49 Ibid., 586.
50 *Oeuvres Diverses*, i. 278.
51 Ibid., 273.
52 Réponses aux quatrièmes objections, AT vii. 246.
53 *Oeuvres Diverses*, i 273, *et passim.*
54 *Oeuvres Diverses*, ii. 547.
55 *Oeuvres Diverses*, i 273, *et passim.*
56 *Oeuvres Diverses*, ii. 547.
57 Ibid., 548.
58 *Oeuvres Diverses*, i. 275.
59 *Oeuvres Diverses*, ii. 547.
60 *Oeuvres Diverses*, i. 278–9.
61 Perrault also comments (ibid., 277) that we demonstrate more rationality in the first months of our lives than we ever do subsequently!
62 *Oeuvres Diverses*, ii. 547.
63 *Oeuvres Diverses*, i. 279.
64 Ibid., 279.
65 Ibid., 274.
66 *Search after Truth*, 106, *Recherche* i. 223.
67 *Search after Truth*, 108, *Recherche* i. 226.
68 AT vi. 130.
69 AT viii. 81.
70 *Passions*, §34.
71 AT vii. 87.
72 AT vii. 88.
73 AT vii. 81.
74 It is interesting to note that Descartes himself considers and rejects this way of considering sensations early in the sixth Meditation. The seventeenth-century French translation approved by Descartes reads: '*Et parce que les idées que je recevois pars les sens étoient beaucoup* plus vives, plus expresses, et mesme à leur façon plus distinctes, *qu'aucunes de celles que je pouvois feindre de moy-mesme en méditant . . . il sembloit qu'elles ne pouvoient proceder de mon esprit.*' (my emphasis, AT ix. 60). In the *Principia* (I, arts. 45–6) Descartes appears to hold that sensations are normally 'clear' but *not* 'distinct' (AT xiB. 44).
75 *Oeuvres Diverses*, ii. 550.
76 '*Les unes & les autres sont employées dans les sensations, qui sont ou douloureuses ou agréables, le premier effet que objet produit étant d'exciter la pensée confuse de la maniere qu'il le fait ordinairement dans toutes les fonctions naturelles; mais parce que la dans les causes de la douleur ou du plaisir la solution de continuïté a quelque chose d'extraordinaire, la pensée confuse reveille la pensée expresse . . . et se trouve accompagnée de la reflexion par laquelle on sçait que l'on sent. . . .*' (Ibid., 550).
77 Ibid., 518.
78 Ibid., 518–19.
79 'Du Bruit', *Oeuvres Diverses*, i. 277.
80 §44, AT xi. 361.
81 The senses 'inform us of things only in relation to the preservation of our bodies and not as they are in themselves' (*Search after Truth*, 46; *Recherche* i. 119). Cf. Descartes: '. . . The proper purpose of the sensory perceptions given to me by nature is simply to inform the mind of what is beneficial or harmful for the composite of which the mind is a part . . .' (AT vii. 83).
82 *Search after Truth*, 34: *Recherche* i. 97.
83 *Search after Truth*, 41; *Recherche* i. 109.
84 *Search after Truth*, 46–7: *Recherche* i. 119.
85 *Oeuvres Diverses*, i. 284.

28 The body and the brain

John Sutton

1 Self-knowledge and the body

Does self-knowledge help? A rationalist, presumably, thinks that it does: both that self-knowledge is possible and that, if gained through appropriate channels, it is desirable. Descartes notoriously claimed that, with appropriate methods of enquiry, each of his readers could become an expert on herself or himself. As well as the direct, first-person knowledge of self to which we are led in the *Meditationes*, we can also seek knowledge of our own bodies, and of the union of our minds and our bodies: the latter forms of self-knowledge are inevitably imperfect, but are no less important in guiding our conduct in the search after truth.

If our textbooks acknowledge the connections Descartes sought to make between 'metaphysics, medicine, and morals', the three principal branches of the tree of knowledge,[1] they focus on his elimination of contingency. Just as, we are told, Descartes excludes from the mental realm anything which smacks of accident, fallibility, or uncertainty (let alone passion or mortality), so he thinks we can, partly through objective knowledge of the body with which the soul is temporarily united, learn to restrict the scope of our desires, accept what we cannot change, and thus live better.

According to this interpretation, the metaphysics of the free rational mind required the contrasting reduction of all bodies to sameness, to fit a single micromechanical model. In a curious consensus across analytic history of philosophy, medical anthropology, feminist theory, dynamicist cognitive science, and phenomenology, the assumption that Descartes stamped out context and particularity stretches into an image of Descartes as anti-magus, stripping nature and the body of all powers and activity. His objectification of the human body is, on this view, but one symptom of the mechanistic violation of an earlier enchanted world. Where once holistic herbalists and natural magicians embraced analogy and sympathy over representation and intervention, coupling earthy bodily realism with organicist ecologism, the Cartesian birth of modernity enforced divisions of philosophy from biology, science from history, power-mongering

manipulators of nature from the dead ecology which they exploit, and of active rational male observers from passive fragmented female bodies. Despite a marvellous debunking by T.M. Brown of attempts to set up Descartes as villain in New Age psychosomatics and 'liberatory eco-holism', and despite powerful warnings about fetishised 'false nostalgia' for 'some lost, but recoverable, perfection' in the pre-Cartesian world,[2] this sad narrative of disenchantment retains its cultural force. Descartes, we are told, made the body just another object in a world 'not of meaning and love and laughter and tears ... but of material particles going about their lonely business': and the person subsequently disappeared from medical theory, since this 'materialization' of flesh 'takes the juice out of animate bodies, leaving only bare bones and pulp'.[3]

From another direction, pragmatic critiques of the ideal of self-knowledge seek to undermine the very plausibility of finding truths about the self. Ian Hacking, for example, is sceptical about the idea, 'dazzling in its implausibility', that memory might provide a kind of 'scientific key to the soul' by uncovering 'facts' about what happened deep in personal history. From this point of view, the Cartesian confidence in the possibility of erasing the accidental effects of our specific education and experience, our bodily and psychophysiological quirkiness, as we embark on the Method, might be seen as a precursor of the characteristically modern error of basing a picture of *how* to live on some putative *facts* about inner sense.[4] And in Adam Phillips' diagnosis, the body is the first casualty of Descartes' perverse quest for certainty about the self: because of the body's entanglement in dependency and risk, the expert relies on the mind, 'a fiction invented to solve the problem of wanting to make the turbulence disappear'.[5] In theory as in life, difficult work is required to restore a sense of the erratic.

Some writers take a more positive view of Descartes' individualism, but still ascribe individuality only to Cartesian *minds*. Margaret Atherton, citing the encouragement which seventeenth-century women intellectuals like Mary Astell and Damaris Masham found in Descartes' concept of reason, emphasise a quite general notion of reasoning which is open equally to all. The only relevant differences are between humans and animals or machines, who do not reason at all: differences *between* humans, due to the idiosyncratic nature or history of individuals and their bodies, are less significant.[6]

A further, diverse group of philosophers who are engaged with quests for objective knowledge of self in contemporary 'dynamical' sciences of mind nevertheless share the negative appraisal of Descartes' efforts in this direction. They are united in opposition to 'a generally Cartesian picture of the nature of mind', by which cognitive processes are cut off from the world in 'a realm whose essence owes nothing to the accidents of body and surroundings'.[7] Even if cognitive scientists have successfully dropped dualism, we are typically told, they have retained Descartes' persistent, insidious explanatory divides: 'perception, thought, and action must be temporally distinct, and theoretically separable', while body and world are relegated to (respectively) a mere 'courier system' for sensory and motor messages to and from the thinking thing, and an alien source of input with which minds must sadly and indirectly interact.[8]

In this paper I reject the interpretation of Descartes, shared by many of these critics, which makes Descartes' dualist view of the body as negative or as pathological as that expressed by Socrates in Plato's *Phaedo*. I argue not just that the old moral cosmobiological disgust at the body is absent in Descartes, but that, positively, Descartes *requires* us to contract full intimacy with our own body and our own peculiar past. He does wish for objective knowledge in these difficult domains, but this does not render his neurological ethics a universal prescription, for such objective knowledge is nevertheless knowledge of local phenomena, of the peculiarities of idiosyncratic associations. Civilising the body, in seeking dominion over it, is a *process*; and, I will argue, Descartes was too firmly convinced that the body constantly changes its nature to have thought consistently that the process could come to an end.

