ADAM'S SPECTACLES

NATURE, MIND AND BODY IN THE AGE OF MECHANISM

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Abstract

This thesis explores the ways in which the mind-body relationship was problematized after Descartes, in the context of the scientific revolution in the second half of the seventeenth century, both in France and in England. It is an attempt to historicize ongoing debates within the cognitive sciences and the philosophy of mind about the problem of consciousness. By reconstructing a history of the status of the self-aware, human mind through the history of scientific explanation, I address the *question* of whether or not a complete, scientific explanation of higher consciousness is possible.

Adopting a conceptual, rather than chronological framework, I concentrate on figures who played a role in the scientific, theological and philosophical debates of their day, rather than on the subjects studied in modern philosophy curricula, although Descartes, Locke and Malebranche are present throughout. Part I focuses mainly on post-Cartesian views on dualism. Part II relates these theoretical debates to discussions about the nature of scientific enquiry. The thesis begins with Fellows of the Royal Society, including William Holder and George Dalgarno, who discussed the possibility of devising a language for the deaf, as well as the nature of language, ideas and perception. Orthodox followers and later interpreters of Descartes like Gérauld de Cordemoy, François Fenelon and Louis de La Forge also wrote about these issues. Debates over the Cartesian 'beast-machine' thesis and over definitions of reason and instinct, are considered next, by looking at the works of Ignace-Gaston Pardies, Antoine Dilly and Pierre Bayle. These discussions were a manifestation of the need to define human nature apart from its physical embodiment. Part II begins with a consideration of the various ways that sceptical traditions informed programmes of scientific enquiry on both sides of the Channel, through the writings of Joseph Glanvill and Bernard de Fontenelle, among others. Arguments about teleology and about the relation between anatomical form and physiological function by thinkers and natural philosophers such as Robert Boyle, Nicolaus Steno and Thomas Willis are treated in the next chapter. These enquiries prepare the ground for the final chapter, which considers texts by physicians and anatomists, including Claude Perrault and Guillaume Lamy, on the physiology of the 'corporeal soul'.

CONTENTS

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This project, like many PhD dissertations, has taken a fairly long time to complete. It has been a privilege to be able to spend these years on research, thinking and writing, with few cares in the world apart from the joys and anxieties usually associated with the contemplative life. For better or worse, this is a doctorate I can claim to have needed to write, and I am immensely grateful to all those who have supported me in my wish to pursue this line of enquiry, and who have believed in its potential interest.

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to pursue postgraduate studies - at the end of a formative internship at the *New York Review of Books*. While there, I had already begun developing an interest in the history and philosophy of the mind sciences; but it was fed over the following years by many conversations with Israel, by his scepticism about our capacity to understand minds and brains and his knowledge of the role of history in shaping our beliefs about them.

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A note on the text

- Full bibliographical references are given at their first appearance in each one of the two sections; they are then in short title for the remainder of the section.

- In the footnotes as well as in the bibliography, the place and date of publication in the first set of parentheses following the title are those of the first edition or of the edition most often used or referred to, including translations. Any further date is that of the edition used in the text, either in the original or in a modern edition. In the case of a modern edition, the place and date of publication are indicated as well.

- All quotations from original sources follow the spelling of the edition used. In the case of seventeenth-century editions, original spelling and punctuation are followed in all cases except in the use by some authors of 'u' instead of 'v'. In translations, quotations are modernized in both spelling and punctuation. In the case of Descartes, a modern-spelling edition has been used throughout.

- All translations into English are the author's, except where stated otherwise.

Introduction

1. Subject-matter, methodology and purpose

This dissertation presents a history of the mind-body problem in the context of the new corpuscularian philosophies of nature which characterized the Scientific Revolution. It concentrates on the period immediately after Descartes's death in 1650 until the late 1690s, just before the fully fledged establishment in France and England of Enlightenment society, culture, science and philosophy. Its main concern is to historicize some key concepts in current discussions about the mind.

The mind-body problem as it stands today is the outcome of a puzzlement growing out of the increasing sophistication, precision and refinement with which we are able to comprehend the nature of matter, of our bodies and of our brains. It addresses the question of how a precise understanding of matter can yield, or correspond to, a precise understanding of what it is to be human - to have consciousness, subjectivity, a self, memory, a mind.[1] But apart from representing a battle on the ground of science's new capacity to identify, gather and interpret data about our brain and about our mental life, the mind-body problem constitutes one of the great chapters in the history of ideas, because it sits at the confluence of scientific and humanistic pursuits. In its earlier guise - from Plato and Aristotle on - this enduring question centred on exploring what sort of relation could possibly exist between soul and body (rather than between mind and brain), given that we were both embodied and capable of thought, positioned somewhere between beasts and angels. But the idea that matter alone could be amenable to scientific scrutiny and that it was entirely separate from the self-aware, conscious, immaterial mind is known to have begun life in its modern form with Descartes. He split apart matter and mind, forcing human higher cognition into a realm available only to individual introspection. The philosophical and theological debates which followed among

[1] Thirty years ago, Thomas Nagel offered a succint formulation of the problem in his article 'Brain Bisection and the Unity of Consciousness', originally published in *Synthese*, 22, 1971, pp. 396-413, reprinted e.g. in J. Glover, ed. *The Philosophy of Mind* (Oxford, 1976), pp. 111-125: p. 111: 'the personal, mentalist idea of human beings may resist the sort of co-ordination with an understanding of humans as physical systems, that would be necessary to yield anything describable as an understanding of the physical basis of mind'. See also Galen Strawson's 'Realistic Materialism', forthcoming in L. Anthony and N. Hornstein, ed., *Chomsky and His Critics*, and at http://ww.neologic.net/rd/chalmers/Strawson.html. On the issue of subjectivity within the mind-body problem see Ronald de Sousa, at http://www.chass.utoronto.ca/~sousa/ subjectivity.html.

natural philosophers and men of letters alike in the mid- and late- seventeenth-century were momentous, and the issues they engaged with are ones we still consider unresolved.

It is these debates, in the wake of Descartes's hypothesis of mind-body dualism, which I shall attempt to reconstruct, moving between England and France and often comparing the discussions in each country. If these debates can help us put into historical, contingent context our own perplexity about the power of scientific enquiry to shed light on human nature, it is because they took place at a time when the disciplinary boundaries which prevail today in the academic world did not yet exist. These disciplinary boundaries ensure that the plentiful scholarship on the history of that period's science and philosophy often fails to inform the prodigiously rich and varied work that has been emerging in the new fields which constitute the cognitive sciences, the neurosciences and the philosophy of mind.[2] Standing at a juncture between the histories of science, medicine and psychology, the history of philosophy, epistemology, and the philosophy of mind itself, I do not claim to contribute new material to either of these fields, nor to offer a synthesis of the existing scholarship growing every day within them. What I have tried to do, instead, is to transcend disciplinary and methodological barriers that did not exist in the period covered here; failing to do so would be, in effect, to distort from the outset the nature of the mind-body problem at that time.

Analysing what this 'problem' was about during the period between 1650 and the 1690s entails studying a variety of texts which participated in configuring the cultural debates around the questions inherent in the very plausibility of positing an hypothesis such as Cartesian mind-body dualism, that is, the strict distinction between the body, defined as *res extensa*, and the soul, defined as *res cogitans*. These texts concern - in order of appearance in the dissertation - effects of sense-impairment on experience and thought; language use and language acquisition; learning and education; animal minds and animal souls; definitions of scientific observation and scepticism; teleology and functionalism; the modalities of sense-perception and second-order cognition. Research into all of these aspects of mental

[2] Two web-sites provide examples of what a history of the issues could look like: Robert H. Wozniak's excellent, synthetic *Mind and Body: Descartes to William James*, at http://serendip.brynmawr.edu/Mind/Table.html; and Stephen Jones's *The Brain Project*, at http://www.culture.com.au/brain_proj/

activity would be pursued in the eighteenth century, a period when materialist creeds became consolidated and atheism more widespread; and in the nineteenth century it would lead to the first attempts at a scientifically modern neurology. These same issues continue to be investigated today by cognitive scientists, whose assumptions about the nature of the mind are, however, informed by research into a biological universe that was unknown, and arguably inconceivable, until recently, whose relevant history is not entirely contained within the historiography of biological sciences and medicine.

What made it impossible for the mind's contents to be a concern of biology before the modern era is one concrete historical question that this dissertation seeks to answer.[3] A thorough treatment of this question would obviously require an in-depth study of the decisive events in the history of eighteenth- and nineteenth-century science, medicine and philosophy. The story told here is concerned instead with the background to these developments. Criss-crossing disciplines rather than centuries, I attempt to unravel the relation that late seventeenth-century empirical observations of the mind's workings bore to the period's philosophical, theological and ethical concerns. Such an approach should help us understand the nature of the assumptions underlying early modern, foundational philosophical enquiries which, eventually, made it possible to devise questions and methods for the scientific investigation of cognition through analysis of the brain and nervous system, as well as through the study of the psyche and the observation of behaviour. Nevertheless, our desire to comprehend the mind-body relation is still not wholly satisfied by the increasing ability of the neurosciences and cognitive psychology to tell us what we are made of.[4] It is hard to interpret the data, partly because we do not know exactly

[3] Richard Gregory has asked this question in a similar way: 'In spite of the findings of academic psychology, we still rely almost entirely on the quick intuitions of prehistoric folk psychology for our everyday living with friends, colleagues and lovers. This is so, even though the physical sciences and technology have utterly transformed our view of the world and how we live with inanimate objects. This great difference is odd, for it seems likely that attempts to understand and predict behaviour are far older than experiments in understanding matter. Why is there such a disparity between the physical sciences and psychology? Why is the development of physical understanding so much more successful?' See R. L. Gregory, 'Engineering Mind', in his *Odd Perceptions* (London and New York, 1986), pp.209-224, at p. 209.

[4] For papers on the fields linking the cognitive sciences, psychology and the philosophy of mind, see David Chalmers's bibliography at http://www.u.arizona.edu/~chalmers/biblio.html. See also Pascal Engel, *Philosophie et psychologie* (Paris, 1996); Peter Carruthers and George Botterill, *The Philosophy of Psychology* (Cambridge, 1999). For an example of the sort of questions pursued within this framework, see Naomi Eilan, Rosaleen McCarthy and Bill Brewer, ed., *Spatial Representation: Problems in Philosophy and Psychology* (Oxford, 1993).

what data to look for and partly because the bounds within which science can explain us to ourselves are not fixed.

The approach here is interdisciplinary insofar as it is based on the close reading of texts with an eye to both the early modern intellectual context and the modern issues of epistemology on which they shed light. In adopting this methodology, I do not claim affiliation to any particular school of thought. What has guided me is an interest in historicizing the scientific mind, in the belief that doing so would give us a perspective on what is involved in relying, or not relying, on scientific explanation as a means of understanding ourselves, our lives, our bodies and our world. This is why I have paid attention to the reasons for holding beliefs about the nature of mind and matter, rather than to the internal coherence of these beliefs, which usually preoccupies those who study the history of philosophy.[5] In no way, however, does this constitute an endorsement of an anti-realist or subjectivist position with regard to science;[6] nor is it intended as a defence of 'alternatives' to properly scientific explanation, such as vitalism, the belief in occult forces and so on. Nevertheless, the notable popularity of extreme relativism,[7] on the one hand, and of 'alternatives' to mainstream science, on the other, points to the need to examine what relation mind and reason bore to body and emotion at a point in time which precedes the entrenchment of positivism in mainstream scientific theory and practice.[8]

2. Philosophical context

The advent of the 'new philosophies' of mechanism and atomism during the century preceding the Enlightenment - roughly, from Galileo and Descartes to Newton and Locke - shattered the harmony between man and nature which had been imposed on

[5] See, e.g., Margaret Wilson, *Ideas and Mechanism: Essays on Early Modern Philosophy* (Princeton, 1999).

[6] On scientific realism and anti-realism, see, e.g., Paul K. Feyerabend, *Realism, Rationalism and Scientific Method* (Cambridge, 1981); Rom Harré, *Varieties of Realism: A Rationale for the Natural Sciences* (Oxford, 1986); Hilary Putnam, *The Many Faces of Realism* (La Salle, 1987); Robert Nola, ed., *Relativism and Realism in Science* (Dordrecht, 1988); David Papineau, ed., *The Philosophy of Science* (Oxford, 1996); Richard Boyd, Philip Gasper and J. D. Trout, ed., *The Philosophy of Science* (Cambridge, Mass., 1991), esp. chs. 10-13: Bas van Fraassen, 'To Save the Phenomena', Richard Boyd, 'On the Current Status of Scientific Realism', Larry Laudan, 'A Confutation of Convergent Realism' and Ian Hacking, 'Experimentation and Scientific Realism'.

[7] Alan Sokal caricatured this stance in his infamous hoax before analysing it in Alan Sokal and Jean Bricmont, *Impostures Intellectuelles* (Paris, 1997; London, 1998). See also the web-site dedicated to the hoax and the controversy surrounding it, at http://www.physics.nyu. edu/faculty/sokal/.

[8] For a careful rationalist critique of the subjectivist stance with regard to logic, language, science and ethics, see Thomas Nagel's important *The Last Word* (New York and Oxford, 1997).

the practice of natural philosophy in the Renaissance by the almost exclusive reliance on traditional, Aristotelian and scholastic texts. It thus provoked major changes in the understanding of the nature of matter and bodies, together with elaborate discussions about the status of the new physics and about physical explanation generally, about causality and forces in nature, and about the limits of reason. These discussions can be illuminating for us, as can be the humanist scepticism which informed the best writings of the time. There was a pressing need then to redefine, in order to preserve, the privileged status of human beings in the realm of nature, as creatures of God endowed with an immortal soul and with free will. At the forefront of the debates about and within the new mechanistic and atomistic systems was the profound anxiety about their consequences for the non-material human soul. In this way, epistemology (questions about what constituted human knowledge) was inseparable from both psychology (questions about the human passions and their relationship to reason) and metaphysics (questions about the place of humans and of the human soul in the God-created universe).

Having separated the soul from the body, Descartes failed to convince many of his contemporaries of the viability of the resulting physical organism, which led him to identify beasts with automata. Today's 'zombies' are not dissimilar to Descartes's 'automaton' and 'beast-machine': they are creatures spawned by a thought-experiment frequently used by modern philosophers of mind to imagine how an artificially contrived organism mirrored on ourselves but deprived of 'consciousness' would function. Descartes's own thought-experiment served the opposite goal, since it was supposed to prove the immateriality of mind rather than show how hard it was to prove it; but it provoked fear in his time that a 'man-machine' might eventually be conjured up, as indeed Julien Offray de La Mettrie would do a century later, in *L'homme-machine*.[9] Furthermore, our questions about how an organic substance could ever 'produce' consciousness and reason are not far removed from the earlier worries about the place of the soul within the purely mechanical Cartesian organism. Given that we think of higher consciousness as unique to humans, our puzzlement about its status within our mortal frame echoes, too, the need of seventeenth-century religious thinkers to preserve the immortal

[9] Julien Offray de La Mettrie (1709-1741), *L'homme-machine* (Paris, 1751). See Aram Vartanian's critical edition (Princeton, 1960) and his introduction to the volume.

‘rational soul’ which humans alone possessed and which marked the difference between man and beast.

Although the theological concern with the immortality of the human soul is no longer a defining element in Western culture, the evident wedge between man and animal ensures the persistence of human exceptionalism.[10] It is true that, ever since Darwin, we do not dare to think of nature in anthropocentrically hierarchical terms, with humans at the top. It is now widely accepted that consciousness must be embedded in cognitive processes we share with other creatures: even language, it seems, began with physical gesture.[11] But the interest today in speculating about the nature of animal minds[12] does have an historical counterpoint in the obsessive need of earlier thinkers to draw the - theologically necessary - boundaries between animal and man by establishing what kind of soul God could possibly have granted to creatures seemingly deprived of higher cognition and language. There was a metaphysical dimension to debates about how to distinguish deliberative reason and acquired knowledge from natural instinct, just as there is today a philosophical dimension to debates in the cognitive sciences about the nature of mental representations and of their relationship to our distinctly human linguistic capacity.[13] These present-day debates include questions about the nature of what is understood as ‘higher order thought’, or ‘metarepresentational’ consciousness,[14] a concept which

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[10] See Ronald de Sousa, *I am an Animal*, at http://www.chass.utoronto.ca/~sousa/animal.html.

[11] See, e.g., Philip Liebermann’s provocative *Eve Spoke: Human Language and Human Evolution* (New York, London, 1998) and bibliography; Terrence Deacon, *The Symbolic Species: The Co-Evolution of Language and the Human Brain* (New York, London, 1997) and bibliography; D.F. Armstrong, W. C. Stokoe, S. E. Wilcox, ed., *Gesture and the Nature of Language* (Cambridge, 1995).

[12] See, e.g., the recent study by Marc Hauser, *Wild Minds: What Animals Really Think* (London, New York, 2000) and bibliography; Peter Carruthers, ‘Animal Subjectivity’, in *Psyche: An Interdisciplinary Journal of Research on Consciousness*, 1998, at http://psyche.cs.monash.edu.au/v4/psyche-4-03-carruthers.htm; Daniel Dennett, ‘Animal Consciousness: What Matters and Why’, *Social Research*, 62, 1995, pp. 691-710, reprinted in Dennett, *Brainchildren: Essays on Designing Minds* (London, 1998), pp. 337-350, and also at http://ase.tufts.edu/cogstud/papers/animconc.htm; Colin Allen, ‘Animal cognition and animal minds’, in Peter Machamer and Martin Carrier, ed., *Philosophy and the Sciences of the Mind* (Pittsburgh, Constance, 1997), pp. 227-243; Cecilia Heyes, ‘Theory of Mind in Nonhuman Primates’ and bibliography, *Behavioural and Brain Sciences*, 21, 1, pp. 101-134 and at http://www.cogsci.soton.ac.uk/bbs/Archive/bbs.heyes.html.

[13] See, e.g., Gloria Origgi and Dan Sperber, ‘Evolution, Communication and the Proper Function of Language’, in Peter Carruthers and Andrew Chamberlain, ed., *Evolution of the Human Mind: Modularity, Language and Meta-Cognition* (Cambridge, 2000), pp. 140-169, and at http://gloriaoriggi.free.fr/GO&DS.html or at http://www.dan.sperber.com/evo-lang.htm. See also above, p. 10, n. 4.

[14] See, e.g., Peter Carruthers, ‘The evolution of consciousness’, in Carruthers and Chamberlain, ed., *Evolution and the Human Mind*, pp. 254-275; David M. Rosenthal, ‘Consciousness and Metacognition’, in Dan Sperber, ed., *Metarepresentations: A Multidisciplinary Perspective* (Oxford,

appears to be parallel to that of the earlier rational soul. They also include questions about the nature and significance of our capacity to know 'other minds', a problem posed with great force from Descartes onwards and which formed one aspect of the deliberations about animal minds.[15] These discussions now reflect wider, topical concerns - at times ideologically inflected - about how to define 'innate' and 'acquired' knowledge, which are themselves connected to anthropologically inflected questions regarding the ways in which we define the relation of 'nature' to 'culture'.[16]

3. Conceptual framework

Although I have been aware throughout the writing of this dissertation that anachronistic fallacies lay just around the corner, I have strived to remain on a straight line in the telling of a story that in itself is not temporally linear. Its structure is based on a number of assumptions that arise from the course of ongoing discussions about the nature of the human and the animal mind and about the related difficulties inherent in defining the self-conscious, human person as an individual member of a species. The dissertation is thus conceptually, rather than chronologically driven, in that its protagonist is a concept (and anti-hero of sorts): the 'explanatory gap',[17] inherent, as some argue today, in physicalist explanations of

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2000), pp. 265-295, and in general for essays on the notion of metarepresentation, which in this dissertation appears as 'self-representation' or simply 'consciousness'.

[15] On other minds, see, e.g., P. F. Strawson, *Individuals: An Essay in Descriptive Metaphysics* (London, 1959); Norman Malcolm, *Problems of Mind: Descartes to Wittgenstein* (New York, 1971). Much work in cognitive and developmental psychology focuses on the modalities of the capacity to 'know' other minds. Autism, for instance, has been described as the absence of this possibly 'modular' capacity and of what is known as a 'theory of mind': see, e.g., Simon Baron-Cohen, *Mindblindness: An Essay on Autism and Theory of Mind* (Cambridge, Mass., 1995).

[16] See, e.g., Kenan Malik's insightful *Man, Beast and Zombie: What Science Can and Cannot Tell us About Human Nature* (London, 2000) and bibliography.

[17] On the explanatory gap, see, e.g., Ned Block and Robert Stalnaker, 'Conceptual analysis, dualism and the explanatory gap', *The Philosophical Review*, 1999 and at http://www.nyu.edu/gsas/dept/philo/faculty/block/papers/ExplanatoryGap.html; Peter Carruthers has been arguing for ways of doing away with the explanatory gap, in e.g., 'Consciousness: explaining the phenomena', in Denis Walsh, ed., *Naturalism, Evolution and Mind* (Cambridge, 2001), forthcoming, and also at http://www.shef.ac.uk/~phil/department/staff/carruthers/concexplain.htm; 'Natural theories of consciousness', in *European Journal of Philosophy* 6, 1998, pp. 203-222, and also at http://www.shef.ac.uk/~phil/department/staff/carruthers/natconc. See also David Papineau's attempt at redescribing the explanatory gap as an illusion derived from the very structure of conscious cognition, in 'Mind the gap', *Philosophical Perspectives* 12, 1998, pp. 373-89; discussions by Peter Bieri, 'Why is consciousness puzzling?' and Joseph Levine, 'Qualia: intrinsic, relational, or what?', in Thomas Metzinger, ed., *Conscious Experience* (Paderborn, 1995), pp. 45-60 and 277-292; Stephen White, 'Why the property dualism argument won't go away', at http://www.nyu.edu/gsas/dept/philo/courses/consciousness/papers/WHYPDAW.html; Brian Loar, 'Why is the explanatory gap

consciousness. Such arguments state that since human consciousness is irreducibly subjective and immaterial in phenomenal terms, its depiction in physical and naturalistic terms seems to leave out the very element such an account seeks to embrace, the 'what-it-is-like-ness' of subjective experience, the so-called 'qualia' that make it up. Seventeenth-century discussions of the mind-body problem in the context of Cartesian dualism reveal an equivalent explanatory gap. Unnamed until the twentieth century, it is nevertheless at the heart of this discussion simply because it determines the very structure of the mind-body problem in its post-Cartesian guise.

I take the explanatory gap to designate primarily the sense that any theory of cognition based on neurological or generally physical explanations does not constitute an answer to the question of how it is that we are what we are, *in the terms in which we experience, and think ourselves to be* what we are, that is, individuals endowed with consciousness. This was a truism at a time when the concept of 'soul' had potency. Today, given the available tools of scientific interpretation, together with the scientific ineffectiveness of this earlier concept of 'soul', there remains a great difficulty in explaining what sort of relation consciousness, invisible as it is, bears to the visible white and grey matter with which it is obviously associated, how brain events correspond to mental events, which is the cause of which, and what the modality is of this correspondence. 'Consciousness' as such only became a subject-matter by default, out of the sense, which arose in the wake of the short-lived behaviourist trend of the 1960s, that models of the mind based on neuroscientific theories left it out of the picture. I assume from the outset that the existence of this metarepresentational capacity as a central aspect of our embodied, evolved and mutually interacting selves must be taken into account within any theory of the

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perplexing?' (paper delivered at a conference at the School of Advanced Study, University of London on *Sensation and Consciousness*, 3 Dec. 1999) and 'Phenomenal intentionality as the basis of mental content', at http://www.nyu.edu/gsas/dept/philo/courses/concepts/loar.html; Galen Strawson, 'Conceivability, Identity, and the Explanatory Gap', *CogNet Proceedings: Towards a Science of Consciousness 3*, at http//cognet.mit.edu/posters/TUCSON3/Strawson.html; James Hopkins, 'Mind as metaphor: a physicalist approach to the problem of consciousness' at http://www.kcl.ac.uk/kis/schools/hums/philosophy/mindasmetaphor.html; Ned Block's entries on 'Consciousness' and 'Qualia' in Samuel Guttenplan, ed., *A Companion to the Philosophy of Mind* (Oxford, 1994). Michael Tye's entry on 'Qualia' in the online *Stanford Encyclopedia of Philosophy*, at http://plato.stanford.edu/entries/qualia/. David Chalmers's online index to online papers on consciousness is extremely useful, at http://jamaica.u.arizona.edu/~chalmers/online.html. For zombies, see David Chalmers's 'Zombies on the Web', at http://www.u.arizona.edu/~chalmers/zombies.html and his *The Conscious Mind: In Search of A Fundamental Theory* (New York and Oxford, 1996).

human mind for such a theory to be plausible.[18] This is a relatively new notion, although by now monism does seem to be slowly replacing the Cartesian dualism within which the explanatory roles of modern philosophy and modern science, respectively, were defined.[19]

The issue of whether or not the explanatory gap can be closed has been discussed abundantly in recent years. My concern, however, is not to treat the explanatory gap within a technical philosophical discourse, but rather to trace its genealogy by reconstructing the terrain on either side of it. This terrain is made of shifts in the very notion of explanation. Today, it is a terrain on which conflicting, seemingly incommensurable beliefs about the place and status of naturalistic scientific explanation[20] coexist within a universe which it is acknowledged we still barely understand. My account is not guided by the attempt to find answers about the nature of consciousness or about the existence of souls in either man or animal. It focuses instead on showing the extent to which the construction of theories about cognition and the conscious mind is rooted in the *historically shifting* nature of the semantic ground on which we ask questions about ourselves - about our lives, our bodies and our world.[21] It thus turns around the central matter of the status of the immaterial, rational soul at a point in history when the explanatory gap, this blind spot in our knowledge, was fully accepted, if not required within a theodicy. The 'mind' here, then, is not so much an object of scientific or philosophical enquiry as the very site of the blind spot, the blurred boundary between metaphysical and

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[18] See especially Israel Rosenfield, *The Strange, Familiar, and Forgotten: An Anatomy of Consciousness* (New York, 1992), which makes a convincing case for this position and which first inspired me to think further about these issues within a historical framework.

[19] For an inspired analysis of why 'mental reality' can be accounted for within monism, see Galen Strawson, *Mental Reality* (Cambridge, Mass., 1994). Recent work on embodiment includes, e.g., Antonio Damasio, *The Feeling of What Happens: Body, Emotion and the Making of Consciousness* (London, 2000) and *Descartes's Error: Emotion, Reason and the Human Brain* (London, 1995); Andy Clark, *Being There: Putting Brain, Body and World Together Again* (Cambridge, Mass. and London, 1997); J. L. Bermudez, A. Marcel, N. Eilan, ed., *The Body and the Self* (Cambridge, Mass., 1995); Francisco Varela, Evan Thompson and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience* (Cambridge, Mass. and London, 1991).

[20] On the problems with and conditions for a naturalistic account of representation, see, e.g., Joëlle Proust, *Comment l'esprit vient aux bêtes : essai sur la représentation* (Paris, 1997) and Ronald de Sousa's review at http://www.chass.utoronto.ca/~sousa/proust.html; on what could be said to constitute a 'naturalistic causal explanation', see, e.g., Dan Sperber, 'Conceptual Tools for a Natural Science of Society and Culture', forthcoming in *Proceedings of the British Academy*, and also at http://www.dan.sperber.com/Rad-Brow.htm.

[21] Richard Rorty started out with a similar concern when he wrote his *Philosophy and the Mirror of Nature* (Princeton, 1980).

physical or biological enquiry, which sets the realm of modern philosophy, apart from the practice of experimental natural philosophy.[22]

4. Themes and outline

The study of this semantic ground on which we ask questions about ourselves - the very ground on which reason reveals itself to itself - constitutes the starting point of this dissertation and the subject of the first chapter. It presents the enquiries of Fellows of the Royal Society such as George Dalgarno, William Holder and John Wilkins into the role and status of language with regard to human knowledge, particularly through the case of the deaf persons' ability to acquire it. Language was considered the most direct manifestation of higher cognitive faculties and was discussed as a manifestation of rationality within the dualist framework by the Cartesian lawyer Gérauld de Cordemoy, who presented language as proof of the dualist thesis. Fénelon discussed its acquisition in his treatise on the education of children. These enquiries touch on the question of whether or not language was a tool exceptional to humans. They are also related to worries about whether or not animals could be considered endowed with a mind comparable to that of humans. These worries - which correspond to our 'other minds' problem[23] - and their historical background in the breakdown of the Aristotelian tripartite soul from Descartes onwards, are recounted in Chapter 2: it presents a study of the status of human reason within the new science and Cartesianism, via John Locke, Nicolas Malebranche and the Cartesian Louis De La Forge, and Pierre Bayle's account of arguments put forth by Antoine Dilly and Ignace-Gaston Pardies about the border between animal and man. Malebranche and Locke reappear in Chapter 3, in discussions about the characteristics of animal minds following Descartes's beast-machine thesis; Marin Cureau de la Chambre and Pierre Chanet follow, with earlier arguments about the distinction between, and respective definition of, reason and instinct.

