

5 Controlling the passions

Passion, memory, and the moral physiology
of self in seventeenth-century
neurophilosophy

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INTRODUCTION: CONTROLLING BRAIN AND MEMORY

It is difficult to determine for sure whether this relation or connection between the thoughts of man's mind and the movement of his body is a punishment of sin or a gift of nature . . . We know that before his sin man was not the slave but the absolute master of his passions and that with his will he could easily arrest the agitation of the spirits causing them.¹

Some natural philosophers in the seventeenth century believed that they could control their own innards, specifically the physiological animal spirits coursing incessantly through brain and nerves, in order to discipline or harness passion, cognition, and action under rational guidance. Moralizing wishes and recommendations for the self's action on turbulent internal fluids were buttressed by reference to the prelapsarian limit case: 'before the Fall, the soul could erase the brain's images' and 'instantaneously arrest the disturbance in the brain's fibers and the agitation of its spirits merely by considering its duty'.² The result of sin is that the inner dynamics of traces and animal spirits no longer depend on the will: our efforts 'to combat licentiousness' and 'the confused pleasure of the passions' must now be indirect, the product of long, weary acquaintance with 'the charms and endearments' and 'the threats and terror that the passions cause in us', as the seeker after truth becomes injured to coping with 'their clatter and shadows'.³

In this chapter I try to understand the mechanisms thought necessary after Eden for controlling the physiology of passion. They were entangled with related techniques for organizing and ordering the past, since passions operate in time, desire inevitably colluding with memory. The tragedy of human embedding in the body, with its cognitive and moral limitations, was paired with a sense of our confinement in sequential time: whereas 'Adam needed no spectacles' and no

knowledge of history, and angels have no need of memory,⁴ we are engaged in an ongoing struggle to tame the past. Memories could be disciplined in both personal and theoretical contexts, in the intimacy with which the self dealt with its unruly brain traces, or in the ridicule and denigration of models of memory which overemphasized that unruliness. I use two strands of seventeenth-century natural philosophy to exemplify forms of the perceived connections between physiology, memory, and the passions. I deal at length with Cartesian mechanism,⁵ and much more briefly with some tendencies in Restoration natural philosophy in England.⁶

First I outline in some detail the link between the passion of wonder and the physiology of memory in Descartes and Malebranche to show that the problematics of psychological control involved not just the old dualist diatribe against the body, but also consideration of how to deal with certain sorts of mental representation. It is not just (and not even) that a life oriented towards the good and the true would neglect or suppress the body, as the *Phaedo* and certain forms of Christianity encouraged; but that, because memory as well as the body carries the personal past, the struggle is to keep that past in order, to retain distinctness from and thus control over the collection of memories layered through the folds of the brain. Cartesian ethics demands, in part, the gradual use of habit and association (to be understood through knowledge of the mechanisms of memory and of the idiosyncrasies of a specific brain and body) in order to encourage the bodily sources of passion to shift into morally sanctioned paths. The recommendations of Descartes's *Passions of the Soul* are not just scientific ravings, not an exasperated response to Elisabeth which madly asks us just to engage in direct introspection of our brain states;⁷ rather, they are provisional maxims, applicable differently in each individual, for applying intelligence to the reflexes, and (fallibly, interminably) recolonizing the body.⁸

Elsewhere in this volume Susan James suggests that modern philosophers of mind lost touch with earlier, more differentiated theories of motivation when the many varieties of passion which could cause action were reduced to a single notion of 'desire' meant to combine with belief. But one of the reasons it is difficult to think back into those prior, 'pre-modern' systems is that the psychological states (fears, hatreds, and joys, or memories, images, and beliefs) were all closely tied to, constrained by, or identified with physiological states (the metaphysics of mind, often crucial theologically, was less relevant for moral physiology). Love, wonder, dreams, desire, and memory were all implicated in the greater circulations of spirits, fluids, and humours

in the body and between body and world, just because they were (or were carried by, or correlated with) diverse and patterned motions of animal spirits through nerves and brain pores, and because those spirit motions were influenced by all the environmental and cultural input which whirled across and through the body. This permeability was, to a great extent, retained in the mechanized picture of the body developed by Descartes. Both Descartes's interactionist metaphysics of mind-body relations and Malebranche's occasionalism still required, in the practical realm of moral physiology, intense engagement, in the moral quest for knowledge and for mental purification, with the confusing, fleeting body fluids: 'all the changes occurring in the imagination and the mind are only the consequences of those encountered in the animal spirits and the [brain] fibres.'⁹ The unobservable animal spirits, strangely surviving through to the mid-eighteenth century, threaten the entire domain of cognitive processes with their wriggling power, and must be rigorously neutralized and employed by the expert.

I then go on briefly to examine English responses to these models of memory. Before the increasing division of physiology from both ethics and philosophy of mind in the later eighteenth century, many worried that Cartesian memories, thought of as motions (rather than stable, static, ordered bodies lodged in neat cells), would indiscriminately mix with each other, 'and bring all into confusion'. How could chaos be averted if access to the past was filtered through the fickle, affect-ridden animal spirits, which would scarcely allow 'any determinate motion' to be 'long preserved untaunted in the braine'?¹⁰ Because the history of theories of memory and of brain anatomy has been seen primarily in the context of the search for the localization of function in specific brain structures, and of consequent concerns about materialism, key forms of rhetoric have been missed: the perceived need to keep memories in place, stated in terms of an order/confusion dichotomy, was coupled with a conception of virtue, the control of excessive passion, as the institution of appropriate relations between self and memory, or between self and those parts of body and brain which carry memory. Why are memories often 'rouzed and tumbled out of their dark Cells . . . by some turbulent and tempestuous Passion' without the involvement of the soul?¹¹ Do we really have a hand in the process of forgetting? What knowledge is required, what moral stance necessary, for the rumble of reminiscence to be brought under the sway of the will and thus to be made, presumably, less troubling?

These are fruitful historical domains for seeking to connect cognition and culture, since relations of domination, disruption, or accommodation present and past are in play for both selves

and societies. As Susan James further suggests, the sense of 'activity' against which early modern philosophers of mind defined the 'passivity' of the passions is too extreme for us to understand fully, because of the strength of dualist requirements of mental autonomy. But this allows us to investigate their stratagems of control over those thoughts, memories, or passions which were not officially active but which, indubitably, had their own powerful, experienced force. Unintegrated feelings, or wayward items arising in stray recall, had to be constructed as lying outside the self, produced in an alien dynamics of body fluids beneath the compass of attention and the will. Without the metaphysical insurance of confident dualism, we are even less confident than was Descartes that we can deal with the strangeness in our selves, if those selves just are, in part, the mixed sediment of particular parts in specific brains and bodies. It is too easy, though still important, to carp at historical moralists blithely idealizing mental independence, to undermine their 'relentless optimism about the autonomy and power of the will',¹² by exposing 'the soft underbelly of reason' in affect and the passions: but there is so much more to do in examining historical hints or methods for working *with* the psychophysiological mix, for dealing with or stabilizing excess flux from within, for accepting the embedded fate of self and passions in the environmental, social, and bodily dynamics in which they inevitably exist and shift.

MECHANISM AND THE PASSIONS

Man never remains the same for very long: everyone has sufficient inner evidence of his changeability. At one moment we judge in one way, the next in another, on the same subject. Briefly, man's life consists only in the circulation of the blood, and in another circulation of his thoughts and desires. And it seems we can hardly use our time better than in seeking the causes of these changes that happen to us, thereby learning to know ourselves. . . . our main goal here is to control the mind.¹³

Epistemology of the innards

Malebranche, describing changes in the animal spirits which roam the body, suggests a method for testing his 'simple explanation' of the mechanisms: when 'surprised by some violent passion', one must be 'careful to reflect upon what one feels in one's entrails and in the other parts of the body where the nerves are embedded'.¹⁴ How can this strange body-phenomenology of emotional turbulence promote the moral life? How could the ideal of cognitive penetration beneath the

skin, of entrails transparent to the eye of reason, have seemed to offer progress in the search after truth? In particular, the brain seems the most absent of body parts, but early modern theorists found it oddly relevant in moral contexts: the brain came to notice only when something was wrong, with the sensing of turbulence or stagnation, and with concerns over psychological transience or surrender to the sensuous projected inside onto the fleeting, violent, random animal spirits in commotion in the moralized interior.¹⁵

In Cartesian theories of the passions, goodness depends on knowledge of bodily mechanisms. In particular, Cartesian treatments of the crucial passion of wonder are in the strange realm of moral physiology, a zone of engagement, both theoretical and practical,¹⁶ with memory and the body. Ethics must be, in part, neurological.¹⁷

Physiology and wonder

Wonder (*l'admiration* or *admiratio*) is for Descartes 'the first of all the passions': it normally augments almost all other passions.¹⁸ It occurs 'when our first encounter with some object surprises us and we find it novel'. The causes of the 'sudden surprise of the soul' in wonder are twofold: 'an impression in the brain, which represents the object as something unusual', and

a movement of the spirits, which the impression disposes both to flow with great force to the place in the brain where it is located so as to strengthen and preserve it there, and also to pass into the muscles which serve to keep the sense organs fixed in the same orientation so that they will continue to maintain the impression in the way in which they formed it.¹⁹

The utility and the danger of wonder both spring from its physiological peculiarity. Even though Descartes professes to discuss all the passions 'only as a natural philosopher and not as a rhetorician or even as a moral philosopher',²⁰ scattering the subtle animal spirits across his explanations of love or of vanity, wonder receives a more detailed neurophilosophical treatment than any other passion. This is, I suggest, for two reasons. Wonder theory is more closely tied to memory than other passions are, because Descartes needs to explain how a surprise results in the tracing of impressions in the brain pores which are, unusually, not already formed by the tracks made by animal spirits over long experience and prejudice: Descartes's existing physiology of memory lies behind his suggestion that wonder, uniquely, offers the hope of an open cognitive engagement with the world which

is not already overlaid by the past. Second, and in consequence, the isolation of a memory trace from others which occurs in wonder is a model for Descartes's preferred picture of psychological control: wonder is the passion in which internal body dynamics, which carry the peculiarities of individual history and the accretions of learned tradition and habit, make the least contribution. In wonder, the external world is the controller, and the brain submits to the world. Likewise, as a result of training, the rational soul, mimicking and extending this control of the brain by the world, can impose distinctness on brain traces by controlling the fickle dynamics of association, minimizing psychophysiological confusion.