I start with attention to the points in Descartes' work at which difference, dynamics, and the erratic take centre stage, to sketch a more ambitious and more speculative interpretation of possible relations between human nature, medicine, and morals. Descartes told Burman that he did not like writing on ethics.[9] He rejected the notion that philosophy should seek to regulate the behaviour of others: that, he wrote, is the business of kings and other authorities.[10] The goal of his reductionism is a form of care of the self based on knowledge of one's own body and one's own history. When Adam Phillips worries over the ease with which even an apparently disruptive framework like Freudian psychoanalysis can become 'a covert continuation of the Cartesian project', as scientistic optimism seeks to know and subsume the dynamic unconscious, he sketches a shadow, 'anti-Enlightenment' Freud whose aim is not self-knowledge, but tolerance of the impossibility of self-knowledge. I borrow Phillips' strategy, identifying glimpses of a shadow Descartes who also remembers that not everything can be remembered or accounted for, not every circumstance circumscribed. For Descartes as for Freud, the sources of this preference for care over expertise lie in a set of views on the dynamics of the mind–body union.

My case rests first on an analysis, in the next three sections, of capacities which, according to Descartes, we share with other animals. Sections 2 and 3 argue for strongly dynamic interpretations of Descartes' views on body and on corporeal memory respectively. Then Section 4 backtracks to support more firmly the surprisingly complex form of 'automatic' responses which I attribute to Descartes' beast- and body-machines. Finally, in section 5, I reintroduce the soul and the capacities for reflection which it allows in the human compound, showing how closely

Descartes thinks we must work with the body, its habits and its history, in deliberately moulding our associative responses with active mind.[11]

Immersion in Descartes' physiology and general natural philosophy shows how deeply Descartes cares about the vast range of human capacities which involve change in time. In the face of this bewildering range of critical attacks, the rehabilitation of the evil demon of modern philosophy of mind is of more than scholarly interest. These critics do often explicitly distance the Descartes whom they are merely 'invoking . . . as an emblem' from the more complex views of the historical Descartes.[12] But a cramped and implausible vision of 'modernity' too easily results: it is not just *historically* crude to characterise modernity by announcing that 'from Descartes' time on, attention was focused on timeless principles that hold good at all times equally: *the permanent was in, the transitory was out*'.[13] If we care about both self-knowledge and contingency, remembering that brains, for example, are both complex and particular, and that there can still be sciences of mind without the goals of control and total predictability, we might wonder if, paradoxically, Descartes himself could hint at the possibilities and the perils of what's become known as 'post-Cartesian agency'.[14]

2 Bodies

Knowledge of the brain and body, Descartes claims, can help in two ways. The understanding of human and other organic bodies which I acquire in studying physiology aids the general quest for assured rules in medicine and for the blessings of health.[15] But the physiological framework itself demands, second, attention to *specific* bodies: the body I will come to know best is not anonymous but particular. As natural philosopher I may seek to master *my* body as well as 'body' in general, but it escapes my will to dominate it because its boundaries are not firm, and because it is constantly changing. I may, and indeed should, seek in turn to *possess* my body, to make it more securely my own, but all that this amounts to is interminable attention to the shifting effects of its internal patterns, the true causes of which may always escape my notice.

In extending mechanism to the biological domain, Descartes stresses the potential complexity of mechanical phenomena. The earthen machines described in *L'Homme* are importantly unlike the clocks and simple automata with which they are conceptually analogous, for their capacities far outstrip those we usually imagine or ascribe to them.[16] Human and animal bodies are neither passive nor predictable, for, as one historian of physiology puts it, Descartes was 'a representative of the baroque, partial to a dynamic conception of nature'.[17] But can this be so? Is it not the defining feature of the mechanists' programme that nature should be drained of all activity, the organism being submerged by the machine?[18] And even if Descartes failed to eliminate all dynamism from his picture of the body, won't this just leave him with an oddly Rococo physiology within a general physics of barren matter?

Nature

Certainly Descartes, like Mersenne, sought sharp contrasts between nature and the active supernatural realm. But this is achieved through a minimal requirement that matter be inert, which comes to little more than the point that changes in motion must be due to the contact action of matter on matter, rather than to any ultimately intrinsic tendencies. Reminders that forces must *ultimately* derive from God in no way push those forces outside matter as we find it in natural philosophy: Descartes thinks it 'certain' that, once a body has begun to move, it 'has in itself for that reason alone the power to continue to move'.[19] Since 'there is nothing anywhere that is not changing',[20] and since 'there are infinitely many diverse motions that endure perpetually in the world',[21] all bodies in nature always have power within themselves.[22]

Descartes bases his accounts of these motions on his understanding of the dynamics of fluids. In cosmology, solid bodies like planets, which are packed conglomerations of corpuscles, are 'embedded in a fluid which carries them along in a vortical motion'.[23] This physics of circulation, displacement, and endless motion is secured by rejecting the void in favour of a plenum.[24] Moving bodies are always surrounded by other bodies, which move as they move. There is no fluid-free part of the plenum, so bodies are always in mutual causal contact, with every natural interaction being part of a continuous field of interconnected interactions.

This means that the ideal fiction of atomist kinematics, the attempt to break down complex interactions into sets of isolated collisions in the void, is never a realistic goal in Descartes' corpuscularian hydrostatics. Descartes does not start by thinking of bodies moving entirely without constraint, free of surrounding context; instead, he proceeds by assuming that 'systems of constraint are constitutive' of the phenomena under investigation.[25] The full fluid cosmos, then, is causally holistic, with every context-dependent motion inevitably coupled with other motions.

This holistic mechanism cannot entail deadening inattention to emergent phenomena, to the ways in which wholes act differently from their parts. The physics is indeed reductionist, in the sense that all events are constituted by microscopic impacts and collisions, but this in no way entails that understanding of vortical or other complex motions can be achieved without attention to local and temporal patterns of change in their particular physical contexts. Correspondingly, mechanism did not require the *elimination* of puzzling and complex natural phenomena. Indeed, Descartes accepts some of the stranger facts of the organicist world: he rejects not the baffling phenomena (the bleeding of wounds on

the approach of the murderer, the weapon salve, sympathies, the maternal imagination imprinting on the foetus), but only certain candidate explanations of these phenomena which attribute thought or free will to corpuscles.[26]

Human bodies

But this is not yet a dynamic *physiology*. Even if Descartes' physics is modelled more closely on the mechanics of fluids, does he not still close off the human body, rendering it a possession of the individual soul? Drew Leder clearly articulates the view that a Cartesian devitalising and demystification of the body worked to neutralise and subdue any corporeal threat, so that bodily events, including death, happen as if to another: 'the true self cannot be threatened by the demise of that which from the start was mere mechanism.'[27] The triumph of 'the colder eye of science', it seems, silenced the human body, which was 'divested of its latent capriciousness'.[28]

But it is not true that in Descartes' work 'all spirits were effectively removed from nature',[29] as Catherine Wilson argues, 'there is no sudden impoverishment' in corpuscularian natural philosophy.[30] The survival of troublesome 'animal spirits' at the very core of Descartes' physiological theories is not an accidental residue, a pun uneasily transmitted between organicist and mechanical worlds. Descartes thinks of them primarily not, in the howler to which students are commonly directed, as the intermediates which 'solve' the mysteries of mind–body interaction, but as the impetuous nervous fluids which drive the brains of animate machines. Animal spirits (which are neither animals nor spirits) 'are merely bodies'.[31] The finest, most subtle, fastest-moving parts of the blood, these spirits 'vary in strength depending on the differences in the particles which make them up'.[32]

It is customary to see the partial survival of ancient and Renaissance physiologies of humours and spirits in Descartes, if acknowledged at all,[33] as a mark of his failure, of the extent to which the exuberant, radical ambition of his mechanism was bound to need illegitimate supplementing, in explanatory practice, from tradition and lived experience. In developing what Emily Grosholz labels a 'corpuscularized Galenism',[34] Descartes, on this view, tacitly introduces old dynamically tinged annexations which enrich and thus violate a basically pure, static official mechanism.

But the survival of non-linear feedback systems in physiology at which Grosholz bridles looks quite different if we do not assume in advance that mechanism and dynamics must be incompatible. The incorporation of spirits into pulsing body-machines was part of an adaptation, not a wholesale rejection, of older medical holisms. Bodies are still porous, spongy, thrown, fragile.