The very definition of the human, as opposed to the animal, mind was thus presented in part as a linguistic issue. Moreover, the territory that language defined and described was the natural world. At stake in these enquiries, in the context of the

[22] W. V. Quine's important article 'Epistemology Naturalized', in *Ontological Relativity and Other Essays* (New York, 1969), pp. 69-90, pointed in analytic terms to the problems bred by this separation between epistemology and natural philosophy.
[23] See above, p. 7, n. 14.

practice of experimental, empirical, Baconian science, was the question of the knowability of this natural world and of our place in it, as well as the relationship between knowledge and human reason. The second part of the dissertation, in which the focus is mainly on natural philosophical works, takes off from here. The knowability of the world was debated within the framework of scepticism about the cognitive capacities of humans. This is the subject of the first Chapter in this section, with the study of works by the clergyman and Fellow of the Royal Society Joseph Glanvill, by Bernard le Bovier de Fontenelle (eventually Secretary of the Académie des Sciences in Paris) and by other notable natural philosophers including Robert Hooke. The role of teleology in shaping the functionalist assumptions underlying the investigation of the natural world (including the human body and brain) is analysed in Chapter 2, in relation to texts by the anatomists Nicolaus Steno and Thomas Willis and by the natural philosopher, natural historian and architect Claude Perrault (the brother of Charles, author of the famous *Contes* for children). This Chapter traces the shift in the use of teleological explanations of the relation between - visible or invisible - structure and - visible or invisible - function in the natural world, much studied by historians of science over the past decades. It prepares the ground for a look at the fate of debates about the rational soul - and thus, in modern terminology, of consciousness - in the context of the new mechanistic explanations of the motion of living and inert bodies. This is the subject-matter of Chapter 3, where the possibility of materialism is explored with the Parisian physician - and 'libertin' - Guillaume Lamy. All these issues, and in particular the recurrent problem of the status of animal minds, needed to be considered in an era that had not yet given birth to the 'man-machine', but which foresaw it with great anxiety. This essentially moral anxiety about the consequences of naturalism for the human soul was partly expressed in the difficulty of placing living, biological creatures somewhere on the long, complex continuum between the mechanical and the organic. This difficulty is still with us.

Part I, then, mainly analyses the ramifications of the dualist, post-Cartesian (but not necessarily pro-Cartesian) picture of the mind-body relationship in fields beyond those currently surveyed by philosophers and historians of science. Part II introduces issues surrounding the definition of what constituted empirical research at this late stage of the Scientific Revolution; and it ends by suggesting that, within the

mainstream natural philosophy of the period, there were accounts of reason as embodied. The notion that modern philosophy began with Descartes may thus be shown to breed confusions regarding the nature of the questions to which it has led.

5. Choice of sources

The many voices I discuss, apart from those of Bacon, Harvey, Descartes, Malebranche and Locke, are mostly of 'minor' - as opposed to canonical - figures from France and England. Because of the abundance of sources and exchanges, together with the interconnection of themes and the variety of views, what I offer is a necessarily biased selection, informed by a concern not only to reveal them with historical accuracy, but also to let them speak to us about the issues which remain important today. Some fundamental aspects of the period, as well as names and schools of thought, have had to be left out of this study. Great thinkers such as Spinoza and Leibniz, who found highly inspiring alternatives to mechanism and atomism, do not appear here precisely because they are exceptional. Hobbes, another great exception, appears in Part I, but only briefly. Some pages might have been devoted to Pascal and to Jansenism, but that would have taken us off-track. There is also the matter of space: to do justice to the great thinkers and to the secondary literature on them would have been impossible in the limited context of this dissertation. Neoplatonist alternatives, especially the views of the Cambridge Platonists, are excluded from this account for the same reason, but also because such alternatives to the corpuscularian philosophies do not help explain why the latter eventually became dominant. Moreover, an investigation of the Cambridge Platonists would have to consist in a study in the metaphysics of mind, which is not the purpose here.

Those who do appear here owe their presence, however, to outstanding qualities. Glanvill was wonderfully eloquent about scepticism (though equally so about the existence of witches). Cordemoy can be considered a forerunner of Malebranche; and both he and La Forge espoused Cartesianism in a novel, important way. Bayle has earned a place in intellectual history on account of his monumental *Dictionnaire historique*, his elaborate, foundational use of footnotes, his erudition, prolixity and scepticism. Pardies was a Jesuit with apparently Cartesian sympathies, well-known for his work in geometry, physics and optics, which had an influence on

Newton. He and Dilly were also known for their controversy about animal minds, which, in many ways, reflected intense but confusing disagreements over the possible dangers inherent in overthrowing Aristotelianism for the sake of Cartesianism. Chanet and Cureau de la Chambre confronted each other earlier on, but for similar reasons. Cureau de la Chambre was a physician to Louis XIV and a dedicatee of Steno, who himself had unusual, but widely respected ideas about anatomy. Willis remains a major, influential figure in the history of neurology and psychiatry. Perrault's breadth of activities and interests, as well as his connections with the Paris establishment, make him a central character on the official French scene. Lamy was a materialist when few dared to be, as well as an intriguing, quarrelsome, polemical physician and anatomist.

These, and other authors in the account, may be familiar to historians of medicine; still others will be familiar to historians of science. The context in which they appear, however, as I have indicated, is not that of the history of science or medicine. It should be pointed out, too, that the focus here is exclusively on the life sciences - physics makes only a tangential appearance: there is no mention of Newton, for example, just as I have not taken into account the important and well-studied relationship, especially in Italy, of the Jesuits to physics and mathematics and to assaults on Aristotelianism.[24] Many more treatises of the period on the corporeal soul, anatomy and physiology could likewise have been included. Italian and German natural philosophers are virtually absent as well (there is one Dane, Steno, but he worked for a while in Paris, on his way to Italy). The reason for these limitations is, again, partly lack of space; but it is also because France was the epicentre of arguments about Cartesianism, and England of arguments about empiricism. The relationship between the two traditions is rich and complex; and it has consequently been given priority over the concern to draw a complete picture of the pan-European,

[24] See, e.g., Pietro Redondi, *Galileo: Heretic* (Princeton, 1987, London, 1989); Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?* (Cambridge, 1995); Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago and London, 1995); Michael John Gorman, 'A Matter of Faith? Christoph Scheiner, Jesuit Censorship and the Trial of Galileo', *Perspectives on Science*, 4, 1996, pp. 283-320.

politically intricate web of relations between natural philosophers at the time,[25] such as it was reflected, for example, in the activities of Athanasius Kircher.[26]

6. Relevant scholarship

It has not been possible for me to consult all the vast quantity of secondary literature which has been written over the past fifty years or so on the two major areas that make up the subject-matter of this dissertation: on the one hand, epistemology and metaphysics, the philosophy of science, the philosophy of mind and the cognitive sciences; and on the other, early modern intellectual history broadly understood. There is a plethora of literature concerning the subjects included in the first area, some instances of which I have referred to in the footnotes to sections 1-3 of this Introduction (and the number of books on mind and consciousness destined for the specialist as well as the non-academic public increases every month). Material on the great seventeenth-century philosophers who treated it is also more than abundant. Descartes, Locke, Hobbes, Leibniz and Spinoza are routinely integrated within the philosophical curriculum. Descartes and Locke, especially, are points of reference in the study of epistemology and the philosophy of mind. All these thinkers constitute fields of research in their own right, along with those who remain more historical than canonical, such as Gassendi or Malebranche, and who are studied mainly within the history of philosophy and ideas.

The intellectual and political worlds in which these philosophers worked is also a thoroughly ploughed terrain, although its findings tend not to inform significantly the actual practice of philosophy. It is now established within the general field of intellectual history, however, that one needs to contextualize the thought of the great, canonical figures, if only to understand better where they were coming from, and why they became - and remained - canonical in the first place. This is what the *Cambridge Companion* series has done for Bacon, Descartes, Locke, Malebranche, Spinoza, Leibniz and others. The recently published *Cambridge*

[25] This has been carried out, e.g., in Roy Porter and Mikuláš Teich, ed., *The Scientific Revolution in National Context* (Cambridge, 1992).

[26] The correspondence of Athanasius Kircher has been scanned and is being published on the internet by Michael Gorman and Nick Wilding; see http://150.217.52.68/kircher/index.html. On scientific communication, see also David S. Lux and Harold J. Cook, 'Closed Cicles or Open Networks?: Communicating at a Distance during the Scientific Revolution', *History of Science*, xxxvi (1998), pp. 179-211.

History of Seventeenth-Century Philosophy is contributing to broadening the field.[27] The history of education is an important tool for understanding the intellectual situation; Laurence Brockliss, for example, provided a magisterial work on education in France.[28] Michael Hunter has been editing the correspondence of Boyle and has completed the edition of his complete works;[29] he has also written extensively on the history of science in England in its social, political, religious and generally intellectual context.[30] The history of scepticism in the England of the period was traced many years ago by Henry Van Leeuwen,[31] while the complexity of philosophical reactions to Cartesianism has been studied by Richard Watson[32] and Albert Balz.[33] Amos Funkenstein has provided an in-depth analysis of the relationship between metaphysics, rational theology and natural philosophy from the Middle Ages to the early modern era.[34] (There also exists a tradition of writing on the notion of interiority in the seventeenth century, which I have not followed here.)[35]

Descartes's sources and background have been much analysed by, among others, Henri Gouhier;[36] and more recently, Stephen Gaukroger in his illuminating biography.[37] Gaukroger also co-edited a volume on Descartes's natural philosophy,[38] now studied along with his metaphysics. His Augustinianism has been studied by Stephen Menn,[39] and his relationship with scholasticism by Roger Ariew.[40] Daniel

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[27] Daniel Garber and Michael Ayers, ed., *The Cambridge History of Seventeenth-Century Philosophy* (Cambridge, New York, 1997), 2 vols..

[28] Laurence Brockliss, *French Higher Education in the Seventeenth and Eighteenth Centuries: A Cultural History* (Oxford, 1987).

[29] Robert Boyle, *The Works*, Michael Hunter and Edward B. Davis, ed. (London, 1999-2000), 14 vols.

[30] Michael Hunter, *Science and Society in Restoration England* (Cambridge, 1981); *The Royal Society and its Fellows 1660-1770: the Morphology of an Early Scientific Institution* (Oxford, 1994); with Simon Schaffer, ed., *Robert Hooke: New Studies* (Woodbridge, 1989).

[31] Henry G. Van Leeuwen, *The Problem of Certainty in English Thought, 1630-1690* (The Hague, 1963).

[32] Richard A. Watson, *The Downfall of Cartesianism, 1673-1712: A Study of Epistemological Issues in Late Seventeenth-Century Cartesianism* (The Hague, 1966)

[33] Albert G. A. Balz, *Cartesian Studies* (New York, 1951).

[34] Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth century* (Princeton, 1986).

[35] See, e.g., Louis Marin, *Philippe de Champaigne ou La présence cachée* (Paris, 1995) and *Pascal et Port-Royal* (Paris, 1997). This French tradition is connected to literary studies on the period, such as Paul Bénichou's *Morales du Grand Siècle* (Paris, 1948). See also Benedetta Papàsogli, *Il 'fondo del cuore': figure dello spazio interiore nel Seicento francese* (Pisa, 1991).

[36] Henri Gouhier, *Cartésianisme et augustinisme au XVIIe siècle* (Paris, 1978).

[37] Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford, 1995).

[38] Stephen Gaukroger, John Schuster and John Sutton, *Descartes' Natural Philosophy* (London, 2000)

[39] Stephen P. Menn, *Descartes and Augustine* (Cambridge, 1998).

[40] Roger Ariew, *Descartes and the Last Scholastics* (Ithaca and London, 1999). See also Roger Ariew and Marjorie Grene, ed., *Descartes and his Contemporaries: Mediations, Objections, and Replies* (Chicago and London, 1996).

Garber has written extensively on Descartes both as an historian of ideas and as a philosopher.[41] Roger Woolhouse has explored the concept of substance in Descartes, Leibniz and Spinoza but with a view to embracing the period rather than figures isolated from one another.[42] Studies on the impact of Cartesianism in Germany,[43] Holland[44] and Italy[45] have been added to our previous knowledge of its fate in France and England. Margaret Osler and Lynn Joy have produced fundamental work on Gassendi.[46] Steven Nadler's *Arnauld and the Cartesian Philosophy of Ideas*[47] was heavily immersed in the Cartesian and Jansenist context in which Arnauld thought, focusing in particular on the controversy with Malebranche; Nicholas Jolley's *The Light of Nature* includes a detailed account of Malebranche's theory of ideas, along with that of Descartes and Leibniz.[48] Susan James has written on theories of the passions, though confining herself largely to the canonical figures.[49] Anthony Levi's work on theories of the passions in France is an earlier classic.[50] André Robinet, for his part, has investigated mainstream French philosophy, theory of language and metaphysics in the seventeenth century, from Descartes to Arnauld, Malebranche and Leibniz, notably producing an edition of the Leibniz-Malebranche correspondence.[51] Editions of correspondences in general have been giving us a more accurate picture of how concepts developed through the intense interaction of scholars and thinkers, and thus feeding into the history of scholarship, as well as the history of science.

The history of science tends to overlap with the history of philosophy. The pre-1950s classic by Arthur Lovejoy, *The Great Chain of Being*, had the ambition to trace, as its subtitle indicated, 'the history of an idea' in a broad sweep through the

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[41] Daniel Garber, *Descartes Embodied* (Cambridge, 2001).
[42] R. S. Woolhouse, *Descartes, Spinoza, Leibniz: The Concept of Substance in Seventeenth-Century Metaphysics* (London and New York, 1993).
[43] See, e.g., Francesco Trevisani, *Descartes in Germania: la ricezione del cartesianismo nella facoltà filosofica e medica di Duisburg (1652-1703)*, (Milan, 1992).
[44] See the work of Theo Verbeek, especially his *Descartes and the Duth: Early Reactions to Cartesian Philosophy, 1637-1650* (Carbondale, 1992).
[45] See, e.g., Claudio Manzoni, *I Cartesiani Italiani: 1660-1760* (Udine, 1984).
[46] Margaret Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (Cambridge, 1994); Lynn S. Joy, *Gassendi the Atomist: Advocate of History in an Age of Science* (London, 1987).
[47] Steven M. Nadler, *Arnauld and the Cartesian Philosophy of Ideas* (Princeton, 1989).
[48] Nicholas Jolley, *The Light of the Soul: Theories of Ideas in Leibniz, Malebranche and Descartes* (Oxford, 1990).
[49] Susan James, *Passion and Action: The Emotions in Seventeenth-Century Philosophy* (Oxford, 1997).
[50] Anthony Levi, *French Moralists: The Theory of the Passions 1585-1649* (Oxford, 1964).
[51] André Robinet, ed., *Malebranche et Leibniz: relations personnelles présentées avec les textes complets des auteurs et de leurs correspondents* (Paris, 1955).

complexities of man's relation to nature.[52] More prosaically, and more recently, Ernst Mayr's history of biological thought is a useful work of reference which bridges the philosophy of science and its history, helping to understand, for example, where Darwinian theory came from.[53] Henry Harris has traced the history of the cell from Hooke onward,[54] while, some fifty years ago, Walther Riese[55] and F. N. L. Poynter[56] produced histories of neurology in terms of ideas about brain function and localization. Andrew Pyle has analysed forms of atomism from Democritus to Newton and John Yolton a history of theories of perception from Descartes to Reid.[57] The classic study by Jacques Roger on the sciences of life,[58] and especially on early Enlightenment theories of reproduction and generation, remains an invaluable source of information on a world where natural history, natural philosophy and metaphysics were dependent on one other. In the 1950s, Jean Ehrard provided a study of the ramifications of the idea of nature for a slightly later period,[59] as did Bernard Tocanne later on, for the second half of the seventeenth century.[60] The relationship of Hobbes to the Royal Society was a central aspect of a much-discussed work by Steven Shapin and Simon Schaffer.[61] Shapin's introductory book *The Scientific Revolution* contains an excellent, commented bibliographical guide, with a particular slant towards the historiography of studies on the relation between the creation of scientific knowledge, religion and politics.[62] Catherine Wilson, in a vein close to Peter Dear on experiment,[63] has analysed the complex relation between theory and practice specifically with regard to the introduction of microscopes as a tool of

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[52] A. O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge, Mass., 1936).
[53] Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Mass., 1982).
[54] Henry Harris, *The Birth of the Cell* (New Haven and London, 1999).
[55] Walther Riese, *A History of Neurology* (New York, 1959)
[56] F. N. L. Poynter, *The History and Philosophy of Knowledge of the Brain and Its Functions* (Oxford, 1958).
[57] Andrew Pyle, *Atomism and its Critics: From Democritus to Newton* (Bristol, 1997); John W. Yolton, *Perceptual Acquaintance from Descartes to Reid* (Oxford, 1984). See also Stephen Gaukroger, *Explanatory Structures: A Study of Concepts of Explanation in Early Physics and Philosophy* (Hassocks, 1978).
[58] Jacques Roger, *Les sciences de la vie dans la pensée française au XVIIIe siècle: La génération des animaux de Descartes à l'Encyclopédie* (Paris, 1963).
[59] Jean Ehrard, *L'idée de nature en France dans la première moitié du XVIIIe siècle* (Paris, 1963).
[60] Bernard Tocanne, *L'idée de nature en France dans la seconde moitié du XVIIe siècle: contribution à l'histoire de la pensée classique* (Paris, 1978).
[61] Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton, 1995).
[62] Steven Shapin, *The Scientific Revolution* (Chicago and London, 1996).

enquiry in the 1660s.[64] Lorraine Daston and Katharine Park's study of wonders, gestated over many years and published in 1998, traces more broadly the psychology of scientific enquiry over five centuries in the context of the changing status of nature and of explanations of natural and supernatural phenomena;[65] their bibliography is another useful reference tool. Dennis Todd's *Imagining Monsters* did something similar for eighteenth-century England.[66] These works also fit into the category of the ample literature on the social and political history of scientific practice and academies,[67] which is related to the history of epistemology but on which I have not relied to any great extent in this dissertation.

In the realm of the history of medicine and anatomy, Edwin Clarke and C. D. O'Malley's compilation of historical texts on *The Human Brain and Spinal Cord* remains a useful source book,[68] as does Edwin Clarke and Kenneth Dewhurst's *An Illustrated History of Brain Function*.[69] There are a number of recent interdisciplinary volumes covering key aspects of the history of seventeenth-century medicine and physicians.[70] Roy Porter's history of madness in England, *Mind-Forg'd Manacles*, analyses not only the social history of what we understand as 'psychiatry' but also its intellectual and ideological underpinnings.[71] The body itself, as a historical object, is today in vogue. Jonathan Sawday has explored what was involved in the study and dissection of the body in the early modern period,[72] while the bodies of scientists are scrutinized in a volume edited by Christopher Lawrence and Steven Shapin.[73]

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[63] See above, p. 13, n. 23.
[64] Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope* (Princeton, 1995).
[65] Lorraine Daston and Katharine Park, *Wonders and the Order of Nature* (Cambridge, Mass., 1998).
[66] Dennis Todd, *Imagining Monsters: Miscreations of the Self in Eighteenth-Century England* (Chicago and London, 1995).
[67] See also, e.g., Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley, Los Angeles and London, 1994) and bibliography.
[68] Edwin Clarke and C. D. O'Malley, *The Human Brain and Spinal Cord* (Berkeley and Los Angeles, 1968).
[69] Edwin Clarke and Kenneth Dewhurst, *An Illustrated History of Brain Function* (Oxford, 1972).
[70] See, e.g., Ole Peter Grell and Andrew Cunningham, ed., *Religio Medici: Medicine and Religion in Seventeenth-Century England* (Aldershot, 1996); Roger French and Andrew Wear, ed., *The Medical Revolution of the Seventeenth Century* (Cambridge, 1989).
[71] Roy Porter, *Mind-Forg's Manacles: A History of Madness in England from the Restoration to the Regency* (London, 1987).
[72] Jonathan Sawday, *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture* (London and New York, 1995) and bibliography.
[73] Christopher Lawrence and Steven Shapin, *Science Incarnate: Historical Embodiments of Natural Knowledge* (Chicago and London, 1998).

As for the history of ideas about animal minds, it has been studied in the context of the evolution of the idea of nature, for instance, in Keith Thomas's *Man and the Natural World*,[74] which concentrates on England. Elizabeth de Fontenay's recent *Le silence des bêtes*, on the other hand, focuses on animal minds, but is mainly confined to France.[75] Leonora Cohen Rosenfield's book on the beast-machine thesis in early modern philosophy has been a standard work for decades.[76] The seventeenth-century debate has been explored in a special issue of the periodical *Corpus*;[77] and articles abound on various aspects of the topic, including its classical and Renaissance sources.[78] The philosophical debate is connected to ethical questions about the status of man in nature, like those posed some twenty years ago by Mary Midgley in her *Beast and Man*,[79] and analysed by Peter Carruthers.[80] Laura Bossi's forthcoming history of the soul also engages in the ethical issues inherent in our relationship with the non-human animal world, tracing the shifts in this relationship as they appear in science, philosophy and general letters from antiquity to our day.[81]

To the best of my knowledge, however, here again there is a dearth of literature which bridges the philosophical issues underpinning contemporary work on animal minds with the history of these issues.[82] Similarly, I have found few analyses of the relationship between theories on animal minds and the place of human language in the configuration of the mind-body problem at the time. The state of the literature that falls into the category which Jonathan Rée, in the afterword (and subtitle) to his history of deafness, *I Hear a Voice*,[83] has called 'philosophical history' - and philosophical history is what I have tried to write - is just as difficult to pin down. This might be because philosophical thought must treat its objects as open, and its outcome as open-ended, whereas the history of philosophical thought is less

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[74] Keith Thomas, *Man and the Natural World: Changing Attitudes in England 1500-1800* (London, 1983).
[75] Elizabeth de Fontenay, *Le silence des bêtes: la philosophie à l'épreuve de l'animalité* (Paris, 1998).
[76] Leonora Cohen Rosenfield, *From Beast-Machine to Man-Machine: Animal Soul in French Letters from Descartes to La Mettrie* (New York, 1941). It was preceded by George Boas, *The Happy Beast in French Thought of the Seventeenth Century* (Baltimore, 1933).
[77] *Corpus, Revue de Philosophie*, 16-17 (Paris, 1991): *L'âme des bêtes*.
[78] See e.g. Richard Serjeantson, 'The philosophy of animal language, 1540-1700', forthcoming in *Journal of the History of Ideas*, 2001.
[79] Mary Midgley, *Beast and Man: The Roots of Human Nature* (London and New York, 1979).
[80] Peter Carruthers, *The Animals Issue: Moral Theory in Practice* (Cambridge, 1992).
[81] Laura Bossi, *Histoire naturelle de l'âme*, forthcoming and bibliography.
[82] Richard Sorabji is an important exception: his *Animal Minds and Human Morals: The Origin of the Western Debate* (Ithaca, 1993), and his work generally, is at once historical and philosophical.

concerned with constructing arguments than with reconstructing the concepts which thinkers in the past have explicitly used to defend their ideas.

It might appear that Michel Foucault would be an unavoidable reference in a history of the kind I have undertaken; he has not, however, been a primary intellectual source for this project. I was mostly inspired by the concept-driven history of science of Georges Canguilhem[84] and, to an extent, of Gaston Bachelard.[85] Both William James's *Principles of Psychology*[86] and Maurice Merleau-Ponty's *Phénoménologie de la perception*[87] bridge philosophy and psychology in ways I also find inspiring. The approach guiding Élie During in his compilation of extracts from key texts on the soul is close to what I have attempted to do in this project.[88] André Pichot's compilation of texts on the notion of life is a helpful guide.[89] Some thirty years ago, Ian Hacking provided what was then a new reading of the birth of the science of probability in an attempt to integrate historical narrative and conceptual drama.[90] More recently, John Sutton has provided a sophisticated example of how to combine the historical exegesis of philosophical texts on the nature of memory, whether well known or relatively 'obscure', with an explicit effort to relate them conceptually to models of mind discussed today, especially connectionism.[91] His approach is similar, if only in its foundations, to the one I have adopted, although he has dared to analyse an historical model of mind in terms of a contemporary one in much more explicit terms than I do. Catherine Wilson[92] was also interested in analysing conceptually the confusions about the nature of scientific knowledge in the seventeenth century, but within a strictly historical framework; reading her book helped me to define my thinking more sharply.

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[83] Jonathan Rée, *I Hear A Voice: Language, Deafness and the Senses: A Philosophical History* (London, 1999), esp. pp. 379-86.
[84] Georges Canguilhem, *La formation du concept de réflexe aux XVIIe et XVIIIe siècles* (Paris, 1977); *La connaissance de la vie* (Paris, 1965).
[85] Gaston Bachelard, *La formation de l'esprit scientifique: Contribution à une psychanalyse de la connaissance* (Paris, 1938).
[86] William James, *Principles of Psychology* (New York, 1890)
[87] Maurice Merleau-Ponty, *Phénoménologie de la perception* (Paris, 1945).
[88] Elie During, ed., *L'âme: textes choisis et présentés* (Paris, 1997); see also Daniel Robinson, ed., *The Mind* (Oxford and New York, 1998); M. James C. Crabbe, ed., *From Soul to Self* (London and New York, 1999).
[89] André Pichot, *Histoire de la notion de vie* (Paris, 1993).
[90] Ian Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas about Probability, Inducion and Statistical Inference* (Cambridge, 1975).
[91] John Sutton, *Philosophy and Memory Traces: Descartes to Connectionism* (Cambridge, 1998).

It will emerge from this investigation that, as the foundations of modern science were established on the grounds of a scepticism about the scope of human knowledge, what has since been identified as an 'explanatory gap' was an intrinsic part of seventeenth-century accounts of the relation between mind and body. Today, it is easy to forget this early modern connection between scepticism and the claims of science. A few years ago, the evolutionary biologist E. O. Wilson suggested that the reason why 'the history of modern philosophy, from Descartes and Kant forward, consists of failed models of the brain', is that what 'has been learned empirically about evolution in general and mental processes in particular suggests that the brain is a machine assembled not to understand itself, but to survive'.[93] That the brain has had to 'survive' must be true. But Wilson's assertion presupposes that there exists a scientific account of what the brain is (a machine); that this account can be formulated entirely in terms of the machine's finality (survival); and that the evolutionary hypothesis overrides the brain's incapacity to understand itself while also constituting a scientific explanation for this incapacity. The explanatory gap is here replaced with evolutionary theory. A physicist, by contrast, might be given to wonder why any effort at all should be expended on an organ (the brain) and a phenomenon (consciousness) which no 'hard' science will ever entirely explain, regardless of the causes of this nagging blind spot. This 'hard' scientist would agree with Wilson that no one knows what is really involved in 'thinking', but unlike him would not offer to explain why this is the case. On this view, questions about the nature of reason would be scientifically irrelevant, the philosophy of mind redundant and the presence of an explanatory gap unproblematic.[94]

I invite the reader to an exploration of these sceptical grounds as they stood three hundred years ago, in the hope that it may help us decide whether or not such a point of view can be justified.

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[92] See above, p. 25, n. 64.

[93] E. O. Wilson, *Consilience: The Unity of Knowledge* (New York, 1998), p. 96.

[94] The foundation for such a belief can be understood with the help of a description Jerry Fodor has given of the difference between understanding the matter, say, of plants, and the matter of minds: 'how minds qua material objects could have the properties they do' is not like asking 'how a plant qua material object could photosynthesize', which requires an explanation of 'how photosynthesis works' - so a botanist need not bother to reconcile 'materialism with the facts about plants'. But a 'materialistic psychology' does not effect the reconciliation of 'the facts about the mind with materialism': how minds have the mental properties that they do is a question 'without a botanical counterpart since, though there is plenty that's puzzling about plants, their materiality seems not to be much in doubt'. See the entry 'Fodor, Jerry A.', in Guttenplan, ed., *Companion,* p. 292.

I

SIGNS OF MIND AND THE SOULS OF BEASTS

I - Signs of Mind and the Souls of Beasts

> *How my soul, which I look upon to be an immortal Being in me, that is the Principle of thinking, should extinguish with my Body I cannot in any reasonable way of thinking conceive. But that it is immaterial appears hence. Vizt. that the immediate Actions thereof which are thinking have not the least affinity with matter, nor often do those Actions when exerted terminate in it. As when I think of time, or when I think this present thought which is my present subject, Vizt. that my soul is immaterial. And indeed most of those Ideas which the art of Logick in the whole Latitude thereof furnishes me withall are totally removed from matter, and yet are so necessary that unless I have them either by nature or art I cannot think true without them. If it shall be thought that whatsoever is must needs be material, and whatsoever is not so must be nothing at all: I would enquire whether by matter we do not understand that which is the Object of some one or other of our senses?*[95]

With the rejection of scholasticism and the emergence of new philosophies of nature, from corpuscularianism to Cartesian dualism, established doctrine about the kind of relation that bound humans to other living creatures underwent significant upheavals in the period of the Scientific Revolution. It is impossible to recount a history of the relation between body and mind at that time without considering the shifts in the understanding of what sort of thing the human body was, given what sort of capacities humans had and, notably, given their ability to speak. Metaphysical concerns about the need to preserve the exceptional status of human beings within the created realm were inseparable from considerations about the characteristics, capacities and limitations of language, given the widespread belief that language was unique to humans and a manifestation of higher reason. In this section, we look at post-Cartesian ideas about the fate of human reason. We do so by considering the relation of reason to the definition of language among both English natural philosophers and French Cartesians, in Chapter 1; through the debates, following Descartes's beast-machine thesis, about the nature of animal minds in relation to human language and reason, in Chapter 2; and through a study of discussions and polemics on the nature of the capacities of beasts, in Chapter 3.

The changes which took place during those years did not consist in a clean, easy break from previous doctrines. As this presentation to Part I explains - especially through the earlier, but central case of Harvey and his dealings with Aristotelianism - the past was still present, and problematically so, within the very

[95] Thomas Sydenham, *Theologia Rationalis*, in Kenneth Dewhurst, ed., *Dr. Thomas Sydenham (1624-1689): His Life and Original Writings* (London, 1966), p. 150.

issues which would seem most pointed during the second half of the century.[96] According to the tradition bequeathed in various forms to the Renaissance via scholasticism and Galenism,[97] human beings belonged to the 'great chain of being': life and its manifestations were explainable according to different sorts of souls which were all related to one another. The basic model was a tripartite soul. Humans shared with beasts a sensitive soul, responsible for perceptual and motive faculties, and with both beasts and plants a vegetative soul, responsible for the faculties of growth, nutrition and generation. In Aristotle's view, some aspects of the higher, intellective soul of humans also belonged to beasts; but deliberative reason was the prerogative of man alone,[98] in whom there was, as he wrote, 'a part of the divine'.[99] The faculties of these three souls constituted the *psyche*, usually translated generically, as soul, *anima* in Latin, which for Aristotle was the substantial form[100] of the body - the substance, *ousia*,[101] in virtue of which matter manifested itself and had its identity. In his words, in *De anima*, the soul was 'the cause and principle of the living body',[102] responsible for self-nutrition, movement and perception.[103]

Previously, the Greek concept of *psyche* had always denoted the condition of being alive.[104] For Plato too, as he wrote for example in the *Phaedrus*, 'a body

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[96] See, e.g., Simon Schaffer, 'Godly Men and Mechanical Philosophers: Souls and Spirits in Restoration Natural Philosophy', *Science in Context*, 1, 1987, pp. 55-85. For a study of how Robert Hooke's thought and work, for instance, lay in a continuum with natural magic see John Henry, 'Robert Hooke, The Incongruous Mechanist', in Michael Hunter and Simon Schaffer, ed., *Robert Hooke: New Studies* (Woodbridge, 1989), pp. 149-180.

