetic systems (automatic)

THE VSM (ON LEFT) IN ANALOGY WITH THE NERVOUS SYSTEM & BRAIN

The VSM proved much more succcessful in practice than biocomputing, and has many practitioners to this day. Beer's most famous application of the model was to the reorganisation of the Chilean economy in the early 1970s under the Socialist government of Salvador Allende (brought to an abrupt halt by the Pinochet coup).

In parallel with the VSM, Beer also developed an approach to collective decision-making that he called Team Syntegrity. Syntegration situated participants on the edges of an imaginary icosahedron, and each participant would engage in discussions of relevant topics with participants with whom they shared a vertex. These discusssions were orchestrated in several rounds (the first of which would concern what the topic for discussion was), so that deliberations could echo around the icosahedron and come back to their origins transformed. Beer claimed that syntegration was a perfectly democratic way of managing decision-making inasmuch as all of the edges and vertices of an icosahedron are equivalent, and that a profoundly non-dualist collective consciousness could emerge in syntegration, with the final conclusions independent of any given participant. As ontological theatre, syntegration also thematised emergence, defining in advance only an empty form with the expectation that novelty would emerge in the process of syntegration itself.

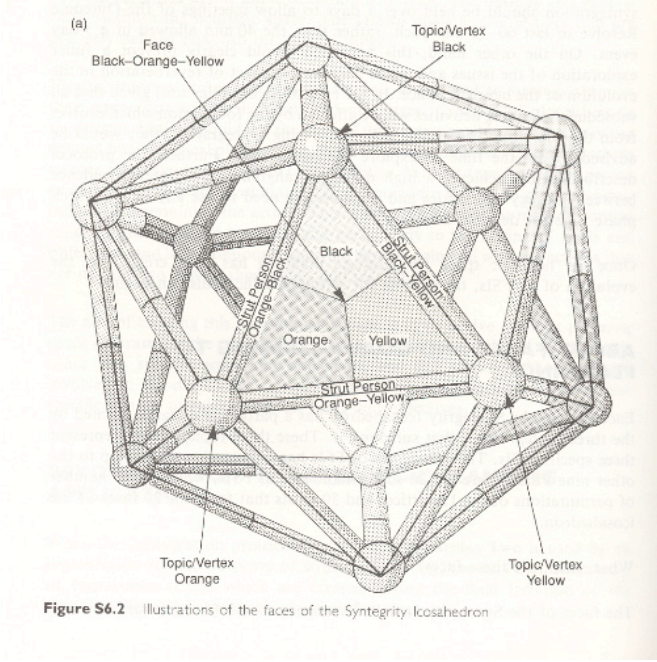

Figure S6.2 Illustrations of the faces of the Syntegrity Icosahedron

THE SYNTEGRATION ICOSAHEDRON

Beer's diagrams of democracy—the VSM and the syntegration icosahedron—interest me a lot. From one angle, they are very concrete proposals for how to organise our lives, in terms of symmetric power relations and decision-making procedures. On the other hand, they make no foundational assumptions about what people are like and what they want—these emerge in processes within the systems. Again there is a striking contrast with conventional forms of politics, where, for example, the best one can hope for is an electoral choice between a couple of predefined alternatives. Again, ontology makes a visible difference in practice.[20]

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To conclude: this essay has taken on a more linear form than I expected. The plot turns out to go like this. My concern has been with a specific dualism of people and things that, following Latour, I see as particularly salient in science and technology studies, and with an associated conceptualisation of modernity. Of course, we can usually tell the difference between people and things in a commonsense fashion, but the dualism at issue here is one that would understand the two terms—the human and the nonhuman—differently, as in the modern natural and social sciences. The argument from STS was that if one explores the heartland of modernity—modern physics, for example—one finds that the dualist separation does not stand up in practice, that key features of cultural extension hinge upon a constitutive and dynamic coupling of the human and the nonhuman. Neither term has its own pure dynamics; something important disappears when we try to hold them apart.