In the mixed Hippocratic/Galenic traditions (tied only loosely to specific ancient texts) which fuelled learned Renaissance medicine, the state of animal spirits, blood, and other 'naturals' varied with the changing influences of the 'non-naturals': climate, food and drink, sleep, motion, evacuation and repletion, and the passions worked on the spirits either through the blood or directly through the skin.[35] Highly individualised schemes of therapy required attention to regimen, diet, sexual behaviour, travel, and responses to stress and distress.[36] In continual interaction with the *krasis* (blend) of internal fluids, the non-naturals combined to produce an individual's current, fragile balance against imminent stagnation or excess. Only those who denied animal spirits and their influence by airs and places, like William Harvey, would 'cut man off from his environment'.[37]

The individual's specific fluid balance depended on more than initial biological temperament (by which some were predisposed, for example, to melancholy and domination by Saturn), for this temperament *was* just the dynamic mixture of fluids in different proportions and conditions. So theories of individual *complexio* were at once medical and cultural.[38] The departure of internal mixture from its (relative, changing) 'proper blend' due to excessive, deviant, or insufficient environmental or psychological input was a framework for explaining not only disease but also the varieties of health.[39]

These psychophysiological frameworks were dynamic in that they assumed what modern dynamicists call 'continuous reciprocal causation', a mesh of 'mutually modulatory influences linking brain, body, and world'.[40] The dynamicism implied in physiological theory was also, as Gail Paster argues, part of lived experience: bodies were (not only theorised as but lived as) semipermeable irrigated containers, moist sponges filled with interchangeable fluids.[41]

Descartes does not deny or neutralise this framework. He accepts the turbulence of the innards and the continual exchange between world and body as key physiological *explananda*. The animal spirits connect the deepest interior, the pineal gland, with the world, for their condition shifts with changes in environment, climate, diet, and habits, and with changes in other parts of the body.

In *L'Homme*, after extended treatment of the senses,[42] Descartes turns to the 'internal senses'. His careful approach to the internal senses has recently been given some weight,[43] and it is clear that he breaks with tradition by including hunger and thirst in his list of internal senses.[44] But what is striking about the structure of *L'Homme* is that, while Descartes does then go on to discuss imagination, memory, and dreams (topics which his readers would have expected to find under the label of internal senses), he feels it necessary first to expand greatly on his earlier account of animal spirits.[45] As well as suggesting some specific causes of emotional states in the variations of animal spirits (see section 3 below), Descartes

undertakes in turn to explain the causes of these variations: spirits can differ in quantity, in the coarseness of their constituent particles, in their degree of agitation, and in the uniformity or diversity of their size, shape, and force.[46]

It is hard, I suggest, to overestimate the pivotal role which these differences in the nature and flow of animal spirits play in Descartes' picture of brain and body. The differences derive in part from changes in the nature of the blood from which the particles which compose animal spirits are filtered or separated.[47] Descartes devotes a lengthy passage to explaining that 'whatever can cause any change in the blood can also cause change in the spirits'.[48] These factors include a wide array of internal and external influences. The qualities of food and the nature of the rhythmic digestive processes, the nature of air inhaled and mixed with blood in respiration, and the disposition of the liver which elaborates blood going to the heart all affect the abundance and degree of agitation of the spirits produced by that blood;[49] gall bladder and spleen must remove, respectively, parts of the flammable and of the inflammable components of the blood before it reaches the heart; and 'the little nerve that ends in the heart' modulates the flow of blood into and out of the heart, so that it 'can cause a thousand differences in the nature of the spirits'.[50]

The continuous influence of all these factors on blood and thus on animal spirits connects or couples the human body, 'with its interactive openness',[51] with the physical and social world. Descartes has broken from the cosmobiological tradition which identified bodily spirits with quintessential cosmic spirit; but this identity had never been ubiquitous among spirits theorists, and certainly was not required to force attention to the dangers and difficulties of the ceaseless exchange of fluids between body and world.[52] Malebranche, introducing his account of the passions, draws on this physiological holism in arguing against the Stoic view that our happiness depends only on ourselves. We are joined, as a result of sin, by our body 'to all sensible things', and it is God's will that all created beings 'should depend on one another'. After the Fall,

> we are to some extent joined to the entire universe. . . . There is now no one who is not both joined and subjugated to his body and through his body to his relatives, friends, city, prince, country, clothes, house, land, horse, dog, to this entire earth, the sun, the stars, to all the heavens.[53]

It is hard to get more holistic than that. This is a field of multiple simultaneous interactions in which everything simultaneously affects everything else. Changing external parameters like diet, climate, social interaction, and stress, which change at a relatively slow rate, directly affect the fast dynamics of internal state variables of blood and spirits: but because the spirits partly cause behaviour, changes in those external parameters are

themselves partly caused by the internal processes with which they are coupled.[54]

The body and the brain

Now we can apply this biophysics to the brain. Animal spirits, once separated from the blood, pass from the pineal gland through the cerebral ventricles and into the brain. There they flow through brain pores, to which Descartes assigns a central explanatory role. Pores are like 'the spaces that occur between the threads of some tissue; because, in effect, the whole brain is nothing but a tissue constituted in a particular way'.[55] The brain is a net or mesh of filaments with pores between them. The pores are affected by the motions of animal spirits in three ways. Pores can be 'diversely enlarged or constricted by the force of the spirits that enter them', and, second, the filaments 'can be flexed rather easily'. Most important here, the filaments 'can retain, as if made of lead or wax, the flexure last received until something exerts a contrary pressure upon them'.[56]

The harmonious functioning of the body depends on the spirits, the pores, and the distribution of spirits through the pores.[57] This distribution of spirits is unceasing, since the spirits are in continual motion.[58] Flowing into the brain from the cavities, they trace figures by their motions through the pores. Descartes uses both 'trace' and 'figure' for these explicit, transient patterns of motions at a time. The spirits in the neural system keep the filaments 'so tense' that figures are easily transmitted.[59]

There are two distinct kinds of 'trace' or 'figure' in play in Descartes' account of brain processes. There are transient patterns of spirit motions. But there is also the pattern of filaments and pores, an architecture of connections which is itself modifiable but which does endure longer than the motions.[60] These are the flexures which, Descartes suggested, can be retained over time.

As well as this distribution of spirits through the cavities and pores of the brain, the spirits figure in a less direct relation or balance between the brain and the body. Not all particles of blood are fine and lively enough to pass up through the carotid artery to the brain and become animal spirits; others are drawn instead to 'the organs designed for generation'.[61] As Desmond Clarke shows, a specific hypothesis of a link between intellectual activity and male fertility, based on the 'dependence and communication which obtains between the spirits of the brain and those of the testicles', quickly became entrenched in Cartesian physiology, so that 'those who weary their imaginations by study are less suitable for procreation, while those who, on the contrary, dissipate their minds in debauching women are not as suitable for study'.[62] While in *L'Homme* Descartes himself did 'not wish to enter further into this matter', I will suggest below that he did take related problems about control of the distribution of spirits to have a significant moral force.

3 Memory

One key problem in physiology which animal spirits had long been used to answer was muscular motion. Many, like Descartes, thought that spirits flow from the nerve into the muscle in contraction.[63] This balloon or inflation theory of muscular motion would become increasingly important in debates about the existence of animal spirits from the 1660s onwards.[64] But the influence of animal spirits was not restricted to straightforwardly physiological topics: spirits were requisite theoretical entities in Renaissance accounts of memory, dreaming, and imagination, and of emotion, moods, and madness.

Descartes knew how thoroughly Renaissance psychologists, in what Burton called 'those tedious tracts *De Anima*',[65] employed animal spirits to embed cognitive function in the body. He followed tradition in extending the scope of spirits theory from the physiological to the emotional. Differences in the abundance, coarseness, agitation and uniformity of the particles of spirits alter our humours or 'natural inclinations'. Unusual abundance excites movements that give evidence of generosity, liberality or love; coarseness or strength of the spirits gives rise to confidence or courage, agitation to promptness, diligence and desire, and so on.[66] In the *Passions*, these physiological-fantastical accounts of the peculiarities of spirit motions are further developed: in hatred, for example, gall entering the blood from the liver boils up and causes spirits going to the brain to 'have very unequal parts' and to 'move very strangely'.[67]

So the thoughtless zombies of *L'Homme*, who can imitate all human actions, are not restricted to capacities we take to be physiologically basic. They can not only move, breathe, sleep and wake, nourish themselves, digest, and reproduce; they also have what are to us mental capacities like sensation, memory, imagination, and emotion. Even commentators who prefer a much more austere interpretation of 'Cartesian mechanism' than that which I am advocating agree that Descartes' description 'models activity which looks very much like cognition'.[68]

Figures transmitted by or in the incessant motions of animal spirits are 'imprinted in the internal part of the brain, which is the seat of Memory'.[69] This is achieved through bending or rearranging brain filaments so as to alter the intervals between pores through which the spirits will flow in future. The spirits 'trace figures in these gaps, which correspond to those of the objects'; on the repetition of a pattern of input, more enduring changes are made in the pores, so that figures can be more easily formed again, in the absence of the specific stimulus.[70] The pattern of the pores, which constrains the patterned flow of spirits, is itself altered over time by the differing motions of the spirits. These patterned motions are not themselves stored, but merely 'retained in such a way that' previous figures can be recreated. Even if a particular input is only partially represented, recognition may still occur if the connected pores have been disposed so as to open together more easily.[71]