I develop these readings below. But, in anticipation, it is natural to ask what historians of the passions are meant to do with references to 'those "traces" that still plague psychology' and to the 'inherently self-contradictory concept' of animal spirit, that 'common subterfuge of ignorance'.²¹ How can Descartes's *Passions of the Soul* be in any way related to the establishment of the 'sure foundations in moral philosophy' towards which (as Descartes told Chanut) physics would help,²² if the relevant part of physics is this 'antiquated' physiology? Must we assume that the physiological details, while 'extremely ingenious, are of comparatively little importance in this context'?²³

Descartes's speculative psychophysiology, notoriously, is ' quaint', 'a little fantastical'. His microreductions of emotions, temperaments, and humours to diverse mixtures of animal spirits are 'intuitive but extraordinarily simplistic', and his physiological treatment of memory is 'particularly incoherent'.²⁴ Rationalist inattention to observation and anatomy in preference for the drama of a whirl of invisible spirits in hollow nerves, it is thought, is a symptom of Descartes's reduction of the phenomenological complexity of lived bodily experience to the atomic combinations of mythical particles: his exuberant confidence in neurophilosophical 'explanation', critics complain, marks his 'attempt to cut ourselves off from the norm of animal existence', bypassing 'the concrete life of feeling' which he 'had done his best to avoid'.²⁵

Mechanism, memory, and method

I want, however, to combat a common double line of criticism here. The critic first overstates the inertness of Cartesian bodies and their parts, granting Descartes the very meagre mechanical ontology which must allegedly be derived from his first principles of method, and then, second, complains that (when dealing with the passions, memory, and other puzzling phenomena of the body-mind union) Descartes illegiti-

mately introduces 'smuggled goods', cerebralizing mental functions (like memory) and psychologizing the animal spirits, which ought to be dutiful, passive, corporeal bodies.²⁶ A full response to this complaint would both demonstrate the roles of forces and activity in Cartesian bodies once set in motion in a plenum, and argue for a large intermediate class of behaviours which lie between simple hard-wired automatisms and incorporeally-mediated rational actions.²⁷

It is more relevant here, in the context of the desire to know and to control internal bodily motions, to address the post-Wittgensteinian motivation for the critics' complaints. Neither mental representations nor bodily processes, they argue, need be the immediate object of the will, intervening between intention and willed action: neither a sensory image of my arm rising, nor a complex set of patterns in my animal spirits, need be the precursor of my raising my arm. The Wittgensteinian lament against both Cartesian mentalism and scientific physicalism is that they unnecessarily introduce a complicated relationship between self and body (or self and mental representation), where common sense would never dream of even opening up the shadow of a gap between decision and action. Descartes 'failed to realize that he was introducing an extraordinary use of the word "body"', in which a 'distinction between *himself* and his body' makes sense (where it allegedly does not in ordinary language).²⁸ It seems strange, too, to locate memory *outside* the mind, as Malebranche must to note that those most prone to error include 'scholars, who use their memories more than their minds'.²⁹ Thus the rhetoric of common sense, for example in Grene's work, of replacing the disastrous, science-fictional philosophizing of animal automata and 'turbulent animal spirits' with invocations of the need for 'full-bodied' concepts in 'a world where, though in a complicated and often messy way, things make sense' and in which 'without the artifice of Cartesian method, we would find ourselves spontaneously at home': all that philosophers should do, following Aristotle, Wittgenstein, Merleau-Ponty, or J. J. Gibson, is to 'restore our primary means of making contact with the realities around us to an organic place in the living world'.³⁰

It is true, in our anti-dualist age, that we prefer to say, against Descartes, that *we are* our bodies than that we *have* them. But, with struggles against dualism and its oppressions won, it will, I suggest, be misguided to say wearily that there are no problems here, that the dropping of the ghostly soul acting behind and through the dead flesh leaves us with a simple, successful (Aristotelian/phenomenological/direct realist) view of mind and action: all the difficult issues remain, for the bodies which we are are neither simple nor unified. They

include conflicting memory traces, opposing desires, beliefs in tension, as well as multiple purely physiological processes which escape our notice and which continue beneath attention, or against the demands of the currently dominating thought and cultivated moral character. The dislocations and fragmentations between the parts of a somatopsychic 'unity' still require attention: we do sometimes flee from memory and the passions, or seek to escape genuine, puzzling, experienced conflicts between self and thoughts. Our difficulties with memory in the late twentieth century suggest that it is not so stupid to ask questions about the possible range of relations between self and memories and between body and self. We might not now characterize control over wayward memories as 'virtue', but we are aware of the difficulty of altering the ways in which norms, attitudes, and fears are internalized in memory.³¹

One way of demonstrating the complexity of the relations between body, time, and mind in Descartes is through the theory of memory embedded in what Hume would refer to as 'the Cartesian philosophy of the brain'.³² Apart from its interest as a model of memory, Descartes's inchoate neurophilosophy is particularly relevant because of an unnoticed connection with his treatment of wonder and the passions.

Corporeal memory and superpositional storage

In the soulless world of Descartes's *L'Homme*, earthen machines exhibit life functions just like ours. These animated statues are not, however, restricted to behaviour inevitably determined by the interaction of hard-wiring and current stimuli: these dreaming machines not only walk, breathe, sleep, and reproduce, but also exhibit what are to us cognitive functions, including sensation, imagination, memory, and passions. Descartes's fable seeks to catch at the very pulse of the machine.³³

This is accomplished (thanks to God's skilled craft) by the animal spirits, incessantly undergoing *criblage* or *tamissage* (sifting, filtering, sieving) in the textured brain mesh, forming and reforming patterns of motions across the inner surfaces of the fibrous brain tissue. Corporeal ideas are the figures which animal spirits trace on the surface of the pineal gland. Whether these figures derive from sensory impressions, from imagination, or from other internal causes, the spirits then imprint traces of the figures in the internal part of the brain, which is the seat of *Memory*.³⁴ Descartes sketches a theory of recall or retrieval. The patterned motions of spirits over time leave structural

alterations in the brain pores, which are bent and rearranged in such a way that

[figures] that existed previously on this gland can be formed again long afterward, without requiring the presence of the objects to which they correspond. And it is in this that *Memory* consists.³⁵

The reconstruction of figures depends only on physical variables (such as the degree and pattern of openness of pores, and the direction and strength of the flow of spirits), but functions over long time-periods. Figures need not endure in the same form over the temporal gap between experience and remembering, but are evoked by the interaction in a context of current spirit-flow and residual dispositional traces in brain tissue. Total recall is possible on partial input.³⁶ But this initial treatment of memory does not deal with the mechanisms of retention and storage: what happens in the pores and spirits when a particular trace is unactivated, which yet allows its future reconstruction?

Later in *L'Homme*, Descartes describes how movements of the pineal gland can be caused by sensory input, or by the differing flow of spirits leaving it. Idea-figures can be formed without the involvement either of the soul or of the currently-perceived external world, when caused, for example, by 'the imprints of memory', which tend to impress in the spirits any associated figure 'at the region of the brain toward which the gland is inclined':

And it is thus that past things sometimes return to thought as if by chance and without the memory of them being excited by any object impinging on the senses.

But when, as 'usually happens', 'several different figures are traced in this same region of the brain almost equally perfectly', the spirits acquire a combined impression of them all: this is how chimeras and other monsters arise in the daydreaming imagination, when the disciplinary constraints of reason and perception are relaxed.³⁷

This suggests that memory storage is superpositional, with many traces in the same region. Since they are 'stored' implicitly, as dispositions for the reconstruction of explicit figures, interference and blending among memories naturally occurs in the mix. Traces are not inevitably distinct one from another. Imagination is, then, the work of memory, rather than a separate capacity, a disturbing possibility which would haunt early modern moral physiology. Memory traces act in a causally holistic way, all potentially influencing the course of ongoing processing: there is no *place* for a single, independent memory item in an inner *locus* or address.³⁸

This is confirmed in a series of references to memory in the letters of 1640. Descartes is specifying which physical regions may be involved in memory storage, and canvasses the gland, the brain, nerves and muscles, the hands of a lute player, and external storage systems like books.³⁹ These suggestions are not due to recognition of the problem of finding room in the brain for every memory:⁴⁰ although this had concerned Descartes at the time of the *Regulae*, the use of superpositional storage in the later memory model rendered the idea that the brain is too small to contain every memory simply a 'prejudice', as Malebranche would state.⁴¹ Descartes reiterates that it is 'especially the interior parts' of the brain 'which are for the most part utilized in memory'.⁴² There does not need to be such a large area of brain tissue dedicated to memory, because 'the folds of the memory get in each other's way', with many traces in the same place: 'a single fold will do for all the things which resemble each other'.⁴³

My reading of Descartes's model of memory as a distributed one is supported by its more explicit development in Malebranche. Differences in animal spirits cause differences 'in the depth and clarity of the traces in the imagination'.⁴⁴ Malebranche's account of the lasting effects of experience on the brain which result is central to his wish to explain 'all the errors of men and their causes'.⁴⁵ Vestiges or 'traces' of perceptual impressions survive, and become reciprocally connected. Some 'natural connections' are 'necessary to the preservation of life', but others are acquired and fortuitous: it is the latter, which may 'rise again' together without perceptual or rational source, which lead to dangerous plasticity in memory. Brain fibres altered by previous flows of spirits 'retain some facility for receiving these same dispositions for some time. Now, memory consists only in this facility . . .'.⁴⁶ Because these dispositional traces are superposed, interference is likely. Brain traces can become 'confused with each other, because there are so many of them': it is 'nearly impossible for so many traces, formed without order, to avoid becoming mixed up and bringing confusion into the ideas'.⁴⁷ The preservation of original order is not a natural property of distributed memory, and temporal fragmentation is always more likely: the avoidance of confusion is an achievement, for there are no permanent independent traces, and confusion is the primitive mechanism of remembering.