[97] For an account of the various Renaissance conceptions of the mind, see the section on 'Psychology' in Charles Schmitt, Eckhard Kessler, Quentin Skinner and Jill Kraye, ed., *The Cambridge History of Renaissance Philosophy* (Cambridge, 1988), including the chapters respectively by Katharine Park on 'The organic soul', pp. 464-484, and by Eckhard Kessler on 'The intellective soul', pp. 485-534. See also Katharine Park, 'The Imagination in Renaissance Psychology' (unpublished M.Phil Thesis, Warburg Institute, 1974).

[98] Aristotle, *Historia animalium*, I, 1, 488b. Cited in Elizabeth Fontenay, *Le silence des bêtes: la philosophie à l'épreuve de l'animalité* (Paris, 1998) p. 90. On Aristotle's various conceptions of the differences and overlaps between animal and man, see ibid., pp. 88-101.

[99] Aristotle, *Parts of animals*, II, X, 656a. Cited in Fontenay, *Le silence des bêtes*, p. 94. On Aristotle's various conceptions of the differences and overlaps between animal and man, see ibid., pp. 88-101.

[100] See R. S. Woolhouse, *Descartes, Spinoza, Leibniz: The Concept of Substance in Seventeenth-Century Metaphysics* (London, 1993), and the introduction for a succint account of the Aristotelian concept of substance bequeathed to the seventeenth century, pp. 7-12.

[101] As Hugh Lawson-Tancred puts it in the introduction to his edition of Aristotle's *De anima*, 'the theories of the soul current in Greece before the composition of the De Anima would seem universally to have been not just substantialist but unreflectingly substantialist' (London, 1986), pp. 26-27.

[102] Aristotle, *De anima* (transl. Lawson-Tancred), 415b.

[103] Ibid., 402a6-7.

[104] See Steven Everson's 'Introduction' to the volume edited by him, *Companions to Ancient Thought 2: Psychology* (Cambridge, 1991), p. 4, in which he sets out a historiographical methodology similar

deriving its motion from a source within itself has a *psyche*',[105] which he thought was necessarily uncreated and immortal, and separate from the body. Aristotle also saw the soul as incorporeal. But he could not accept the Platonic notion that it was separate from the body: it was because of the very 'partnership' of soul and body, he wrote, 'that the body acts and the soul is affected, that the body comes to be moved and the soul produces motion'.[106] He sought to explain the natural world in terms of its finality, accounting for living organic matter in terms of its intrinsic functions[107] and of what the various bodies were designed to accomplish, given their shape, form, qualities and so on; so, he held 'natural bodies' to be the 'soul's instruments, those of plants in just the same way as those of animals'.[108]

The Baconian 'new science' was characterized by the programmatic, although never simple rejection of this teleological account of the physical world - long-lived but too rigidly dependent on Aristotle's notion that 'in some way the body exists for the sake of the soul, and its parts for the sake of those tasks for which each grew'.[109] The data of physics and natural history were now to consist of quantitative rather than formal and qualitative analyses of matter,[110] and of the empirical observation of natural phenomena; organic processes were now to be identified inductively rather than deductively. Verbal descriptions would have to be clear and scholastic formulations shunned;[111] but reality itself need not be neat. In the second of his

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to the one adopted here (esp. pp. 5-7). The volume as a whole offers thorough analyses of Greek concepts of mind, using to good effect the tools of contemporary analytical philosophy.

[105] Plato, *Phaedrus*, 245e.

[106] Aristotle, *De anima*, 407b13-26.

[107] See Lawson-Tancred, 'Introduction' to *De anima*, pp. 33-35, for an explanation of why one could understand Aristotle's biological account as a 'functionalist' one, and T. H. Irwin, 'Aristotle's philosophy of mind', in Everson, ed., pp. 56-83.

[108] Aristotle, *De anima*, 415b.

[109] Aristotle, *Parts of Animals*, I.5 645b19-20. See Christopher E. Cosans, 'Aristotle's Anatomical Philosophy of Nature', *Biology and Philosophy*, 13, 1998, pp. 311-339, at p. 328.

[110] The mathematization of the universe was founded in Pythagorean and Neoplatonic metaphysics, but can be said to have developed into a system explanatory of empirical data first with Kepler, and then with Galileo. For an account of this complex but momentous shift as a chief characteristic of the beginnings of modern science, see Edwin A. Burtt's now classic work, *The Metaphysical Foundations of Modern Physical Science: A Historical and Critical Essay* (London and New York, 1932), esp. pp. 52-60.

[111] Kenelm Digby, for example, wrote in his *Observations upon Religio Medici* (London, 1644), pp. 14-15: 'When I enquire what light (to use our Authors [i.e. Thomas Browne's] example) is I should be as well contented with his Silence, as with his telling mee it is *Actus Perspicuus*; unless hee explicate clearly to me what those words mean, which I finde very few goe about to do. Such meate they swallow whole, and eject it as entire. But were such things, scientifically, and methodically declared, they would bee of extreame satisfaction, and delight.'

momentous essays on the circulation of the blood,[112] William Harvey (1578-1657) declared, against those 'who repudiate the circulation because they see neither its efficient nor its final cause', that the 'facts manifest to the senses wait upon no views' and 'the works of Nature upon no antiquity: for there is nothing older or of greater authority than Nature'.[113] This did not mean that Aristotle should be dismissed. On the contrary, Harvey referred to him frequently, for example in his description of the formation of the heart in the chick and human embryo.[114] Rather, the observation of nature and the search for concrete mechanisms would have to take precedence over those scholastic formulae which favoured formal and final causes, because 'explanations in terms of forms'[115] began to look unsatisfactory, and because the use of teleological explanations became redundant.

Moreover, Aristotle himself most probably had performed dissections,[116] and his resulting observations were present throughout his writings. In his first essay on the circulation of the blood, Harvey also quoted approvingly Aristotle's words in *De generatione animalium* to the effect that: 'Faith is to be given to reason if the things which are being demonstrated agree with those which are perceived by sense: when they have become adequately known, then sense should be trusted more than reason'.[117] But in the absence of comparative dissections such as those Harvey was

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[112] William Harvey, *Exercitationes duae anatomicae de circulatione sanguinis* (Cambridge, Rotterdam, 1649; English ed., 1653), in Kenneth J. Franklin's edition and translation, *The Circulation of the Blood: Two Anatomical Essays* (Oxford, 1958): 'A Second Essay to Jean Riolan. In which many objections to the circuit of the blood are refuted', pp. 29-67.

[113] Ibid., pp. 44-45.

[114] William Harvey, *Exercitatio anatomica de motu cordis et sanguinis in animalibus* (Frankfurt, 1628), in Kenneth J. Franklin's edition and translation, *Movement of the Heart and Blood in Animals: An Anatomical Essay* (Oxford, 1957), pp. 36, 38. See also C. B. Schmitt, 'William Harvey and Renaissance Aristotelianism', in *Humanismus und Medizin*, ed. R. Schmitz & G. Keil (Weinheim, 1984), pp. 117-138. See also Don Bates, '*Machina Ex Deo*: William Harvey and the Meaning of Instrument', *Journal of the History of Ideas*, 61, 2000, pp. 577-593. For a qualification of the view that Harvey depended thoroughly on Aristotle, see Anna Minerbi Belgrado's 'Introduction' to her edition of Guillaume Lamy, *Discours anatomiques* and *Explication méchanique et physique des fonctions de l'âme sensitive* (Paris and Oxford, 1996), p. 11.

[115] Thomas Kuhn, 'Concepts of Cause in the Development of Physics', in *The Essential Tension*: *Selected Studies in Scientific Tradition and Change* (Chicago and London, 1977), p. 25.

[116] On Aristotle's practice of dissection and use of observation in his natural philosophy, see Cosans, 'Aristotle's Anatomical Philosophy of Nature'. Thanks to dissection, Aristotle was able to give an alternative account of the heart's structure to that given by Plato in the *Timaeus* (at 70b in particular), where he described it as the centre of a system of vessels which transport sensation as well as blood. As Cosans writes, p. 322: 'With his greater willingness to vex and alter animals, Aristotle cuts Plato's Gordian knot. He systematically describes a single vascular system in which all major vessels have the heart as their origin.'

[117] Harvey, *Circulation*, second essay, p. 55. The passage from Aristotle's *De generatione animalium* is at III, X, 760b, in the context of his theory of the generation of bees. In the later translation by Arthur Platt in the edition of Aristotle's works by J. A. Smith and W. D. Ross (Oxford, 1912), the

able to practice, the available conclusions had been limited and remained stuck in time in the form of 'a universal syllogism on the basis of a particular proposition'.[118] No revision was possible without further facts, gathered from observation, dissection and vivisection.

Harvey's precise but respectful revision of established doctrine thus invoked the authority of observation to ground a new account of blood circulation which he eventually would explain in terms of its relation to heart function, misunderstood until then, as he wrote, and fixed in the erroneous description of the septum between left and right ventricle as porous. The perpetuation of error had been caused in part, he thought, by the Galenic emphasis on 'the close connection of the heart and the lungs in the human subject',[119] where the lungs had been understood to act as the refrigerator of the innately hot heart. Instead, the heart was, in Harvey's words, 'the starting point of life and the sun of our microcosm', 'the tutelary deity of the body, the basis of life, the source of all things',[120] present in the embryo before either liver or brain, although probably not before blood. The view that blood in fact *circulated* between arteries and veins via the heart,[121] moreover, triggered a need to revise some key features of the Galenic edifice, which relied on the vital spirits that coursed through the organism. In the second essay on the *Circulation of the Blood*, Harvey discussed the nature of the spirits contained in the blood (itself, as he showed, contained in the veins), stating that 'there are many and opposing views' regarding what spirits were and regarding 'what is their state in the body, and their consistence, and whether they are separate and distinct from blood and the solid parts, or mixed with these. So it is not surprising', he went on, 'that these spirits, with their nature thus left in doubt, serve as a common subterfuge of ignorance'.[122] Those half-material, half-spiritual organisms had always acted as the key to the connection

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passage appears thus: 'Such appears to be the truth about the generation of bees, judging from theory and from what are believed to be the facts about them; the facts, however, have not yet been sufficiently grasped; if ever they are, then credit must be given rather to observation than to theories, and to theories only if what they affirm agrees with the observed facts.'

[118] Harvey, *Movement of the Heart and Blood*, p. 44; he adds, in parentheses, 'like those who think they can construct a science of politics after exploration of a single form of government, or have a knowledge of agriculture through investigation of the character of a single field'.

[119] Ibid., p. 41. In this case he defended the position of Erasistratus against that of Galen, pp. 41-43.

[120] Harvey, *Movement of the Heart and Blood*, p. 59.

[121] See Robert G. Frank Jr., *Harvey and the Oxford Physiologists: A Study of Scientific Ideas* (Berkeley and Los Angeles, 1980), for a seminal study of Harvey's legacy and Chapter 1, pp. 1-20, for a precise account of the doctrines with which Harvey worked and of the ways in which he shifted them.

between sensation and cognition, emotion and movement. Until Harvey, they were concocted by cardiac heat[123] and expelled by the aorta, from where they were distributed throughout the body via the arteries. But these originally Galenic spirits remained very much alive in some form or another as key explanatory structures for the functioning of sentient, cognizant living creatures, beyond Harvey, beyond Descartes and well into the modern era.

In the Galenic scheme, which was also the medieval one, the liver's 'temperament' was the seat, or form, of Aristotle's nutritive and vegetative soul (and of Plato's concupiscible soul). As for the heart's 'temperament', it was the irascible form of the soul.[124] Both the irascible and the concupiscible souls, along with the imagination, partook of the sensitive soul, and, at least on the Thomist version of this Aristotelian model, all human passions belonged to either one of those.[125] The brain was the seat of the rational, or intellective, soul: the two anterior lateral ventricles housed imagination, the middle ventricle housed thought, the posterior ventricle, memory. According to this scheme - some of whose terminology at least was still in use throughout the seventeenth century and beyond - the blood and its contents, broadly speaking, were expedited from the liver to the brain via the heart. Some of the vital spirits transported by the blood would be refined by the cerebellum into smaller animal spirits, responsible for the transmission of sense-perceptions to the *sensus communis*, the seat of common sense, separate from reason and will.[126] Formal explanations - shaped first in an Aristotelian mould and reworked by medieval Arabic commentators and Renaissance humanists - both accounted for and implicitly assumed a continuum between organ and cognition, between blood and spirit. What is striking, and commonplace among historians of science but nonetheless important, is that the shift in method, in place already in the early part of the century, did not

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[122] Harvey, *Circulation*, p. 37; see also pp. 37-41.

[123] On the notion of 'concoction', see Audrey B. Davis, *Circulation Physiology and Medical Chemistry in England 1650-1680* (Lawrence, Kan., 1973), pp. 65-130.

[124] Galen, *On the Faculties of the Soul According to the Temperaments of the Body*, transl. Vincent Barras, Terpsichore Birchler, Anne-France Morand in *L'âme et ses passions* (Paris, 1995), pp. 87-88. In the second essay on the *Circulation of the Blood*, Harvey discussed the nature of the spirits contained in the blood (denying that the veins contained only spirits), stating that 'there are many and opposing views' regarding what spirits were: see Harvey, *Circulation*, second essay, p. 37.

[125] For a detailed account of this, see Anthony Levi, *French Moralists: The Theory of the Passions 1585-1649* (Oxford, 1964).

[126] For an account of this scheme and its variations, see above, p. 31, n. 3.

entail even by the latter part of that century a shift in vocabulary or in assumptions about the mutual dependence of physiology and theories of human nature.

Descartes (1596-1650) is a prominent instance of this lag between method and concept. His mechanistic account of matter entailed the idea that motion in space - including the motion of heart and blood - was due to mechanical action. While, as we shall see further on, the programmatic structure of the arguments he used to demonstrate the truth of his picture of the organism was itself novel, his physiology nonetheless rested, within the realm of natural philosophy, on a Galenic scheme.[127] He thus believed that the body's motive faculties were taken care of by Galenic animal spirits, the subtlest parts of the blood, which travelled from the arteries to the nerves and muscles via the 'pores' of the brain, causing us to perceive, feel, move and remember. As he recounted in the *Discours de la méthode* and in *L'homme*, the spirits were propelled by the heart's heat and changed according to the blood's composition, determining passions and bodily states.[128] The movement of the blood, due to a combination of heat and fermentation, was the cause of the heart-beat, itself caused by the heart's heat, 'a fire without light'.[129] Once in the brain, the animal spirits passed through the ventricles and entered the pineal gland, or *conarium*, from where they kicked into action. Via the nerves, they determined muscle flexion and distension, the cause of movement; and via the same nerves, they affected the brain according to the part of the body they were coming from, causing all sense perception and all sensation.[130]

Georges Canguilhem made a good case in 1977 for claiming that Harvey's theory of heart-beat was too incompatible with a mechanistic account of its motion

[127] For a discussion of this, see Gary Hatfield, 'Descartes' physiology and psychology', in John Cottingham, ed., *The Cambridge Companion to Descartes* (Cambridge, 1992), pp. 335-370, especially p. 341. Hatfield helpfully points out, p. 340, that 'although [Descartes] did not use the term "psychology" at all, he discussed sensory perception and other psychological phenomena in ways that should be distinguished from his purely mechanistic physiology on the one hand and from his concern with the status of sensory knowledge on the other'.

[128] Descartes, *Discours de la méthode*, in *Œuvres philosophiques*, ed. Ferdinand Alquié (Paris, 1988), I, pp. 567-650, at pp. 624-627 ; *L'homme*, in ibid., pp. 379-480, esp. at pp. 436-451

[129] Descartes, *L'homme*, in *Œuvres*, ed. Alquié, I, p. 382: 'la chair du cœur contient dans ses pores in de ces feux sans lumière … qui la rend si chaude et si ardente, qu'à mesure qu'il entre du sang dans quelqu'une des deux chambres ou concavités qui sont en elle, il s'y enfle promptement, et s'y dilate'.

[130] Ibid., pp. 379-480 passim.

for Descartes to dare accept it.[131] The heart could not be a muscle, as Harvey had claimed (against Galen), for that would have meant that the animal spirits it produced would also have to travel to it in order for it to function. Clearly this was not possible, and it was inconceivable to picture the heart as a pump,[132] as Harvey had done. Better, in the Cartesian scheme, to retain the kind of account which allowed for clear, mechanical explanations of all possible emotions and ailments.[133] The organ-cognition, blood-spirit continuum thus remained with Descartes, but as a mechanical chain, and with the addition of the pineal gland as the "operations headquarters" of the soul. Galen would continue to rule in medical practice even as Harvey's theories begot heirs. Animal spirits thus continued to explain the workings of living organisms; and Aristotelian finalism continued to exert its hold on medical theory.

Thomas Sydenham (1624-1689), for example, London's most respected physician in the 1660s and 70s, friend of Robert Boyle (1627-1691) and John Locke (1632-1704), preferred observation to text books and received 'anatomie'. But his faith in observation was sustained by the belief 'that there is a most perfect and exquisite Order in the severall natures of the world, fully conducing to the preservation of their individual Beings, and to the propagation of their kinds'.[134] This determined the order of causes; so, 'it cannot be, but if I shall be shipwrackt at sea I must needs be drowned'. And yet, this order was such that 'to the preserving me

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[131] Georges Canguilhem, *La formation du concept de réflexe aux XVIIe et XVIIIe siècles* (Paris, 1977), pp. 25, 32-34. As Roger French has put it, 'Descartes's reading of *De Motu Cordis* involved one of the first, and certainly the most important of the misunderstandings of the doctrine of circulation'. See Roger French, 'Harvey in Holland: circulation and the Calvinists', in Roger French and Andrew Wear, ed., *The Medical Revolution of the Seventeenth Century* (Cambridge, 1989), pp. 46-86, for an account of the reasons which led Descartes to 'misunderstand' Harvey, in part internal to Descartes's system, and pp. 47, 50-51 for an explanation of the causes of this 'misunderstanding'. See also Anna Minerbi Belgrado, 'Introduction' to Guillaume Lamy, *Discours anatomiques, Explication méchanique et physique des fonctions de l'âme sensitive* (Paris and Oxford, 1996), p. 10.

[132] See also Jacques Roger, *Les sciences de la vie dans la pensée française au XVIIIe siècle* (Paris, 1963), pp. 120-121. As he notes there, Harvey had indeed suggested that the heart functioned as a pump by effect of a *vis pulsifica* which he could not define, and which was too close to an occult force for Descartes. He also accepted as plausible, though not necessarily knowable through reason, the presence of souls and faculties in generation; an occult quality was simply a property whose causes we did not know at present but might know in the future, just as we could get to know its effects.

[133] Nicolas Malebranche took up this picture of the body in *La Recherche de la Vérité: Où l'on traite de la nature de l'esprit de l'homme et de l'usage qu'il en doit faire pour éviter l'erreur dans les sciences*, (Paris, 1674; here, *Œuvres complètes*, ed. Geneviève Rodis-Lewis, Paris, 1962), I (II, I, iv, 1-2), explaining first, p. 204, that the nerves which projected and transported animal spirits into the chest and stomach were responsible for the passions and thus 'extrémement dangereux pour l'ame; parce que ces nerfs ne dépendent point dans leur action de la volonté des hommes, comme ceux qui servent à remuer les bras, les jambes, & les autres parties extérieures du corps, & qu'ils agissent beaucoup plus sur l'ame, que l'ame n'agit sur eux'.

[134] Sydenham, *Theologia Rationalis*, ed. Dewhurst, p. 145.

from this mischief [of dying at sea] he [God] may be pleased so to dispose the previous Circumstances of my Will and other things, as to prevent my going to sea, and so in this and in other things he may hinder the Occasions leading to my destruction'.[135] Freedom of will and divine foreknowledge could coexist.[136] On the one hand, there was a causal order in the world, over which we had no control; on the other, the causal order was such that God could know everything about it. To know God was the only way of having control over events. Sydenham contrasted the lowly soul we shared with brutes with the higher, intellectual, immortal soul, which alone was able to worship God. Our position with regard to the 'Lawes of nature' was such that, while these laws were 'written on our minds', our sensuality might 'deface' them.[137] We were 'partly rational and partly brutal', but it was possible to live beyond our passions, however 'riveted' into our nature these laws of nature (which included 'self preservation') were.[138] Here, then, was a doctor holding on to finalism within a dualist framework - arguing that we are such that we do what we are made to do, contemplate God - while also advocating that we should conceive of the human body as an elaborate organism not explicable in terms of forms.[139] Robert Boyle, too, believed that 'all consideration of final causes is not to be banished from natural philosophy; but that is rather allowable, and sometimes commendable, to observe and argue from the manifest uses of things, that the author of nature pre-ordained those ends and uses'.[140]

Meanwhile, treatises on natural theology such as that of the botanist John Ray (1628-1705) could fill the explanatory gap left by mechanistic accounts of living matter:[141] Ray attacked the Cartesians or 'Mechanic Theists' and pointed to the inability of the mechanical account of matter in motion to explain the variety,

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[135] Ibid., p. 147.
[136] For an account of debates on these issues, see D. P. Walker, *The Decline of Hell: Seventeenth-Century Discussions of Eternal Torment* (London, 1964).
[137] Sydenham, *Theologia Rationalis*, ed. Dewhurst, p. 157.
[138] Ibid., p. 158.
[139] See also Jacques Roger's discussion of the presence of finalism in the study of nature, in *Sciences de la vie*, pp. 224-254. Roger does, however, qualify the extent to which finalism played a role in devising theoretical approaches to the life sciences, in the sense that admiring how the eye, say, was suited to its task had little impact on the actual search for efficient causes.
[140] Boyle, *A Disquisition about the Final Causes of Natural Things: The Conclusion*, in M. B. Hall, ed., *Robert Boyle on Natural Philosophy* (Bloomington, Ind., 1965), p. 153.
[141] John Ray, *The Wisdom of God Manifested in the Works of the Creation* (London, 1691).

formation and organisation of animals' bodies.[142] As we shall see throughout this section, a commitment to new explanatory schemes was posing problems to the common-sense assumption, previously protected by scholastic structures, that all living creatures were equipped with some sort of mind.[143] Accounts of the biology of humans and beasts had them both meet undercover, so to speak, disguised as 'automata' by Descartes and later Cartesians. Materialistic explanation was potentially menacing now that the hierarchy of souls, disbanded along with the scholastic heritage, no longer guaranteed the preeminence of man-as-animal among fellow animals - a preeminence salvaged only through the claims of teleology. The availability of mechanism and Gassendist atomism as explanatory structures led to doubts that the biology we shared with animals signified anything about the nature of our souls; the reality of both man and beast might lie hidden from the senses. On the other hand, it became possible to say that, since human thought and voluntary action partook of the immaterial soul substance, involuntary action was a matter of biology, just as it was for animals. The relation between will and biology, however, remained unclear.

We begin this section with verbal knowledge - theories about the nature and truth-value of language and its relation to ideas in the human mind; and end it with questions about 'natural', innate knowledge - theories aimed at establishing the respective roles of reason and instinct in guiding human and animal action. On the way, we hear proclamations about virtue and reason, loud appeals to the fate of the human soul and various logical or ethical formulae, all employed in arguments against, as well as for, the notion of an animal soul, mind or thought. Together, these discussions contributed to bringing to the philosophical fore a good deal of puzzlement about the function of a rational faculty in creatures such as ourselves, whose bodies functioned like those of animals, according to the laws of nature - of matter in motion, mechanical action and blood circulation - but whose souls had to remain immortal. The efforts to map the human mind's hidden contents in terms of our capacity for symbolic representation are presented here as one manifestation of this perplexity about reason. These efforts included the creation of a language for the

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[142] See John Farley, *The Spontaneous Generation Controversy from Descartes to Oparin* (Baltimore and London, 1980), p. 16.

[143] See Byron Williston, '*Akrasia* and the Passions in Descartes', *The British Journal for the History of Philosophy*, 7, 1999, pp. 33-55, at p. 35.

deaf-mute, along with the quest for a universal language; and they were related to the establishment of criteria for the practice of natural philosophy, as well as to debates on ideas and thought in French Cartesian circles. It appears that questions regarding the nature of language and its acquisition could not be set apart from those regarding the nature of thought; but neither could questions about the nature of reason be formulated without language. It is thus with this puzzle about the place of language in the natural world that we open our enquiry.

1. Deafness, ideas and the language of thought

Psychology describes what was observed.[144]

The centrality of language to thought and to the construction of exchangeable information, scientific or otherwise, within a community meant that natural philosophers in the Royal Society were concerned with its transparency with regard to the world they studied, and that Cartesian thinkers in France took pains to depict it as a proof of substance dualism. In England, where this chapter begins before heading to France, the metaphysical constraint of demanding that language reflect the Baconian requirement of basing science on observation and induction led a number of members of the Royal Society to reflect on the three-fold relationship between language, ideas and knowledge. A case study for this enquiry concerned the ability of the deaf to bear in mind ideas which might, or might not, exist without language. In what follows, I shall explore the efforts to devise a language for the deaf, within the context of both the quest for a universal language and the philosophical debates on the nature of language and its relation to ideas.

In 1669, the Royal Society published a work by its Fellow William Holder (1616-1698) - 'English phonetician, music theorist, composer, mathematician, and divine'.[145] Entitled *Elements of Speech: An Essay of Inquiry into The Natural Production of Letters: with An Appendix Concerning Persons Deaf and Dumb*, the book was a practical guide dedicated to instructing the deaf and those who had become dumb 'how to pronounce all Letters, and Syllables, and Words, and in a good measure to discern them by the Eye, when pronounced by another'.[146] Holder had communicated 'an Experiment, concerning *Deafness*'[147] to the Royal Society in 1668, in which he recounted the case of a patient, 'born Deaf, and continued Dumb

[144] Ludwig Wittgenstein, *Remarks on Colour* (Berkeley and Los Angeles, 1978), p. 13 (I-80): 'Die Psychologie beschreibt, was beobachtet wurde.'
[145] See R.W. Rieber and J.L. Wollock, *William Holder on Phonetics and Deafness: An Introduction to the New Edition of* Elements of Speech (New York, 1975), p. i.
[146] William Holder, *Elements of Speech: An Essay of Inquiry into the Natural Production of Letters* (London, 1669; New York, 1975), p. 15.
[147] See 'Of an Experiment, concerning *Deafness*', communicated to the R. Society, by that Worthy and learned Divine Dr. *William Holder*, as followeth', *Philosophical Transactions of the Royal Society*, 35, 1668 (May 18), pp. 665-668. See also Roy Porter, 'The Early Royal Society and the

till his Age of 10. or 11. years'.[148] He studied the young patient's ear, tried to understand the structure and role of the tympanum and noted that the boy could hear when one 'beat a Drum fast and loud by him'.[149] The same interest in the anatomy, physiology and typology of deafness, as well as a concern to mitigate its effects, can be traced in the treatise which Holder published a year later. Here, he took as a given that the precise description of pronunciation and the use of an elaborate phonetic vocabulary could enable those whose access to language was restricted by deafness to acquire a working knowledge of its sounds and to use it along with those who could hear. His treatise was thus not a theoretical disquisition on the nature of language and semantics. The system appears to have worked: the deaf-mute child Alexander Popham is recorded to have learned how to speak for a while. Holder believed that 'the natural Elements of Speech', that is, 'Motions of the parts of the Mouth', which he reproduced with the help of a plaster model,[150] were artificial. Languages, he wrote, arose 'when, by institution and agreement, such a composure of Letters, i.e. such a Word is intended to signifie such a certain thing'.[151] It was precisely because language arose 'by institution', however, that it should be possible to communicate the rules of its system to those who had been unable to acquire them from birth onwards through hearing and imitating. Indeed, while language was 'the most excellent Instrument for Communication … of our Thoughts and Notions', speech was 'nothing else, than A sensible Expression and Communication of the Notions of the Mind by several Discriminations of utterance of voice'.[152]

Holder focused on what made communication possible in spite of the shortcomings of language. He did not investigate the reasons which might explain, theoretically at least, what these limits might be, or why they might be inscribed within the very nature of language, as some believed to be the case. His was an empirical, not a theoretical undertaking. Others around him, however, did focus on these speculative questions. Holder belonged to a group of linguists at Oxford of whom another prominent member was George Dalgarno (1626-1687), author of the

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Spread of Medical Knowledge', in French and Wear, ed., *The Medical Revolution*, pp. 272-293, at p. 288.

[148] Ibid., p. 665.

[149] Ibid., p. 667.

[150] See Jonathan Rée, *I See a Voice: A Philosophical History of Language, Deafness and the Senses* (London, 1999), pp. 107-120 for his account of the cures by Holder and Wallis.

[151] Ibid., p. 11.

[152] Holder, *Elements*, p. 17.