So as Hall notes, for Descartes, 'memory traces ... consist in residual patterns of openness among the interstices of the filamentous brain substance'.[72] Only physical factors need be involved in reconstruction: the soul may play a part, when united to the machine, but it is not necessary for memory operation. It 'usually happens', according to Descartes, that 'several different figures are traced in [the] same region of the brain'; thus, 'the spirits will acquire a [combined] impression of them all'.[73] So memories are motions, rather than separate atomic items, and representation in memory does not operate by resemblance. Every trace in a brain region affects any episode of processing; so every memory is composite, just as every sensation dangerously carries the perceptual history of the perceiver. This is how 'chimeras and hypogryphs are formed in the imaginations of those who daydream', who neglect the twin direction offered by external objects and by reason.[74] Descartes was aware that his account allows this kind of misassociation, or the intrusion of imagination into memory. This was the subject of the most intense criticism of his views: Joseph Glanvill, in one of a number of powerful English attacks on theories of corporeal memory as motion, complained that on such a view,

> one motion would cross and destroy another; all would be clashing and discord ... our memories will be stored with infinite variety of divers, yea contrary motions, which must needs interfere, thwart, and obstruct one another: and there would be nothing within us, but ataxy and disorder.[75]

Despite such worries about the confusing effects of interference, this form of storage does avoid the problem of finding room in the brain for every memory, which had worried Descartes in the *Regulae*.[76] In 1640, Descartes tells Mersenne that there need not be a very large number of 'folds' in the brain 'to supply all the things we remember', because a single fold can 'store' many related traces;[77] in other words, experience (in the form of motions of the animal spirits) moulds the patterns of filaments and pores in such a way that old motions can be reconstructed more easily.[78] Malebranche, developing Descartes' account, would simply dismiss 'the prejudice that our brain is much too small to be able to preserve such large numbers of traces and impressions' on the grounds that memories are only 'the changes occurring in the fibres' of the brain.[79]

Note that nothing in this account violates Descartes' dualism, requiring us to interpret him as a closet materialist. It may be surprising that belief in a non-physical mind could coexist with a neurological approach to memory, or that Descartes elaborates such microbiomechanical detail when he sees human flexibility in linguistic response and rational action as forever beyond the powers of matter. But, for him, corporeal memory is not a mental capacity at all, where this means that it does not require consciousness or soul. Its explanation is embedded among other life

functions; although there can be no Cartesian science of the self-conscious mind, there can and must be sciences of memory, imagination, dreaming, and so on.

But if this whole spirits-and-traces fantasy refers only to *implicit* memory, memory where there is no conscious reference to the past, is corporeal memory really a true kind of memory at all? Implicit memory, understood merely as the non-conscious effects of past experience on ongoing brain processing, may be important for biological success, but is it not a far cry from the explicit, subjective autobiographical remembering characteristic of beings like us?

The first response to this objection is to note that Descartes definitely does see corporeal memory as a genuine kind of memory, albeit one not unique to humans: he stresses that it is the most notable effect of memory that 'without there being any soul present in this machine, it can naturally be disposed to imitate all the movements' of true humans.[80] So Descartes is not confused in attributing memory to animals:[81] as he tells Elizabeth, impressions can be formed in animal brains by, among other things, 'the traces of previous impressions left in the memory, or by the agitation of the spirits which come from the heart'.[82]

My point here is not merely to support the increasing consensus that the 'beast-machine' doctrine still allows sentience, memory, and imagination to animals:[83] rather it is to stress just how Descartes thinks that the soul, when it *does* play a causal role, must build on and use precisely these associative mechanisms among spirits and brain pores. He continues his point in the letter to Elizabeth by arguing that 'in man the brain is also acted on by the soul, which has some power to change cerebral impressions'. I will suggest in the final section of this paper just how literally Descartes takes the moral importance of this power of the soul. But I must first provide a more thorough response to the objection I just canvassed. Surely, without a soul, the only kind of 'memory' possible would be reflex action, mere automatism? Is not the fact that Descartes' physiology of memory excludes consciousness not enough for us to dismiss it, as it seems 'clear that the one thing Descartes was not explaining was the *psychologicality*' of memory?[84]

4 Automata

Put this way, the objection to my reading of Descartes on corporeal memory trades on a dichotomy between two kinds of response to the world. One form of response is inflexible, wholly stimulus-driven, while the other is incorporeally mediated conscious action. The first form covers all animal behaviour and much human behaviour, and the second characterises true human action. I argue in response that this is not an exhaustive classification, and that Descartes accepts an intermediate form of interaction with the environment, including a wide class of responses of great interest to him and to us.

Owen Flanagan describes the impoverished world of the 'Cartesian automaton', restricted, because it is only body, to automatic reflex behaviour:

> the complete system of wired-in reflex arcs exhausts its behavioural potential. What a particular automaton does, how it in fact behaves, is the inevitable result of the interaction between the environment and the wired-in arcs.[85]

The point of Descartes' fables of automata, on this view, is to exclude the contingencies of individual experience from consideration in natural philosophy, for these automata are 'endlessly repeatable, and by definition not particular, not the subjects of a specific history'.[86] It is the consequent intelligibility of automata that is 'the fundamental point of Descartes' mechanical philosophy'.[87]

But there is no reason to accept that hard-wiring or biology, on the one hand, and current stimuli, on the other, must be the sole determinants of machine behaviour. The example of memory makes this easy to see. In the memory processes of the automaton, the effects of experience are transmitted over long temporal gaps, and are causally involved in behaviour mediated by complex internal processes. The determinism involved is not a simple stimulus/response link, for the corporeal causes act holistically. To put it another way, memory shows that an automaton's physiology changes over time. Automata with different histories, different 'experiences' marking their brains and bodies, will (*contra* Flanagan) respond differently, and one automaton will respond differently to the same stimulus at different times, after new experience has modified the pores and folds of its brain.

There are, of course, cases in which biology and environment are jointly sufficient causes of behaviour. Descartes' account of reflex phenomena is 'short on detail about the specifics of neuroplumbing',[88] but it seems clear that swallowing, blinking, coughing, sneezing, and yawning depend only on fixed, hard-wired arcs.[89] This kind of automatic behaviour is like the immediate, fixed chain between the passage of air through organ pipes and the particular sounds the organ produces.[90] Let us call this simple automatism. Here the pineal gland is not involved; the switch from sensory to motor response occurs when the entrance to a brain pore or tube is opened by the motion of a nerve fibre, and animal spirits from the ventricles enter and are carried through the nerve tubes to various muscles.[91]

Simple automatism is thus significantly different from processes like corporeal memory, which we might call a case of complex automatism. Memory requires ideas to have been traced in spirits on the surface of the gland, and to have been transmitted as figures to the modifiable pores of the brain, which incur enduring changes as a result. Reflex pathways are

unalterable, whereas the folds of the brain which carry memory exhibit considerable plasticity. Simple automatism involves, we might say, no representation, as there is no need for the capacity for response to be extended over time. Remembering, on the other hand, is not simply automatic, even though it need not involve the soul.

There is extra evidence for this distinction between different classes of response available to Descartes' automata in his attitude to explanation by reflex. There are hard-wired immediate unconditioned reflexes in humans and animals: sheep run from wolves, and humans throw out their arms when falling 'without the assistance of any soul'.[92] But there are also much longer-term, yet still wholly physical, responses in which corporeal memory is at work. Some are cases we would call 'conditioned response', the acquisition of learned associations where there is no natural 'relation' between a representation and its 'meaning'. 'If you whipped a dog five or six times to the sound of a violin, it would begin to howl and run away as soon as it heard that music again.'[93] Setters can be trained, against their natural inclinations, to stop at the sight of a partridge and run towards it on hearing a gun.[94]

However, rather than conceptually isolating these conditioned responses in dog-machines, or linking them with simple reflex automatism (as Flanagan's picture would lead us to expect), Descartes couples them with more complex human cases which he considers equivalent in principle. The case of the dog howling at the music of whipping comes in the context of a discussion of individual differences in judgements of beauty: judgements often differ, Descartes argues, because of traces left by individual history. Music which makes one man want to dance may make another want to cry, because different ideas are evoked in memory: if the latter man has 'never heard a galliard without some affliction befalling him, he would certainly grow sad when he heard it again'.[95]

So not everything, in dogs any more than in humans, is innately wired in, for the movements of the brain change in the course of experience. Cartesian automata are not the uncanny 'Neurospasts', nimble sprightly puppets which only seem to be moved from within, feared by vehement English defenders of free will like Cudworth and More.[96] Once set in motion, they really are moved by changing internal states; they lack only the acausal autonomy attributed by Descartes to souls which will and act freely, and judge rationally. The long-term workings of corporeal associative memory are extremely flexible, and the notions of experience and individual learning history do apply. The diverse causal factors involved in registering, integrating, and acting on information include 'previous brain episodes' and non-neural bodily events, as well as current environmental input: 'this is the model of an automaton, to be sure, but not one which operates by reflex'.[97]

The natural philosopher's desire to master and possess nature, then, is inevitably limited by the complexity and the flexibility of the bodies with which the soul is united. It is just because body-machines are weak and exist in history, because hair turns white,[98] that medicine is central to Descartes' project. The myth of the pre-programmed machine dully reproducing its hard-wired fate, eternally churning out fixed action patterns, does not apply to the animated statues of organic nature. The intermediate level of response, neither simple reflex nor incorporeally derived action, opens up Cartesian bodies to memory and history, with all the sadness, resistance, and complexity which the matter of the past brings.