Body holism and hydrodynamics

That a Cartesian model of memory took this form is surprising for many reasons, for it conflicts with fundamental assumptions about

early modern mechanism and theories of mind. I address below its relation to Descartes's 'intellectual memory'. But there is a more urgent objection. Descartes's mechanical philosophy requires, notoriously, that matter (including the human body) be passive, pure extension in motion: doesn't this vitiate the picture I am sketching of a dynamic physiology in which brain and body are always active? A curious consensus across analytic history of philosophy and cultural studies promotes the image of 'Descartes as anti-magus, stripping nature and the human body of power and activity: 'the Cartesian legacy has furnished contemporary thinking with a paradigm of the body as an inert, closed, and anonymous object'.⁴⁸ But in fact, as Malebranche puts it in introducing his account of the passions, the Cartesian view of the body implies that 'we are to some extent joined to the entire universe': the forces of cosmos and culture traverse and permeate the innards, influencing the animal spirits, for everyone is joined 'through his body to his relatives, friends, city, prince, country, clothes, house, land, horse, dog, to the entire earth, the sun, the stars, to all the heavens'.⁴⁹ It takes revision of received wisdom to find room in Cartesianism for the picture of highly theorized, porous, particular bodies as temporary pockets of stability embedded in social and physical worlds. The resulting orientation renders less surprising the notion of distributed memories, always in motion, never stored passively and faithfully in inert cells in a memory palace, but superimposed and reconstructed according to the peculiarities of history and current context.

It is not quite true that in Descartes's work 'all spirits were effectively removed from nature'.⁵⁰ The survival of paradoxically corporeal spirits was not an accidental residue: their incessant motion was one of a variety of forms of genuine activity which remained in the mechanical cosmos, ultimately deriving, even as it did, from God. The spirits' coalescences, branchings, foldings, and commotions, retaining and transforming patterns over time, disrupt historiography as much as they did the will. Descartes's physiology, like his cosmology, was modelled on fluid dynamics: everything affects everything else in the plenum.⁵¹ The focus on the constant collision of bodies should upset critics' stress on the evil effects of mechanistic reductionism, for Descartes's concern is not to explain the isolated interactions of discrete units of matter, how a body 'behaves when not under constraint, but rather to account for what happens when a body moves from one system of constraints to another': 'systems of constraint are constitutive of' the phenomena under investigation.⁵² Distributed memory traces are not anomalous, for they exhibit in a particular

domain the context-dependence and causal holism typical of all natural interactions. The specific form of any reconstructed trace depends not only on current input from world, body, or soul, but also on the contingent dispositional states of the pores in the relevant brain regions, and also on a messy range of factors influencing the state of the animal spirits. In the case of memory, the relevant constraints are those that tie the organism to its particular body, its particular past.

This is not, then, 'the submergence of the organism by the machine', the reduction of all bodies to sameness, the imaging of automata as 'endlessly repeatable, and by definition not particular, not the subjects of a specific history'.⁵³ It is not only that the homeostatic 'maintenance system' in the self-moving automata which organic bodies are must remain healthy to ground reliable information-processing;⁵⁴ in fact, the Cartesian 'body, with its interactive openness', far from being inevitably moulded to a single hard-wired model, is the means by which difference is introduced into the human compound.⁵⁵

In ancient and Renaissance physiologies of humours and spirits, across boundaries between Aristotelian and Hippocratic/Galenic systems, the body was by nature open, the internal environment always in dynamic interrelations with the external environment. Its state depended on interaction with the 'non-naturals' (such as air or climate, diet, sleeping and waking, evacuation and repletion, and the passions), on regulation of temperature, and on the maintenance of fragile internal fluid balances. Certain proper mean states could seal its openness, allowing resistance to immediate stimuli and avoiding surrender to temporary environmental upheaval. Steps could be taken, for example, to close off its vents and windows, barring the orifices by which external agitations could intrude to taint the animal spirits. But this seasonal body was always vulnerable to climatic effects and permeated by the environment by way of diet, place, and so on.⁵⁶

Almost all of this survived in Descartes's 'corpuscularized Galenism',⁵⁷ transformed into principles of fluid mechanics by which inner and outer interact. Because animal spirits are derived from the blood, they are affected by anything that 'can cause any change in the blood': this is why Descartes's accounts of memory and corporeal ideas are prefaced by long descriptions of the effects on blood and thus on spirits of food, digestion, respiration, and climate, and of the states of liver, gall bladder, spleen, and heart.⁵⁸ There are lines of causal influence straight from cosmos and culture to the quality and context-specific nature of 'cognitive' functions like memory, imagina-

tion, and sensation. The causal factors affecting the spirits and all psychophysiological functions do not stop at the skin.

It is not that Descartes's mechanization is incomplete, leaving him with an oddly baroque physiology in a general physics of barren matter, but that a psychophysiology modelled on hydrodynamics explicitly theorizes an active, runny, permeable body, embedded in a full fluid universe. The moral advice on psychological control, which I address below, is then in part a set of maxims for trying to bind this open body, to stabilize the flux. The strangeness of this demand is again worth pausing over. It should complicate further the difficult attempt to document conceptual and phenomenological shifts in the early modern period from grotesque and open to classical and closed bodies, from spectacular to docile bodies, or from public to private bodies. Theory which itself is alien to us imposes puzzling requirements for self-control, in which the part of nature that it is most important to master is the part we might have thought we already possessed, our own body.

Wonder and body

One reason that wonder is an unusual passion, for Descartes, is precisely that its operation is isolated from this body holism. Other passions demonstrate the interrelatedness of emotional, neurological, and circulatory processes, since they involve brain and nerves in tandem with heart and blood, with animal spirits mediating the two systems. Wonder, in contrast, 'has no relation with the heart and blood... but only with the brain', the sudden movement of spirits to the new impression effecting a temporary isolation of the brain.⁵⁹ Wonder is free of the vicissitudes of intervention from below, giving it importance in the imposition of cognitive discipline. But the absence of interference from irrelevant contextual influences outside the brain is matched in wonder by a freedom from interference *within* the folds of memory. Wonder fixes a memory trace as if it were local, as animal spirits flow between brain, muscles, and sense organs so as to 'continue to maintain the impression in the way in which they formed it'. This is not merely a temporary perceptual fixation, for wonder contributes directly to longer-term changes. It is useful because 'it makes us learn and retain in our memory things of which we were previously ignorant'.⁶⁰ The 'novelty' and the strength of the motions of spirits⁶¹ conspire to isolate a memory trace and render it, temporarily, independent of others.⁶²

Wonder and intellectual memory

One of Descartes's arguments for a non-physical intellectual memory of universals, unique to humans, with folds and traces of its own, depends on the claim that there cannot be any corporeal trace of novelty. The mind must recognize that brain traces were 'once newly impressed', and must 'have made use of pure intellect' at the time of their first impression in order 'to notice that the thing which was then presented to it was new'.⁶³ Brain traces are not sufficient for memory, the claim seems to be, but are, rather, parasitic on the soul's initial surprise. But this is in some tension with the discussion of wonder in the psychophysiological context of the *Passions*. There, Descartes does accept that it can 'perhaps' be through 'an application of our intellect as fixed by our will in a special state of attention and reflection' that the trace of something novel and extraordinary is retained in the memory: but, in apparent contradiction of the claim that 'there cannot be any corporeal trace of this novelty', he writes that an idea of something novel can also be 'strengthened in our brains by some passion'.⁶⁴

It has been suggested that Descartes's discussions from 1640 to 1648 of an 'altogether spiritual' memory, 'not found in animals', which 'we mainly use'⁶⁵ were due to an abandonment of the theory of *L'Homme* by relegating corporeal memory to beasts alone.⁶⁶ But this fails to explain Descartes's continued adherence in the *Passions*, where the intellectual memory is not mentioned, to the spirits-and-traces account of memory.⁶⁷ My diagnosis, instead, is that Descartes was aware of the philosophical limitations of this odd form of memory, the objects of which are universals, rather than particular events in a personal past, and which are in fact 'not strictly remembered' at all.⁶⁸ Beyond noting that the letters to Arnauld are among the contexts where Descartes sought to show the distance of mind in his theory from the corporeal and forgot what the brain can do, it is possible to pinpoint in his treatment of wonder a hope for greater cognitive and moral discipline within the corporeal realm. The deep encoding of a local, independent memory trace, its continual explicit representation, is rare within the general distributed model. It is, normally, difficult for the corporeal mechanism to sense (or to reveal to the soul) the novelty of a newly-presented object, because new traces are almost always already superposed on other traces in the same fold of the brain. Since a pattern of animal spirit motions through brain pores must be reconstructed (rather than reproduced from cold storage), there is no internal mechanism to tell whether an object of perception has or has not been perceived previously.⁶⁹ This contrasts with the easy localist

account of the perception of duration and of the temporal placing of memories according to the location of each independent item on the coils of memory which critics like Hooke would prefer (see p. 136, later in this chapter).