Ars signorum, a project for a universal language, and the *Didascalocophus*,[153] a didactic treatise aimed at the deaf. Other members included the mathematician, grammarian and linguist John Wallis (1616-1703), who, in parallel with Holder, also worked with the deaf and dumb (he would take on Holder's deaf-mute patient Alexander Popham after the boy's relapse),[154] and Seth Ward (1617-1689), Savilian Professor of Astronomy at Oxford, a student at Wadham of John Wilkins, Bishop of Chester (1614-1672). Ward and Wilkins together wrote a pamphlet, *Vindiciae Academiarum*, against proposals for educational reform by John Webster (1610-1682),[155] set out by Webster in *Academiarum Examen, or the Examination of the Academies*.[156] Together with Wallis, Ward had also helped Dalgarno in his early effort to devise an 'investigation of Real Characters' (the *Ars signorum*),[157] which was sponsored by Samuel Hartlib (c.1600-1662). Boyle, for his part, had taught himself shorthand 'in order to write up his experiments',[158] using a stenography,[159] in effect a primitive, workaday version of the 'Universal Character' John Wilkins was developing at the time. The Royal Society had commissioned from Wilkins the *Essay towards a Real Character and Philosophical Language* in 1662,[160] executed with the help of John Ray and Ray's collaborator Francis Willughby (1635-1672) for the

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[153] George Dalgarno, *Ars signorum, vulgo character universalis et lingua philosophica* (London, 1661); *Didascalocophus Or The Deaf and Dumb mans Tutor* (Oxford, 1680).

[154] Ibid., Introduction, pp. i-ii,. According to Rée (whose source is in Christopher J. Scriba, 'The Autobiography of John Wallis, FRS', in *Notes and Records of the Royal Society of London* 25, 1970, pp. 17-47, p. 41), Wallis, wanting to 'emulate Holder's success' with Popham, 'found another deaf boy, Daniel Whaley', whom he trained to high level, exhibiting him at Court before the King and members of the Royal Society. Wallis then the same with Popham, though Holder managed to have his pupil back, and revealed that Whaley had not been deaf from birth. See Rée, p. 108.

[155] John Wilkins and Seth Ward, *Vindiciae Academiarum, Containing, Some briefe Animadversions upon Mr Websters Book, Stiled The Examination of Academies. Together with an Appendix concerning what M. Hobbs, and M. Dell have published on this Argument* (Oxford, 1654). The text of the 1654 edition is reprinted in facsimile in A. G. Debus, *Science and Education in the 17th Centur: The Webster-Ward Debate* (New York and London, 1970), pp. 193-259.

[156] John Webster, *Academiarum Examen: or, the Examination of Academies: Wherein is discussed and examined the matter, method, and customes of academick and scholastick learning, and the insufficiency thereof discovered and laid open; as also some experients proposed for the reforming of schools, etc.* (London, 1653). The text is reprinted in facsimile in Debus, *Science and Education*, pp. 67-192.

[157] Samuel Hartlib mentioned this in his notebook-diary, *Ephemerides*, quoted by Vivian Salmon in 'The Evolution of Dalgarno's "Ars Signorum"', in Vivian Salmon, *The Study of Language in 17th-Century England* (Amsterdam, 1979), pp. 157-175: p. 161.

[158] Ibid., p. 164.

[159] John Wilkins had written an *Art of Stenography* (London, 1628), a system of 'simple analogous symbols' in which 'new Illiterall Characters be inuvented and vsed for certained words: betweene which words and their Characters, appeareth some Analogie and proportion of reason'. See Salmon, *The Study of Language*, p. 160.

[160] John Wilkins, *Essay Towards a Real Character and a Philosophical Language* (London, 1668).

classification of animals and plants.[161] In short, this was a tight-knit community of natural philosophers, theologians, grammarians and mathematicans, embarked on a variety of interconnected projects whose theoretical underpinnings, whether implicit or explicit, concerned the relation between the order of nature and the modalities and significance of the human capacity to classify this order, mentally, linguistically and scientifically.[162]

The preoccupation with the communicability of language, whether between individuals or between groups and nations, was thus intimately connected with a concern to find a way of reading the 'book of nature' and of communicating its contents in an intelligible way. There was intense disagreement - notably between Paracelsians, members of the Royal College of Physicians and scientists at the Royal Society[163] - over how and whether this 'book' could be opened in the first place, and over what conditions were necessary for the communication of information to be possible. Webster complained in his *Academiarum Examen* that 'Many do superficially and by way of *Analogy* (as they term it), acknowledge the Macrocosm to be the great unsealed book of God, and every creature, glory and power'; but no one could 'read the legible characters that are onely written and impressed by the finger of the Almighty.'[164] One possible remedy, thought Webster, for this alleged defect in the educational system of his day - an allegation that Wilkins and Ward vehemently attacked in their reply to Webster - would be 'the discovery of the universal Character', a universal semantic system for the benefit of 'all mankind', enabling 'Nations of divers Languages' to have 'commerce and trafick one with

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[161] Ray and Willughby produced a system of classification which would influence Carl Linnaeus, founder of modern taxonomy in natural history. Henry G. van Leeuwen, in *The Problem of Certainty in English Thought, 1630-1690* (The Hague, 1970), p. 56, points out that, according to Wallis in his *A Defence of the Royal Society … In Answer to the Cavils of Dr. William Holder* (London, 1678), p. 17, Willkins 'did not expect the scientific language to gain universal acclaim or use, but was interested in showing only that such a language was a real possibility'. See also Hans Aarsleff, 'The Royal Society: Hooke, Ray, Boyle, and Locke' in his *Language, Man and Knowledge in the Sixteenth and Seventeenth Centuries* (Princeton, 1964), p. 126.

[162] A history of these issues was traced by Frances A. Yates in *The Art of Memory* (London, 1966).

[163] See, for instance, Debus, 'The Paracelsians and Educational Reform', in his *Science and Education*, ch. 3, pp. 15-32 and David S. Lux and Harold J. Cook, 'Closed Circles or Open Networks? Communicating at a Distance during the Scientific Revolution', *History of Science* 36, 1998, pp. 179-211.

[164] John Webster, *Academiarum Examen, or the Examination of Academies. Wherein is discussed and examined the Matter, Method and Customes of Academick and Scholastick Learning, and the insufficiency thereof discovered and laid open; As also some Expedients proposed for the Reforming of Schools, and the perfecting and promoting of all kind of science* (London, 1653), p. 28.

another' and share each others' 'sciences and skill'.[165] It would, he wrote, 'have repaired the ruines of *Babell*, and have been almost a *Catholick* Cure for the confusion of tongues'. The deaf and dumbs' skill at using 'signes and gestures to express their minds' showed that it must be possible

> to convey our notions and intentions one to another, without vocal and articular prolation, as some have all ready invented and practiced by *Dactylogy*, and doubtlesly might be brought to pass by the eies and motions of the face onely. Sir *Kenelm Digby* hath an apposite, though almost incredible story of one in Spain, which being deaf and dumb, was notwithstanding taught to speak and understand others, which certainly was performed chiefly by the eye.[166]

Digby's account, in the section *Of Bodies* in his *Two Treatises*,[167] of the deaf and dumb Spaniard Luis de Velasco, who had been able, 'chien savant'-like, to lip-read and correctly render aloud Irish and Welsh words which he could not understand, was quite well known.[168] Dalgarno referred to it in his *Didascalocophus* in terms which assumed the reader's acquaintance with the anecdote, since he brushed over its details as if they were public knowledge.[169] And unlike Webster - who was dismissive of contemporary scientific efforts that did not promise the utopia of complete knowledge and total communication between all peoples and between macrocosm and microcosm - Dalgarno told the story in order to show the invalidity of its status as an experiment and expose its unlikelihood. Digby was known to tell 'fabulous and Hyperbolical' stories, as he put it, though in this case, it was 'not the *esse*, but the *posse* of the story, that I concern myself to maintain'.[170] Dalgarno was concerned throughout the work with evaluating the respective powers of the senses of sight and hearing, of determining whether who, of the deaf and blind, were more disadvantaged. He wanted to show that 'Dactylology' and 'Cheirology' - a language of signs and a system of gestures respectively - might be the means with which the deaf-mute, given adequate instruction, could communicate, and that it was possible

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[165] Webster, *Academiarum Examen*, pp. 24-25.
[166] Ibid., p.25.
[167] Sir Kenelm Digby, *Two Treatises: In the one of which, the nature of bodies; In the other, the nature of mans soule, is looked into: in way of discovery of the immortality of reasonable soules* (Paris, 1644; London, 1645): 'The First Treatise declaring the nature and operations of bodies', pp. 307-309.
[168] See Rée, *I See a Voice*, pp. 98-99.
[169] George Dalgarno, *Didascalocophus Or The Deaf and Dumb mans Tutor* (Oxford, 1680; reprinted Menston, 1971), pp. 37-40.

to instruct even those who had been deaf from birth to use this semantic system, this particular 'Schematology'.

The concern with the ability of human language to signify adequately, in this sensitive period of adjustment to new modes of learning and discovering, was matched with varying definitions of what was most characteristic of language.[171] On one view, it was fallen, but could be improved upon, as Dalgarno thought,[172] for example by weeding out scholastic obscurities. On another view, it was fallen because fragmented into innumerable versions; but it was also possible to return to the pure, Adamic unity of word and thing of the kind Webster wished for, by investigating etymologies (as suggested by Jakob Boehme), and by creating, as Wilkins tried to do,[173] a 'philosophical language' based on a 'real character'. Such a 'real character' consisted in the elaborate classification of concepts which would reflect reality and the 'syntactical relations between concepts',[174] just as mathematics or Chinese ideograms did. Joseph Glanvill (to whom we shall return in Part II) would attack the conceit of mistaking 'the infusions of *education*, for the principles of

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[170] Ibid., p. 40.

[171] There is an extensive literature on universal languages, universal grammars, universal characters and philosophical languages. See, in S. Auroux, ed., *Histoire des idées linguistiques, vol. II: Le développement de la grammaire occidentale* (Liège, 1994): 'Les questions de l'âge de la science', esp. Vivian Salmon's account of the tradition, 'Caractéristiques et langues universelles', pp. 407-423, and Marc Dominicy's bibliographical essay on the history of grammar, 'Le programme scientifique de la grammaire générale', pp. 424-441. See also James Knowlson, *Universal Language Schemes in England and France, 1600-1800* (Toronto, 1975); Mary M. Slaughter, *Universal Languages and Scientific Taxonomy in the Seventeenth Century* (Cambridge and New York, 1982); Umberto Eco, *La Ricerca della lingua perfetta nella cultura europea* (Rome and Bari, 1993).

[172] On the very first page of his introduction to the *Didascalocophus*, Dalgarno referred to his goal when publishing the *Ars signorum* some twenty years earlier, of 'shewing a way to remedy the difficulties and absurdities which all languages are clogg'd with ever since the confusion, or rather since the fall; by cutting off all Redundancy, rectifying all Anomaly, taking away all Ambiguity and Equivocation… In a word, designing not only to remedie the confusion of Languages, by giving a much more easie medium of communication then any yet known; but also to cure even Philosophy it self of the disease of Sophisms, and Logomachies.'

[173] The literature on Wilkins's *Essay* is enormous. See. e.g., Sidonie Clauss, 'John Wilkins' Essay Toward a Real Character: Its Place in the Seventeenth Century Episteme', in Nancy Struever, ed., *Language and the History of Thought* (Rochester, 1995), pp. 27-49; Vivian Salmon, 'Philosophical' Grammar in John Wilkins's *Essay*', in her *The Study of Language in 17th-Century England*, pp. 96-125; Van Leeuwen, *The Problem of Certainty*, esp. pp. 49-71. Van Leeuwen notes, p. 56, that Leibniz was critical of the *Essay*. He reports that, according to the *Biographia Britannica: or the Lives of the most eminent Persons who have Flourished in Great Britain and Ireland* (London, 1766), VI, II, p. 4273, note S, Leibniz 'told both Mr. Boyle and Mr. Oldenburgh, that he did not think either Dr. Wilkins or Dalgarno had come to the point. They might indeed enable nations who did not understand each other to correspond easily together, but they had not obtained the real character, which would be the best instrument of the human mind, and extremely assist both the reason and the memory, and the invention of things. These characters ought to resemble as much as possible those of algebra, which are very simple and expressive, and are never superfluous or equivocal, but whose varieties are grounded on reason.'

universal *nature*', which denoted the absence 'of a *scientifical Theory*'.[175] On yet another view, taken by John Locke,[176] one could evaluate language not as what it had once been, nor as what it should be, but by trying to understand its relation to the formation of knowledge.[177]

The manifest pragmatism of performing a complete analysis of language and semantics,[178] rather than a chimerical reconstruction or ideal construction, matched the pragmatism which drove the scientific programme of the Royal Society. It was through our senses, primarily vision, that we could acquire knowledge of the book of nature - just as language was the key to reading the book of Scripture and, for some, to unlocking its secrets. But the relation of our senses to our ability to decipher signs must itself be an object of investigation. Our senses provided the information; yet that information had to be processed by the mind, which somehow bridged the different kinds of information which each sense delivered and unified them into one concept, sign or universal. The chief characteristic of the human mind was, then, its ability to process sense-data and use language, an intricate system of abstract signs inaccessible to animal minds. Holder accepted that 'Thousands of Signes may be invented and agreed upon, and learnt, and practiced' - from bells and trumpet calls to facial expressions, pointing and knocking - which the dumb were good at using and which animals made use of too, 'to Call, Warne, Chide, Cherish, Threaten, *&c*., especially within their own kinds'. Nevertheless, the human voice and the alphabet were the 'chief' of all signs. Only man was endowed with speech,

> as with an Instrument suitable to the Excellency of his Soul, for the most easie, speedy, certain, full communication of the Infinite variety of his Thoughts, by the ready Commerce between the Tongue and the Ear. And if some Animals, as *Parrots, Magpies, &c.* may seem to be capable of the same discriminations, yet we see, that their souls are too narrow to use so great an Engine.[179]

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[174] See Salmon, *Caractéristiques*, in Auroux, ed., *Histoire*, p. 410.
[175] Joseph Glanvill, *The Vanity of Dogmatizing: Or Confidence in Opinions. Manifested in a Discourse of the Shortness and Uncertainty of our Knowledge. And its Causes, With some Reflexions on Peripateticism; And an Apology for Philosophy* (London, 1661), p. 132.
[176] John Locke, *An Essay concerning Human Understanding* (London, 1690), P.H. Nidditch, ed. (London, 1975), III, 2-4.
[177] See, for example, Lia Formigari, 'Le langage et la pensée', in Auroux, ed., *Histoire*, pp. 442-454.
[178] On the respective positions of Locke and Leibniz with regard to language, see Hans Aarsleff's seminal article 'Leibniz and Locke on Language', *Philosophical Quarterly*, 1, 1964, pp. 165-188; reprinted in his *From Locke to Saussure. Essays on the Study of Language and Intellectual History* (London and Minneapolis, 1982), pp. 42-83.
[179] Holder, pp. 4-6.

That animals could not express themselves in the way that humans could was at first an Aristotelian assumption, and, as we shall see later on, it held water despite the contrary assertions made in the sixteenth century by Michel de Montaigne and Pierre Charron (1541-1603).[180] We humans had the prerogative of language, through which we made use of our reasoning faculties. For Holder, Wallis and Dalgarno, sign-language was a human language too, a semantic system constructed on the basis of an analysis of semantic function. For the physician John Bulwer, the author of a *Chirologia, or, the Naturall Language of the Hand*, a *Philocopus, or the Deaf and Dumbe Mans Friend* and a *Pathomyotamia, or, A Dissection of the Dignificative Muscles of the Affections of the Minde*,[181] natural language consisted of the languages of the body; and their various versions could be catalogued, grouped, analysed and used to teach the deaf and dumb how to communicate. Gesture was a declamatory technique, and like all techniques, it could be mastered.[182] Controlled, modulated gesture, like controlled, modulated voice, was the rhetorician's tool. Nature could be read without the use of instituted signs; eloquence, however, required nature to be tamed.

Natural, sign-free expression was one mode of expression, however limited; it might also have been the starting-point for any language and indeed for any sign language. The question then arose of whether thought might actually exist without language - of whether it was possible to conceive of thought as independent of semantics. If so, it was even possible to say that thought was clearer when it was not

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[180] See Michel de Montaigne, *Essais* (Paris, 1580), II, xii, 'Apologie de Raymond Sebond'; Charron, *De la sagesse* (Paris, 1601), esp. Bk. 1.

[181] John Bulwer, *Chirologia, or, the Naturall Language of the Hand*: *Composed of the speaking motions, and discoursing gestures thereof. Whereunto is added, Chironomia; or, The art of manual rhetoricke. Consisting of the naturall expressions, digested by art in the hand, as the chiefest instrument of eloquence, by historicall manifesto's, exemplified out of the authentique registers of common life, and civil conversation, with types, or chyrograms, along-wish'd for illustration of this argument* (London, 1644). Bulwer also wrote a *Philocopus, or the Deaf and Dumbe Mans Friend*: *Exhibiting the philosophical verity of that subtle art, which may enable one with an observant eye, to hear what any man speaks by the moving of his lips. Upon the same ground, with the advantage of historical exemplification, apparently proving, that a man born deaf and dumb may be taught to hear the sound of words with his eye, and thence learn to speak with his tongue.* (London, 1648) and a *Pathomyotamia, or, A dissection of the significative muscles of the affections of the minde: Being an essay to a new method of observing the most important movings of the muscles of the head, as they are the neerest and immediate organs of the voluntarie or impetuous motions of the mind: with the proposal of a new nomenclature of the muscles* (London, 1649).

[182] On Bulwer, see Rée, *I See a Voice*, pp.123-131. See also Marina Warner's interesting reading of William Marshall's illustration, reproduced as the frontispiece to Bulwer's book, in her *From the Beast to the Blonde* (London, 1994), pp. 90-91.

rendered 'into' language. If our language was so imperfect, and if the Hermetic tradition, as Webster was inclined to believe,[183] revealed the truths obscured by thought-processes steeped in scholastic logic, the shortcomings of human reason were equal to the inadequacy of language in the task of understanding the universe. Inversely, if language was adequate, an analysis was needed of the operations through which we came to know and describe the world verbally.

The very notion that a deaf and dumb person could actually learn how to speak was difficult to comprehend theoretically, especially if one did not use the plausible notion, favoured for example by Bulwer, that all senses were equivalent. There had been attempts at teaching the deaf how to speak and read from the sixteenth century onwards;[184] and the idea that the body could by default stand in for the voice goes back at least to Plato.[185] The same applies to blindness and William Molyneux's question to Locke as to whether someone who had been blind from birth could, if his vision were restored, visually differentiate a cube from a globe, both of which he had previously distinguished through touch.[186]

Views about the nature of language in the seventeenth century were inseparable from a metaphysical standpoint with regard to God, soul and body, the traditional subjects of philosophy and those which Descartes had revolutionized. But individual discussions of linguistic function such as those of Dalgarno, Holder, Wallis and Wilkins were meant to accomplish particular, potentially concrete and in a specific sense 'scientific' tasks, not philosophical ones.[187] On the whole, these men,

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[183] See Debus, *Science and Education*, pp. 33-64.

[184] Rée, in *I See a Voice*, gives a history of such attempts; see especially chs. 9-13 and references.

[185] Oliver Sacks, in *Seeing Voices* (London, 1991), pp. 14-15, refers to a passage from the *Cratylus* (422d-423b) quoted by the Abbé de l'Epée, the official founder of sign-language in eighteenth-century France: 'If we had neither voice nor tongue, and yet wished to manifest things to one another, should we not, like those which are at present mute, endeavour to signify our meaning by the hands, head, and other parts of the body?.'

[186] Locke inserted the question, with his answer, in the 1694 edition of the *Essay* at II, ix, 8. For a suggestive account of the conclusions one could derive from more recent cases of Molyneux-type patients, see Israel Rosenfield, *The Strange, Familiar, and Forgotten: An Anatomy of Consciousness* (New York, 1992), pp. 9-13 and ch. 1 generally. The thought-experiment has a long history, well documented and central to the development of eighteenth-century epistemology. See, e.g., M. J. Morgan, *Molyneux's Question. Vision, Touch and the Philosophy of Perception* (Cambridge, 1977); W. R. Paulson, *Enlightenment, Romanticism and the Blind in France* (Princeton, 1987).

[187] Dalgarno was the first to create a manual alphabet - dactylology - for the deaf, though John Bulwer preceded him in devising a complete sign language, or arthrologie, in his *Chirologia* and *Philocophus* (1648). For a brief account of the significance of Dalgarno, Bulwer, Holder and Wallis in the development of BSL (British Sign Language) see J. G. Kyle and B. Woll, *Sign Language: The Study of Deaf People and their Language* (Cambridge, 1988), pp. 37-57, where it is suggested that one

as one commentator has put it, have not been 'remembered for their scientific accomplishments', although 'they had an interest in certainty relative to a scientific theory'.[188] Their discussions rested on some *assumptions* about language and raised philosophical questions precisely because an empirical approach could not elucidate the nature of the relation of word and thing,[189] in a way that theorists, including the Port Royal thinkers, tried to do. Indeed, the first paragraph of the first part of the *Logique* by Antoine Arnauld (1612-1694) and Pierre Nicole (1625-1695) established that: 'Since we cannot know anything outside outselves without the mediation of the ideas within ourselves, thoughts we can have about our ideas might be the most important part of logic, because it is the foundation of everything else.'[190]

Earlier, Francis Bacon had developed his theory of language, understanding oral but also written and gestural language as the means for the communication of 'rational knowledge'.[191] Gesture enabled communication between the deaf and dumb and between people 'that understand not one another's language'.[192] Both words and gestures were 'notes of cogitations'.[193] But whereas words were 'the tokens current

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cannot presume that Dalgarno 'ever tried out his ideas with deaf people', and that these ideas 'were hardly known at the time'. They were probably known to Wilkins (a letter from Charles II appended to the *Ars signorum* mentions his name among a list of people who recommended the work), though the latter did not mention it in his own *Universal Character*. The *Ars signorum* relies on Cartesian theories of perception derived from the *Meditations*.

[188] Van Leeuwen, *Problem of Certainty*, p. 48.

[189] Specific assumptions about the relation of word to thing, and in particular about the status of verbal accounts of natural phenomena, informed the development of norms of scientific practice within the Royal Society and were distinct from post-Cartesian philosophical discourse. See Shapin and Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, 1985), p. 72: 'Hobbes was the sort of philosopher who on no account ought to be admitted to the experimental companionship, for he denied the value of systematic and elaborate experimentation as well as the foundational status of the fact and the distinction between causal and decriptive language. The experimental and the rationalistic language-games were perceived to be radically incompatible. There could be no rapprochement between them, only a choice between the one and the other.'

[190] Antoine Arnauld and Pierre Nicole, *La logique ou l'art de penser, contenant, outre les règles communes, plusieurs obsevations nouvelles, propres à former le jugement* (Paris, 1662), ed. Pierre Clair and François Girbal (Paris, 1981), p. 39: 'Comme nous ne pouvons avoir aucune connoissance de ce qui est hors de nous que par l'entremise des idées qui sont en nous, les reflexions que l'on peut faire sur nos idées, sont peut-être ce qu'il y a de plus imprtant dans la Logique, parceque c'est le fondement de tout le reste.'

[191] In this he followed Aristotle, *De interpretatione*, 16a3, citing his notion that 'Words are the images of cogitations, and letters are the images of words'. See Bacon, *Of the Proficience and Advancement of Learning, Divine and Humane* (first published London, 1605), ed. G. W. Kitchin (London, 1861; reprinted 1973), XVI, 1, p. 36: 'the fourth kind of rational knowledge, which is transitive, concerning the expressing or transferring our knowledge to others; which I will term by the general name of tradition or delivery. Tradition hath three parts; the first concering the organ of tradition: the second concerning the method of tradition; and the third concerning the illustration of tradition.'

[192] Ibid., XVI, 2, p. 137.

[193] Ibid., XVI, 3, p. 137.

and accepted for conceits, as moneys are for values',[194] gestures, like hieroglyphics, bore a similarity to the concept they pointed to, like 'impresses and emblems', and 'an affinity with the things signified'.[195] For Bacon, the bodily language of the deaf and dumb would have been superior to the spoken word, which, as a result of the curse of Babel, required grammar in order to function. In his view, as for some of the later creators of a universal character, languages and their grammars resulted from 'the second general curse, which was the confusion of tongues'.[196] Language was our organ of expression, and it functioned well enough; but its grammar was arbitrary and imperfect, and so reflected the inadequacy with which the intellect interpreted sense-data. Errors of judgement were due to these errors of the intellect.[197] Logical propositions did not capture the subtleties of the natural world precisely because 'arguments consist of propositions, and propositions of words', which were the mere tokens of things.

For Bacon, the necessity of interpretation and its arbitrariness coexisted. It was the recognition of the limits of the intellect (rather than those of the senses) that, according to him, could allow one to base the pursuit of knowledge on firm ground by revising the errors that undermined the efficacy of language. His position implied a commitment to the notion that there could be such a thing as a true account of nature, but that the form in which such an account existed was liable to be problematic. Although it could be improved upon, it was discourse that was the source of confusion and error, not perception, nor the human capacity to find out how things worked. There were echoes of this notion in Hobbes, for whom the understanding was 'nothing else, than conception caused by speech'.[198] Words were the means 'whereby men register their Thoughts; and recall them when they are past; and also declare them one to another for mutuall utility and conversation'.[199] But while names signified concepts and speech transformed thought into words,[200] names

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[194] Ibid., XVI, 3, p. 138. I shall discuss later on some implications of this comparison, which recurs in Locke.
[195] Ibid., XVI, 3, p. 137.
[196] Ibid., XVI, 4, p. 138.
[197] Ibid., XIII, 4, p. 126.
[198] Thomas Hobbes, *Leviathan, or the Matter, Forme, & Power of a Common-Wealth, Ecclesiasticall and Civill* (London, 1651), ed. C. B. Macpherson (London, 1981), p. 109 (I.4).
[199] Ibid., p. 100.
[200] Ibid., p. 101. See Ian Hacking, *Why does Language Matter to Philosophy?* (Cambridge, 1975), pp. 15-25, for a discussion of Hobbes's theory of language.

themselves were 'of *inconstant* signification'.[201] To reason, moreover, was to deduce or induce these words from each other, from particulars to universals and back; and the process was not error-proof.[202]

The notion that truth and falsity were primarily features of propositions, rather than of facts, amounted to an emphasis on the linguistic basis of our knowledge of the world and on its grammatical and mentally effected configuration. For Hobbes, scientific knowledge was inductive and thus merely hypothetical. It consisted in the possibility, inscribed within the very nature of language,[203] of inferring general facts from particular cases.[204] Whether Hobbes was sceptical of the Royal Society's programme for scientific investigation because it could only be shared through discourse, or whether it was the very arbitrariness of linguistic constructs and their dependence upon logical and grammatical rules that signified, in his view, the inevitability of epistemological opacity, is not a question that can be addressed here. But it is important to point out how connected the two issues were in the minds of those figures whose discussion of the nature of knowledge took place not merely in a continuum with the traditional concerns of philosophy, but also within the context of debates about the status of a novel kind of scientific enquiry, which was yielding new information about the structure of the physical world.

Dalgarno, in contrast to Bacon's view of Babel as the farewell to linguistic purity and unity, and with none of the concern he had displayed in the *Ars signorum* to reflect in philosophical terms on the fallibility of language, along the lines followed by Hobbes, stated in his *Didascalocophus* that 'tho there be no affinity between the words of some languages; yet there is something of a Natural and Universal Grammar runs thro all Languages, wherein all agree'.[205] Languages, he

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[201] Hobbes, *Leviathan*, pp. 109 and 165 (I.11).

[202] Ibid., p. 113. See also Hobbes, *Elements of Philosophy* (London, 1656), Part I, *On Computation or Logic*, 'Of Names', in Hobbes, *The English Works*, ed. Sir William Molesworth (London, 1839), I, p. 16: 'A Name is a word taken at pleasure to serve for a mark, which may raise in our mind a thought like to some thought we had before, and which being pronounced to others, may be to them a sign of what thought the speaker had, or had not before in his mind. And it is for brevity's sake that I suppose the original of names to be arbitrary.'

[203] As Shapin and Schaffer put it in *Leviathan and the Air Pump*, p. 92: 'For Hobbes, perhaps even more than for Boyle, right philosophy was predicated upon the proper use of language' and 'one route to proper philosophical language lay through a definitional exercise'.

[204] For a discussion of Hobbes's views on the relationship between language and scientific knowledge, and on the ways in which they bear upon his understanding of scientific inquiry, see Douglas Jesseph, 'Hobbes and the method of natural science', in Tom Sorell, ed., *The Cambridge Companion to Hobbes* (Cambridge, 1996), pp. 86-107, especially pp. 96-102.

[205] Dalgarno, *Didascalocophus*, p. 18.

thought, along with his 'worthy friend Dr. Wallis',[206] were 'guided by the instinct of Nature'. Many words were formed as if 'there is something Symbolizing, and Analogous to the notions of the things; which makes them both more Emphatic, and easy to the memory'. Written words, however, were 'a meer arbitrary Institution', and 'because speaking being before writing, has more of Nature and less of Art in it.'[207] Both Dalgarno and Holder, in devising in their manuals a method for teaching language to the deaf from scratch as well as a sign-language that would enable the deaf-mute to communicate, manifested little if any doubt about the feasibility of their project, born, clearly, of the mix of 'Art' and 'Nature', and aimed at the improvement of the latter. The notion of a sign-language in Dalgarno was conceived on the same grounds as was the 'shorthand' in his earlier *Ars signorum*, which originated, he said in the *Didascalocophus*, from his awareness that Hebrew alone was diphthong-free, hence probably very close to Adam's tongue.[208] It was the compactness of Hebrew that gave it its elevated status, in the same way that the elegance of a mathematical demonstration was a function of its concision. Dalgarno seemed committed to the idea that there once was an Adamic language, now lost, but preserved to some extent in Hebrew and a plausible source of inspiration for new methods of communication.