5 Passions

This plasticity of response in the machines with which souls are united is the basis for the neurological strand of morality. We need knowledge of our own internal processes as much because of the hopes and opportunities they afford us as because of the dangers with which they threaten us. But where Toulmin, for example, suggests that this is a recipe for 'moral escapism' by dividing us from our body, that Descartes' ethics 'relieves us of all responsibility' for the passions by treating them 'as mere effects of causal processes [and taking] them out of our hands',[99] I argue that Descartes urges the awesomely difficult moral task of excavating, managing, and correcting a vast and changing array of psychophysiological associations. Moral life is not the imposition of norms onto bodies from outside the causal field, but the slow, reciprocal adjustment of internal causes.

The organic automata of *L'Homme* function without a soul. But, unlike them, we do have souls; in the fabular context, Descartes tells us that 'God will later join a rational soul to this machine'.[100] What difference, then, will the soul make to this marvellously intricate engine? It may, first, make significant qualitative differences: animals, Descartes retorts to Fromondus, 'do not see as we do when we are aware that we see, but only as we do when our minds are elsewhere'.[101] But however this notoriously difficult view is to be understood, I suggest that Descartes also allows the soul to make something more like a quantitative or additive difference, providing us in the mind–body union with extra capacities which build on and employ those we have considered as bodies alone.

Using familiar material from the *Passions*, I hope to show just how far removed these processes of the union are from the bewildering kind of 'bifurcation' of inner and outer lives of which Ryle accused Descartes.[102] Some of the ways by which souls act on bodies are nothing at all like the direct and unicausal para-mechanical interventions of a ghostly governor; instead, they extend or apply the multicausal treatments of disease characteristic of 'pre-modern' medicine to the psychophysiological realm. The soul's occasional influence on the bodily states of associative memory is its only, imperfect way of instituting better habits in the wayward dynamics of spirits and brain.[103] Descartes does indeed acknowledge the kind of gaps

between self and body which cosier Wittgensteinian and phenomenological philosophies repudiate; theory provides stratagems for identifying, coming to terms with, and occasionally healing these troublesome traces and 'wounds received by the brain'.[104]

At the end of the *Passions*, Descartes says that he has described two quite different classes of 'remedy' for the passions. One he calls the 'most general' remedy, as it can be employed when the other fails: when tempted by a passion or action which the intellect repudiates, we should call up other, opposing thoughts at will, seek to postpone action if appropriate, or simply distract ourselves with different thoughts. This strategy is 'readily applicable', Descartes says, and is the only remedy most people ever use.[105]

But the advice on life embodied in most of the book, and in many of Descartes' recommendations to Princess Elizabeth, is based on the other, much more difficult remedy, through which we can find wisdom and joy: those who are most moved by the passions, who have sufficiently prepared themselves by this method, 'are capable of enjoying the sweetest pleasures of this life'.[106] This second remedy requires, says Descartes, 'forethought and diligence', and long training. It is based on a single psychophysical principle, aptly dubbed the Principle of Habituation by Stephen Voss.[107] Descartes calls it 'the principle which underlies everything I have written about [the passions]'.

According to this associative principle, particular physical movements in the brain and body are joined with thoughts and passions. These linkages depend on 'nature or habit',[108] and they can occur between thoughts, on the one hand, and both overt bodily movements and internal motions of the brain and innards, on the other. They are of various different kinds and strengths. I want to work briefly through the varieties of connection, and in doing so to demonstrate how thoroughly this principle, introduced immediately after a reprise of Descartes' associative account of memory,[109] is integrated with that account.

The causes of these connections between bodily motions and thoughts or passions are all opaque to us as acting and thinking subjects: the correlations were set up either before our awareness, or beyond and beneath it. Any modifications we seek to make to psychophysiological responses must be just as indirect as our knowledge of them. As the will does not have the power to excite or displace the passions directly,[110] it is constrained to employ '*industrie*': this is 'artifice' or, we might say, (psychological) work in which knowledge of our nature and, most importantly, of our own history and experience, is laboriously brought to bear on the landscape of our pores and passions.

There are, first, fixed connections. Some movements of the brain cause passions by 'institutions of nature', instituted by God. These are generally to our benefit, for the preservation of life. They are parallel to the unconditioned reflex phenomena described above, but also include, for example, the emotional extensions of basic attraction and repulsion, such

as sexual desire and the fear of death. When they become further associated with specific stimuli, these responses may be alterable; Descartes does not think that 'the touch of an earthworm, the sound of a rustling leaf, or our shadow' must forever bring dread because of our aversion to the threat of death they seem to bring:[111] indeed, eradication of the fear of death is, he tells Mersenne, 'one of the main points in [his] own ethical code'.[112] The precise sense in which they are 'fixed', then, is only that their institution depends simply on God and on the given nature of the machine, not on any historical or individual experiences.

The power of these 'biological' or natural connections is sometimes seen as the main threat to the good life. On this understanding of Cartesian ethics, Descartes 'offers the hope that by careful training, and the resolute exercise of our will, we can become not the slaves but the masters of our biological inheritance'.[113] This gives the impression that Descartes took the enemy, in moral life, to be the fixity of biology, the rigidity of the machine's programming, which it is the task of the will to overcome. It might seem that the conclusion to the *Passions* confirms this interpretation, as Descartes says that he has told us how to 'correct our natural faults'.[114] But the institutions of nature do not reach all that deeply: by themselves they are neither the main problem, nor the major hope. The 'natural faults' in question are not, I submit, this limited class of fixed connections between brain movements and specific passions, but rather the (fixed) mechanisms which, in contrast, support or ground variable connections, which are in fact Descartes' main concern. Not fixity, but our fixed tendency towards uncontrolled plasticity, is the problem.

So not nature, but what Descartes calls 'habit' (*habitude*) is the moral key. The term covers various kinds of *variable connections* between motions and thoughts or passions. Habits are grounded in dispositions, which in turn are grounded in the arrangements of physical parts.[115] '*Habitude*' reaches much further beyond the individual than does the English 'habit'. All the teachings of childhood are sedimented in associations: the route by which culture intrudes into the soul is by way of the brain. Descartes thus has a physiological basis for worry about our prereflective views of the world. He does not hold the intellectualist view that everything implicit in our forms of life must be explicitly encoded in the brain. This would require the equally implausible separate rooting out and challenging of each and every belief.[116] Memories do not have to be stored independently or discretely to be causally active; there are no independent storage boxes which can be either full or empty, only the sets of folding pores in the net of the brain. Our bodies thus hold cultural forms of life not as quasi-theoretical axioms, but as nested sets of causal tendencies, realised differently in each brain. Descartes' psychophysiology makes the kind of total epistemological reevaluation, and wholesale destruction of false beliefs, which mainstream interpretations attribute to him, quite incoherent. We should reject these interpretations, and acknowledge instead that Descartes

accepts the inevitability of working with our prereflective cognitive equilibrium, while seeking also to hone in on the more damaging of the inconsistencies and anomalies, accretions of the (social and individual) past, which we have internalised.

So in addition to the ways that culture has, since childhood, soaked through the pores of the brain, there are also more particular 'habits'. Striking examples of these psychophysiological accidents of experience are phenomena of single-trial learning. Some dispositions of the brain can be acquired by a single action and do not require long practice: it takes only one nasty surprise in a favourite food to produce a permanent abhorrence.[117] These are the most extreme cases of the kinds of individual differences in which Descartes was keenly interested. They offer a physiological basis for his remark to Elizabeth that 'each of us is a person distinct from others whose interests are accordingly in some way different from those of the rest of the world';[118] difference, or history, arises already in the body and is not due solely to the possession of a separate soul. There is nothing natural about the experiential coupling of affliction with the hearing of a galliard. The cases Descartes typically describes are, like this, instances of aversion, in which a peculiar response to the smell of a rose or to the presence of a cat is due to some earlier individual trauma: in line with his general acceptance of associations set up before birth, he notes that someone, for example, may have 'sympathetically felt the sensation of their mother who was shocked by cats while pregnant'.[119] This extends backwards in developmental time the stress on the dual sources, in nature and habit, of association: just as natural connections may have been instituted in the womb,[120] so there is no principled reason why the *'habitudes'* of the mother may not have influenced association.