To put the point differently, the normal situation according to the Cartesian philosophy of the brain is that every sensation is, in a sense, many sensations, every memory many memories. Wonder, uniquely, provides a possibility of contact between mind and world less mediated by physical, perceptual, and mnemonic habits, of seeing in the moment without the accretions which tradition, prejudice, and experience have marked on the fibres and tissues.

Wonder and error

Because error is so easy, confusion so natural, on a distributed model, the kind of safe, pure cognitions which moral physiologists desire are an achievement, to be worked at and valued. Two chapters in Malebranche's treatment of the passions as sources of error deal with the ill and the good effects of wonder, of what happens 'when the brain is struck in places in which it has never been struck before, or when it is struck in an entirely new way'.⁷⁰ Wonder can work ill effects through the dangerous traces formed by violent and unruly animal spirits. But, of the passions, only wonder 'illuminates the mind', making it alone potentially 'useful to the sciences'.⁷¹ This is because

in wonder, the animal spirits are forced toward those parts of the brain representing the new object as it is in itself; there they make distinct traces that are deep enough to be preserved a long time. Consequently, the mind has a sufficiently clear idea of the object and easily remembers it.⁷²

Where other passions move the spirits so that 'they represent objects only according to their relation to us and not as they are in themselves', wonder seems, sometimes, to allow acontextual remembering.

Malebranche thinks, then, that clear and distinct remembering requires the difficult isolation or localizing of each memory trace from others. Wonder is the limiting case in which this happens, when one trace is distinct, deep, and independent enough to be preserved explicitly for a long time: it partitions representational space into sufficiently orthogonal traces to guarantee their immunity from melding. This contrasts with the normal case on a distributed model, whereby, in the superposition of traces, no particular trace is itself explicitly preserved for a long time. It is very hard, Malebranche says, to apply oneself to

something which fails to excite wonder, 'since then the animal spirits are not so easily led into those parts of the brain necessary to represent it'.⁷³ The self must train the spirits, wishing or hoping to achieve some local representation, desiring that distributed memory not be all.

Again, men are in greatest need of stratagems here, techniques for controlling the brain by the use of wonder, for men are most prone to psychophysiological confusion. The extra delicacy, in general, of women's brain fibres renders their access to local representations easier: because they 'consider only the surface of things', they are more prone to wonder, easily distracted by the slightest cry or the least motion, with 'great motions' produced in their brains by any 'insignificant things'.⁷⁴ Male susceptibility to the passions is more dangerous, men's supposed access to depth a curse. If one is not defended against violent passions, error inevitably follows through the confusions of brain traces. Fixations and obsessions can result. If one passion dominates, then as some animal spirits 'violently descend' in unnatural motions to the periphery of the body, others, 'swirling irregularly in the brain, stir up so many traces' that the soul, which is 'continually constrained to have the thoughts tied to these traces', 'becomes, as it were, enslaved to them'. Vigilance must, therefore, be unceasing.⁷⁵ Malebranche is worried here not about fixity in itself (stasis is in fact to be willed), but about loss of control.

The necessary effort to be exerted in disciplining the male brain must evolve out of knowledge of these patterns of error, of the various ways in which the spirits, in passion, can suck the moral agent towards insanity or tempt him with garish imaginings. Before treating memory directly, Malebranche had outlined the difference (of degree only) between veridical perception and imagination. Agitation by the spirits of the fibres leading to the brain is sufficient for the soul to have perceptions. Imagining occurs when the flow of animal spirits disturbs the fibres *without* the presence of the object. But this was the definition of *memory*, not imagination, given by Descartes in *L'Homme*. Memory has become, in the Cartesian philosophy of the brain, the work or production of imagination.⁷⁶ Due to imagination's liberty 'to trans- pose and change its ideas', it does not inevitably preserve the order of past events, and in its operation 'nature... is totally confounded'.⁷⁷ Because of Descartes's physiological 'assimilation of imagination and memory', the deceptiveness of imagination taints memory too.⁷⁸ The peculiar sanctity of memory's ordered access to a real past seems reduced to mere confabulation. These concerns are at once about the lure of easy factual errors, and the seductions of morally impure ideas and memories, thoughts 'on which it is not good to dwell'.⁷⁹

Malebranche tried to cut off this worrying line of thought with the retort that, fortunately, brain fibres are usually 'agitated much more by the impressions of objects than by the flow of spirits'. But confidence in the hook-up between ideas and world is swiftly undermined:

However it sometimes happens that persons whose animal spirits are highly agitated by fasting, vigils, a high fever, or some violent passion have the internal fibers of their brain set in motion as forcefully as by external objects. Because of this such people sense what they should only *imagine*...⁸⁰

The list of contextual factors which, through the body, can disrupt the spirits and confuse cognition is long. Disease and fever, fright and shock, peculiarities of diet, of religious behaviour and feeling, and of emotional extremity can all cause unnatural internal turbulence and consequent error. What contexts are safe? Whence cognitive purity, among so many forms of danger, when at the slightest bodily disturbance the animal spirits are 'impelled into confused Motions, and their Ranks and Connexion broken or ruffled'?⁸¹

So Malebranche advises on the control of these fickle spirits, explaining techniques for controlling the brain and keeping the order of the past unruffled. He warns against the seduction of youth by the wonders of poetry and science. The young man (sic) 'must always guard the purity of his imagination, i.e. he must prevent those dangerous traces that corrupt the heart and mind from being formed in the brain'.⁸² The animal spirits, which 'receive many secret directives from the passions', and are 'easily diverted from the new and difficult channels into which the will would lead them', must be tamed. How? The will, which we often find 'exhausting itself in controlling the unruly spirits', is not sufficient: it must trick the imagination 'in order to stir the spirits' by using 'cleverness' and 'stratagems to deceive an enemy that attacks only by surprise'. Suggested techniques include thinking of things opposed to the objects of the dominating desire (in order to induce revulsion), and as a last resort adding 'the thought of eternity, or some other solid thought'. This is a remarkable line of attack, or defence, on one's own innards: fixity is to be imposed on the fleeting spirits by halting their natural dynamics with unmixed thoughts of the ultimate. Yet not even 'this sort of defense' renders us 'impregnable': sometimes the 'motion of the spirits can be so violent that they occupy the soul's entire capacity'.⁸³ Even the thought of eternity, the last line in this helpless physics of the self, can (Malebranche had earlier sadly admitted) itself excite violent passions, because we use traces even when thinking of universals or insensible spiritual

things: the roaming spirits, whether sluggish or transient, agitated or decayed, naturally tend to cause various degradations of character.⁸⁴

The poor, oppressed soul, its power dependent on unlikely 'obedience rendered to it by the animal spirits', buffeted by their every new distribution and their every heavy flood, is blind to the body's activities.⁸⁵ Possible sources of evil and error are internal. Body fluids are not self, not good, not true, not pure. Despite the necessary rhetoric of control, the mind is fated 'to sit in the brain merely as a spectator of this play which is acted out in the scene of the body'.⁸⁶

Wounds to the brain

Virtue, then, is the process of working out in advance methods to organize and discipline the brain and body, subduing or warding off the unwanted cognitions and actions for which the spirits agitate, exercising volition by watching and modifying, with an active mind, associative responses and gradually becoming an architect of one's own passions, and (correspondingly) of the landscape of pores and fibres which the spirits sculpt. The process is, in this life, endless and fallible, for always operating beneath consciousness are the lures of various 'libertine spirits, which do not voluntarily submit to the commands of the will' and which may 'cause the most important secrets to be revealed'.⁸⁷ 'Acquired' connections between traces, and between the corresponding ideas or memories, are more dangerous than natural connections (where the latter can mean either innate or objective/rational).⁸⁸ A confusion of traces is the tendency of spirits, given the history of their motions through a set of pores, to reconstruct or reform a pattern which is (accidentally, historically) related to the pattern which a more objective input (whether the world or the soul) calls for.