What is most striking both in Holder and in Dalgarno is the absence of debate about the foundations of such a view. Hearteningly optimistic and, to a point, efficacious as they were, both these attempts took for granted the assumption, stated by Holder,[209] that language, as the manifestation of reason, was a system of signs superior to others which distinguished us from the animal world, even though its mode of transmission was physical and in this sense comparable to animal forms of communication. It is in this sense that theoretical presuppositions determined the practices of natural philosophy, and that experiment and thought-experiment did not mix in an obvious way.[210] Enquiries about the ways in which access to the linguistic

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[206] Wallis, along with Seth Ward, was deeply hostile to Hobbes, and both Royal Society Fellows engaged in a heated debate with him which began after the publication of Hobbes's *De corpore* in 1650. For an analysis of the nature and significance of the conflict, and an account of the available sources, see Shapin and Schaffer, *Leviathan and the Air Pump*, esp. pp. 106, 126, 131-154, 311-12, 323-331.
[207] Dalgarno, *Didascalocophus*, pp. 20-21.
[208] Ibid., pp. 100-101.
[209] See above, p. 46.
[210] Catherine Wilson has eloquent lines about this in her *The Invisible World: Early Modern Philosophy and the Invention of the Microscope* (Princeton, 1995), pp. 3-38, esp. p. 10. See also Peter

faculty might be impaired in beings whose very nature was defined by the ability to use language, however, inevitably turned on questions regarding the connection reason bore to both the human creation of meaning and the physiology of perception. As I shall explain, it was within empirical rather than rationalist accounts of perception that thought-experiments about sense-deprivation could fully become tools of scientific investigation.[211]

The view that anomalous sense-perception could tell us something about the nature of cognition and mind was implicit in some early accounts of individual cases.[212] Galen, for example, had already been able to observe that the correspondence of lesions in the brain to changes in behaviour.[213] Descartes, for his part, would note that when the brain suffered lesions, the senses alone were affected, while the body was able to remain mobile.[214] But he had no problem explaining this

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Dear's book on the notion and practice of experiment during the Scientific Revolution, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago, 1995). On the definition and function of thought-experiments, see Shapin and Schaffer, *Leviathan and the Air Pump*, p. 55, n. 62, and Thomas Kuhn's 'A Function for Thought Experiments', reprinted in his *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago, 1977), pp. 240-265, to which Shapin and Schaffer also refer and in which Kuhn analyses what kind of knowledge can be gained from thought-experiments.

[211] In his account of the history of theories of perception from Descartes onwards, Nicholas Pastore focuses on 'empirists', as opposed to 'nativists', in what he notes are Helmholtz's terms: see N. Pastore, *Selective History of Theories of Visual Perception: 1650-1950* (Oxford, 1971).

[212] The theory needed to underpin such a notion was hardly available until the nineteenth century and the contributions of Gall, Broca, or Wernicke; but already Hobbes, in *Leviathan*, pp. 103-104 (I.4), invoked the case of 'a man that hath no use of Speech at all (such, as is born and remains perfectly deafe and dumb)' to explicate the way in which, by imposing names, 'we turn the reckoning of the consequences of things imagined in the mind, into a reckoning of the consequences of Appellations'. Without an appellation at hand, the deaf and dumb would be at pains to infer a 'Universall rule' from 'one particular'.

[213] See Galen, *De placitis Hippocratis et Platonis*, I.6, and Georges Canguilhem's discussion of Galen's understanding of the mind-body connection at the beginning of his *La formation du concept de réflexe aux XVIIe et XVIIIe siècles* (Paris, 1977), pp. 13-20. See also Andrew Peacock, 'The Relationship between the soul and the Brain', in F. Clifford Rose and W. F. Bynum, ed., *Historical Aspects of the Neurosciences: A Festschrift for Macdonald Critcheley* (New York, 1982), pp. 83-98, at p. 84. As we shall see in Part II, the causal diagnosis of pathological symptoms depended on the unquestionable assumption of a consistent and causally effective, though heuristically fluid, connection between mind and body, mainly based on Galenic explanations of emotional and cognitive disorder and persisting beyond the seventeenth century, though the practice of dissection was instrumental in revising the structure of diagnostic explanation. For a history of the notion of illness from early antiquity to Avicenna, see Mirko D. Grmek, 'Le concept de maladie', in M. D. Grmek, ed., *Histoire de la pensée médicale en Occident*, 1*: Antiquité et Moyen Âge* (Paris, 1995), pp. 211-226. See also his 'Il concetto di malattia', in *Storia del pensiero medico occidentale*, 2: *Dal Rinascimento all'inizio dell'ottocento* (Rome and Bari), pp. 259-289.

[214] Descartes, *Diotrique*, in *Oeuvres philosophiques*, ed. Alquié, I, pp. 681-82 : 'On sait déjà assez que c'est l'âme qui sent, et non le corps: car on voit que, lorsqu'elle est divertie par une extase ou forte contemplation, tout le corps demeure sans sentiment, encore qu'il ait divers objets qui le touchent. Et on sait que ce n'est pas pas proprement en tant qu'elle est dans les membres qui servent d'organes aux sens extérieurs, qu'elle sent, mais en tant qu'elle est dans le cerveau, où elle exerce cette faculté qu'ils appellent le sens commun: car on voit des blessures et maladies qui, n'offensant que le cerveau seul,

in terms of his dualism, stated for example in the *Dioptrique*,[215] that it was the *soul* which perceived ('sent'), not the body, and that, lodged in the pineal gland, or *conarium* (as the 'common sense', the medieval *sensorium commune* or *sensus communis*), it received there the sense-perceptions transmitted by the nerves. Just as his *Meditations* began with scepticism about the reliability of the senses, so Descartes's account in the *Dioptrique* of the nerves' mechanism differed sharply from Locke's inquiry about the nature of sense-experience. Empiricists and rationalists, then, shared the assumption that perception, or sensation, must be conscious - that without a mental operation it did not exist as perception or sensation. But they differed in their notion of how perception and thought were connected.

Descartes had staked all on the belief that thought alone could counteract doubt about the veracity of sense-perception, while holding that the senses could only convey information about the way in which objects and their primary as well as secondary qualities were experienced, not about their nature. Locke, on the other hand, believed that objects first affected our senses, causing 'perceptions in the Mind' and 'thereby produce in the Understanding a simple *Idea*'.[216] Ideas, however, were not

> exactly the Images and Resemblances of something inherent in the subject; most of those of Sensation being in the Mind no more the likeness of something existing without us, than the Names, that stand for them, are the likeness of our Ideas, which yet upon hearing, they are apt to excite in us.[217]

Lockean ideas, then, resembled the objects they were images of as much as words resembled the things they designated.[218] This was, for Locke just as it had been for Bacon, an instituted relation related to the notion of intelligibility (thus, 'the Names

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empêchent généralement tous les sens, encore que le reste du corps ne laisse point pour cela d'être animé.'

[215] In the passage where he described what caused visual experience to be of coloured objects, Descartes did compare ordinary, sighted perception with the perception by touch of a blind man - but the emphasis of the comparison here was on the notion of 'l'action qui cause le sentiment de la vue' rather than on the actual experience or phenomenon of sense deprivation: see ibid, p. 656.

[216] Locke, *Essay*, II.viii.1

[217] Ibid., II.viii.7

[218] For a provocative discussion of what one can understand to have been meant in the seventeenth century by the notion of 'idea', see Hacking, *Why Does Language*, pp. 26-42. Note that Locke, in the fourth edition of the *Essay*, shifted from the purely Cartesian notion of 'clear and distinct' ideas to that of 'determined' ideas. See Stephen Medcalf, 'Introduction', in Joseph Glanvill, *The Vanity of Dogmatizing: The Three 'Versions'*, ed. Medcalf (Hove, 1970), pp. xxv-xxvi.

of Colours to a blind Man, or Sounds to a deaf Man' were unintelligible),[219] although we functioned by the fixed and acquired rules that rendered sounds or letters meaningful and that turned sense-data into the primary elements of cognition.[220] Locke's ideas were not images,[221] as he repeatedly pointed out; but they did play the role of a conceptual *deus ex machina* of sorts, a self-explanatory token with which he could account for the possibility of experiencing subjectively a world of objects and qualities. These ideas thus established an equivalence between the experience and the concept, itself the reified problematization of mental representation. To a degree, they were the embodiment of the physical phenomenon of perception, and on the picture of the mind of which they were a part, language could only operate in relation to them. Verbalization was thus studied as an aspect of mental discourse necessary to its very transmission, rather than as the manifestation of higher cognitive capacities. The 'Communication of Thoughts' and of the 'invisible *Ideas*' that made up thoughts was essential to what Locke called the 'Comfort, and Advantage of Society'. This was why he wanted to analyse how words which were 'by Nature so well adapted to that purpose' became the signs of ideas, 'not by any natural connexion, ... for then there would be but one language amongst Men; but by a voluntary Imposition, whereby such a Word is made arbitrarily by the Mark of such an *Idea*'. Words were 'the sensible Marks of *Ideas*; and the *Ideas* they stand for, are their proper and immediate Signification'.[222]

Intrinsic to this view of the role of language was the notion that mental discourse was private; that it preceded what one may term public discourse; that it stood in a relation of correspondence to ideas; and that ideas themselves corresponded to the objects of thought, whether these objects were abstract or concrete. As for thought, Locke described it in these terms: 'When the Mind turns its

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[219] Locke, *Essay*, III, ix, 5, p. 477.

[220] As Tim Crane has put it in *The Mechanical Mind: A Philosophical Introduction to Minds, Machines and Mental Representation* (London, 1995), p. 21: 'A convention associates the word "dog" with the idea in my mind, and it is in virtue of this association that the word represents dogs.'

[221] Hacking, *Why Does Language Matter to Philosophy?*, p. 33. See also Crane, *The Mechanical Mind*, pp. 20-23, where he shows that 'a theory of linguistic representation will need, ultimately, to appeal to a theory of mental representation', and that 'words, like pictures, do not represent in themselves ("intrinsically"). They need interpreting', because 'interpretation is something which the *mind* bestows upon words. Words and pictures gain the interpretations they do, and therefore represent what they do, because of the states of mind of those who use them', though 'these states of mind are representational too'.

view inwards upon it self, and contemplates its own Actions, *Thinking* is the first that occurs. In it the Mind observes a great variety of Modifications, and from thence receives distinct Ideas.'[223] The mind itself was not the main actor. The world and its objects principally made impressions upon it, and thought was the apprehension of the modifications of mind that impressions provoked: thought was an aspect of consciousness.[224] On such a view, the understanding was the sum of cognitive functions; but it was difficult to understand how these functions worked, or how they came to be what they were. Locke's epistemology, as presented within his account of language and cognition, offered a precise description of the genesis of knowledge, which, however, did not so much serve a scientific end as constitute a solid basis for a project that was informed by, and encompassed, wider social and political concerns.[225] Taken on its own, the Lockean notion that we came into the world with a so-called *tabula rasa* for a mind, that perception was necessary to knowledge and that no knowledge was innate, remained open to questions as would be, in our own time, the parallel notion that we are born with fully equipped, pre-programmed minds whose development is not in some way dependent on the environment.[226] Locke's epistemological solutions, some of whose implications we shall return to later on, posited our capacity for knowledge as intrinsically limited; but there was little room within these solutions for a precise account of our perceptual and cognitive structures.

To accept that the deaf could learn how to speak was not necessarily to hold a theory about the linguistic faculty. If, nevertheless, one were to explain how it was that words could be physically reconstructed, with the help of a teacher but without

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[222] Locke, *Essay*, III.ii.1. For an analysis of Locke's point here and in the subsequent passage, see Frank Jackson, 'Learning from Locke on Voluntary Signs', the transcript of a *Talk at the Moral Sciences Club*, Cambridge, 1998, at http://philrsss.anu.edu.au/people/people-defaults/fcj/learn.html.

[223] Locke, *Essay*, II.xix.1. He went on: 'Thus the Perception, which actually accompanies, and is annexed to any impression on the Body, made by an external Object, being distinct from all other Modifications of *thinking*, furnishes the mind with a distinct *Idea*, which we call Sensation; which is, as it were, the actual entrance of any *Idea* into the Understanding by the Senses.'

[224] Locke was the first to try to recognise consciousness as a phenomenon that could be discussed and described, primarily in terms of personal identity: '*Self* is that conscious thinking thing, (whatever Substance, made up of whether Spiritual, or Material, Simple, or Compounded, it matters not) which is sensible, or conscious of Pleasure and Pain, capable of Happiness or Misery, and so is concern'd for it *self*, as far as that consciousness extends.' *Essay*, II.xxvii.17.

[225] The literature on this is enormous, but see the excellent introduction by David Wooton to his edition of Locke's *Political Writings* (London, 1993), pp. 7-122, and the extensive bibliography there.

[226] See, e.g., D. F. Armstrong, W. C. Stokoe, S. E. Wilcox, *Gesture and the Nature of Language* (Cambridge, 1995), for an account of equivalent, present-day debates about the neurophysiology of language.

having been perceived by any senses, this very aspect of the linguistic faculty begged the question of its theoretical underpinning. What the theory would be *of* was unclear, since it needed not just to prove *that*, but to explain *how* a deaf person could be taught how to speak. A Platonist, 'nativist' doctrine of knowledge might serve as a general theory of human nature, one which ran counter to Locke's. Such a doctrine, however, jarred with the Baconian programme of enquiry since there was no available way of formalising the process and methods of its empirical investigation. Visual evidence offered by dissection had been the subject of speculative study since Vesalius;[227] but these explorations of lifeless flesh could only make it possible to view parts of functional systems, natural processes and physical mechanisms:[228] not provide an overall conception of the mode in which higher faculties depended upon the physical organism. Conclusions about the order of explanation - about what would have counted as a valid fact about cognition generally - and about the nature of the explanandum - here, the role of senses in the operations of human cognition - were related, but the mode of their causal implication was not determined by evidence.[229]

Within the accounts described here, organs of sense were always acknowledged as necessary for cognition. The elaborate linguistic function at the heart of our mental activity clearly manifested itself through physical signs and gestures as well as through the capacity to conceptualize, or the evolved tendency to do so.[230] But these accounts did not have the explanatory yield to fill in the gap

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[227] See, e.g., Frederick J.Cole, *A History of Comparative Anatomy*, (London, 1944) and more recently: Martin Kemp, '"The Mark of Truth": Looking and Learning in Some Anatomical Illustrations from the Renaissance and Eighteenth Century', in William F. Bynum and Roy Porter, ed., *Medicine and the Five Senses* (Cambridge, 1993), pp. 85-121; Nancy G. Siraisi, 'Vesalius and Human Diversity in *De humani corporis fabrica*', *Journal of the Warburg and Courtauld Institutes*, 57, 1994, pp. 60-88; Andrea Carlino, *La fabbrica del corpo: Libri e dissezione nel Rinascimento* (Turin, 1994).

[228] Jonathan Sawday suggests in *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture* (London and New York, 1995), pp. 2-3, that 'dissection is an insistence on the partition of something (or someone) which (or who) hitherto possessed their own unique organic integrity', and that to use 'the devices of *Anatomia* involved a confrontation between an abstract idea of knowledge, and the material reality of a corpse. And such a confrontation encountered one of the oldest taboos known within human culture. It meant violating that special domain which belongs to the dead.'

[229] See Dear, *Discipline*, pp. 154-156, for an exposition of the same point. Dear refers, p. 253, to Robert Boyle's 'illustration of the cultural relativity of clockwork' through the story of a clock presented to the emperor of China and at p. 153, n. 8, to 'the story in the Port Royal *Logique* about the Chinese attribution of a "sonorific virtue" to a clock to explain its ticking'.

[230] The notion of an evolved tendency was described, e.g., by Kenelm Digby, who, in his popular pamphlet on the powder of sympathy, referred to a question he attributed to Plutarch, of whether horses run fast because the fastest horse escapes from the wolf at his heels. See *A Discourse made in a*

between the understanding of the human organism as its own end, autonomous from God, and the picture of man as a creature of God. This might explain why natural theology tended to be well served by natural philosophy without any sense that the latter's chief role might be anything other than to celebrate God's creation, as attested for example by the popularity of the naturalist John Ray's *The Wisdom of God*,[231] or by the Anglican clergyman and physician William Derham (1657-1735), in the sermons he preached in London as the Boyle Lectures in 1711 and 1712.[232] (We shall return in Part II to the importance of teleology in the determination of the metaphysical uses to which could be put the empirical study of organic life.) Concepts which accounted for the ontological and epistemic gap between objects in the human mind and objects in the physical world did not reduce the gap's scientific unintelligibility; in effect, the very possibility of modern, Baconian science depended on this gap, 'so differing an harmony there is between the spirit of Man and the spirit of Nature', as Bacon himself put it.[233] Questions about the nature of sense-perception, when illustrated by cases in which certain modes of perception were altered or, as with deafness, non-existent, remained interrogations about the mind's autonomy from the physical world and from the body. Dualism, in the form of the doctrine set out by Descartes, was one response to these interrogations; but debates concerning it were characteristically theoretical, theological and ideological. The gap at the center of dualism was a condition, rather than a matter for empirical investigation.

The relationship between the formation of new tools for the observation of the world and the use of older conceptions of the mind was thus complex and often uneasy. The assumption that language was the manifestation of thought-processes was common-sensical enough to recur throughout the history of speculations about language. As we shall see now, the view that higher-order, verbal thought was *a priori* a property of human nature was popular across the Channel among Cartesian

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Solemne Assembly of Noble and Learned Men at Montpellier in France, by Sir Kenelme Digby, Knight &c., Touching the cure of wounds by the powder of sympathy. With Instructions how to make the said Powder, whereby many other Secrets of Nature are unfolded, 2nd edition (London, 1658), pp. 2-3.

[231] See above, p. 38.

[232] These were collected as *Physico-Theology: Or, A Demonstration of the Being and Attributes of God, from his Works of Creation* (London, 1713). Derham also edited works of John Ray and Robert Hooke's *Philosophical Experiments* (London, 1726).

[233] Bacon, *Advancement*, XIV, 9, p. 133.

property dualists, who advanced it in order to enforce their picture of the mind-body relation.

In 1684, Bishop Bossuet's pious friend and protégé François de Salignac de la Mothe Fénelon (1651-1715) wrote - a few years before being named tutor to the Grand Dauphin, son of Louis XIV, and at the instigation of the abbé Claude Fleury[234] - a treatise on the education of girls, *De l'éducation des filles*.[235] The text gives general, commen-sense advice on how to bring up children, regardless of gender and has not aged much. But it also represents a compromise between the progressive wishes of educated women at the time[236] and conservative views regarding what was commonly seen as their natural weakness, on account of which their educational requirements could not equal those of boys. Girls, said Fénelon, could turn idle if given too much licence in their youth; and with time on their hands they might become the bathetic victims of their own inappropriate curiosity, like the 'précieuses'.[237] Here is how he thought one should attend to the need to teach children - and girls in particular, naturally inclined as they were, he wrote, to focus on their bodies - that 'our soul is more precious than our body', indeed that the two were 'distinct':

> Ask a child who is already able to use reason: is it your soul that eats? If he gives the wrong answer, do not scold him; but tell him gently that the soul does not eat. The body, you will tell him, is what eats; it is the body which is similar to beasts. Do beasts have a mind? Are they knowledgeable? *No*, the child will reply. But, you will go on, they eat, although they have no soul. Thus you see that the mind does not eat; it is the body which takes in meat to nourish itself; it is the body which walks and sleeps. And what does the soul do? It reasons, it engages with the world; it likes some things and has an aversion to others.[238]

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[234] See René and Suzanne Pillorget, *France Baroque, France Classique, 1589-1715*, II: *Dictionnaire* (Paris, 1995), entry 'Fénelon', pp. 401-406, at p. 401.

[235] Fénelon, *De l'éducation des filles* (Paris, 1684; here, Lyon, 1804).

[236] For a contextualized evaluation of egalitarian, 'feminist' thought in Cartesian circles through the case of Poulain de la Barre, see Siep Stuurman, 'Social Cartesianism: François Poulain de la Barre and the Origins of the Enlightenment', *Journal of the History of Ideas*, 58, 1997, pp. 617-640.

[237] Ibid., p. 2. In his *Panégyriqe de Sainte Catherine* (Paris, 1660), Bossuet (1627-1704) wrote that women should avoid acquiring solid scientific knowledge not because it was beyond their means, but because doing so would be 'une épreuve trop dangereuse pour leur humilité'. See *L'éducation des filles* in Fénelon, *Œuvres*, ed. Jacques Le Brun (Paris, 1983), I, p. 1271, n. 5.

[238] Fénelon, *De l'éducation*, p. 98: 'Dites donc à un enfant en qui la raison agit déjà: Est-ce votre ame qui mange? S'il répond mal, ne le grondez point; mais dites-lui doucement que l'ame ne mange pas. C'est le corps, direz-vous, qui mange; c'est le corps qui est semblable aux bêtes. Les bêtes ont-elles de l'esprit? sont-elles savantes? *Non*, répondra l'enfant. Mais elles mangent, continuerez-vous, quoiqu'elles n'aient pas d'esprit. Vous voyez donc bien que ce n'est pas l'esprit qui mange; c'est le corps qui prend les viandes pour se nourrir; c'est lui qui marche, c'est lui qui dort. Et l'ame, que fait-

Put like this, it made sense to posit the duality of mind and body.[239] A child might easily have been convinced that a physical body did not exist in the same mode as that which the adult called the soul - or Cartesian mind - and that the body's needs differed in kind, and qualitative degree, from the soul's non-physical ones. It was simple enough, in this way, to match a hierarchy of functions to their division, and a dualist ethics to a dualist ontology. But there were difficulties inherent in assuming this simplistic mind-body dualism, because the senses were necessary for perception, and something in the human organism must have been going on for sense perception to be associated with the creation and rational use of sense-data. Speculation about visual and sound recognition was concerned with operations of sense-perception. Whatever belief one held about the specific nature of the correlation between mind and body, they were one aspect of the study of the perceptual and, inevitably, mental life of sentient creatures.[240] The problems of accounting for these realities within the dualist postulate and orthodoxy were at the core of the theoretical debates accompanying the absorption of the Cartesian doctrine.[241]

Fénelon emphasized that the high receptivity of small children, not really explainable except by the softness of their brain, indicated that early childhood was the period 'at which the deepest impressions will take be effected', and 'therefore is of significance to all the rest of life' (it was for this reason that he considered it a

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elle? Elle raisonne, elle connoît tout le monde; elle aime certaines choses; il y en a d'autres qu'elle regarde avec aversion.'

[239] As Catherine Wilson points out in *The Invisible World*, p. 25, the notion that children could not understand the rules of grammar before they were able to "comprehend particulars" - quoting Charles Hoole, who first translated Comenius into English - 'eventually reached Locke, who would turn a normative program for the education of children into a genetic account of the origins of knowledge'. Something similar, I suggest, is happening here. See Locke, *Some Thoughts Concerning Education* (London, 1693), § 188 and the point that children received 'little advantage' from learning rhetoric and logic, since 'Right reasoning is founded on something else than the predicaments and predictables, and does not consist in talking in mode and figure itself'. Moreover, he went on, § 189, the art of disputation would breed 'instead of an able man', 'an insignificant wrangler, opinionator in discourse', for 'Truth is to be found and supported by a mature and due consideration of things themselves, and not by artificial terms and ways of arguing'.

[240] See Pastore, *Selective History*, pp .19, 30-32.

[241] On the history of reactions to Cartesianism see, e.g., Albert G. A. Balz, *Cartesian Studies* (New York, 1951) and the useful collection by Vere Chappell, ed., *Essays on Early Modern Philosophers: Cartesian Philosophers* (New York, 1992). See also John Sutton, *Philosophy and Memory Traces: Descartes to Connectionism* (Cambridge, 1998), esp. chs. 5-9

great mistake to entrust young children to governesses).[242] A child's brain was 'like a lit candle in a windy place. Its light flutters constantly.'[243] Children's learning capacities at that point were great, since they were about to acquire language and would do so better than a scholar would ever master a dead language over which he had sweated for years. But, he asked:

> what is it to learn a language? It is not merely to consign to memory a great number of words; it is also, as Augustine said, to look out for the meaning of each of these words. In the midst of his cries and games, the child, he says, notices the object of which each word is the sign; he does so at times by watching the natural movements of the bodies that touch them, or that point to the objects referred to; at other times by noticing the frequent repetition of one word to refer to the same object. It is true that the temperament of a child's brain allows for the admirable ease of impression of all these images. Nevertheless, much attention is needed to discern them and to attach each of them to its object.[244]

According to Fénelon, language acquisition began before words were actually identified by the child: emotions were present from the very beginning of life, and so signalled the propensity to learn language insofar as they were one mode of relation with objects in the world. If Fénelon did not actually say this, it was mainly because his concern was to give parents and educators a practical treatise about child-care. Moreover, his point was that children's moral education began early, whether or not, presumably, they were able to understand the meaning of a word like 'soul', and as long as they could identify the word 'doll' with the object it denoted. The assumption here seems to be that cognition was not buried solely within the linguistic faculty, since emotions were one form of cognition. Again he referred to Augustine, who once saw 'a jealous child; he could not yet speak, and already he stared, pale-faced

[242] Fénelon, *De l'éducation*, ed. 1804, p. 15: 'ce premier âge qu'on abandonne souvent à des femmes indiscrètes et souvent déréglées, est pourtant celui où se feront les impressions les plus profondes, et qui par conséquent a un grand rapport à tout le reste de la vie'.

[243] Ibid., p. 36 : 'Le cerveau des enfans est comme une bougie allumée dans un lieu exposé au vent. Sa lumiere vacille toujours.'

[244] Ibid., pp. 15-16: 'qu'est-ce qu'apprendre une langue? Ce n'est pas seulement mettre dans sa mémoire un grand nombre de mots; c'est encore, dit S. Augustin, observer le sens de chacun de ces mots en particulier. L'enfant, dit-il, parmi ses cris et ses jeux, remarque de quel objet chaque parole est le signe; il le fait tantôt en considérant les mouvemens naturels des corps qui les touchent, ou qui montrent les objets dont on parle; tantôt étant frappé par la fréquente répétition du même mot pour signifier le même objet. Il est vrai que le tempérament du cerveau des enfans leur donne une admirable facilité pour l'impression de toutes ces images. Mais quelle attention d'esprit ne faut-il pas pour les discerner, et pour les attacher chacune à son objet?' See Augustine, *Confessions*, I.8.

and with a gaze full of anger, at the child that was nursing with him'.[245] This meant, according to Fénelon, that one could assume 'children know more than one usually imagines'[246] and would understand, before their linguistic faculty was actually formed, whatever one signalled to them with words and gestures.

Most parents would have no trouble recognizing the truth of this. But it was less evident to find theories capable of sustaining a satisfactory explanation of *what* language acquisition was, and of what, more generally, our capacity to conceptualize amounted to. The question remained: what turned our inner mental discourse[247] into information about the concrete world? That humans alone were endowed with this capacity was not necessarily a given either: as we shall see, it was possible to hold that animals might equally be endowed with information processing abilities, given that they too had senses and a nervous system, and had to function in the world. We have seen earlier the problems which emerged when it was claimed that such abilities could exist only if they were made manifest through verbal expression.[248] For late Cartesian dualists such as Fénelon, the preservation of the specialness of humans, created in the image of God, was at stake here. It was clear to all that animals saw, smelled and heard. To most, except for the radical exponents of the new mechanist orthodoxy (we shall turn to them in the next chapter), animals had sensations and emotions, too, and seemed in some way or other to be able to communicate. But this did not signify that human cognitive capacities were similar to those of animals.

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[245] Ibid., p. 17 : 'un enfant jaloux; il ne savoit pas encore parler, et déjà, avec un visage pâle et des yeux irrités, il regardoit l'enfant qui tettoit avec lui'. See Augustine, *Confessions*, I.7.

[246] Ibid.: 'les enfans connoissent … plus qu'on ne s'imagine d'ordinaire'.

[247] The distinction between a 'language of thought', in the sense coined by Jerry Fodor in *Language of Thought* (Cambridge, Mass., 1975), and grammatical language is of course not new and goes back to Plato. In *Leviathan*, towards the beginning of I.3, Hobbes explicitly differentiated a 'mental discourse', which he assumed animals possessed as well as humans, from the 'discourse in words' established by humans themselves. He made a congruent point in *De homine* (1658), X.2: *Traité de l'homme*, ed. Paul-Marie Maurin. (Paris, 1974), p. 144: Adam *chose* to taste the tree of knowledge before there was any language in which God's entreaty could be expressed. For the current debate on the 'Language of Thought Hypothesis', see the entry in the online *Stanford Encyclopedia of Philosophy*, at http://plato.stanford.edu/entries/language-thought/.

[248] Present-day experiments aimed at demonstrating 'animal intelligence' take as one index the capacity for verbal comprehension and for the use of words as referents. Such experiments, however, require one to accept that, whatever sense one can make of the ability of chimps or parrots to learn human language, our interpretation of what is presupposed by their ability to do so might not tell a significant story in the absence of a preconceived theory about the nature of our own, human linguistic ability. More was advanced, but less presupposed, by Fénelon and his contemporaries. On animal thought, see especially Marc Hauser, *Wild Minds: What Animals Really Think* (London and New York, 2000) and also John Brockman, 'Animal Minds: A Talk with Mark D. Hauser', in 'The Third Culture' forum of the Internet site *Edge*: 54, April 18, 1999: http://www.edge.org/documents/archive/edge54.htm, especially p. 11.

According to the dualist view, one vital reason for this difference was that, however much these capacities were embedded in bodily life, one could account for them solely within the framework of the Cartesian system and its variants. Given the obligatory conceit of our possession of a rational soul, the issue of determining who or what was able to form ideas and concepts was determined by the question of the origin of this capacity its and mode of acquisition. This question, in turn, was ideologically loaded.