It is in this context that such aversions may be imprinted on or in a subject's brain 'till the end of his life',[121] without the subject ever being aware of it. The clear acknowledgment of this kind of permanent opacity of the operation of association marks the limit to the possible deprogramming and reprogramming of the body-machine by the soul.[122] But, fortunately, sometimes modification is possible. The point of the difficult remedy described throughout the *Passions* is to teach how we can apply ourselves 'to separate within ourselves the movements of the blood and spirits from the thoughts to which they are usually joined'.[123] This is the context of the story to which I referred earlier about altering the associations in the brain of a setter towards gunshots and partridges; with a little *'industrie'* the movements of the brain can be changed in humans, just as trainers can change them in animals, and, in general, movements of the brain can by habituation (*habitude*) be separated from the passions to which they have previously been linked, and joined again with others.[124] This is a slightly different sense of *habitude*, referring now not to the (past) setting up of an association, nor to the association thus set up, but to the potential process of *intentional alteration* of the brain by the self.

Descartes tells Chanut of his own experience of this kind of indirect changing of the brain in a story often quoted as a model in this context:

> . . . when I was a child I loved a little girl of my own age who had a slight squint. The impression made by sight in my brain when I looked at her cross-eyes became so closely connected to the simultaneous impression which aroused in me the passion of love that for a long time afterwards when I saw persons with a squint I felt a special inclination to love them simply because they had that defect. At that time I did not know that was the reason for my love; and indeed as soon as I reflected on it and recognized that it was a defect, I was no longer affected by it.[125]

This makes Descartes' hopes about the efficacy of intentional changes to the brain, and of the resulting moral improvement, seem wildly ambitious: working through is not so much harder than remembering or repeating after all. Schouls sees the *Passions* as Descartes' most extreme expression and defence of 'total mastery and . . . full autonomy', where complete fulfilment of the rationalist programme is uniquely envisaged; Cottingham remarks on Descartes 'deep optimism' about the prospects for these investigations into the physiological genesis of passions.[126] Descartes does indeed announce, at the rhetorically charged finales of sections 1 and 3 of the *Passions*, that this method can lead even 'weak souls' to 'acquire a quite absolute dominion over all their passions if one employed enough skill (*industrie*) in training and guiding them',[127] and that the Principle of Habituation, sufficiently well employed, acts as preparation 'against all the contingencies of life'.[128]

Must we return, then, to the encompassing ratiocentrism I invoked at the beginning of the paper, by which total expertise on the self is to be put to work in proto-technological control of one's own body? What will prevent this headlong rush for mastery degenerating into a behaviouristic nightmare, in which those who employ the skill in training and guiding might be authorities rather than oneself? Even though only thoughts are directly in our power, does this psychophysiological scheme not render almost everything else about us ultimately accessible to the marauding soul?

But Descartes did know that the effects of the past, traumatic or simply unnoticed, are not so easily retraced and worked through. The point that some accidental associations from the personal past may remain forever unknown[129] is enough to challenge his 'relentless optimism about the power and autonomy of the will'.[130] The Cartesian soul is not, as Adam Phillips sees it, an enraged bureaucrat, furiously cataloguing unmanageable emotions, making sure everything is accounted for in a system without secrets.[131]

First, we can note that the story Descartes tells Chanut is not necessarily

a genuine case of the intentional alteration of association. Descartes does say that he 'reflected' on the true historical cause of his associations, but the very fact that it was undone immediately suggests that this was more of an accidental discovery than the careful investigation of psychological history which, Descartes acknowledges, can be a long and uncertain process which few people achieve.[132]

We might, further, invoke Malebranche's much more pronounced sense of human limitation, pointing out that it arises from precisely Descartes' considerations about memory and association. Traces in memory are inevitably confused together, with the 'unruly' animal spirits often exhausting the will in its attempts to lead them into 'new and difficult channels'.[133] Malebranche repeatedly invokes the principle of habituation, noting that, in passion, many traces are stirred up by animal spirits 'swirling irregularly in their brain', and that the soul, which is 'continually constrained to have the thoughts tied to these traces', can become 'as it were, enslaved to them'.[134] The most determined attempts to impose some fixity or solidity on them may fail to render us 'impregnable': sometimes the 'motion of the spirits can be so violent that they occupy the soul's entire capacity'.[135] It is true that 'before the Fall, the soul could erase the brain's images' and 'instantaneously arrest the disturbance in the brain's fibres and the agitation of its spirits merely by considering its duty'.[136] The psychophysiological consequence of the Fall, then, is just the possible failure of the project of recolonising the body and the brain with the intellect.

Descartes' sense of sin is not so pronounced; yet, since so much of the picture of plasticity in brain and body which I have outlined dictates against the notion that our psychophysiological capacities are perfectible, there is at least some interpretive ground for refusing to take his high rationalist rhetoric of totalising self-correction too seriously. To take it at face value and then to convict Descartes of over-intellectualist moralising is at least equally troubling. In arguing that Descartes imagines an end to inquiry about the self, a final termination to the self-analysis, such interpretations trade on just the picture of a static, rigid body which, I have suggested, is entirely foreign to Descartes' physiology. For as long as the union of soul and body continues, the brain and its spirits churn and change away, shifting the grounds of the associative dispositions which it is the work of the soul to refigure.

Notes

1 *Principia*, preface. AT ix. 14.
2 T.M. Brown, 'Descartes, Dualism, and Psychosomatic Medicine', in W.F. Bynum, R. Porter, and M. Shepherd, eds., *The Anatomy of Madness* (London, 1985), i. 40–62; Timothy J. Reiss, 'Denying the body? Memory and the dilemmas of history in Descartes', *Journal of the History of Ideas* vol. 57 (1996), 587–607: 592–3.
3 Jonathan Ree, 'Subjectivity in the Twentieth Century', *New Literary History* vol. 26 (1995), 205–17: 205–6; Maxine Sheets-Johnstone, 'The materialization of the body', in M. Sheets-Johnstone, ed., *Giving the Body its Due* (New York, 1992), 132–58: 134.

4 Ian Hacking, *Rewriting the Soul* (Princeton, 1995, 209), although Hacking does not deal with early accounts of self-knowledge, and would likely reject my historiographic analysis, since he believes that 'there was little conception of a knowledge about memory before the nineteenth century.' (219).
5 Adam Phillips, *Terrors and Experts* (Cambidge, MA, 1996), 93–104.
6 Margaret Atherton, 'Cartesian reason and gendered reason', in L.M. Antony and C. Witt, eds., *A Mind of One's Own* (Boulder, 1993), 19–34.
7 Timothy van Gelder, 'What could cognition be, if not computation?', *Journal of Philosophy* vol. 91 (1995), 345–81: 379; Andy Clark, *Being There: putting brain, body, and world together again* (Cambridge, MA, 1997), xi.
8 Michael Wheeler, 'Escaping the Cartesian mind-set: Heidegger and artificial life', in F. Moreno et al, eds., *Advances in Artificial Life* (Berlin, 1995), 65–76: 67.
9 AT v.178. For these quotations see also John Cottingham, 'Cartesian Ethics: reason and the passions', *Revue Internationale de Philosophie* vol. 195 (1996), 193–216: 196. My discussion of the passions is much indebted to Cottingham's.
10 Descartes to Chanut, 20 November 1647, AT v. 87.
11 The material on memory and automatism, in particular, is developed more fully in my *Philosophy and Memory Traces: Descartes to connectionism* (Cambridge, 1998), especially 55–81. Here I employ it in detailed discussion of the role of psychology in the quest for self-mastery.
12 Antonio Damasio, *Descartes' Error* (London, 1995), 247; compare Drew Leder, *The Absent Body* (Chicago, 1990), 198–9.
13 Stephen Toulmin, *Cosmopolis: the hidden agenda of modernity* (Chicago, 1990), 34 (original italics).
14 Van Gelder, 'What could cognition be . . .?', 379–81.
15 AT vi. 62.
16 AT xi. 120. On this point, compare Gordon Baker and Katherine Morris, *Descartes' Dualism* (London, 1996), 37.
17 Karl Rothschuh, *History of Physiology*, trans. G.B. Risse (Huntington, NY, 1973), 78.
18 Carolyn Merchant, *The Death of Nature: women, ecology, and the scientific revolution* (New York, 1980), 193.
19 Descartes to Mersenne, 28 October 1640, AT iii. 213.
20 AT xi. 11.
21 AT xi. 10.
22 For these quotations and a thoroughgoing account of this interpretation see Stephen Gaukroger, *Descartes: an intellectual biography* (Oxford, 1995), 231: here I draw further implications of Gaukroger's defence of forces among the corpuscles by applying it to the case of physiology. Richard Carter offers another suggestive picture of the relations between physics and physiology in *Descartes' Medical Philosophy: the organic solution to the mind–body problem* (Baltimore, 1983): among other differences in strategy, I am more concerned than Carter to integrate the physiology and memory theory of *L'Homme* into an overall interpretation.
23 Gaukroger, *Descartes*, 412; see for example AT xi. 50–83.
24 AT xi. 16–23. See also the clear exposition of Descartes' *Principles of Philosophy* by John Heilbron, *Elements of Early Modern Physics* (Berkeley, 1982), 22–6.
25 Gaukroger, *Descartes*, 247–8; AT viii. 70.
26 See *Principes* IV, art. 187 (AT ix. 308–9); compare *L'Homme* AT xi. 177; and

William R. Shea, *The Magic of Numbers and Motion* (Canton, MA, 1991), 111–20. Annie Bitbol-Hespériès, in her 'Introduction' to *Descartes, Le Monde, L'Homme* (Paris, 1996), pp. x–xiii, claims that Descartes was seeking to eradicate the marvellous: but in my view he attacks not the wonderful phenomena themselves, but only the ignorance which makes the learned wonder at them.