Once the dispositions of confusion are in place in a set of superposed traces, it is hard to displace them, for 'wounds received by the brain heal with greater difficulty than those in other parts of the body'. The task of virtue is to isolate or cordon off the dangerous traces, to drain the spirits of their moral venom by repeatedly encouraging safer associations and memories: 'it is very difficult to close brain traces tightly because they are exposed to the flow of spirits . . . a prejudice is entirely cured only when the trace has been tightly sealed'.⁸⁹ How is this ever possible in the context of the passions, where the soul's attention is not voluntary and the will depends essentially on the body?⁹⁰

Association, self, and training

Descartes believes that the dangers of wonder can be overcome, for its tendency to fix permanent representations can be put to use in strengthening and prolonging good thoughts which 'otherwise might easily be erased'.⁹¹ The mechanisms of association are available to the soul, so that we can learn 'to separate within ourselves the movements of the blood and spirits from the thoughts to which they are usually joined'.⁹²

In Descartes's associationism, the focus is not, as might be expected, on a distinction between, on the one hand, *all* reflexes (unconditioned and conditioned), and, on the other, non-automatic action caused by the soul. Rather, the wide set of responses which interests him most includes both cases of long-term conditioning and the long-term workings of associative memory in linking things not naturally related. Unlike immediate and simple automatic responses (the blink reflex in humans, sheep running from wolves), conditioned responses and long-term learned associations can potentially be altered, providing a hold for the soul in the wayward dynamics of spirits and memory. A dog howls and runs at the sound of a violin which has been coupled with whipping, and setters are trained (against natural inclination) to stop at the sight of a partridge until a gun is fired.⁹³ significantly, Descartes links both of these examples of training in dog-machines with more complex human cases which he considers equivalent in principle. One man may want to dance when another wants to cry if the latter has 'never heard a galliard without some affliction befalling him', because 'it evokes ideas in [his] memory'. The case of the setter, in the crucial final section of Part 1 of the *Passions* on psychological conflict, is

worth noting in order to encourage each one of us to make a point of controlling our passions. For since we are able, with a little effort, to change the movements of the brain in animals devoid of reason, it is evident that we can do so still more effectively in the case of men.⁹⁴

Since 'the movements of the brain' will change with experience anyway, we can will, when not under the sway of violent passion, various thoughts which oppose or counteract those typically produced by association. When he understood that his long standing 'inclination to love' people with a squint was due to a childhood association of the passion of love with the visual image of a particular cross-eyed girl, Descartes freed himself from the tyranny of his animal spirits.⁹⁵

So, by applying the intellect in conjunction with the will, it may be

possible to fix and confirm a single isolated trace.⁹⁶ This is the process of extended auto-persuasion recommended in Descartes's advice to Elisabeth: the deliberate alteration of the physiology of passion by way of effort and habit is simply a development of the ordinary processes of long-term memory, by which control can be extended into domains of body and cognition which are normally (without the preparations characteristic of virtue) out of conscious reach.⁹⁷ Against the immediate dictates of the preservation of the body, the task is to work towards the permeation of body and brain by the intellect and the will, a permeation directly parallel and often contrary to that already enacted by the physical world on the body. As thinking beings embedded in living body-machines, we must often correct for the hasty norms appropriate for those machines as biological beings alone. Only thus might the compound creature which thinks and eats, reasons and dreams in such a marked, particular body ever become more truly what, as a unified whole, it is.

ENGLISH SELVES AND BODIES

This I think that having often recourse to ones memory and tying downe the minde strictly to the recollecting things past precisely as they were may be a meanes to check those extravagant or turning flights of the imagination.⁹⁸

Localization and confusion

In his posthumous *Select Discourses*, John Smith, a Cambridge Platonist, describes in the discourse on the immortality of the soul the animal spirit physiology of 'a late sagacious Philosopher'. Smith warns that it may not only be the soul (which 'sits enthroned, in some mysterious way') which is 'apt to stir these quick and nimble spirits', the state of which, 'either disorderly and confus'd, or gentle and composed', determines our actions and cognitions. Moral worth depends on the soul's knowledge of and control over the 'subtle Mechanicks of our own Bodies': without this, souls have not 'by the exercise of true Vertue got the dominion over them'. Spirits and body are themselves always active, the forces of 'not-self' already on the march, besieging souls which, too easily 'mov'd by the undisciplin'd petulance of our Animal Spirits, shall foment and cherish that Irrational Grief, Fear, Anger, Love, or any other such like Passions contrary to the dictates of Reason'.⁹⁹ In England, too, then, moral exhortation on the disciplining of self by self was necessarily physio-

logical in form, requiring the wishful surveillance of these fleeing spirits. In the realm of the passions, this just is the nature of virtue. Even before Locke suggested that continuity of personal identity, along with the concomitant responsibility and morality, depends on memory and the extension of consciousness backwards into the personal past,¹⁰⁰ the mind finds its true activity in exercising its dominion over the brain traces and mental representations to which, sadly, it is tied.

For this reason the Cartesian theory of reconstructive memory was loathsome, morally abhorrent to the English. The idea that memories are just patterned motions of spirits through brain pores denied the systematicity, stability and structure characteristic of true thinking, reducing all cognition to mere association and the chance con/fusions of jumbling particles. A more pressing danger than materialism, distributed representation threatened to expose the soul to all the excesses of passion by stripping its ability to moderate and discipline mental contents. The requisite authoritarian task of the soul seems too hard if memory is just motions of animal spirits, since it is 'as inconceivable how it should direct such intricate Motions, as that one that was born blind should manage a Game at Chess, or marshal an Army'.¹⁰¹ The English reaction to the Cartesian physiology of memory was not a democratic revolt of free spirits against the authoritarian implications of mechanical models of mind,¹⁰² but the theoretical importing of extra, excess order into the coils of memory.

It is not surprising that memory and the passions it arouses should have increasingly occupied English philosophers after 1660. The obsession with order after the Civil War and after the uncontrolled multiplicity of opinions of the Interregnum produced not only impossibilities of unity in worship, dress, and conduct, but also a set of attempts to keep the past in place. Both collective and cognitive memory had to display unity and concord, even at the cost of imposing false continuities on the political and personal past, by developing clear, clean narrative structures to organize uncertain or fearful events. A fixation on sameness required external discipline to be applied as much to internal, potentially anarchic psychophysiological flux as to unruly social forces. Too many descriptions of memory did not encourage confidence in its stability or accuracy: Margaret Cavendish in 1656 described memory as 'Atomes in the Brain set on fire'.¹⁰³ So Royal Society members wished for control over brain and body as much as over the cosmos. In 1667 secretary Oldenburg asked a correspondent in Connecticut 'to remember, that we have taken to taske the whole Universe': the disappointments of their desires to play

wider roles in running the country¹⁰⁴ were matched by slow progress and waning interest in ordering the body physiologically, but a residue of assumptions about cognitive discipline may have had more lasting impact.

The Cartesian model failed, critics complained, to explain how motions of 'very thin and liquid' animal spirits could be preserved in the 'pervious' and 'clammy' brain for as long as memories last.¹⁰⁵ Worse, the superpositional storage which Descartes envisages would result in 'a great deal of preposterous confusion': the motions of memory would inevitably 'interfere, thwart, and obstruct' each other, so that remembering anything would 'put all the other Images into a disorderly floating, and so raise a little *Chaos* of confusion, where Nature requires the exactest order'.¹⁰⁶ For Glanvill, a theory of memory must guarantee that traces are 'capable of Regularity', and the reader is made complicit in demanding that memories 'should so orderly keep their Cells without any alteration of their site or posture, which at first was allotted them'. But although the claim that memory is ordered rather than being subject to 'tumultuary agitations' is meant to be descriptive, outlining indisputable explananda, in fact it reads like a prescriptive, nostalgic wish that memories *ought* to remain free of 'Ataxy and disorder'.¹⁰⁷ Morally-charged language accentuates the danger: memory-motions in matter would become 'strangely depraved, if not obliterated' in 'a necessary confusion of all'.¹⁰⁸

Positive accounts of memory developed in opposition to Descartes did indeed guarantee traces' immunity from melding, warding off the moral dangers which intrinsic misassociation would bring. Digby took memories to be 'exceeding little' bodies emitted from objects which are driven into the brain, 'where at length, they find some vacant cell, in which they keepe their ranks and files, in great quiett and order. . . . and there they lye still and are at rest, until they be stirred up' by appetite, chance, or will.¹⁰⁹ Storage is separate from processing, and each memory trace remains independent of others. Robert Hooke saw memories as distinct ideas laid out spatially in the 'spirals' of the brain. He argued that these 'material and bulky' ideas must be 'in themselves distinct; and therefore that not two of them can be in the same space, but that they are actually different and separate one from another'.¹¹⁰ This requirement marks off distributed models like Descartes', in which many memories *can* be (dispositionally) in the same space, from localist models which postulate only atomic items in memory.

So, very schematically, it is possible to characterize the difference in these historical approaches. The Cartesians acknowledged the activity

and potential confusion of volatile body mechanisms, seeing memory as a motion, and requiring the careful development of individual strategies for control: in contrast, the English removed or denied the autonomy or danger of the body bits and of the mental representations, seeing memory as a body rather than a motion, thus rendering traces fixed and already ordered in nature.¹¹¹

But Jamie Kassler has argued that Hooke has a partly *non-localized* theory of memory.¹¹² Explaining this apparent disagreement allows the useful separation of different senses of 'localization' in the history of neuroscience. Kassler takes the distinction to mark theorists' views of the *amount* of body and brain substance involved in storage: Descartes is then seen as a localist because he locates mind-body interaction at a specific point, the pineal gland, whereas Hooke, like Hobbes, is a non-localist because he extends remembrance through the physical system of memory coils. This way of setting up the issues means that there is no special distinction between local and distributed apart from the problem of whether the soul is coextensive with the body or acts at a particular seat. The issue here is whether *executive control* is local or distributed. But I have been using the terms, in line with other uses in the cognitive sciences, to mark instead whether, in any theory, *representations* are local or distributed, discrete or superposed.

These differences affect interpretation of the plausibility of the different theories as accounts of human memory. Distributed models in my sense (whether using animal spirits or neural nets) have to explain how any memory is ever retrieved distinctly, while local models have to explain how the phenomena of interference between memories which seem characteristic in humans can occur. Hooke accepts interference as an explanandum, but his account remains atomist and localist. When the soul seeks a memory idea, another idea may interfere, as the sun's radiation on the moon may be impeded by the intervention of the earth.¹¹³ Traces do not fuse or blend, but are only juxtaposed in a particular spatial collocation which blocks executive access. Interference does not fall naturally out of the model, as it did in the Cartesian philosophy of the brain.