The separate status of our immaterial, rational soul allowed the physical world and its knowability to be defined in terms of the human capacity for accurate perception and conscious thought, on the one hand, and provided the theoretical justification for doing so, on the other. This is why, as I have suggested earlier on, Locke's focus on the *consequences* for human knowledge of the need for sense-perception differed so much from the Cartesian focus on the actual mechanisms of sense-perception and language use. Moreover, speculations about cognitive functions seem to have been independent of the ordinary observation of ordinary emotions. So, for Fénelon, children had an emotional life before they were able to talk about it; and for everyone on either side of the animal soul debate, animals did at least manifest emotions and behave in such a way that one was able, perhaps compelled to ascribe emotional states to them. Certain forms of behaviour were recognized as bearing an emotional content or meaning and it was assumed that they could be interpreted as immediate responses to events and objects in the environment.

Gérauld de Cordemoy (1628?-1684),[249] a celebrated lawyer and Cartesian thinker, expressed opinions similar to those of Fénelon with regard to a child's acquisition of language, in his 1668 treatise on language, the *Discours physique de la parole* (which he dedicated to Louis XIV). Children came into the world, he wrote, equipped solely with

[249] Cordemoy was another friend of Bossuet and from 1673 a 'lecteur ordinaire' to the Dauphin; he was elected to the Académie française in 1675. He was an esteemed member of the Cartesian circles fashionable in Paris in the 1660s, around Mme de Bonnevaux, Henry Louis Habert de Montmort, Jacques Rohault, Guillaume de Lamoignon, the abbé Bourdelot, and Lefèvre d'Ormesson. For a full account of Cordemoy's life, see the 'Introduction' to Gérauld de Cordemoy, *Oeuvres philosophiques, avec une étude bio-bibliographique* (Paris, 1968), ed. Pierre Clair and François Girbal. Issues of the (weekly, later bi-weekly) *Journal des sçavans* consitute a valuable source of information on Parisian scientific activity. On the role of journals, academies and correspondences in the early modern and Enlightenment scholarly community, see Anne Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680-1750* (New Haven and London, 1995).

> what nature gives to all humanity in order to express pain, joy, or the other passions, but that is sufficient. If they live, they are able to study their nanny's face so well that she can make them cry or laugh simply by looking at them. Thus, they easily get to know the passions of those who have contact with them, through the external movements which are their natural signs.[250]

Emotions, here again, were a form of cognition, and a form of judgement, evaluation or thought. But, he went on to say, children 'take a bit longer to decipher the signs that men have instituted to signify things'.[251] And signs, here again, were not natural: they were a code, instituted by humans for the communication of information and therefore had to be learned. It was precisely such a code that the deaf, according to the Royal Society group discussed earlier, were able to learn, though how it was that it could be acquired at all, even without the early exposure of 'soft brains' described by Fénelon, was not easy to explain. Indeed, insofar as learning a language amounted to acquiring knowledge of an arbitrary set of grammatical rules, it was not clear how language came to signify at all; nor was it clear how, if these rules really were instituted by man, a word could come to mean anything true about the real world and designate real objects. It seemed that, just as naming an object must go hand in hand with identifying its function - or its essence - so it was via the processing of sense-data that we could have any acquaintance with the world. Inversely, it could also be, as Locke would write (in relation to Molyneux's question), that we could only consciously recognize objects we perceived by having an idea of them in our minds which had been acquired through our senses.[252] We shall shortly see how, in Cordemoy's dualist scheme, using language was, in a rather convoluted way, akin to perceiving. As would be the case for Locke, it involved the conceptualization of data; and the relation between word and thing was equivalent to that between idea and thing: to speak, he said, was 'donner des signes de sa pensée'.[253] For both Cordemoy and Locke, language was unquestionably a coherent system because, quite simply, it

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[250] Cordemoy, *Discours physique de la parole*, in *Oeuvres*, p. 213: 'ce que la nature donne à tous les hommes, pour exprimer la douleur, la joye, ou les autres passions, cependant cela leur suffit. Et, pour peu qu'ils ayent vécu, ils étudient si bien le visage de leur nourrice, qu'elle peut les faire pleurer ou rire, à les regarder seulement. Ainsi ils connoissent aisément les passions de ceux qui les approchent, par les mouvemens exterieurs, qui en sont les signes naturels.'

[251] Ibid., p. 207 (Preface): 'Ils sont un peu plus longs à démêler les signes, que les hommes ont institué pour signifier les choses.' See also p. 21: 'on s'exprime par des choses exterieures et corporelles, ausquelles on fait signifier par institution ce que l'on pense; & c'est en general ce qu'on appelle *parler*'.

[252] Locke, *Essay*, II, ix, 1-10. See also I, ii-iv.

[253] Cordemoy, *Discours physique de la parole*, in *Oeuvres*, p. 206 ('Preface').

supposed and was built upon a constant correspondence between referent, sign and meaning.

Unlike Locke, however, Cordemoy had the intention of establishing that belief in the existence of such a correspondence entailed a commitment to dualism: by showing the first, one inevitably proved that the other was true. He followed Descartes in adopting a 'nativist' picture of the nature of thought and assumed, as in fact Locke also did, that mental discourse preceded verbal discourse, that thoughts preceded words, while words expressed thought. Cordemoy did not need a Lockean doctrine of ideas, however, and was content with the notion that, as Aristotle had put it: 'The things of the voice are symbols of the things of the mind, and the things of writing are symbols of the things of the voice.'[254] But Aristotle's subsequent claim that 'the states of mind … to which these signs refer are the same for everyone, as are the reflections of things which are the same for everyone' was exactly what a Cartesian rationalist might want to doubt hypothetically. And so, since language was the means through which one could 'know others, and be known by them',[255] studying how language functioned was, for Cordemoy, necessary to understanding the nature of communication. He thus began by asking how one could be sure that the language system worked and that the meaning attached to words by the listener or reader was identical to the meaning intended by the speaker or writer. His concern, announced at the beginning of the preface to the *Discours*, was in particular to show why, since the system did work - showing how it worked was not his intention - dualism was true. Speech must surely be the sign of the necessity that all bodies which were similar to mine were united to souls similar to mine, because it was both 'of the Soul' and 'of the Body'.[256]

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[254] Aristotle, *De interpretatione*, 16a3. Cited in K. O. Apel, 'The Transcendental Conception of Language: Communication and the Idea of a First Philosophy', in H. Parret, ed., *History of Linguistic Thought and Contemporary Linguistics* (Berlin and New York, 1976), p. 36. J. L. Ackrill's translation (Oxford, 1963) reads: 'Now spoken sounds are symbols of affections in the soul, and written marks symbols of spoken sounds. And just as written marks are not the same for all men, neither are spoken sounds. But what these are in the first place signs of - affections of the soul - are the same for all; and what these affections are likenesses of - actual things - are also the same.' Bacon, as we have seen earlier, p. 49, n. 44, cited the same Aristotelian passage for this fairly straightforward notion. Cordemoy does not seem to have been referring explicitly to Aristotle but the analogy is evident enough.

[255] Cordemoy, *Discours*, in *Œuvres*, p. 193 (dedication 'Au Roy'): 'je traite … du moyen de connoître les autres, & d'en être connu'.

[256] Ibid., p. 196: 'je fais en ce Discours un discernement exact de tout ce qu'elle [la Parole] tient de l'Ame, & de tout ce qu'elle emprunte du Corps'.

The problem of knowing 'other minds' was here posited as a hypothetical one. Cordemoy used it to undermine its own foundations as a problem, just as Dalgarno and his colleagues were able to eliminate the need to posit it by presenting their project in a positivistic fashion. So, Cordemoy started off his argument by assuming that physical expression alone could not be *meaningful* if not accompanied by parallel movements in the brain. He supposed at first that there were no grounds for him to believe that other people were like himself, that they thought and had a soul like his own.[257] The parrot analogy made an appearance, as it did in Holder[258] and in Locke,[259] to help make the point that while non-rational creatures such as parrots could emit intelligible, seemingly intelligent sounds - just as mechanical contrivances were capable of doing[260] - they were themselves unable to generate unconditioned linguistic constructs. Words, as Descartes himself had pointed out, were related to passions only in humans.[261] The words of parrots were devoid of content. The sounds they made certainly did not signal the existence of a thinking mind and could just as well be echoes resounding off rocks. It was the mind, not the disposition of organs, that determined the capacity to speak.[262] Neither parrots nor the other beings observed by the skeptic spoke meaningfully, whereas the creator of this thought-experiment clearly did.[263] In other words, one could not take for granted the correspondence between external appearance and internal nature.[264] But Cordemoy,

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[257] Cordemoy, *Discours*, p. 196 : 'comme si je n'avois encore jamais été assûré qu'il y eût d'autres hommes que moy, je m'arrête d'abord à considérer s'il est necessaire que tous les corps, que je vois semblables au mien, soient unis à des âmes comme la mienne'. See also pp. 206-209.

[258] See the quotation from Holder's *Elements* above, p. 46.

[259] Locke, *Essay*, III.i.1-2. For an analysis of ancient conceptions of animal communication, see D. K. Glidden, 'Parrots, Pyrrhonists and Native Speakers', in S. Everson, ed., *Companions to Ancient Thought*, 3*: Language* (Cambridge, 1994), pp. 129-148. See also Elisabeth de Fontenay, *Le silence des bêtes. La philosophie à l'épreuve de l'animalité* (Paris, 1998).

[260] Cordemoy, *Discours*, in *Œuvres*, p. 206.

[261] See Descartes, letter 'Au Marquis de Newcastle', 23 November 1646 in Descartes, *Œuvres*, ed. Alquié, p. 694.

[262] See Cordemoy, *Discours*, in *Œuvres*, pp. 331-332, n. 8, the reference Clair and Girbal make to a passage by Claude Perrault in *Histoire de l'Académie des Sciences* (Paris, 1674), p. 179: 'la plupart des Philosophes ont tort de supposer trop généralement, que les Animaux exercent leurs actions, parce qu'ils ont les organes qui y sont propres. Il ne tient pas aux organes que les singes n'articulent des sons, il tient à ce qu'ils n'ont pas assez d'esprit'.

[263] *Discours*, in *Œuvres*, p.196 ('Preface'): 'après avoir trouvé dans le seul arrangement de certaines parties du corps dequoy rendre raison du bruit, des sons, de la difference des voix, et même des mots, que profèrent les échos & les perroquets, je suis enfin obligé d'admettre des ames dans tous les corps, qui ressemblent au mien, & de reconnoître qu'il n'est pas possible qu'ils parlent si à propos, sans avoir de la raison.'

[264] Ibid., p. 206 : 'je veux continuer la recherche, dont j'ay besoin pour connoître l'interieur de ceux qui me ressemblent si parfaitement au dehors …; si les corps, qui sont semblables au mien, n'avoient

the observer, noted that since people's external gestures and words - the signs of objects of thought - seemed to relate to his own objects of thought, since he seemed to interpret these signs of intentions and perceptions in a coherent, accurate fashion, then language, expressed through these conventional signs learned in infancy, must be accompanied by movements in the brain.

Language thus consisted both of sounds - mechanically transmitted, in man as in beast, through the air into the ear and from there, via the nerves, into the brain[265] - and of referents, perceived and understood by the mind. It was for this reason that, for Cordemoy, we must be composed of two separate substances, an extended one and a thinking one: 'nothing is less like our thoughts than that which enables us to explain them'.[266] As with Descartes, this difference between word and thought, physical sound and silent mental event, manifested at once the difference 'between our body and our soul' and 'the secret of their union'.[267] It was because we understood other people's facial expressions, and because the communication of their thoughts to us provoked thoughts in our own mind, that these facial expressions corresponded to real states of mind,[268] these words to real thoughts, and that gestures and words were the manifestation of the union of body and soul. Since words could only signify anything if they corresponded to mental events or movements in the brain - and thoughts were themselves mental events - meaningful signs must be the translation of thoughts, the perception of which triggered in us similar movements in the brain that we freely willed to follow or not.[269] Our minds were not determined by our bodies; but since we were dual creatures, physical events and mental events were bound to one another. We could speak unprompted, or we could choose to remain silent; and this freedom of our will was a function of mind-body duality.

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que la facilité de prononcer des paroles, je ne devrais pas croire pour cela qu'ils eussent l'avantage d'être unis à des ames.'

[265] Ibid., pp. 223-233. According to Cordemoy, the acoustic processes which allowed animals to hear each other were identical to those in humans insofar as speech was also a purely physical activity which did not on its own, or *a priori*, entail a soul.

[266] Ibid., p. 209: 'il n'y rien de moins ressemblant à nos pensées, que tout ce qui nous sert à les expliquer'. Cordemoy posits an equivalence between the relation of word to thought and that of animal, machine or rock to man: see Philippe-Joseph Salazar, *Le culte de la voix au XVIIème siècle: Formes esthétiques de la parole à l'âge de l'imprimé* (Paris, 1995), p. 73; on Cordemoy, pp. 71-77.

[267] Ibid. , p. 210: 'cette extréme diference qu'il y a entre ces signes & nos pensées, en nous marquant celle qui est entre nôtre corps & nôtre ame, nous donne en même temps à connoître tout le secret de leur union'.

[268] Ibid., p. 208.

[269] Ibid., p. 233.

As a response to the 'other minds' enigma, the argument made a circular loop.[270] But its real point resided in the logical twists Cordemoy somewhat earnestly gave to this loop. The first twist was the use of the fear of mental solipsism to establish mutual legibility as the foundation-stone for a dualist metaphysics: it was the very opacity of communication, coupled with the undeniable fact of its existence, that demonstrated our dual nature, where the duality was such that 'an agitation [*ébranlement*], being a movement, can only belong to our body, and perception, being a thought, can only belong to our soul'.[271] The second twist, which followed from the first one, consisted in the affirmation that the existence of language *proved* that one could plausibly *derive* the existence of mental events from the observation of physical ones. This was precisely what Cordemoy thought he might have reason to doubt in the first place; and no empirical proof was available other than the fact, self-evident to him, that for a machine to speak and gesture as we do would be quite impossible. It was this very incapacity of a machine to express itself as humans did, to fool the observer (its inability, one might say, to pass the Turing test),[272] that showed how the necessity of using signs to communicate our thoughts derived from the divinely managed mind-body relationship.[273] According to Cordemoy's extreme dualist position, our bodies were the producers of a language whose syntax was scripted by our minds and whose narrative was made up of the referents of thought; the whole was magisterially directed by God. What Cordemoy assumed, it appears,

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[270] See Noam Chomsky's suggestive talk, published, along with the ensuing discussion, as *Language and Thought* (Wakefield and London, 1993), p. 37, in which he briefly refers to this test, devised by Cordemoy (and other Cartesians, as well as Descartes himself) for 'determining whether another object has a mind like ours', as 'normal, garden variety science, like developing a litmus test for acidity: the task is to determine whether one of the real components of the world is present in a certain case - acidity, or a mind'.

[271] Cordemoy, *Discours*, in *Œuvres*, pp. 233-234: 'Pour la perception, que nous avons à l'occasion de l'ébranlement que la voix cause dans les nerfs de l'oreille, bien qu'elle soit un peu plus difficile à distinguer de cet ébranlement, parce qu'elle l'accompagne toûjours, il est aisé toutefois, à qui s'est un peu accoûtumé à juger des effets par leurs causes, de reconnoître que l'ébranlement étant un mouvement, ne peut appartenir qu'à nôtre corps, que la perception étant une pensée, ne peut appartenir qu'à nôtre ame.'

[272] Chomsky, *Language and Thought*, pp. 37-40, also points to the possibility of comparing the 'Cartesian tests for the existence of other minds with the current reliance on the 1950 'Turing test' to determine "empirically" whether a machine can carry out some intelligent act (say, play chess).' But he then suggests, rather provocatively, that 'it is fair to speak of a conceptual regression since the cognitive revolution of the 17th century, a change from reasonable (though incorrect) science to an approach that is foreign to the methods or concerns of the sciences'. He goes on to argue that one should not submit the study of the mind to a rigidly defined field and set of methods.

[273] Cordemoy, *Discours*, in *Œuvres*, p. 210: ' Au reste, il est évident que c'est de ce raport si necessaire, que l'Auteur de la nature entretient entre le corps & l'ame, qu'est venüe la necessité de faire des signes pour communiquer ses pensées.'

was that our thoughts were simply mental, in the sense that perception, rather than being locked in a causal relationship with them, was merely the corporeal occasion of their formation. To him, this meant that our bodies, *on account of* which movements and signs were necessary for the communication of our minds' contents, were themselves impediments to communication. The movements of our brains were entirely unlike the thoughts that they accompanied. So, on the atomist notion that like was drawn to like, there was no good reason, other than the existence of the body, for thoughts to *need* these movements, since they would rather have the company of other thoughts.[274]

It was thus possible to posit that we might exist without our body: its ontology was not dependent on any metaphysical requirements. Indeed, as pure minds we would be at leisure, if we so desired, to communicate with other minds embodied or not - and rather better than we did as embodied creatures - just as it was possible for minds still united with bodies to communicate, voicelessly, with disembodied minds.[275] Signs were only necessary because we existed as embodied creatures; they were approximate translations of thoughts. Words were not necessary for communication other than as imperfect remedies to the rocky marriage of mind to body, the smooth running of which was overseen by God. The notion that mind-events and physical events kept each other constant company, in a 'necessary correspondence',[276] was one way of explaining how we could function as a unit while having a dual nature;[277] but it was God that ensured the unit's harmony.[278] Descartes had located the soul in the pineal gland,[279] assigning to it a physical place inside the

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[274] Ibid., p. 249.

[275] Ibid., pp. 250-253. See also the 'Preface', p. 199: 'nos esprits mêmes auroient entr'eux une communication plus aisée, si l'étroite union qu'ils ont avec le corps, ne les obligeoit indispensablement à se servir de signes' and 'la peine, que nous avons dans les entretiens, n'est pas de concevoir la pensée de ceux qui nous parlent, mais de le démêler des signes, dont ils se servent pour l'exprimer, qui souvent ne luy conviennent pas. D'où je conclus que la pensée d'un esprit est toûjours claire à l'autre, dés qu'il la peut appercevoir.'

[276] Ibid., p. 238: 'c'est cette correspondence necessaire, par laquelle certaines sensations naissent toûjours en l'ame, dés que certains mouvemens sont excitez dans le cerveau, comme des mouvemens sont excitez dans le corps, dés que l'ame en a la volonté'.

[277] For an insightful analysis of the place of Cordemoy's thought on language in his metaphysics, see the essay by Balz, *Cartesian Studies*, pp. 3-27: 'Geraud de Cordemoy 1600-1684'.

[278] See Watson, *Downfall*, p. 2: 'How can mind know matter? The two major answers offered by the Cartesians are developed from either the denial of the likeness principles or the alteration of the ontological framework. Neither of these answers is intelligible within the Cartesian context. Ultimately, the Cartesians appealed to God to support the Cartesian machine.'

[279] It is now believed to secrete melatonin, the hormone that participates in the regulation of sleep patterns and the response to light. For further references to its functions, see, e.g., Sutton, *Philosophy and Memory*, p. 66, n. 14.

very body from which he had first expelled it. Cordemoy, by contrast, left the need for a physically plausible theory entirely out of the problem of mind-body interaction, which he preferred to consider resolvable by appeal to a version of what was eventually named 'occasionalism'. This was a solution that Nicolas Malebranche (1638-1715) would later develop, according to which the apparent interaction of mind and body was in fact the manifestation of a concurrence of events caused by God, rather than by the causal interdependence of mind and body that one instinctively interpreted it to be.[280]

It appears that language, for Cordemoy, rather than simply manifesting mental activity, stood as a reminder of our embodied nature; and it is perhaps ironic that in writing a treatise on language he ended up demonstrating the theoretical possibility of extra-sensory perception - one section is entitled: 'Que l'ame séparée du corps, pourroit plus aisément communiquer ses pensées à une autre'.[281] What matters to us here, however, is that, within this system, only the existence of the physical and biological processes of perception would have warranted an analysis of the relation of linguistic structure to thought.[282] Cordemoy included in his treatise - and there was nothing exceptional in doing so - a number of pages on the anatomy of the ear and the mechanics and ethology of speech, hearing, pronunciation, grammar, on the acquisition of language and on learning foreign languages. There was also a substantial section on the art of rhetoric, informed by traditional *loci* on the passions,

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[280] Cordemoy developed the notion that we might be mistaking occasion for cause in his *Six Discour*s *sur La distinction & l'union du corps & de l'ame*, first published in 1666. In 'L'occasionalisme d'Arnold Geulincx', in Chappell, ed., *Essays on Early Modern Philosopher*, p. 248, reprinted from *Archives de Philosophie* 37, 1973, pp. 77-105, G. Malbreil sees this as the first real flowering of the doctrine: 'Quant à la doctrine proprement dite, on le sait, elle éclate chez Cordemoy, qui est le premier à analyser le mouvement des corps.' Balz, in *Cartesian Studies*, p. 14, understands Cordemoy's solution as 'a first step towards Occasionalism' rather than as a fully fledged version of it, suggesting that what matters 'is not what his doctrine shall be called, but how it came about that this sort of answer was advanced at all.' He goes on, p. 16: 'There is an appearance of artificiality in all Occasionalism. Taking the antithesis of body and soul seriously, and combining with this all the evidence that indicates that man is one being, mind reaches an impasse. There is no way out save by invoking the Deity as the efficient cause of the union of body and soul (or of their apparent union)'. For an analysis of Malebranche's view of God's causal role and of how it was read by Arnauld and Leibniz, see Steven Nadler, 'Occasionalism and General Will in Malebranche', *Journal of the History of Philosophy*, 31, 1993, pp. 31-47.

[281] Cordemoy, *Discours*, in *Œuvres*, p. 29. Antoine Arnauld, in *La perpétuité de la foi* (Paris, 1674), p. 24, also suggested, according to Hans Aarsleff, 'that the necessity of using words to express our thoughts is a human deficiency that we would get along without if we had the choice, as after the Fall we do not': see Aarsleff, 'Descartes and Augustine on Genesis, language, and the angels', in Marcelo Dascal and Elhanan Yakira, ed., *Leibniz and Adam* (Tel Aviv, 1993), pp. 169-195, at p. 175.

[282] Aristotle, in *De anima*, II, 8, 420b, describes the human voice as an animal sound produced by the impact of air on the trachea along with an image. See Salazar, *Culte de la voix*, p. 31.

perhaps present, in part, on account of his professional activities as a lawyer, but explicitly because, as he wrote, the need for eloquence derived from 'the indispensable necessity we are in during our lifetime to express ourselves through spoken words',[283] and to make the very best of our imperfect tools of communication. Mainly, though, these sections illustrated a finalist belief that our bodies functioned as a result of God's design,[284] and the faculties with which we, along with animals, were equipped, were proof of its perfection. Animals heard sounds that entered their ears and travelled via the nerves to their brain, whose disturbance caused spirits to flow to their legs and induce action. This happened because of a

> necessary order in the mechanical arrangement of the entire body of each kind of animal, and even of every individual beast, which, as it belongs to one species, and so was formed for a particular purpose, possesses all that is required to execute what the Author of nature has intended it to perform in shaping it. Its brain is so well adjusted, according to its temperament, to everything that can help it survive that objects which can harm it will disturb its brain in such a way that it will always open up at those very places from which the spirits can flow into the muscles used to draw back from these objects.[285]

And inversely: the impact of useful objects on the brain provoked it to let spirits flow into the muscles that would enable the animal to approach these objects. Mechanical adaptation to nature was a product of God's work.[286] No aspect of nature's elaborate

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[283] Cordemoy, *Discours*, in *Œuvres*, p. 241: '*Les causes physiques de l'Eloquence*. Enfin cette necessité indispensable, où l'on est pendant la vie, de s'exprimer par les paroles, est cause que ceux qui ont naturellement le cerveau le mieux disposé en tout ce qui peut servir aux operations de l'ame, qui ont les impressions les plus vives de chaque chose, qui les sçavent le mieux disposer, & qui se sont accoûtumez à les exprimer par les mots les plus propres, sont toûjours ceux qui parlent avec le plus de facilité, le plus d'agrément, & le plus de succez. Tellement que, si l'on veut rechercher les causes physiques de l'Eloquence, on les trouvera toutes dans cette heureuse disposition du cerveau.' There is nothing original in the notion that it might be useful to invoke together the existence of language and the necessity of speech; but it is significant that it informs all major early modern arguments about language and the arbitrariness of reference.

[284] The status of final causes was an essential element in scientific, philosophical and theological debates at the time; I shall return to this point. For specific discussions, see Jacques Roger, *Les sciences de la vie dans la pensée française du XVIII*^{ème} *siècle* (Paris, 1971).

[285] Cordemoy, *Discours*, in *Œuvres*, pp. 223-224: 'Or, tout cela se fait par une suite necessaire de la disposition mécanique de tout le corps de chaque animal, & même de chaque bête, qui étant d'une certaine espece, c'est-a-dire, constituée pour une chose ou pour une autre, a justement tout ce qu'il faut pour effectuer ce que l'Auteur de la nature s'est proposé en la formant. Elle a le cerveau tellement ajusté, selon son tempérament, à tout ce qui la peut conserver, que si les objets, qui luy peuvent nuire, meuvent son cerveau, c'est toûjours d'une façon qui le fait ouvrir aux endroits, d'où les esprits peuvent couler dans les muscles qui servent à la reculer de ces objets'

[286] Ibid., p. 224: '& si les objets qui luy peuvent servir, meuvent son cerveau, c'est toûjours d'une façon qui le fait ouvrir aux endroits, d'où les esprits peuvent couler dans les muscles, qui servent à l'approcher de ces mêmes objets'.

engineering, it seemed, should really surprise the dualist, since the realm of matter obeyed the laws of physics, by means of which all physical behaviour could be understood. Mental events were a separate issue. In other words, on this picture, there was no mind-body problem.

What we started off with, then, no longer seems so straightforward: the view that language was the manifestation of higher mental life actually served to throw light on its boundaries, on its origins in our existence in nature as embodied creatures, whose minds must be connected, at most for the duration of terrestrial life, to bodies. The notion of language as partial and limited was equivalent to that of language as reflecting, and resulting from, our fallen and imperfect nature. But here there was no quest for a universal language, for the reestablishment of universality and transparency on earth. The very possibility of unity between sign and object was indeed of no relevance to understanding the physical world and our place within it. Cordemoy's starting-point had been instead to identify the difference between sign and signifier as a difference of substance - just as Descartes had done with the mind and the body - and likewise for the difference between the sound or letters of a word and the object denoted by that word. He further assumed, as Hobbes had also done,[287] that one could not attribute to products of the mind what belonged to physical objects. This might amount to the fallacy of assimilating predication to efficient cause; but it is of more interest and higher import to note that Descartes himself had made a similar point at the beginning of *Le monde ou Traité de la lumière*,[288] the first chapter of which is entitled 'De la différence qui est entre nos sentiments et les choses qui les produisent'.

There, Descartes had insisted that there need be no identity between an object and its sign, the object in this case being light, 'that is, what it is in a flame or in the sun that we call Light'.[289] Crucially, his goal in pointing this out was not solely the

[287] See above, pp. 50-51, n. 56. Hobbes asked what there was in common between voice (which is a sound) and animated being, which is a body.

[288] First published posthumously in Paris in 1664, but written as a companion treatise to *L'Homme*, which itself was first published at Leiden in 1662, in a Latin translation, and, again by Clerselier, in Paris, in the original French in 1664.

[289] Descartes, *Le monde ou Traité de la lumière*, in *Oeuvres*, ed. Alquié, I, p. 319: 'Me proposant de traiter ici de la lumière, la première chose dont je veux vous avertir est qu'il peut y avoir de la différence entre le sentiment que nous en avons, c'est-à-dire l'idée qui s'en forme par l'entremise de nos yeux, et ce qui en est dans les objets qui produit en nous ce sentiment, c'est-à-dire ce qui est dans la flamme ou dans le Soleil, qui s'appelle du nom de Lumière.'

methodological one of establishing viable grounds for doubting the reliability of perceptual experience in yielding the true nature of objects of sense;[290] nor was it at all to devise a positive theory of meaning.[291] His aim was to establish a proper realm for physics, one in which sensible qualities were the mark of subjective experience, and did not reside, as Aristotelians would have it, in the physical objects themselves. Positive description of light according to mechanical explanation resulted from the need, born of scepticism, to test how error-proof sense-experience could be. The trial was set up by assembling the conditions for an ultimately circular 'litmus-test', whose purpose was to reconstruct not the episteme or the observer's gaze but rather the world; it was later repeated by Cordemoy with a vengeance. The banal notion of the arbitrariness of reference was here enriched by the purpose to which Descartes put it. The trick was the identification of percepts with signs, and the description of the experience of percepts as resulting in sensation, 'sentiment': nature, Descartes wrote, has arranged for the sign that produces the 'sentiment' of light to signify light, just as it has established 'laughter and tears, to let us read joy and sadness on people's faces', and just as humans have instituted the meaning of words.[292] The signs were meaningful because our minds, which 'retain the meaning of these words and expressions, represent it to us' while we hear or see them.[293]

If, he continued, as the philosophers (that is, the scholastics) say, 'sound is nothing but a vibration of the air that hits our ears', the image of the object of hearing that should be brought to our minds is the vibrating air itself.[294] Since this was not the

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[290] Ibid., p. 315: 'Et toutefois je n'ai point apporté ces exemples pour vous faire croire absolument que cette lumière est autre dans les objets que dans nos yeux; mais seulement afin que vous vous en doutiez, et que, vous gardant d'être préoccupé du contraire, vous puissiez maintenent mieux examiner avec moi ce qui en est.'

[291] Hacking, in *Why does Language*, p. 23, shows how Hobbes, despite having a definite notion of language, '*did not have a theory of meaning*', (Hacking's italics) and that to grasp the specificity of the seventeenth-century debate, one should bear in mind how recent is the notion that theories of meaning can tell us something about the functioning of language. Precisely because thought and language were not construed as interdependent, the concept of meaning was not supervenient on the analysis of the linguistic function. See also Chomsky, *Language*, pp. 22 and 59 (the observation by Eric Wanner).