27 Leder, *The Absent Body*, 148.
28 Jonathan Sawday, *The Body Emblazoned* (London, 1995), 22, 37.
29 Merchant, *The Death of Nature*, 204.
30 Catherine Wilson, *The Invisible World: early modern philosophy and the invention of the microscope* (Princeton, 1995), 21–2.
31 AT xi. 335; AT xi. 129.
32 Descartes to Vorstius, 19 June 1643, AT iii. 689.
33 Descartes helped medicine 'veer from the organismic, mind-in-the-body approach, which prevailed from Hippocrates to the Renaissance' (Damasio, *Descartes' Error*, 251). The error of such talk of a radical split is clearly revealed by the wonderful notes on Descartes' sources in both Hall's and Bitbol-Hespériès' editions of *L'Homme*.
34 Emily Grosholz, *Cartesian Method and the Problem of Reduction* (Oxford, 1991), 120.
35 L.J. Rather, 'The "Six Things Non-Natural"', *Clio Medica* vol. 3 (1968), 337–47; Peter H. Niebyl, 'The Non-Naturals', *Bulletin of the History of Medicine* vol. 45 (1971), 486–92.
36 Vivian Nutton, 'Medicine in Western Europe, 1000–1500', in L.I. Conrad et al, eds., *The Western Medical Tradition* (Cambridge, 1995), 139–205: 141.
37 Robert G. Frank, *Harvey and the Oxford Physiologists* (Berkeley, 1980), 40.
38 Nancy Siraisi, *Medieval and Early Renaissance Medicine* (Chicago, 1990), 101–14.
39 Linda Deer Richardson, 'The generation of disease', in A. Wear et al, eds., *The Medical Renaissance of the Sixteenth Century* (Cambridge, 1985), 175–94; Harold J. Cook, 'The New Philosophy and Medicine in Seventeenth-Century England', in D. Lindberg and R. Westman, eds., *Reappraisals of the Scientific Revolution* (Cambridge, 1990), 397–436, especially 405–11.
40 Clark, *Being There*, 163.
41 Gail Kern Paster, *The Body Embarrassed* (Ithaca, 1993), especially 1–22; Paster, 'Nervous Tension: networks of blood and spirit in the early modern body', in D. Hillman and C. Mazzio, eds., *The Body in Parts* (London, 1997), 107–25. As Michel Serres puts it in a different context, 'the organism is a barrier of braided links that leaks like a wicker basket but can still function as a dam' *Hermes: literature, science, philosophy* (Baltimore, 1982), 75.
42 AT xi. 141–63.
43 D. Sepper, *Descartes's Imagination* (Berkeley, 1996); Baker and Morris, op. cit.
44 AT xi. 163–4.
45 AT xi. 129–32. In the earlier preview of the remaining contents of *L'homme* (AT xi. 132), Descartes foreshadowed his discussions of muscular motion, of breathing and other reflex phenomena, and of the external senses. He then described the topic of the final long sections, which in fact include the treatments of memory, dreams, and so on, thus: 'after that I shall explain in detail all that happens in the cavities and pores of the brain, what pathway the animal spirits follow there, and which of our functions this machine can imitate by means of them'.
46 AT xi. 166.
47 AT xi. 130; Descartes to Vorstius, 19 June 1643, AT iii. 688.
48 AT xi. 167–70.
49 AT xi. 167–8.
50 AT xi. 169–70.

51 Véronique Fóti, 'Presence and Memory: Derrida, Freud, Plato, Descartes', *The Graduate Faculty Philosophy Journal* vol. 11 (1986), 67–81: 76.
52 See my *Philosophy and Memory Traces*, 31–49.
53 Nicholas Malebranche, *The Search After Truth*, trans. T.M. Lennon and P.J. Olscamp (Columbus, 1980), 341–2. Compare Descartes to Elizabeth, 15 September 1645, AT vi. 290–6.
54 For this formulation compare, in the modern context, Tim van Gelder and Robert F. Port, 'It's About Time: an overview of the dynamical approach to cognition', in Port and van Gelder, eds., *Mind as Motion* (Cambridge, MA, 1995), 1–43: 23–5.
55 AT xi. 170.
56 AT xi. 171.
57 AT xi. 165–6.
58 AT xi. 171.
59 AT xi. 175.
60 This two-factor framework of fleeting patterns and 'relatively stable transforming elements', which ground occurrent and dispositional traces respectively, operates 'at a decidedly abstract level', and could be realised either in neural networks or in a system of spirits and pores: compare Paul and Patricia Churchland, 'The Future of Psychology, Folk and Scientific', in R. McCauley, ed., *The Churchlands and Their Critics* (Oxford, 1996), 219–55, at 225–7.
61 AT xi. 128. The interconnected nature of all body fluids, with continual cycles running between blood, sperm, spirits, humours, sweat, tears and so on, is marked also in Descartes' acceptance of a neural circulation equivalent to that of the blood: see Edwin Clarke, 'The Neural Circulation', *Medical History* vol. 22 (1978), 291–307. On Renaissance assumptions about the interconvertibility of body fluids, see also Thomas Laqueur, *Making Sex* (Cambridge, MA., 1990), 35–43: 103–8.
62 Desmond Clarke, *Occult Powers and Hypotheses* (Oxford, 1989), 154, quoting La Forge and Gadroys.
63 AT xi. 134–7; AT xi. 335–6.
64 Sutton, op. cit., 177–88; William T. Clower, 'From Animal Spirits to Neural Electricity', *Journal of the History of Neuroscience* vol. 8 (1999).
65 Robert Burton, *The Anatomy of Melancholy (1621)*, ed. T.C. Faulkner et al. (Oxford, 1989), i. 140.
66 AT xi. 166–7.
67 AT xi. 404–5; compare *L'Homme*, AT xi. 169.
68 Grosholz, op. cit., 122.
69 AT xi. 177.
70 AT xi. 178.
71 AT xi. 178–9.
72 T.S. Hall, *René Descartes: Treatise of Man* (Cambridge, MA, 1972), 96 n. 145.
73 AT xi. 185.
74 AT xi. 185.
75 Glanvill, *The Vanity of Dogmatizing*, ed. S. Medcalf (Brighton, 1970), 39 [first pub. 1661]; on these critics see Jamie Kassler, *Inner Music: Hobbes, Hooke, and North on internal character* (London, 1995), 108–47, and Sutton, op. cit., 129–48.
76 AT x. 415.
77 AT iii. 143.
78 Like the account of hatred, Descartes' theory of corporeal memory is consistent from *L'Homme* to the *Passions* (see AT xi. 360). This is enough to challenge John Morris' claim ('Pattern-Recognition in Descartes' Automata', *Isis* vol. 60 [1969], 451–60) that Descartes' references to a non-physical 'intellec-

tual memory' from 1640 onwards were driven by his belief that the room-in-the-brain problem was insoluble. For other suggestions on why Descartes added sketchy remarks on intellectual memory to his 'thorough and complex theory of [corporeal] memory', see Richard Joyce, 'Cartesian Memory', *Journal of the History of Philosophy* vol. 35 (1997), 375–93, and Sutton, op. cit., 67–73.