Association and anatomy

Theories of associative memory in England and Scotland owed as much to the Cartesians as to Hobbes, with early eighteenth-century philosophers as likely to study *L'Homme* as the *Meditations*, and psychophysiology as much as occasionalism in Malebranche.¹¹⁴ Their

development occurred in the context of these concerns about interference and confusion: Locke's influential chapter on association was a response to Malebranche, demonstrating various conspiracies of cultural and sub-cognitive influences which alter 'Trains of Motions in the Animal Spirits' and consequently 'set us Awry in our Actions, as well Moral as Natural'.¹¹⁵ It is far from clear whether Hume's extension of association to cover all mental sequences, rather than just dangerous and undesirable ones, was intended, by 'reducing all reasoning to association', to expose 'the sordid background of reason itself'.¹¹⁶ but certainly the spectre of misassociation did counteract confidence in the possibility of distinguishing appropriate from inappropriate causes of cognition and action. Is it the external world or the contagious imagination, the incorporeal soul or the devilish art of an evil spirit which is altering or tainting the animal spirits? There had to be a neurological counterpart to sound social status, but Shaftesbury's desire that everyone 'must prove the Validity of his Testimony by the Solidity of their Brain'¹¹⁷ was hopeless, for everyone knew that brains have the consistency of mushy porridge and are filled with wriggling animal spirits, satirized by Swift as 'a Crowd of little Animals, but with Teeth and Claws extremely sharp'.¹¹⁸

The physiological basis of associationism would fade over the eighteenth century, as the imagination was tamed and aestheticized and as more specialized sciences of brain and body drifted away from the moral psychology of sensibility and the philosophical metaphysics of mind. But the safe metaphorizing of animal spirits only hid the ways in which concerns about chaos, order, and psychological control would inevitably continue to operate inside the hardest, most rigorous domains of neuroscience.¹¹⁹ Recognition that the key issue connecting cognition and culture in early modern moral physiology was about the separateness or mixture of memory traces (about localism in respect to representations rather than function or executive control) is the first step towards using historical cognitive science positively in analysing later and contemporary models. Despite the difficulty of integrating affect with cognition in large-scale theories of brain and mind, the capacity to treat passion and memory together is necessary for any future cognitive sciences even to begin addressing issues which those outside the field care about: the rhetoric and the fears of historical debates, in which it is easier for us to spot the links between social/moral assumptions and theoretical prescriptions than it is for current sciences, offer some prospect for helpful speculation about the stakes in our modern struggles with repetition and with temporal fragmentation.

NOTES

- 1 Nicolas Malebranche, *The Search After Truth*, trans. T. M. Lennon and P. J. Olscamp (Columbus, Ohio, 1980), Book 5, chapter 1, 339. Further references to *De la recherche de la vérité* are given to this translation (LO) of Genevieve Rodis-Lewis's edition in *Oeuvres Complètes I-II* (Paris, 1962-3), in the form LO 5.1, 339.
- 2 Malebranche, LO 5.4, 360
- 3 LO 5.4, 357, 362
- 4 Joseph Glanvill, *The Vanity of Dogmatizing* (1661, reprinted Brighton, 1970), 5; Malebranche, *Oeuvres Complètes XVIII*, 40; John Locke, *An Essay Concerning Human Understanding* (Oxford, 1975), II.10.9, 154.
- 5 Although a number of Cartesian moral physiologists picked up on Descartes's suggestions about memory and the passions, Malebranche's developments are, in this area, explicit and (in my view) faithful. Although neurophilosophy occupies a huge amount of Malebranche's writing, it has been neglected by both French and Anglophone historians, despite Alquié's note that 'chez lui comme chez Descartes, les conseils de méthode sont inséparables d'une conception physiologique de la mémoire, de l'imagination, et de l'association des idées', *Le Cartésianisme de Malebranche* (Paris, 1974), 30. But see John Yolton, *Thinking Matter* (Oxford, 1984), 160-2. On related concerns in other Cartesians see Solomon Diamond, 'Seventeenth-Century French Connectionism: La Forge, Dilly, and Régis', *Journal of the History of the Behavioral Sciences* 5 (1969), 3-9.
- 6 This chapter extends and develops themes which I mention without sustained treatment throughout the historical sections of my *Philosophy and Memory Traces: Descartes to Connectionism* (Cambridge, 1998).
- 7 Marjorie Grene, 'Cartesian Passions: the ultimate incoherence', in *Descartes* (Brighton, 1985), 23-52.
- 8 Thanks to Doris Mellwain for suggesting this way of formulating my interpretation.
- 9 LO 2.2.2, 134.
- 10 Kenelm Digby, *Two Treatises...* (1644, reprinted London 1978), 284.
- 11 Locke, *Essay*, II.10.7, 152-3.
- 12 Amélie Rorty, 'Descartes on Thinking with the Body', in J. Cottingham (ed.), *The Cambridge Companion to Descartes* (Cambridge, 1992), 384.
- 13 Malebranche, LO 2.1.1.iii, 90; LO 5.6, 369.
- 14 LO 2.1.4.iii, 98.
- 15 Drew Leder, *The Absent Body* (Chicago, 1990), 111-14, 69-106; Jean Mundy and Warren Gorman, 'The Image of the Brain', in W. Gorman, *Body Image and the Image of the Brain* (St Louis, 1969), 187-251. On histories of the invisible and on techniques for visualizing a shadow realm of bodily spirits, see Barbara Duden, *Disembodying Women* (Cambridge, MA, 1993), 8-10; Barbara Stafford, *Body Criticism* (Cambridge, MA, 1991), 1-83, 401-63.
- 16 Ian Hacking, arguing that the sciences of memory were new in the late nineteenth century, claims that both architectural mnemonics and early-modern models of memory like Locke's were only or primarily disciplines or technologies, not part of a search for knowledge about memory: see *Memory-notlike trauma and the coup* *History of the Human Sciences*.

- 7 (1994), 29–52. *Rewriting the Soul: multiple personality and the sciences of memory* (Princeton, 1995), 198–209. I suggest, in contrast, that practical advice and the inculcation of methods for imposing rigidity and order on the mind, for avoiding spillage and catastrophic interference between memory items, were intimately entwined with theoretical quests for facts about memory, knowledge that as well as knowledge-how. Indeed the Foucauldian models for examining historical technologies of the self on which HACKING builds include abundant analysis of the close interplay between theoretical knowledge-claims and mundane bodily and psychological practice. The civilizing process of learning to tame one's own body was not just a matter of maintaining appropriate habits at table and in bed: it required also intense attention to medical theories about internal fluids and the regulation of memories.
- 17 This has long been recognized for the eighteenth-century ethics of sensibility: see G. S. Rousseau, 'Discourses of the Nerve', in F. Amrine (ed.), *Literature and Science as Modes of Expression* (Dordrecht, 1989), 29–60. But the point is less familiar in the context of seventeenth-century mechanism: see however John J. Blom, *Descartes: his moral philosophy and psychology* (Brighton, 1978), 6–11, 84–90.
- 18 René Descartes, *The Passions of the Soul* (1649), Book 2, paragraphs 53, 72; *Oeuvres Philosophiques*, C. Adam and P. Tannery (eds) (Paris, 1964–1976) (=AT), vol. xi, 373, 382; *The Philosophical Writings of Descartes*, trans. J. Cottingham, R. Stoothoff and D. Murdoch (Cambridge, 1985) (CSM), vol. 1, 350, 353. I give further references to this work in the text in the form *Passions* 2.53, AT xi.373, CSM 1.350. See also the useful edition by Stephen Voss (Indianapolis, 1989).
- 19 *Passions* 2.70, AT xi.380–1, CSM 1.353.
- 20 Prefatory letters to *Passions*, 14 August 1649, AT xi.326, CSM 1.327.
- 21 Grene, *Descartes*, 43; D. P. Walker, Ficino's *spiritus* and Music', in D. P. Walker, *Music, Spirit, and Language in the Renaissance*, P. Gouk (ed.) (London, 1985), 150; William Harvey, 'Second Letter to Riolan' (1649), in *The Circulation of the Blood and other writings* (London, 1990), 117. On the history and historiography of animal spirits, see my *Philosophy and Memory Traces*, chs 2, 8–10.
- 22 To Chanut, 15 June 1646, AT iv.441, in *The Philosophical Writings of Descartes*, vol. III: *The Correspondence* (CSM-K) (Cambridge, 1991), 289.
- 23 Blom, *Descartes*, xvii, 80, 85; Anthony Levi, *The French Moralists: the theory of the passions 1585 to 1649* (Oxford, 1964), 279.
- 24 Margaret Wilson, *Descartes* (London, 1978), viii; Ferdinand Alquié, *Descartes: Oeuvres Philosophiques I* (Paris, 1963), 479; Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford, 1995), 273; Graham Richards, *Mental Machinery: Origins and Consequences of Psychological Ideas, 1600–1850* (London, 1992), 41.
- 25 Grene, *Descartes*, 52.
- 26 Genevieve Rodis-Lewis, 'Limitations of the Mechanical Model in Descartes's Conception of the Organism', in M. Hooker (ed.), *Descartes: Critical and Interpretive essays* (Baltimore, 1978), 152–4; Grene, *Descartes*, 46–9; Emily Grosholz, *Cartesian Method and the Problem of Reduction* (Oxford, 1991), 126–7.
- 27 This intermediate class includes behaviour involving (corporeal) memory, imagination, passion, and sensation, which can occur in other animals. They do involve the pineal gland (unlike simple reflexes) but need not involve the soul, and they occur over long periods of time, well beyond the span of any simple reflex arc. They include functions we would call cognitive, but for Descartes, strictly speaking, they are life functions rather than mental functions, just because he restricts the latter to consciously mediated functions. This point in no way reduces their importance, for him or for us.
- 28 John Cook, 'Human Beings', in P. Winch (ed.), *Studies in the Philosophy of Wittgenstein* (London, 1969), 118–21, 123–6.
- 29 LO 2.2.3, 137.
- 30 Grene, *Descartes*, 36, 52, 199, 206–9.
- 31 On the 'prospects for strategic control of memory', compare John Kihlstrom and Terrence Barrhardt, 'The Self-Regulation of Memory', in D. Wegner and D. Pennebaker (eds), *Handbook of Mental Control* (Englewood Cliffs, N.J., 1993), 88–125. Remembering is, in part, a skilled activity, dependent on narrative training in a society (Robyn Fivush and Elaine Reese, 'The Social Construction of Autobiographical Memory', in M. Conway et al. (eds), *Theoretical Perspectives on Autobiographical Memory* (Dordrecht, 1992), 115–32): neither its cultural nor its sub-cognitive and physiological causes are available for voluntary inspection or easy deliberate tampering in the service of goodness, discipline, or peace.
- 32 'Hume's Early Memoranda', E. C. Mossner (ed.), *Journal of the History of Ideas* 9 (1948), 502. Hume is noting a case of amnesia which, he thinks, confirms the Cartesian theory.
- 33 T. S. Hall (trans.), *René Descartes: Treatise of Man* (Cambridge, MA, 1972); AT xi.119–202; brief extracts in CSM 1.99–108. I refer below to Hall's translation as H.
- 34 AT xi.177, H 86–7, CSM 1.106. The language of figures and traces does not imply that these corporeal ideas are images in any straightforward sense. Here, as elsewhere, Descartes denies that representation must function by simple pictorial resemblance.
- 35 AT xi.178, H 87–88, CSM 1.107.
- 36 AT xi.179, H 90. This account of the memory trace is all but repeated in the *Passions* 1.42, AT xi.360, CSM 1.344.
- 37 AT xi.184–5, H 96; David Krell, *Of Memory, Reminiscence, and Writing: On the Verge* (Bloomington, 1990), 72–3, on 'liggledy-piggledy' impressions 'prone to moral turpitude, lassitude, lethargy, and benumbment'.
- 38 This is one reason for Descartes's hostility to Renaissance techniques of local memory: compare Dennis Sepper, 'Ingenium, memory art, and the unity of imaginative knowing in the early Descartes', in S. Voss (ed.), *Essays on the Philosophy and Science of René Descartes* (Cambridge, 1993), 142–61; John Sutton, 'Body, Mind, and Order: local memory and the control of mental representations in medieval and Renaissance sciences of self', in A. Coronas and G. Freeland (eds), *1543 and All That: Word and Image in the Proto-Scientific Revolution* (Dordrecht, 1997). A concern with the localization of memory function, in this sense, is quite distinct from a belief in the local (as opposed to the distributed) nature of specific memory traces. There could be a memory module in