[292] Descartes, *Le monde*, in *Œuvres*, ed. Alquié, p. 316: 'Or, si des mots, qui ne signifient rien que par l'institution des hommes, suffisent pour nous faire concevoir des choses avec lesquelles ils n'ont aucune ressemblance, pourquoi la Nature ne pourra-t-elle pas aussi avoir le sentiment de la lumière, bien que ce signe n'ait rien en soi qui soit semblable à ce sentiment? Et n'est-ce pas ainsi qu'elle a établi les ris et les larmes, pour nous faire lire la joie et la tristesse sur le visage des hommes?'

[293] Ibid., pp. 316-317: 'c'est notre esprit qui, ayant retenu ce que signifient ces paroles et cette contenance, nous le représente en même temps'.

[294] Ibid., p. 317: 'Et la plupart des Philosophes assurent que le son n'est autre chose qu'un certain tremblement d'air, qui vient frapper nos oreilles, en sorte que, si le sens de l'ouie rapportait à notre

case, our experience of sensation was not identical with the encounter with the objects which caused it: we perceived effects, not causes. Sensible qualities told us nothing about the true fabric of the world, because sense-experience did not give us direct access to this fabric. Just as a child who was being stroked by a feather as he was falling asleep would not identify the tickle with its cause,[295] so the sensation of light did not reside in the objects from which it seemed to arise. In a sense, we lived in the dark until we realized this, and until we began to investigate what that fabric was really made of.[296] This tight argumentation can be contrasted with a statement by Robert Hooke (1635-1703), typical of the optimistic and forcefully empirical ethos of the Royal Society, that

> the best and utmost we can do towards the discovery of them [Causes, Principles, and Operations … far removed from the reach of our Senses], is only accurately to observe and examine all those Effects produced by them, which fall within the Power of our Senses, and comparing them with like Effects produced by Causes that fall within reach of our Senses … and so from Sensibles to argue the Similitude of the nature of Causes that are wholly insensible.[297]

The dualist stance established the necessity of dividing the set of objects to be studied into two realms, shading the illuminated realm of physics and physiology with the other, mysterious, immaterial one. Language, in this context, was a product of both realms. Descartes, by packing all perception into the semiological realm, assimilated words to sensations, to the experience of the touch of a feather. If it were

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pensée la vraie image de son objet, il faudrait, au lieu de nous faire concevoir le son, qu'il nous fît concevoir le mouvement des parties de l'air qui tremble pour lors contre nos oreilles. Mais, parce que tout le monde ne voudra peut-être pas croire ce que disent les Philosophes, j'apporterai encore un autre exemple.'

[295] Ibid., p. 318.

[296] For a discussion of the philosophical implications and impact of Descartes's theories of vision and depiction, see in particular John Hyman, *The Imitation of Nature* (Oxford, 1989).

[297] Robert Hooke, *Posthumous Works*, ed. Richard Waller (London, 1705), p. 165. Quoted by John Henry, 'Robert Hooke', in Michael Hunter and Simon Schaffer, ed., *Robert Hooke: New Studies*, pp. 149-180, at p. 163. Similarly, Hooke writes, at the very start of the Preface to his *Micrographia*: *Or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses. With Observations and enquiries thereupon* (London, 1665; reprinted New York, 1961), a1r: 'It is the great prerogative of Mankind above other Creatures, that we are not only able to *behold* the works of Nature, or barely to *sustein* our lives by them, but we have also the power of *considering, comparing, altering, assisting*, and *improving* them to various uses. And as this is the peculiar priviledge of humane Nature in general, so is it capable of being so far advanced by the helps of Art, and Experience, as to make some Men excel others in their Observations, and Deductions, almost as much as they do Beasts. By the additions of such *artificial Instruments* and *methods*, there may be, in some manner, a reparation made for the mischief, and imperfection, mankind has drawn upon it self … whereby every man, both

not for the fact that language was - as we saw at the beginning of this chapter - a system which we could use freely, unprompted, creatively, then words would be whistles, akin to echoes, merely vibrations of the air. But they were not. What, then, were whistles? Animals emitted sounds, and they behaved as though they too had sensations. At stake in the preservation of the Cartesian wedge between sensation and higher cognition was the place of self-conscious beings such as ourselves in the natural world. It is not one we have yet fully understood. But Descartes was the first to simplify it, by corralling animals away from the sight and emotional investment of human affairs. How he did this, and what subsequent arguments he made possible, is the subject of the following chapter.

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from a deriv'd corruption, innate and born with him, and from his breeding and converse with men, is very subject to slip into all sorts of errors.'

2. From other minds to animal bodies

> *We talk of man being the rational animal; and the traditional intellectualist philosophy has always made a great point of treating brutes as wholly irrational creatures. Nevertheless, it is by no means easy to decide just what is meant by reason, or how the peculiar thinking process called reasoning differs from other thought-sequences which may lead to similar results.*[298]

The definition of man as the 'rational animal', which William James alludes to in the quotation above, depends on an understanding of reason bequeathed to us by the Enlightenment, but which developed - from its classical roots - during the course of the seventeenth century and especially after Descartes,[299] into a new sense of the independence of human reason from 'nature'.[300] Broadly speaking, the belief in the capacity of focused deliberation to guide human knowledge grew into a conviction that such knowledge could guide behaviour and action towards what had rationally and correctly been determined as appropriate, right and good. Animals, as creatures whose stories do not seem to include facing moral dilemmas and inner conflicts - indeed who might not be possible subjects of *stories* at all - must stand outside the realm of what essentially constitutes humans.[301] True as this might seem, it also is the case that human reason is often powerless in the face of what looks like instinct, and that rational deliberation often falls short of representing reality. It is on this assumption that the question arises of what picture of the human mind would be required for an ontological gap between humans and beasts to be intrinsic to defining its very constitution. This chapter presents an account of arguments pertaining to this question.

We have seen the Cartesian Cordemoy make a radical distinction between sign and sound, positing it as the equivalent and proof of the distinction between mind and

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[298] William James, *Principles of Psychology* (New York, 1890), II, p. 325.

[299] But see Sylvana Tomaselli, 'The first person: Descartes, Locke and mind-body dualism', *History of Science*, xxii, 1984, pp. 185-205, for the notion that Descartes's position as the founder of modern philosophy and its putative ills, through his role in radically separating mind and body, is the product of myth-making; see, esp., p. 196: 'Descartes may be said to have posed the self as the rock on which reason would build philosophy. Philosophy being then, if not now, a critical practice aimed at edification, he implicitly posed the self as a problem, as [sic] epistemological and an ontological problem.'

[300] See Charles Taylor, *Sources of the Self: The Making of the Modern Identity* (Cambridge, 1989), pp. 143-176, and his discussion of the way in which the Cartesian turn to introspection also calls for a 'disengagement' of the experiencing self.

[301] Ronald de Sousa made a similar point in his 'I am an animal', written for a conference on *Animals*, March 1995 (Toronto), and published at http://www.chass.utoronto.ca/~sousa/animal.html.

body. In a passage entitled 'Que le mensonge est opposé à la veritable Eloquence',[302] he suggested that lying was akin to breaking the intimate bond between thought and sign, between emotion and its expression,[303] and thus to breaking our bond with God,[304] who gave us the capacity to think and speak our thoughts. One can see why he valued the fantasy of soundless, wordless communication over ordinary, physical voice: a sign could be divorced from its signifier and thus end up 'resembling animal cries, reducing the human voice to the voice of beasts', as one commentator recently put it, which would be a 'kind of sin against the humanity of voice, as opposed to that of language'.[305] Beasts emitted mere cries, and their cries did not signify anything that humans could determine as bearing moral value. By denying animals any existence as moral creatures, one emphasized the need to define humans precisely in terms of their moral nature. But to do that was also to show up the limitations of reason - at the root of the need for moral deliberation in the first place - while at the same time relying entirely on the use of purely mental, 'clear and distinct ideas' in a world partly invisible to mere senses. Theories of passions which depended on the expulsion of reason from the body - on a claim that our reasoning faculty could not be material - thus perpetuated the dualist thesis by exposing our animal-like emotionality as a dangerous weakness in us,[306] although its power was what enabled a talented orator to manipulate his audience.

This was an Aristotelian topos,[307] analysed by Descartes in his *Passions of the Soul*.[308] Malebranche, who, as mentioned in the previous chapter, developed the

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[302] Cordemoy, *Discours*, in *Œuvres*, p. 246

[303] Ibid., p. 247: 'il y a naturellement un tel rapport entre les sentimens des hommes, & les signes ou paroles, dont ils se servent pour les exprimer, que jamais une même personne ne sçauroit de si bonne grace dire un mensonge qu'une verité'; and further (p. 248), 'tandis que nos ames demeurent unies à nos corps, tous nos mouvements seront si bien d'accord avec nos sentimens, que jamais nous ne pourrons inspirer les uns que par les autres'.

[304] Ibid., p. 248.

[305] See Salazar, *Le culte de la voix*, pp. 75-76.

[306] See, e.g., Sydenham, *Theologia Rationalis*, ed. Dewhurst, pp. 151-154. For Sydenham, the immateriality of the human soul was a consequence of the unquestionable fact that matter could not think; as he wrote, p. 153: 'why may not the action of thinking in men proceed from the matter only? This I confess I should be very inclinable to believe could I be assured that Brutes did at all think. And tho' we do not know the utmost power of matter, yet we do the utmost power of what we can conceive, and we cannot conceive that matter should think. But tho' it me more hard for the Principles of natural science to draw Conclusions that are demonstrable of the immortality of the soul, for as much as the soul itself can no more discern it self, save by its operations, then the eye can do the eye … Yet there is another and that in my opinion a more true way of thinking, grounded upon Moral Science'.

[307] See Aristotle, *Rhetoric*, Bk. II, ch. 1-11.

occasionalist picture of mind-body interaction already emerging in Cordemoy, could thus write that 'the thoughts we have which depend on the body are all false, and all the more dangerous to our soul for being more useful to our body'.[309] Here, 'thoughts' which depended on the body - sensations, desires, dreams - were not the products of reason; what is more, they could bypass rational deliberation altogether. They could be expressed verbally, but were not truthful: they did not correspond to the truths which we were able - by our very nature, and in virtue of the possession of language - to identify, perceive or discover. They might as well be lies, and as such, they were, indeed, dangerous to our soul. Central to the assumption that animals did not make verbal sense in the way that we did and, by the same token, could not make elaborate sense of their lives and sense-experiences in the way that we did, was a notion that some form of purposefulness must be an intrinsic feature of any definition of human life, and that purposefulness must entail the search for - and adherence to - some form of truth.

To define human life - and to ascribe to it its correct, true finality - amounted to some extent to identifying its origins. That God created the world and its creatures was important, but was not enough for theorists of souls. Movement mattered too, since it was one crucial manifestation of life. Animals somehow had become endowed with the capacity for autonomous bodily movement, which included the emission of vocal sound. But the manner in which this capacity had been 'instilled' into creatures, or into the atomic particles that composed them, remained unknown.[310] To understand the origin of goal-oriented action was to enquire into the role, range and function of what lay behind it, whether it was will, impulse, instinct or deliberation. Language, as a willed action, and as a tool for exploring nature, also involved movement. For Hobbes, the existence of language *implied* the activity of

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[308] See Descartes, *Les passions de l'âme*, art. 28, in *Œuvres*, ed. Alquié, III, p. 924: 'l'expérience fait voir que ceux qui sont les plus agités par leurs passions ne sont pas ceux qui les connaissent le mieux, et qu'elles sont du nombre des perceptions que l'étroite alliance qui est entre l'âme et le corps rend confuses et obscures' ('experience shows that those who are most agitated by their passions are not those who know them the best, and that these passions count among those perceptions which are confused and obscured by the close connection between soul and body').

[309] See Malebranche, *Recherche*, in *Œuvres*, I, p. 378 (II, iii, 6, §2): 'toutes les pensées que nous avons par dépendance du corps, sont toutes fausses, & d'autant plus dangereuses pour nôtre ame, qu'elles sont plus utiles à nôtre corps'.

[310] See Canguilhem, *La formation du concept de réflexe*, p. 17. See also Roger, *Sciences de la vie*, pp. 135-137 and his reference to Gassendi, *Syntagma philosophicum*, in *Opera* (Lyon, 1658), II, pp 274-275, ch. 3, for an account of Gassendi's influential notion that the (material) soul of beasts was made

volition: God spoke to Adam in a supernatural way before Adam had tasted the fruit of the tree of knowledge, and so human language was born thanks to Adam's will for it exist.[311] On a voluntarist view such as this, animal expression and communication did not constitute language. Animals, however, seemed to have been endowed with some sort of will: it remained to be determined *what* sort of will. As we shall see in the next chapter, a physician like Pierre Chanet felt entitled to identify animal will with instinct.[312] He did so in a tract which part of a series he exchanged in the 1640s with his ideological adversary Marin Cureau de la Chambre (1596-1669), an acquaintance of Gassendi, once a protégé of Richelieu and, later, a founding member of the Académie des Sciences, created in 1666.[313] He was also a reputed physician to the king, who in this instance wanted to assert, following the tradition of so-called 'theriophily'[314] derived from Plutarch and taken up most notoriously by Montaigne and Charron, that animals were in fact endowed with reason.

As we saw in the Presentation to this section, the Cartesian picture of the mind-body relation and Descartes's 'nearly surgical split'[315] between soul and matter necessitated complicated adjustments and redefinitions of scholastic categories to make room for something like an animal's will.[316] The Aristotelian conception of a 'chain of being', and the tripartite division of the soul which assigned a specific role to each soul in a hierarchical order, had by definition included the animal world. As with the notion, discussed above in Chapter 1, of an originally transparent, Adamic language, which inventors of universal languages tried to reconfigure, it set up as a

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of atoms dispersed throughout the body and his belief that this soul did not have the knowledge required for the formation of the embryo, which remained also beyond our understanding.

[311] See above, p. 62, n. 104.

[312] Pierre Chanet, *De l'instinct et de la connaissance des animaux, avec l'examen de ce que M. de la Chambre a écrit sur cette matière* (La Rochelle, 1646).

[313] See letter from Henri Justel to Oldenburg, 3 October 1666, in *The Correspondence of Henry Oldenburg* ed., transl. A. Rupert Hall and Marie Boas Hall (Madison, Milwaukee and London, 1965-77), 13 vols.: III, pp. 240-241, at p. 240: 'On a nommé quelques personnes pour estre de l'Academie, entre autres Monsieur de la Chambre et M. Pereau, un Apoticaire, Monsieur du Clos et Mr Gayen pour l'Anatomie.' See Antoine Picon, *Claude Perrault ou la curiosité d'un classique* (Paris, 1989), p. 260, n. 20 and Leonora C. Rosenfield, *From Beast-Machine to Man-Machine: Animal Soul in French Letters from Descartes to La Mettrie* (New York, 1968), p. 118. See also Richard Serjeantson, 'The Philosophy of Animal Language, 1540-1700', forthcoming in *Journal of the History of Ideas* (2001), p. 18 of ms. (I thank Richard Serjeantson for sending me a draft of this paper.)

[314] The term 'theriophily' was coined by George Boas, *The Happy Beast in French Thought of the Seventeenth Century* (Baltimore, 1933).

[315] Elisabeth de Fontenay's expression in *Le silence des bête*s, p. 277: 'la séparation quasi chirurgicale'.

conceptual reference a world - preserved after the Fall and after Babel - in which there was no gap between man and nature, and so one in which emotions were fully translatable into the body's motions. In such a world, animals could be represented as allegories for human passions: here, as a modern commentator has put it, the 'signs of the passions of beasts resemble the signs of human passions, and this resemblance serves in turn to reinforce the principle of the human being as a microcosm'; animals became 'cyphers, insignificant in themselves, yet useful for humans at every level'.[317]

Such references to animals served to throw light on what was animal-like in humans and in human bodily language, rather than to show up how we differed from them. Attention to the existence and expressivity of passions in both humans and non-humans cohered with the assertion of a transparency of signs, based on the unity of nature, and left little room for any fuss to be made over the opacity of minds that could not speak up.[318] On what grounds, Montaigne had asked, should we assume that animals had less freedom of will than we did in activities which they, like us, engaged in? Similar effects must have similar causes, he thought; so why should we not assume that their cries of joy or pain were a form of language? We preferred to imagine ourselves belonging to the realm of angels than to accept where we really lived, here in the mud. Animals, at least, lacked the nefarious, vain imagination responsible for our presumption.[319] How could we presume to know the internal workings of animals? 'In virtue of what comparison between them and us can we be sure that they have as much stupidity [*bêtise*] as we think they do?'[320] Surely, 'we are neither above, nor below the rest: everything under the sky, says the wise man

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[316] See, e.g., Francine Markovits, 'Remarques sur l'histoire du problème de l'âme des bêtes', *Corpus*, 1991, pp. 79-92; Luciano Floridi, 'Scepticism and Animal Rationality: The Fortune of Chrysippus's Dog in the History of Western Thought', *Archiv für Geschichte der Philosophie*, 79, 1997, pp. 27-57.

[317] See Peter Harrison, 'The Virtues of Animals in Seventeenth-Century Thought', *Journal of the History of Ideas* 59, 1998, pp. 463-484, at p. 468.

[318] De Fontenay, in *Le silence des bêtes*, p. 268, quotes a passage from Augustine's *Opus imperfectum contra Julianum* in which he asks what need there is to uncover the inner world of the silent beast, given that our cause does not depend on it, and goes on to state a version of what will become a standard argumentative strategy in the post-Cartesian debate about animal minds: that if animals do not suffer when they give birth, we need not worry about the puzzling matter of their being punished although innocent of sin; that, if they do suffer, then humans are punished by being made equal to beasts; and that we must have been punished for a fault we did commit.

[319] Montaigne, *Essais*, ed. Pierre Michel, (Paris, 1965), II, xii: 'Apologie de Raymond Sebond', pp. 138-351, at pp. 155-156.

[320] Ibid., p. 156: 'Comment connaît-il, par l'effort de son intelligence, les branles internes et secrets des animaux? Par quelle comparaison d'eux à nous conclut-il la bêtise qu'il leur attribue?'

[Lucretius], obeys the same rules and the same fate'.[321] If man alone among the animals had the prerogative of 'freedom of imagination and unruliness of thoughts, which tell him what is, what is not, and what he wants, the false and the true', this prerogative was 'a costly privilege, and not one he can be proud of, for it is the main source of the ills he is beset with: sin, illness, irresolution, confusion, despair'.[322] For Montaigne, we could learn something from observing ourselves in the act of disparaging our fellow creatures - that we must avoid painting a glorified picture of our ordinary, human condition. But his use of classical exempla proving animal sagacity did not amount to a theoretical stance, just as the exempla themselves did nothing to solve the paradoxes posed by imposing human categories on non-human creatures. In this context, it made sense to point out how exclusive language was to humans - as did opponents of the tradition represented by Montaigne and perpetuated by thinkers such as Cureau de la Chambre - in order to show what did set us apart, irrevocably, from animals and the natural order.

Questions of a philosophical kind, however, soon arose about the implications of assuming further, with Hobbes, that language was a necessary element for the creation of the commonwealth and for the construction of the 'political animal'[323] - an element whose ingredients were arbitrary, since, for Hobbes, words were to ideas what speech was to the operations of the mind.[324] On Hobbes's

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[321] Ibid., p. 164. 'Nous ne sommes ni au-dessus, ni au-dessous du reste: tout ce qui est sous le ciel, dit le sage, court une loi et fortune pareilles.' The quote from Lucretius's *De rerum natura* which Montaigne inserts here is at V, 876: 'Indupedita suis fatalibus omnia vinclis'. See also M. A. Screech, *Montaigne's Annotated Copy of Lucretius: A Transcription and Study of the Manuscript, Notes and Pen-Marks* (Geneva, 1998), p. 442.

[322] Ibid: 'et c'est ainsi que lui seul, de tous les animaux, ait cette liberté de l'imagination et ce dérèglement de pensées, lui représentant ce qui est, ce qui n'est pas, et ce qu'il veut, le faux et le véritable, c'est un avantage qui lui est bien cher vendu et duquel il a bien peu à se glorifier, car de là naît la source principale des maux qui le pressent: péché, maladie, irrésolution, trouble, désespoir'.

[323] For Aristotle's conception of the 'political animal', see his *Politics*, I. 2., trans. Benjamin Jowett (Princeton, 1984): 'that man is more of a political animal than bees or any other gregarious animals is evident. Nature, as we often say, makes nothing in vain, and man is the only animal whom she has endowed with the gift of speech. And whereas mere voice is but an indication of pleasure or pain, and is therefore found in other animals (for their nature attains to the perception of pleasure and pain and the intimation of them to one another, and no further, the power of speech is intended to set forth the expedient and inexpedient, and therefore likewise the just and unjust.'

[324] Hobbes, *De homine*, ch. X. In his commentary on this notion, Paul-Marie Maurin, observing that in the Latin original Hobbes wrote that language was created not 'ad significandum conceptus' but 'ad significandum seriem conceptuum', draws a distinction between two alternative interpretations of Hobbes's conception of language: either he meant that 'le langage constitue une somme de signes destinés à désigner la succession psychologique des contenus de pensée', in which case 'les mots ne signifieraient pas des idées, mais la seule trace psychologique que laisse en notre esprit le cours de notre pensée, étant exclu qu'il existe des objets réels de pensée: des substances intellectuelles'; or, Hobbes meant by 'series' 'non pas la succession mais l'ensemble, qui se trouve être successif, des

account, language was less an intrinsic feature of human nature such as God created it, than a necessity born of social existence. It was a tool created by human will but also an aspect of conscious, instrumental knowledge.[325] We have seen, following Shapin and Schaffer, the problem such a view could pose for the Royal Society fellows who were endeavouring to lay the foundations of the experimental philosophy. Evidently, mere assent to linguistic rules (and Hobbes insisted on how easy it was to err because of linguistic confusion)[326] could not ground empirical knowledge. This was similar to the way that the Cartesian version of the mechanistic physics, which developed along with the dualistic psychology, ensured a clearly defined, separate place for reason while leaving the sensitive soul in the lurch.

If the sensitive soul's mode of relation to reason, in the form of movement, perception, or emotion, could really be accounted for mechanistically and materially, according to the laws of physics and to the motion of particles, then both humans and animals were simply machines,[327] or organisms that could be taken apart and anatomised.[328] Descartes had understood passions as a kind of 'internal sense', on a par with 'natural appetites', which he thought could be identified as motions of the nerves. In some ways he did postulate a physically reductionist psychology, where passions were conceived to be fully explained by a physicalist account of emotional life. 'Thus', he wrote,

> when we believe we are enjoying a good of some sort, the imagination of that enjoyment does not in itself contain the feeling of joy, but it operates in such a way that the animal spirits travel from the brain to the muscles to which these nerves are attached; so, just as it enables the dilation of the entrances to

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concepts, et, dans ce cas, on est conduit à limiter fortement le nominalisme de Hobbes'. See P. M. Maurin, translation and edition of *De homine: Traité de l'homme* (Paris, 1974), p. 148.

[325] See Hobbes, *Leviathan*, I. 4, p. 104: 'A naturall foole that could never learn by heart the order of numerall words, as one, two, and three, may observe every stroak of the Clock, and nod to it, or say one, one, one; but can never know what houre it strikes'.

[326] As Shapin and Schaffer put it, 'For Hobbes, perhaps even more than for Boyle, right philosophy was predicated upon the proper use of language': *Leviathan and the Air-Pump*, p. 92.

[327] See Dennis Todd, *Imagining Monsters: Miscreations of the Self in Eighteenth-Century England* (Chicago, 1995), p.120, where he refers to the Cambridge Platonist Ralph Cudworth's criticism of Descartes in a quotation from Cudworth's *True Intellectual System of the Universe* (London, 1678), p. 761.

[328] On the idea of the anatomized body, see Sawday, *The Body Emblazoned*. On the notion that there is no real distinction between machines and organisms, and for a discussion of Descartes's point, see Guido Giglioni, 'Dalla meraviglia dei sensi alla meraviglia dell'intelletto: note sul concetto di automa nel XVII secolo', in G. Galli, ed., *Interpretazione e meraviglia, XIV colloquio sulla interpretazione*, Macerata 29-30 Marzo 1993 (Pisa, 1994), pp. 23-52.

> the heart, the imagination also enables these nerves to move in the way nature has established to bestow the feeling of joy.[329]

This materialistic account was expounded in the *Passions de l'âme*, as well as in *L'homme*, where it was one aspect of the thought-experiment - akin to the Turing Test[330] - on which Descartes based his investigation of the human organism; Cordemoy, as we have seen, made use of it as well. The plausibility of doing so was, in Descartes, itself a function of the assimilation of an organism to a machine. A few pages after the passage cited above, Descartes stated clearly that: 'I see no difference between the machines manufactured by artisans and the various bodies that nature alone creates', and inversely, that 'all the rules of mechanical things belong to physics, in such a way that artificial things are also natural'.[331]

This, then, was the backbone of what became known as the beast-machine thesis.[332] If - to remain with Cartesian terminology - active, deliberative thought was what defined the human mind and delimited the boundaries of the *res cogitans* within the human machine; and if we experienced all emotions and sense-perceptions, which we shared with animals, as *passions* of the soul, suffered by our conscious selves;[333] then the human realm really did stop at the bounds of what one might metaphorically take to be the pineal gland. Animals, therefore, could very well be automaton-like

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[329] Descartes, *Les Principes de la philosophie*, IV, 190, in *Œuvres*, ed. Alquié, III , p. 505: 'Ainsi, lorsque nous pensons jouir de quelque bien, l'imagination de cette jouissance ne contient pas en soi le sentiment de la joie, mais elle fait que les esprits animaux passent du cerveau dans les muscles auxquels ces nerfs sont insérés; et faisant pas ce moyen que les entrées du coeur se dilatent, elle fait aussi que ces nerfs se meuvent en la façon qui est instituée de la nature pour donner le sentiment de la joie.'

[330] On the Turing Test, see Alan Turing's own 'Computing Machinery and Intelligence', originally published in *Mind* 49, 1950, pp. 433-460; republished as 'Can a Machine Think?', in James R. Newman, ed., *The World of Mathematics* (New York, 1956), pp. 2099-2123; available at http://www.sscf.ucsb.edu/~sung/comm115w…efine-computing/Computing-machinery.html. See also the 'Alan Turing Home Page', at http://www.turing.org.uk/turing/.

[331] Descartes, *Principes*, IV, 203, in *Œuvres*, ed. Alquié, III, p. 520: ' je ne reconnais aucune différence entre les machines que font les artisans et les divers corps que la nature seule compose' and 'toutes les règles des mécaniques appartiennent à la physique, en sorte que toutes les choses qui sont artificielles, sont avec cela naturelles'. See Giglioni, 'Dalla meraviglia dei sensi'.

[332] The thesis would be formulated later on as, for example, it is here by Daniel Tauvry, in *Anatomie raisonnée* (Paris, 1690), Preface: 'Pour bien appliquer la Physique au corps de l'homme, j'en ôte tout ce que je n'y connais point; c'est-à-dire toutes les facultés, et je le considère comme une machine Statique, Hydraulique et Pneumatique, dont les os sont les appuis et les leviers, les muscles les cordes, le cœur et les poumons la pompe, les vaisseaux sont des canaux où les liqueurs circulent perpétuellement'. Quoted in Bernard Tocanne, *L'idée de nature en France dans la seconde moitié du XVIIème siècle. Contribution à l'histoire de la pensée classique* (Paris, 1978), p. 48.

[333] Descartes, *Passions de l'âme*, I, 17-25, in *Œuvres*, ed. Alquié, III, pp. 966-972. We shall return to Descarte's theory of the passions below, in Part II, Chapter 3.

organisms; and the emotions they exhibited could be merely one aspect of the organism's life - including that of the human organism. It was primarily in response to this thesis that speculations about the nature of animal souls became so heated by the end of the seventeenth century. The matter was 'a central preoccupation of seventeenth- and eighteenth-century European intellectuals'.[334] But this, as we shall see, was not so much the expression of a sensitive concern for non-human beings as a cerebral mode of debating issues that often had nothing to do with animals at all. Scholastic concepts were being manipulated at a time when their authority was becoming increasingly questionable,[335] and it was fashionable among many intellectuals to treat them as dispensable and old hat.[336] With the demise of Aristotelian souls, there arose the problem of determining how the mechanisms of sense-perception, memory, imagination and will, which we seemed to share with animals, could form the basis for specifically *human* forms of intentional cognition and will, as well as for operations of the mind which could not be reduced to physical ones but which remained available to introspection. A typical formulation of the question posed to the post-Aristotelian definition of life subsumed hypothetical biological constructs under a theological *a priori* regarding the immortality of the soul.

Moreover, the need to integrate human psychology - in the sense of a map of the soul - within the new explanatory framework entailed the need to examine the 'animal', emotive, non-rational parts of man. The priest Antoine Dilly, for example,

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[334] Keith Thomas, *Man and the Natural World: Changing Attitudes in England 1500-1800* (London, 1983), p. 35. Thomas argues, pp. 35-36, that the insistence on drawing a firm line between man and beast had 'practical advantages' in that it helped to justify 'the total qualitative difference between man and brute': such a view rendered very clear the real extent to which 'Man stood to animal as did heaven to earth, soul to body, culture to nature'; but its 'theoretical rationale was elusive'.

[335] See Laurence W. B. Brockliss, 'Descartes, Gassendi, and the Reception of the Mechanical Philosophy in the French Collèges de Plein Exercice, 1640-1730', *Perspectives on Science*, 3, 1995, pp. 450-479, for an account of the changes in the philosophy curriculum in French education and of the gradual, conflicted and complex ways in which Cartesianism and Gassendism were each assimilated into the mainstream; 'Les atomes et le vide dans les collèges de plein exercice en France de 1640 à 1730', in Sylvia Murr, ed., *Gassendi et l'Europe (1592-1792)*, (Paris, 1997), pp. 175-187. See also Tocanne, *L'idée de nature en France*, ch. III: 'La diffusion du mécanisme', esp. p. 50, where he quotes a comment by Père Daniel from his *Voyage du Monde de Descartes* (Paris, 1690; here, Utrecht, 1732), Part III, to the effect that 'c'est un crime pour eux [professors] d'être cartésien; mais c'est un honneur de se bien servir de ce que l'on trouve de bon dans M. Descartes (…) les péripatéticiens trouvent maintenant dans Aristote ce qui, selon eux, n'y était point il y a trente ans.'