79 Malebranche, *The Search After Truth*, 106–7.
80 AT xi. 185.
81 Marjorie Grene, *Descartes* (Brighton, 1985), 47–8.
82 AT iv. 310.
83 Gaukroger, op. cit., 287–9, 392–4; Baker and Morris, op. cit., 91–100.
84 Graham Richards, *Mental Machinery: the origins and consequences of psychological ideas, vol. 1, 1600–1850* (London, 1992), 65–6.
85 Owen Flanagan, *The Science of the Mind* (2nd edition, Cambridge, MA, 1991), 3. Compare Otto Mayr, *Authority, Liberty, and Automatic Machinery in Early Modern Europe* (Baltimore, 1986), 66: 'In animals it was the brain that, consisting entirely of memory and therefore capable only of initiating preprogrammed action, corresponded closely to the mechanical program controlling automata.' Mayr's interpretation of mechanistic physiology as intrinsically authoritarian overemphasises the dull passivity of the early modern machines which served as Descartes' models: in fact, as he acknowledges elsewhere (42–54, 124; compare Baker and Morris, op. cit., 91–4), machines and automata were just as strongly associated with unreliability, uncertainty, and fragility.
86 Reiss, 'Denying the Body?', 604.
87 Peter Dear, 'A Mechanical Microcosm: bodily passions, good manners, and Cartesian mechanism', in C. Lawrence and S. Shapin, eds., *Science Incarnate* (Chicago, 1998), 51–82, at 76–7.
88 Gary Hatfield, 'Descartes' Physiology and its relation to his Psychology', in J. Cottingham, ed., *The Cambridge Companion to Descartes* (Cambridge, 1992), 335–70: 348.
89 AT xi. 140–1. See Georges Canguilhem, *La Formation du Concept de Réflexe aux XVIIe et XVIIIe Siècles* (Paris, 1955), 29–30; and, for a different account of the mechanisms involved, Jean-Marie Beyssade, 'Réflexe ou admiration: sur les mécanismes sensori-moteurs selon Descartes', in J.-L. Marion, ed., *La Passion de la Raison* (Paris, 1983), 113–30.
90 AT xi. 165–6.
91 AT xi. 142. 'The cavity F' to which Descartes refers here is not the pineal gland, but the ventricle.
92 AT vii. 204.
93 Descartes to Mersenne, 18 March 1630, AT i. 134.
94 *Passions*, AT xi. 370.
95 AT i. 133–4.
96 Alan Gabbey, 'Cudworth, More, and the Mechanical Analogy', in R. Kroll et al, eds., *Philosophy, Science, and Religion in England 1640–1700* (Cambridge, 1992), 109–27: 117. This is to query Brian Baigrie's claim that Descartes saw the self-instigated movement of machines as a kind of cosmic deception: Baigrie, 'Descartes' Scientific Illustrations and "*la grande mécanique de la nature*",' in Baigrie, ed., *Picturing Knowledge* (Toronto, 1996), 86–134: 109–11.
97 Ann W. Mackenzie, 'Descartes on Life and Sense', *Canadian Journal of Philosophy* vol. 19 (1989), 163–92: 174–5.
98 Descartes to Huygens, 5 October 1637, AT i. 434.
99 Toulmin, op. cit., 41.
100 AT xi. 143. Among the numerous references to the soul in *L'homme* compare

especially, for similar locutions, AT xi. 131, 177, 183. It is unlikely that the promised section of the overall project of *Le Monde* on the soul was written and lost, as Bitbol-Hespériès concludes ('Introduction', xl-xli). *Le Monde*, including *L'homme*, should be seen as unfinished.
101 AT i. 413. Compare Gaukroger, op. cit., 287–8.
102 Gilbert Ryle, *The Concept of Mind* (London, 1949), 14.
103 As I say, this is a straightforward reading of a text carefully analysed in similar directions by others. I am particularly indebted to Peter Schouls, *Descartes and the Enlightenment* (Kingston, 1989), 144–72; to Cottingham, 'Cartesian Ethics', op. cit., and to John Cottingham, *Philosophy and the Good Life* (Cambridge, 1998), ch. 3. See also Anthony Levi, *The French Moralists* (Oxford, 1964), especially 279–82; John J. Blom, *Descartes: his moral philosophy and psychology* (Brighton, 1978), especially 84–96; Jeffrey Barnouw, 'Passion as "Confused" perception or thought in Descartes, Malebranche, and Hutcheson', *Journal of the History of Ideas* vol. 53 (1992), 397–424; and Vance G. Morgan, *Foundations of Cartesian Ethics* (New Jersey, 1994), 149–71. But it is rare for this material to be understood in the light of the physiological accounts of memory and association with which, I argue, it is closely linked. My reading of Descartes' psychosomatics differs a little from that of Dennis Des Chene (ch. 29 of this volume). I do not find such a severe developmental shift in Descartes' views from the early 1630s to the late 1640s (for a chronological account similar to Des Chene see Gaukroger, *Descartes*, 387–8): this is because I do not see the earlier physiological theory as in any sense incompatible with psychosomatic therapy, and because I do not see the later psychosomatic theory as in any sense less neurally inspired. Similarly, Toulmin's complaint that Descartes' 'physiological interests thus anticipate "biomedical science" more than they do clinical medicine' (*Cosmopolis*, 76) founders not so much on the false dichotomy between the two forms of medicine, which has of course had its historical effects, as on its neglect of the attentive, careful, and expectant aspects of the therapies which Descartes' dynamic physiology requires.
104 Malebranche, *The Search After Truth*, 607.
105 *Passions*, AT xi. 486–8.
106 AT xi. 488.
107 Stephen Voss, ed., *The Passions of the Soul* (Indianapolis, 1989), 42, n. 43.
108 AT xi. 361; AT xi. 368–9.
109 AT xi. 360.
110 AT xi. 362–3, 365–6.
111 AT xi. 394–5.
112 AT ii. 480–1.
113 John Cottingham, 'The Self and the Body: alienation and integration in Cartesian ethics', *Seventeenth-Century French Studies* vol. 17 (1995), 1–13: 11. But in his later paper 'Cartesian ethics', Cottingham acknowledges the force of 'our past psychological history' as well as our physiological make-up. In *Philosophy and Memory Traces*, I too misleadingly described the associations which Descartes thinks we need to correct as primarily biological (102).
114 AT xi. 486.
115 See the entries for *disposition* and *habitude* in Voss' outstanding lexicon, in his edition of the *Passions*, 138, 140.
116 See Reiss, 'Denying the Body?', op. cit.
117 AT xi. 369.
118 AT iv. 293.
119 AT xi. 428–9.
120 As described for primitive connections between movements and love, hatred,

joy, sadness, and desire in the *Description*, AT xi. 407–11; and compare Descartes to Chanut, 1 February 1647, AT iv. 605–6.
121 AT xi. 429.
122 For this terminology, see Schouls, *Descartes and the Enlightenment*, 168–9; Cottingham, *Philosophy and the Good Life*, 90–2.
123 AT xi. 486.
124 AT xi. 369–70.
125 6 June 1647, AT v. 57.
126 Schouls, *Descartes and the Enlightenment*, 170–2; Cottingham, 'Cartesian Ethics', 216.
127 AT xi. 370.
128 AT xi. 486.
129 AT xi. 429.
130 Amélie Rorty, 'Descartes on Thinking with the Body', in Cottingham, ed., *The Cambridge Companion to Descartes*, 371–92: 384.
131 Phillips, *Terrors and Experts*, 99–100.
132 AT xi. 486.
133 Malebranche, *The Search After Truth*, 141, 386.
134 Ibid., 203, 151.
135 Ibid., 388–9.
136 Ibid., 360: compare 339: 'we know that before his sin man was not the slave but the absolute master of his passions'.

29 Life and health in Cartesian natural philosophy

Dennis Des Chene

Introduction

In a letter of 1637, Descartes, then forty-one, writes that he has less leisure than he once had, since 'the white hairs that hasten my way are warning me that I should not study anything but how to slow them down'.[1] The *Discours*, published that same year, had already proposed that 'if it is possible to find a way to render men in general wiser and more able than they have been until now, I believe that it is in Medicine that one must look for it'.[2] Writing to the Marquis of Newcastle a few years later, Descartes goes so far as to say that 'the conservation of health has been at all times the principal end of my studies'.[3] That, no doubt, is hyperbole. But even if it would be too much to call Descartes' philosophy a medical philosophy through and through, there is no doubt that the preservation of human health was one of its chief aims.

It is curious, therefore, that within his natural philosophy there seems to be no place for a normative conception of well-being. We have, on the one hand, the project of a scientific medicine – one of the crowning glories of the tree of knowledge – and, on the other, a world – that of *Le Monde, L'Homme,* and the *Principia* – which, though it certainly allows for the description of the human body, is not merely indifferent to, but is designed to exclude, notions that would seem requisite to defining the aims of any medicine: life, health, disease. Such notions must, it would appear, refer to ends; but ends are rigorously banished from Cartesian physics.

There was, it turns out, more than one way to make up the loss. The first I call *biomechanics*. Its object is the body alone, regarded as a pure instrument, whose ends are imposed upon it in just the way that time-keeping is imposed upon a clock. The second I call *psychosomatics*. The object of psychosomatics is not the body-machine alone, but rather the union of mind and body. The union is a proper subject of teleological properties, and thus of normative predicates defined in terms of them. For the body-machine, health and sickness are external valuations, but for the union they are genuine properties.