- the brain (localized in the first sense), in which distributed (non-local in the second sense) memories are stored superpositionally: it is quite consistent to argue that 'representations ... are local at a global scale but global at a local scale' (G. E. Hinton, J. L. McClelland and D. E. Rumelhart, 'Distributed Representation', in Rumelhart and McClelland (eds), *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*, vol. 1 (Cambridge, MA, 1986), 79).
- 40 John Morris, 'Pattern Recognition in Descartes's Automata', *Isis* 60 (1969), 451-60.
- 41 Malebranche, LO 2.1.5.iii, 107; Descartes, *Regulae*, Rule 12, AT x.415, CSM 1.41-2. Finding room in the brain is only a problem for memory models employing local representation, and was of such concern in Robert Hooke's localist model of 1682 that he engaged in laborious calculation of the maximum independent atoms of information likely to be stored in an individual lifetime: Hooke, *Lectures of Light*, in *The Posthumous Works of Robert Hooke*, R. Waller (ed.) (1705, reprinted London, 1971), 143; J. J. MacIntosh, 'Perception and Imagination in Descartes, Boyle, and Hooke', *Canadian Journal of Philosophy* 13 (1983), 327-52.
- 42 To Mersenne, 1 April 1640, AT iii.48, CSM-K 146.
- 43 To Mersenne, 11 June 1640, AT iii.84, CSM-K 148; to Mersenne, 6 August 1640, AT iii.143, CSM-K 151. See also to 'Hyperaspistes', 8.1641, AT iii.424-5, CSM-K 190; to Mesland, 2 May 1644, AT iv.114, CSM-K 233. The letters also mention 'intellectual memory' with 'its own separate impressions', which I discuss below.
- 44 LO 2.1.1.iii, 89. Malebranche explicitly links his views on animal spirits and the brain to Descartes's *L'Homme* (the reading of which, in 1664, made his heart palpitate with excitement) at LO 2.1.2.iii, 93.
- 45 LO 1.4.iii, 18.
- 46 LO 2.1.5.iii, 106.
- 47 LO 2.2.4, 141.
- 48 Steve Burwood and Gill Jagger, call for papers, *Body Matters* Conference, University of Hull, 1995.
- 49 LO 5.2, 342. Although, as I show below, Malebranche attributes women's presumed weakness to projected excesses of vulnerability in the female brain, here men are the marked sex: men are not self-contained autonomous agents set off from society and nature in contrast to overly embedded women, but suffer from excesses of relatedness. Cartesian physiology depicts the parts of men's bodies as too intimately interconnected, turning fears about the scholar's fragile virility, for example, into a theory of the mutual interchangeability of the animal spirits supplying cognitive energies and the reproductive spirits driving libidinal energies (Sutton, *Philosophy and Memory Traces*, ch. 9).
- 50 Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (New York, 1980), 204.
- 51 Gaukroger, *Descartes*, 84-9, 228-56.
- 52 Gaukroger, *Descartes*, 247-8. Examples of the critical complaints I have in mind include, from quite different perspectives, Merchant, *The Death of Nature*, 227-35; Grene, *Descartes*, 195-213; Otto Mayr, *Authority*,
- Liberty, and Automatic Machinery in Early Modern Europe* (Baltimore, 1986), 62-7, 117-18.
- 53 Merchant, *Death of Nature*, 193; Timothy J. Reiss, 'Denying the Body? Memory and the dilemmas of history in Descartes', *Journal of the History of Ideas* 57 (1996), 587-608.
- 54 Rorty, *op. cit.*; Ann Wilbur Mackenzie, 'Descartes on Life and Sense', *Canadian Journal of Philosophy* 19 (1989), 173-5. Rorty demonstrates clearly the interdependence of epistemology and physiology in Descartes: what she calls the maintenance and informational systems are even less distinct than she assumes, since animal spirits, the bearers of accurate or distorted information, are themselves generated in and marked by non-cognitive bodily processes.
- 55 Véronique Foltz, 'Presence and Memory: Derrida, Freud, Plato, Descartes', *Graduate Faculty Philosophy Journal* 11 (New School for Social Research, 1986), 76; Reiss, 'Denying the Body?'
- 56 To fill in detail on this rapid sketch, see for example Marie-Christine Pouchelle, *The Body and Surgery in the Middle Ages* (New Brunswick, 1990); Nancy Siraisi, *Medieval and Renaissance Medicine* (Chicago, 1990); Gail Kern Paster, *The Body Embarrassed: Drama and the Disciplines of Shame in Early Modern England* (Ithaca, 1993), 1-22.
- 57 Groszoltz, *Cartesian Method*, 120.
- 58 *L'Homme*, AT xi.130, H 21; AT xi.167-70, H 73-5. On the cosmobiological model of circulation see also Richard Carter, *Descartes's Medical Philosophy* (Baltimore, 1983); Carter, 'Descartes's Bio-Physics', in G. Moyal (ed.), *René Descartes: vol. IV* (London, 1991), 194-219. Carter does not, however, use the material in *L'Homme*. See also Malebranche's discussion of the influences of air, climate and culture on the spirits and thus on character and psychology at LO 2.1.3, 94-5.
- 59 *Passions* 2.71, AT xi.381, CSM 1.353. Descartes stressed to Elisabeth that wonder 'cannot be caused solely by the condition of the blood, as joy and sadness can'; but it can (asymmetrically) cause bodily changes (5.1646, AT iv.409-10, CSM-K 286-7). This asymmetry between wonder and body is exactly parallel to that between wonder and memory: although wonder, in league with other passions, 'makes us learn and retain in our memory things of which we were previously ignorant' (*Passions* 2.75, AT xi.384, CSM 1.354), it is not itself affected by prior memories.
- 60 2.75, AT xi.384, CSM 1.354.
- 61 2.72, AT xi.382, CSM 1.353-4.
- 62 My reading is thus in one sense the reverse of that proposed by Luce Irigaray, 'Wonder: a reading of Descartes' *The Passions of the Soul*', in *An Ethics of Sexual Difference* (Ithaca, 1993), 72-82. She portrays wonder as a window-passion, an intrusion of otherness and of fluidity into an otherwise static Cartesian system: for me, in contrast, wonder is anomalous because it provides the only hope of fixity in an otherwise fluid system. Memory is always already reconstructing, always filtering perception, but wonder temporarily cuts off memory by shocking the spirits into 'more tender' parts of the brain, parts not accustomed to the usual incessant flow (*Passions* 2.72, AT xi.382, CSM 1.354). Irigaray, further, sees wonder as 'a mourning for the self as an antithetic entity' because it bridges without foreclosing the gulfs between self and other

and between past and future: but in fact it provides a rare context in which Descartes's ideal of autonomy is conceivable, since in wonder the self is purely present, in contact only with the novel object rather than encrusted with past traces. Elsewhere Descartes is more sanguine about the impossibility of realizing his wish to bypass memory entirely, and accepts that the process of 'rejuvenating one's brain' (Trigaray, 81) cannot be the wholesale willed erasure of every layered memory.