The temptation then is to claim that dualism has been shown to be false in the hardest of hard cases; that duality is the false consciousness of modernity, a veil cast over the world and us in it. I think that's right to a degree, but I have tried to go further. The metaphor of the veil is too passive; it cannot speak to the generative aspects of modernity. The modern sciences have as their *telos* a remaking of the world as more dual. I talked about the production of free-standing machines and instruments; there is also a sense in which the *telos* of science is the production of free-standing knowledge—knowledge that appears to inhere in the world itself, independent of its human creators; and later I have talked about the modern autonomous self. The products of

[20] There are interesting connections to Eastern spirituality in Beer's work: he practised and taught Tantric yoga; the VSM was envisaged as a recursive structure and in his later writings Beer made it clear that it extended upwards to encompass the cosmos (as accessible in meditative practice), and he was very keen on the fact that the syntegration icosahedron embraced the mystical figure of the enneagram. From another angle, there is an interesting connection from Beer's cybernetics to music. Brian Eno recalls that it was a key moment in his career when he read Beer's *Brain of the Firm* (1972).

science (and enginering, and all sorts of other activities) thus speak to us of a dualism that wasn't there in the first place.

We thus inhabit a world in which the highest status activities both presume and intensify a dualist ontology, and in which an ever-growing array of material and social objects stage that same ontology as we move through them and interact with them. This is my analysis of the power and hegemony of dualist modernity over our imaginations—of why we tend to approach the *next* situation from a dualist stance.

Like Heidegger, I worry about this hegemony, though perhaps in a different way. It constricts our imaginations, narrows our practical options and increasingly seems to leave us with no alternative to heroic but grim domination projects, with catastrophe and disaster as the inevitable other side. I don't think we need to remain in this grey, joyless and desperate space and I have tried to show that by listing examples of non-dualist practices and objects from recent history up to the present, from science, mathematics, engineering, robotics, brain science and psychiatry, the arts, entertainment and architecture, spirituality, organisation and politics.

What am I doing with this list? Most obviously, I want to show that we do not have to be dualist, always, all the time. There are other ways to go on. Beyond Latour's maxim that 'we have never been modern' I want to show that there are nonmodern practices and objects that Latour (2004) himself seems never to have imagined. I also want to suggest that we should take these seriously, which is why I have emphasised fields of nonmodern science and engineering, psychiatry and organisations—and, from another angle, why I have indicated a few times that cybernetic artefacts inevitably look strange, puzzling and amusing as we try to fit them into a dualist grid. I can see no reason why we shouldn't treat Dream Machines as everyday objects which we might either like or dislike, but the very idea of them seems vaguely obscene and makes many people, including me, feel uncomfortable. And beyond that, the metaphor of the gestalt switch has become increasingly important to me as I have been writing, It is not simply that modern physics, say, displays for us a dualist way to proceed, or that its products echo dualism back to us. All of the elements of the modern dualist assemblage echo the same message back and forth between themselves, too, each reinforcing the other—this whole assemblage forms a coherent pattern, which we can then project onto all that falls outside it. This, I think is where the hegemony of dualism finds its strength. What I have been trying to do, then, is to conjure up a counter-pattern,

gesturing at this and that and trying to show how the bits fit together in a non-dualist picture, in which dualist modernity can find its place as a finite zone, not the whole thing.

Have I succeeded? Probably not. If mainstream physicists can make fun, as they do, of complexity theory, what chance does a Dream Machine stand against a particle accelerator? Is the whole exercise therefore a waste of time? I would like to think not, and I find some sort of solace in the fact that in living memory dualism was severely tested in popular culture. A large segment of the Western world did once adopt a non-dualist form of life and with great enthusiasm and joy, for a decade or so. I refer, of course, to the 60s, and the so-called counterculture in particular. The whole interest in altered states of consciousness, for example, and the technologies of the self (not called that) that went with them, points to the counterculture's radically non-dualist aspect. It is not inconceivable, then, that something like this could happen again.

Is the idea, then, that we should go back to the 60s? Personally, I wouldn't mind, but no. On the one hand, one can never go back; on the other, in retrospect the counterculture appears structurally very weak—focussed too much on the self and the senses, the arts, style, fashion. Hence my focus here on a broader range of topic: the sciences, engineering, architecture, organisations, as well as the arts, spirituality, psychiatry, altered states. If we could put all of this stuff together next time around, perhaps we could construct a more robust gestalt, a real challenge to the hegemony of dualism.

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