- 63 To Arnauld, 29 July 1648, AT v.220, CSM-K 356; to Arnauld, 4 June 1648, AT v.192-3, CSM-K 354.
- 64 *Passions* 2.75, AT xi.384, CSM 1.355.
- 65 To Mersenne, 6 August 1640, AT iii.143, CSM-K 151.
- 66 Morris, 'Pattern-Recognition', 455-7.
- 67 Indeed the continuity between the physiological-fantastical theories of *L'Homme* and the *Passions* is rarely noticed. One example is Descartes's account of how animal spirits 'move very strangely' towards and in the brain in the case of hatred (*Passions* 2.103, AT xi.405, CSM 1.364; compare *L'Homme* H 75, AT xi.169). Morris has to downplay the importance of the *Passions*, strangely suggesting that 'Descartes was not yet prepared to defend the doctrine [of intellectual memory] in public'. This is implausible, given its theological orthodoxy (Eckhard Kessler, 'The Intellectual Soul', in C. B. Schmitt and Q. Skinner (eds), *The Cambridge History of Renaissance Philosophy* (Cambridge, 1988), 509-18). Paul Landormy, defending Cartesian dualism in 'La mémoire corporelle et la mémoire intellectuelle dans la philosophie de Descartes', *Bibliothèque* 4 (1902), 259-98, argued that intellectual memory is the reconstructive force in Descartes's scheme, since corporeal memory must be passive and static, merely combining the debris of past impressions.
- 68 *Descartes's Conversation with Burman*, J. Cottingham (ed.) (Oxford, 1976), 8-9, AT v.150; to Hyperaspistes, 8.1641, AT iii.425, CSM-K 190-1. Compare to Huygens, 10 October 1642, AT iii.598, CSM-K 215-16; to Mesland, 2 May 1644, AT iv.114, CSM-K 233. In *Philosophy and Memory Traces*, ch. 3, I discuss the implications of intellectual memory for Descartes's views on universals and particulars, on personal resurrection and on infantile amnesia.
- 69 Just as there are no 'other eyes within the brain' to inspect visual images and decide which objects they resemble (Descartes, *Optics* 6, AT vi.130, CSM 1.167), so there is no memory-homunculus to compare a current trace with a veridical previous trace: the current trace is all there is.
- 70 LO 5.7, 375.
- 71 LO 5.8, 385.
- 72 LO 5.8, 385.
- 73 LO 5.8, 385.
- 74 LO 2.2.1, 130-3.
- 75 2.2.1, 141; 5.3, 349; 3.1.2, 203; 2.2.2, 151.
- 76 'No imagination without memory; no memory without imagination' (Diderot, quoted by Marie-Helene Huet, *Monstrous Imagination* (Cambridge, MA, 1993), 103).
- 77 David Hume, *A Treatise on Human Nature* (1739, Oxford 1978), 85, 10.
- 78 Véronique Foti, 'The Cartesian Imagination', *Philosophy and Phenomenological Research* 46 (1986), 636.
- 79 Descartes, *Passions* 2.74, AT xi.383, CSM 1.354.
- 80 LO 2.1.i, 88.
- 81 Richard Blackmore, *A Treatise of the Spleen* (London, 1725), 31. On error and physiology in early modern philosophy see also Michael Ayers, 'Belief without Reason', forthcoming in *The Cambridge History of Seventeenth-Century Philosophy*; Michael DePorte, *Nightmares and Hobbyhorses* (San Marino, 1974), 3-53.
- 82 LO 5.8, 388.
- 83 LO 5.8, 386-9.
- 84 LO 5.2, 345; 6.2, 502-3.
- 85 LO 2.1.i, 88; 5.3, 350-2.
- 86 William Croone, *De Ratione Motus Muscularum* (London, 1664), 161.
- 87 Malebranche, LO 2.1.2.iii, 92; 2.2.2, 135.
- 88 John P. Wright, 'Association, Madness, and the Measures of Probability in Locke and Hume', in C. Fox (ed.), *Psychology and Literature in the Eighteenth Century* (New York, 1987), 111-14.
- 89 LO, *Elucidation* 9, 607.
- 90 Descartes, *Passions* 1.46, AT xi.363, CSM 1.345; Malebranche, LO 5.1, 337.
- 91 *Passions* 2.74, AT xi.383, CSM 1.354.
- 92 Jeffrey Barnouw, 'Passion as "Confused" Perception or Thought in Descartes, Malebranche, and Hutcheson', *Journal of the History of Ideas* 53 (1992), 406-8. Compare pp. 397 and 400 on Descartes's inchoate acknowledgement of 'the virtues of confusion' and its inevitability in passion and cognition.
- 93 To Mersenne, 18 March 1630, AT i.133-4, CSM-K 20; *Passions* 1.50, AT xi.370, CSM 1.348.
- 94 *Passions* 1.50, AT xi.370, CSM 1.348.
- 95 To Chanut, 6 June 1647, AT v.57, CSM-K 322.
- 96 *Passions* 2.75, AT xi.384, CSM 1.355.
- 97 Walther Riese, 'Descartes as a Psychotherapist', *Medical History* 10 (1966), 238; Descartes, *Passions* 1.44, AT xi.361-2, CSM 1.344-5. Malebranche, noting the similarity between memory and habit, repeats that it is through the animal spirits that the soul can recover its control over the body (LO 2.1.5, 107-8).
- 98 John Locke's journal, 22 January 1678, in Kenneth Dewhurst, *John Locke (1632-1704): physician and philosopher* (London, 1963), 101.
- 99 John Smith, *Select Discourses* (1660, reprinted New York, 1979), 116-19. An account which, Locke worried, might be threatened by 'Absurdity' if we knew how the soul was 'tied to a certain System of fleeting Animal Spirits' (*Essay*, II.27.27, 347). Here I stick to the contexts of physiology and memory, which reveal direct conceptual connections across some otherwise quite distinct theorists. On the general physiological background see T. M. Brown, 'Physiology and the Mechanical Philosophy in Mid-Seventeenth Century England', *Bulletin of the History of Medicine* 51 (1977), 25-54; Robert G. Frank, *Harvey and the Oxford Physiologists* (Berkeley, 1980).
- 101 Glanvill, *Essay against Confidence in Philosophy*, 5, in *Essays on Several Important Subjects* (London, 1676).
- 102 Mayr, *Authority, Liberty, and Automatic Machinery*, 122-36.

- 103 Quoted by B. R. Singer, 'Robert Hooke on Memory, Association, and Time Perception', *Notes and Records of the Royal Society of London* 31 (1976), 126.
- 104 Michael Hunter, *Science and Society in Restoration England* (Cambridge, 1981), 13, 37, 136; Hunter, *The Royal Society and its Fellows 1660–1700* (Oxford, 1994), 35–54.
- 105 Henry More, *An Antidote Against Atheism*, in *A Collection of Several Philosophical Writings*, vol. 1 (1662, reprinted London, 1978), Book 1, chapter 11, paragraph 2, p. 33; Glanvill, *Vanity of Dogmatizing*, 35, 38.
- 106 More, *The Immortality of the Soul*, in *A Collection*, vol. 2, 2.2.7, 68; Glanvill, *Vanity*, 39, 35–6.
- 107 Glanvill, *Vanity*, 36, 39.
- 108 More, *Immortality*, 2.10.9, 105; 2.5.7, 83.
- 109 Digby, *Two Treatises*, 284–5.
- 110 Hooke, *Lectures of Light*, 142. (This was a 1682 lecture on memory to the Royal Society.)
- 111 This theoretical imposition of order went together, for Hooke, with practical but external schemes for the organization of information about the past in diaries, lists and other memory aids: see Lotte Mulligan, 'Robert Hooke's "Memoranda": memory and natural history', *Annals of Science* 49 (1992), 47–61.
- 112 Jamie Kassler, *Inner Music: Hobbes, Hooke, and North on internal character* (London, 1995), ch. 3.
- 113 Hooke, *Lectures of Light*, 144. This is a strict analogy between 'the Soul in the Center of the Repository' and the sun irradiating or resonating throughout the sphere of the bodies which it regulates and governs by an attractive power. Compare More, *Antidote*, 1.11.11, 36.
- 114 John P. Wright, *The Sceptical Realism of David Hume* (Manchester, 1983), 5–9, 70–4, 212–15, 224–6.
- 115 Locke, *Essay*, II.33.6, 7.
- 116 Wright, 'Association, Madness, and the Measures of Probability', 116–20.
- 117 *Letter Concerning Enthusiasm* (1708), quoted by DePorte, *Nightmares and Hobbyhorses*, 43–4.
- 118 *The Mechanical Operation of the Spirit* (1704), quoted by Hillel Schwartz, *Kraves, Fools, Madmen, and the Subtle Effluvium* (Gainesville, 1978), 53.
- 119 Roger Smith, *Inhibition: history and meaning in the sciences of mind and brain* (Berkeley, 1992); Georges Canguilhem, *La Formation du Concept de Réflexe aux XVII^e et XVIII^e Siècles* (Paris, 1955); Michel Foucault, *Madness and Civilization*, trans. R. Howard (New York, 1965), 124–46; G. S. Rousseau, 'Towards a Social Anthropology of the Imagination' (1969), in his *Enlightenment Crossings* (Manchester, 1991), 1–25; W. F. Bynum, 'The Anatomical Method, Natural Theology, and the Functions of the Brain', *Isis* 64 (1973), 445–68.