[336] Dismissals of Aristotelianism abound in the writings of all types of exponents of the 'new science'. See, e.g., Walter Charleton, *Physiologia Epicuro-Gassendo-Charltoniana* (London, 1664), III, 4, p. 197: 'The Nature of Colours', Sect. III: 'We are not ignorant, that the aspiring Wit of *Des Cartes* hath

in a tract aimed at defending the Cartesian picture of beasts,[337] argued that the enquiry into 'the true [*veritable*] difference between the human soul and the animal soul' was necessary for the 'study of ourselves', which was 'the most important of all', since ethics [*la moralité*],

> with which we must concern ourselves for our whole lives, is based on nothing but this knowledge. For how can we regulate our passions without knowing them, if we have not beforehand enquired into the nature of our soul, into that of our body, and into the way in which the Author has preferred to unite these two substances, since the passions are merely the consequence of this union?[338]

In order to reconcile mechanistic and atomistic accounts of voluntary action with the notion of the independence of human will from nature, it became imperative to define the respective realms of biology and physiology, *given* that reason, in theological terms, had to be accepted as the defining characteristic of humans over and against other living creatures. But just as Cartesian accounts of language both depended on and reinforced dualism, accounts of voluntary action depended implicitly on a theory of mind which took as a given its irreducible nature and its independence from physiology. Meanwhile the practice of explaining passions and emotional behaviour - ordinary psychology - along physiological and medical lines continued to remain in vogue, both among the medical profession and in popular culture, insofar as such accounts, still Galenic in purview, retained their explanatory power. There was no room here for psychology in the sense of a scientific, causal account of human behaviour.[339] Cartesian introspection, as we shall now see, was a

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made a towring Flight of all these sublime Abstruisities, and boldly fastned the hooks of his Mechanick Principles upon them, thinking to stoop them down to the familiar view of our Reason.'

[337] Antoine Dilly, *De l'ame des betes, ou après avoir démontré la spiritualité de l'ame de l'homme, l'on explique par la seule machine, les actions les plus surprenantes des Animaux* (Lyon, 1676). Dilly's book was avowedly a reaction to Ignace-Gaston Pardies's attack on the beast-machine hypothesis, *Discours de la connoissances des bestes* (Paris, 1672). See the Jesuit August Ziggelaar's monograph, *Le physicien Ignace Gaston Pardies S.J.* (Odense, 1971). On the Parisian academies see Roger *Sciences de la vie*, pp. 170-184. See also L.C. Rosenfield's introduction to the facsimile reprint of Pardies's *Discours* (London and New York, 1972), pp. ix-xlii, at pp. xiv-xv. Pardies, who also wrote treatises on physics and attempted to attack Cartesian physics, geometry, and light, attended sessions of the Académie Thévenot in the 1670s, at which Cartesians like Cordemoy and Rohault were also known to have been present, gathering at the Hôtel de Condé. See also above, p. 63, n. 106.

[338] Dilly, *De l'ame des betes*, 'Preface', pp. vi-vii: 'L'étude de nous mêmes est la plus importante de toutes, & la morale qui doit nous occuper durant toute la vie n'est appuyée que sur cette connoissance. Car comment pouvoir regler nos passions sans les connoître, si nous n'avons auparavant penetré dans la nature de nôtre ame, dans celle de nôtre corps, & dans la maniere dont il a plû à l'Autheur d'unir ces deux substances puisque les passions ne sont que des suites de cette union?'

[339] See Pascal Engel, *Philosophie et psychologie* (Paris, 1996).

handmaiden to epistemology; it did not have the role of yielding the kinds of observations obtained through self-analysis, whose practice and validity would later be taken for granted.[340] The animal soul debate, certainly in France, was an instance of a sophisticated philosophical game, in which questions about the possible ways of defining the boundary between man and nature mattered rather more than determining the actual contours of that boundary. The intellectual speculations concerning the beast-machine thesis tended to serve, rather than to determine, the position thinkers took with regard to the status of animal souls themselves. Whatever conclusion they chose to uphold about the status of beasts, what was at stake here was the problematization of the biological nature of humans, not the nature of non-human creatures.

This was a conundrum which arose out of the possibility, afforded by sceptical traditions, of doubting our capacity to know the minds of creatures and the nature of objects which lay beyond the grasp and realm of intelligible language. In the form of the so-called 'other minds problem', as we have seen, it was posited by Descartes as a means of grounding, through an Augustinian exercise in introspection, the human capacity to know within the very capacity to think and within the ambit of what, in the history of philosophy, is simply referred to as the 'cogito'.[341] One could identify the function of the 'cogito' as transcendental. As Richard Rorty saw, the 'cogito' converted philosophical practice into an abstract search for ways of *grounding* the very possibility of enquiry and the exercise of reason,[342] serving as proof that the philosophical system which relies on this ground must be true. Once the split between perceptions acquired through sense-experience, on the one hand, and ideas, or concepts in the mind, on the other, was confirmed, what was left whole

[340] See Charles Taylor's chapter on 'Descartes's Disengaged Reason' in his *Sources of the Self*, pp. 143-158.

[341] Note, however, that, as Edwin Burtt explained in *The Metaphysical Foundations of Modern Physical Science* (London and New York, 1932), p. 107, 'the main motive' for Descartes's carrying through his programme of universal doubt was 'no mere general distrust of his own early beliefs', but the need 'to get an absolute guarantee that his clear and distinct mathematical ideas' (constituted of 'mathematical laws of nature established by God, the eternal invariableness of whose will is deducible from his perfection') '*must* be eternally true of the physical world'.

[342] Richard Rorty, *Philosophy and the Mirror of Nature* (Princeton, 1980), pp. 9, 50-69, 126, 262. This search would culminate in Kant's transcendental philosophy. For a logical analysis of the 'cogito' as a proposition, see Jean-Claude Pariente, 'La première personne et sa fonction dans le *Cogito*', in Kim Sang Ong-Van-Cung, ed., *Descartes et la question du sujet* (Paris, 1999), pp. 11-48.

was the person's self, mind and body united as one individual.[343] For Locke, it was because mental representation and percepts remained distinct from one another that human knowledge was both possible and limited. He wrote, for example, that 'Colours, Sounds, Tastes, Smells, Pleasure and Pain, etc.' were all 'mechanical Affections of Bodies', which had

> no affinity at all with those Ideas, they produce in us … and can reason no otherwise about them, than as effects produced by the appointment of an infinitely Wise Agent, which perfectly surpass our Comprehensions. As the *Ideas* of sensible secondary Qualities, which we have in our Minds, can, by us, be no way deduced from bodily Causes, nor any correspondence or connexion be found between them and those primary Qualities which (Experience shews) produce them in us; so on the other side, the Operation of our Minds upon our Bodies is unconceivable. How any thought should produce a motion in Body is as remote from the nature of our *Ideas*, as how any Body should produce any Thought in the Mind.[344]

The ideas we had in our minds differed altogether in kind from the experience we had of the world's objects, which was dependent upon sensation. Their mode of relation, thought Locke, was determined by God, but was a mystery to us, and beyond the grasp of 'our weak Understandings'. The operations involved in cognition could be the object of investigation: we had direct knowledge of ourselves, indeed, 'The Knowledge of *our own Existence* by Intuition',[345] and we could be secure in the knowledge of ideas in our minds. Yet we could only know 'of the *Existence of* GOD by Demonstration; and of other Things by Sensation'.[346] The Cartesian origin of Locke's grounding of self-knowledge in intuitive apprehension is plain:[347] 'nothing can be more evident to us', he wrote, 'than our own Existence. *I think, I reason, I feel Pleasure and Pain*; Can any of these be more evident to me, than my own Existence? If I doubt of all other Things, that very doubt makes me perceive my own *Existence*.'[348]

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[343] For an alternative analysis of what is implied here, see Taylor, *Sources of the Self*, especially ch. 9: 'Locke's punctual self'.
[344] Locke, *Essay*, IV, iii, 28, pp. 558-559.
[345] Ibid., IV, ix, 2, p. 618.
[346] Ibid.
[347] See also Taylor, *Sources of the Self*, p.166, and Tomaselli, 'The first person'.
[348] Locke, *Essay*, IV, ix, 3, p. 618. Descartes's 'first principle', as Arnauld realized in the 'Quatrièmes Objections' to Decartes's *Meditations*, goes back to Augustine's *De libero arbitrio*, II.iii.7. See Stephen Menn's recent *Descartes and Augustine* (Cambridge, 1998) for a detailed account of Descartes's important connections with Augustine.

Locke, then, as much as Descartes and later Cartesians[349] such as Louis De La Forge (1632-1666),[350] accepted that one could hedge doubt about the reality of the material world by appealing to the very possibility of introspection. But Locke had a problem with the notion that the soul was simply a thinking thing - the *res cogitans* humans alone are endowed with - and wondered how those who did believe this '*come to know, that they themselves think, when they themselves do not perceive it*'.[351] His conclusion was, of course, that there was 'no Reason therefore to believe, that the *Soul thinks before the Senses have furnish'd it with Ideas* to think on'.[352] In this context, one can see how the postulate made by a Cartesian like Cordemoy that we could securely infer knowledge of other minds by appealing to the existence of language might have appeared rather flimsy. It relied far too much on the assumption that we knew exactly what language was, what the thought-processes it expressed were, and what sort of relation existed between the two. The argument merely told us that language was such that it could only be human. The mystery of other minds was closed, while the mystery of the modalities of human knowledge remained wide open. Mentality became a mere accessory of verbal language, while remaining opaque in virtue of its silence. The use of language, or of structured signs alone, enabled by and expressive of reason, was here the key to other minds. For a Cartesian, to interpret instances of intelligibly sophisticated animal behaviour as indications of reasonableness could not be right, since it was tantamount to transferring human language into a non-human realm. This is the point from which to start making some philosophical sense of the plethora of tracts, texts and books engaged in detailed argumentation - syllogistic, dogmatic or otherwise - about the

[349] I use the term in the wide sense of adopting in its broad lines Descartes's scheme for unravelling the scholastic system, without necessarily adopting in every detail the method which grew out of it.
[350] This Saumur-based doctor and thinker edited, along with Clerselier, the French version of Descartes's *L'homme*, published in 1664. In his *Traité de l'esprit de l'homme* (Paris, 1666), he repeats Descartes's own description of his philosophical programme (in the *Méditations métaphysiques* and *Les principes de la philosophie*) as the shedding of infantile illusions about the capacity for the senses to give us knowledge of the true nature of things, rather than of their perceptible qualities. In La Forge, similarly, to understand that our senses fool us is also to understand ourselves as rational creatures who tend to confuse senses with reason. See Louis De La Forge, *Traité de l'esprit de l'homme, de ses facultez et fonctions, et de son union avec le corps. Suivant les principes de René Descartes*, in his *Œuvres philosophiques, avec une étude bio-bibliographique*, ed. Pierre Clair (Paris, 1974), p. 107.
[351] Locke, *Essay*, II, 1, 18, p. 114 (Locke's italics).
[352] Ibid., II, 1, 20, p. 116.

status of animal souls, in the context of an increasingly deflated scholasticism.[353] It was a debate in which explanations of matter and its motion, so crucial both to the Aristotelian world and to its demise, were closely bound up with speculations about human freedom from merely organic life, the mind's freedom from the body, and, ultimately, the freedom that was our capacity to rule our own animal passions.

The question of where to place animals in nature, given what we could *know* about nature, about animal functions, and about ourselves respectively, was also a question about possession and property: it could amount to asking who had what, over whom, and how, and to ascribing a value to the possession of a faculty. Thus, the deaf could not perceive sound; but whoever was securely in possession of what the deaf lacked might have wondered about what it was like to have that lack, and what sort of knowledge they actually did have. Again, the blind could at best imagine what the world looked like; but a sighted person, securely in possession of information unavailable to the blind, could ask, as did Descartes, Locke and Molyneux, how they experienced and made sense of other kinds of perception. By the same token, animals did not have the faculty of speech; but, again, its absence could make humans, whose very thought-processes were communicable through language, wonder about the nature of the minds of animals, about what it was like, that is, to be a bat.[354]

Malebranche, in an attempt to illustrate the usefulness of the occasionalist doctrine, suggested that it was precisely because the association of the 'ideas of things' with particular words depended on the will of humans that one could not adequately describe a sensation with words. The experience of sensation did not depend on human will, although we were, nevertheless, perfectly capable of recognizing it when it occured, in ourselves and in others.[355] He would also suggest -

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[353] La Forge, pp. 76-77, was careful in the 'Preface' to his *Traité* to distinguish between those who were constrained to teach Aristotelianism 'que pour obeir à la coutume & contre leur sentiment', others who were 'Sectateurs d'Aristote' but not opposed to Cartesianism, and those, whom he characterized in an entirely negative fashion, who 'ne sçavent des sentimens de Platon & d'Aristote, qu'autant qu'on leur en a dicté dans leur escrits, & qu'ils en ont retenu des explications de leurs Professeurs. Ceux-ci sont les plus fâcheux adversaires des Disciples de Monsieur Descartes'.

[354] The phrase is a much discussed, oft-quoted title of an essay by Thomas Nagle in which he asks whether and how there can be external knowledge of conscious states, which are intrinsically subjective: see Thomas Nagel, 'What is it like to be a bat?', originally published in *The Philosophical Review* 83, 1974, pp. 435-350; reprinted in Douglas R. Hofstadter and Daniel C. Dennett, ed., *The Mind's I: Fantasies and Reflections on Self and Soul* (London, 1981), pp. 391-403.

[355] Malebranche, *Recherche*, in *Œuvres*, I, p. 145 (I.13.iii): 'si on me demande, que j'explique donc ce que c'est que la douleur, le plaisir, la couleur, &c., je ne le pourrai pas faire comme il fait par des

and this was the core of the occasionalist doctrine - that the body's sentience was due not to its union with the soul, but to God's producing thoughts in the soul on the occasion of the movements of matter. This alliance was 'the natural and mutual correspondence of the soul's thoughts with the traces in the brain, and of the soul's emotions with the movements of animal spirits'.[356] Humans had the capacity to speculate about God and to investigate nature; but they did not have God's mind, their mode of communication was limited, and they did not agree on how to define the bounds of what was knowable. They were in possession of what no member of the set of other living creatures had: a rational soul, language and will. But the concept of 'rational soul' was not only a product of the Aristotelian understanding of the soul as divided according to function. It also encompassed characteristics - such as volition and, related to that, the linguistic capacity - which on the Aristotelian account had been connected to the operations of perception and motion which humans and animals alike were equipped to perform.

Theories about the body could thus serve metaphysics. Descartes, as we have seen, tried to give an account of the living, mobile, perceiving, physical organism, in such a way that the extended body's separation from the soul not only defined its realm but also constituted the premise on which the account was built. 'I shall describe to you', he wrote at the beginning of *L'homme*, 'first, separately, the body, then, also separately, the soul; and then I shall show you how these two natures must be joined and unified so that they constitute humans who resemble us.'[357] To many people, there was something awkward about splitting up the human entity, unified under

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paroles; mais il ne s'ensuit pas de-là, que si je vois de la couleur, ou tout que je me brûle, je ne connoisse au moins en quelque maniére ce que je sens actuellement. Or la raison pour laquelle toutes les sensations ne peuvent pas bien s'expliquer par des paroles, comme toutes les autres choses, c'est qu'il dépend de la volonté des hommes d'attacher les idées des choses à tels noms qu'il leur plaît. Ils peuvent appeler le Ciel, Ouranos, Schamajim, &c., comme les Grecs et les Hebreux: mais ces mêmes hommes n'attachent pas comme il leur plaît, leurs sensations à des paroles, ni même à aucune autre chose. Ils ne voyent point de couleurs, quoique l'on leur en parle, s'ils n'ouvrent les yeux. Ils ne goûtent point de saveurs, s'il n'arrive quelque changement dans l'ordre des fibres de leur langue, & de leur cerveau. En un mot, toutes les sensations ne dépendent point de la volonté des hommes: & il n'y a que celui qui les a faits, qui les conserve dans cette mutuelle correspondence des modifications de leur ame avec celle du corps.'

[356] Ibid. (II, I, § v), p. 215: 'Toute l'alliance de l'esprit & du corps qui nous est connuë, consiste dans une correspondance naturelle & mutuelle des pensées de l'ame avec les traces du cerveau, & des émotions de l'ame avec les mouvemens des esprits animaux.'

[357] Descartes, *L'homme*, in *Œuvres*, ed. Alquié, I, p. 379: 'il faut que je vous décrive, premièrement, le corps à part, puis après l'âme aussi à part; et enfin, que je vous montre comment ces deux natures doivent être jointes et unies, pour composer des hommes qui nous ressemblent'.

Aristotelianism, in order to put it back together again; and it seemed crude to base an account of physiological anatomy on the premise of a thought-experiment which consisted in setting up 'a statue or earthen machine', supposedly 'formed by God for the purpose of making it resemble us as much as possible'.[358] This physiology, however, purported to explain, as Descartes wrote in the *Discours de la méthode*, 'what must be the structure of the nerves and muscles of the human body, for the animal spirits within it to be able to set its limbs in motion: just as heads, shortly after having been chopped off, still wriggle and bite the earth, although they are no longer animated'.[359] On the strength of this, it was possible to suppose that a machine which looked like a monkey or any other animal deprived of reason could easily be mistaken for one, whereas a human being could not be confused with a human-like automaton, because such an automaton would fail to exhibit the malleable structures of language and reason - would fail, that is, to pass the Turing Test. The arguments about the linguistic function, especially in their relation to the 'other minds' problem, gained in relevance in this context. Merely corporeal functions could be explained in anatomical and mechanical terms, if one used evidence from dissection and relied on geometric principles.[360] Again, neither faculties, substantial forms or final causes were needed in a scheme from which Aristotelian souls had been expelled.[361] Yet, banishing the interconnected souls in favour of Descartes's dual creature would prove problematic, and nowhere more clearly than in speculations about the true nature of beasts.

The beast-machine thesis, as we have seen, was the upshot of a postulate about metaphysics and about the origins and nature of motion,[362] however much it

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[358] Ibid.: 'Je suppose que le corps n'est autre chose qu'une statue ou machine de terre, que Dieu forme tout exprès, pour la rendre la plus semblable à nous qu'il est possible.'

[359] Descartes, *Discours de la méthode*, V, in ibid., p. 627: 'j'y avais montré quelle doit être la fabrique des nerfs et des muscles du corps humain, pour faire que les esprits animaux, étant dedans, aient la force de mouvoir ses membres: ainsi qu'on voit que les têtes, un peu après être coupées, se remuent encore, et mordent la terre, nonobstant qu'elles ne soient plus animées'.

[360] See Descartes, *Principes de la philosophie*, IV, 203, in *Œuvres*, ed. Alquié, III, pp. 519-520.

[361] In May 1641, Descartes wrote to Regius that the triple soul doctrine was 'heretic'. See Descartes, 'A Regius', in Descartes, *Œuvres*, Alquié, ed., II, p. 332: 'La première chose donc que je ne saurais approuver dans vos thèses, est ce que vous dites que l'âme de l'homme est triple: ce mot est une hérésie parmi ceux de ma religion.'

[362] Descartes's selective reading of Harvey is a good example of the way in which metaphysics determined theories of physiology. As Roger French has pointed out, Descartes's 'misunderstanding' of Harvey was due to 'the constraints of his own system. Descartes maintained against his theological critics in the universities that his natural philosophy showed directly and clearly the hand of God in the world. The validity of his physical laws rested on their metaphysical foundation, ultimately the existence of God. These laws were concerned with the transfer of motion from particle to particle, a motion that

came across as a substantive, though hypothetical, description of the natural world's non-human creatures. It is important to be aware of its structural genealogy in order to understand fully why Descartes believed that the body - and the operations of sense-perception without which a body cannot survive in the world - was best described in terms applicable to an automaton-like organism. As he wrote at the end of *L'homme*, the functions of this organism 'derive naturally, and solely, from the disposition of its organs', just as a clock's mechanism, say, was a function of its constituent parts. The old vegetative and sensitive souls of the Aristotelian tradition were now 'nothing but [the machine's] blood and spirits';[363] and physiology could be explained in mechanical terms.[364] It was quite clearly erroneous to believe that the will, or something like the rational soul, could be the efficient *cause* of the physiological processes which operated in internal physical motions such as digestion, breathing or heart-beat, in movements such as walking or pointing, and in what we now define as reflex action, such as hiccuping, blinking, and so on.[365] It was, thought Descartes, 'against all logic to conceive of the *soul* as a genus [*genre*] of which the species [*espèces*] are *thought, vegetative force and the motive force of animals*' insofar as 'by *sensitive soul*, one can only mean *motive force*, unless one confuses it with rational soul: but this motive force does not differ from, indeed is of the same species as the vegetative force, though they each entirely differ in kind from

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derived from the metaphysics of creation and not from secondary causes'. Descartes, suggests French, might have been attracted to the doctrine of circulation because 'the single motion of the heart could be seen as a source (by particle to particle contact) for all other motions of the body, including those of the muscles, veins, glands and spirits, none of which were related to the heart in older doctrines'. Descartes also replaced Harvey's 'forceful systole' (which he interpreted as functioning like the 'physiological soul', 'excluded from the animal machine' by the motive faculty of attraction rather than by contraction) as the source of the heart's motion, with 'a major principle of his natural philosophy as a whole, heat': French, 'Harvey in Holland', pp. 50-51.

[363] Descartes, *L'Homme*, in *Œuvres*, ed. Alquié, I, pp. 479-480: 'ces fonctions suivent tout naturellement, en cette machine, de la seule disposition de ses organes, ne plus ne moins que font les mouvements d'une horloge, ou autre automate, de celle de ses contrepoids et de ses roues; en sorte qu'il ne faut point à leur occasion concevoir en elle aucune âme végétative, ni sensitive, ni aucun autre principe de mouvement et de vie, que son sang et ses esprits, agités par la chaleur du feu qui brûle continuellement dans son cœur, et qui n'est point d'autre nature que tous les feux qui sont dans les corps inanimés.'

[364] Some fifty years later, the physician Daniel Tauvry, in *Anatomie raisonnée* (Paris, 1690), 'Preface', would write the following mechanistic creed: 'Pour bien appliquer la Physique au corps de l'homme, j'en ôte tout ce que je n'y connais point; c'est-à-dire toutes les facultés, et je le considère comme une machine Statique, Hydraulique et Pneumatique, dont les os sont les appuis et les leviers, les muscles les cordes, le cœur et les poumons la pompe, les vaisseaux sont des canaux où les liqueurs circulent perpétuellement'. Quoted in Tocanne, p. 48.

[365] See, e.g., Descartes's responses to the 'Quatrièmes objections' to the *Meditations Métaphysiques* made to him by Antoine Arnauld, in Descartes, *Œuvres*, ed. Alquié, II, p. 670: here Descartes explains

the *spirit*'. There was indeed 'only one *soul* in man, that is, the *reasonable* soul, for only actions which depend on reason can count as human actions'. And so the *'vegetative and sensitive force of the body'*, which were 'souls' in plants and animals, in man were not souls, since they were 'not the first principle of his actions', but rather 'a certain disposition of parts of the body which, etc.'.[366]

The Cartesian organism, then, was conceived primarily out of a new metaphysics of matter - a new theory of what constituted substance and the principles of matter's motion.[367] Put in another way, integrated into the new account of substance and matter was a theory of action - exemplified in Descartes's 'psychological' writings on the passions of the soul - coherent with the mechanical philosophy's theory of motion. This new framework also acted as a theoretical structure for reading the dissected body. It did not result from an open-ended investigation of the body as sentient organism, however proficient Descartes was in the practice of dissection. But the fact that the very notion of substance remained in the new philosophy - indeed that physics, the science of matter, continued to be understood in terms of metaphysics - indicates how problematic it might have been to insert in the realm of natural philosophy an account of the human mind which would be entirely independent from theological discourses on the human soul and represent a genuine break from Renaissance naturalism.[368]

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again that the soul is not the immediate cause of the limbs' motion, but rather determines the course of the animal spirits which travel from the heart to the brain and from there to the muscles.

[366] Descartes, letter 'A Regius', May 1641, in *Œuvres*, ed. Alquié, II, pp. 332-333 (continuing on from the passage cited n. 64, above): 'il est contre toute logique de concevoir l'*âme* comme genre *dont la pensée, la force végétative, et la force motrice des animaux* soient les espèces; car par *âme sensitive* vous ne devez entendre autre chose qu'une *force motrice*, à moins de la confondre avec la raisonnable: or, cette force motrice ne diffère pas même en espèce de la force végétative, mais l'une et l'autre diffèrent de l'*esprit* d'un genre tout entier … Il n'y a qu'une seule *âme* dans l'homme, c'est-à-dire, *la raisonnable*; car il ne faut compter pour actions humaines que celles qui dépendent de la raison. A l'égard de *la force végétative et motrice du corps* à qui on donne le nom d'âme végétative et sensitive dans les plantes et dans les brutes, elles sont aussi dans l'homme; mais elles ne doivent pas être appelées dans lui âmes, parce qu'elles ne sont pas le premier principe de ses actions, et elles sont d'un tout autre genre que l'âme raisonnable. Or, la *force végétative* dans l'homme n'est autre chose qu'une certaine disposition des parties du corps, qui, etc.'

[367] Given that Descartes justified his dualism on the basis of the 'cogito', any notion that matter, or the body, could in fact be the *subject* of thought, as Hobbes suggested in the second of his 'Objections' to the *Meditations*, was unacceptable. Hobbes's objection rested on a supposition that a substance must be corporeal, and so that the thinking substance is the material subject endowed with the faculty of thought. Thought, he said, could not be reified in the way that Descartes wanted it to be the case. See *Troisièmes objections faites par un célèbre philosophe anglais avec les réponses de l'auteur*, in Descartes, *Œuvres*, ed. Alquié, II, pp. 600-602, and Alquié's footnote, p. 601. See also Descartes's letter to Regius of January 1642, discussed in James, *Passion and Action*, p. 67.

[368] On the problem of naturalism see Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford, 1995), pp. 146-149; on how 'qualms about the completeness of naturalism', such as they

Arguments about substance pertained to the realm of metaphysics in the sense that they constituted a theorization of beliefs about the nature and powers of matter as investigated by physics. The use of substances and forces as explanatory tools assumed the possibility of reifying mental concepts. It was manifest most saliently in Descartes's division of the human organism into two substances, and in the notion, made explicit in the quotation above from the letter to Regius, that these forces and substances had *dispositional* properties and modes.[369] Such a use relied on readers' attentiveness to the distinctions between substance and mode, thanks to which it was possible to predicate functions of 'active' bodies.[370] But in the post-Aristotelian scheme, the notion of substance would have to bear meaning only in reference to the actual, concrete description of bodies available to the natural historian, the physician or experimentalist. On the other hand, while the scholastic notion of substantial form ceased to be useful, it did not die that quickly.[371] The first edition of the *Dictionnaire de l'Académie française*, published in 1694, defined 'essential form, substantial form' as 'that which determines something to be what it is, that which makes, constitutes it', and merely went on to signal that 'a number of philosophers do not accept substantial forms'.[372] Although the debate about animal minds was not especially concerned with theories of substance, it is at this highly conceptual level - not far removed, in fact, from the concerns of scholasticism[373] - that the many participants in the animal minds debate got caught up in their own logic.

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were expressed in Bernardino Telesio, inflected the debate about animal souls, see pp. 288-289. As Woolhouse points out, Cordemoy, for example, in his *Le discernement du corps et de l'ame en six discours pour servir à l'éclaircissement de la physique* (Paris, 1666), noted that bodies 'cannot initiate motion because they can be at rest without ceasing to be bodies and so they do not have motion "of themselves"', a statement which smacks of Aristotelian metaphysics if not in content then at least in form: see Woolhouse, *Descartes, Spinoza, Leibniz*, p. 140 (Woolhouse's translation). See Cordemoy, *Discernement*, 'Discours IV', in *Œuvres*, ed. Clair and Girbal, p. 136: 'Conclusions: I. Nul corps n'a le mouvement de soy-même. Preuve : - Par le premier Axione, on n'a pas de soy ce qu'on peut perdre, sans cesser d'être ce qu'on est. - Or, par le second, tout corps peut perdre son mouvement, sans cesser d'être corps. - Donc nul corps n'a le mouvement de soy-même.'

[369] See Sutton, *Philosophy and Memory Traces*, pp. 56, 133-34. See also above, p. 71, n. 142.

[370] See James, *Passion and Action*, p. 79.

[371] See Laurence W.B. Brockliss, *French Higher Education in the Seventeenth and Eighteenth Centuries: A Cultural History* (Oxford, 1987), pp. 351-354.

[372] *Dictionnaire de l'Académie française* (Paris, 1694), 1:474: 'On dit en Philosophie, *Forme essentielle, forme substantielle*, pour dire, Ce qui determine une chose à estre telle qu'elle est, Ce qui la fait, la constituë, la rend ce qu'elle est. *Il y a plusieurs Philosophes qui n'admettent point les formes substantielles*.' See the edition digitalized by the ARTFL Project (Project for American and French Research on the Treasury of the French Language) of the University of Chicago, at http://www.lib.uchicago.edu/efts/ARTFL/projects/dicos/ACADEMIE/PREMIERE/premiere.fr.html.

[373] See, e.g., Jean-Marie Beyssade's discussion of Antoine Arnauld's theory of sensation and ideas, in 'Sensation et idée: le patron rude', in J. C. Pariente, ed., *Antoine Arnauld: Philosophie du langage et*

The functions of organic life might well be described as suitable to ideas about the position in the created universe of the body (as opposed to the immaterial spirit); but there was no guarantee that the observation of organic life and animal activity would always fit in with the prerogatives of metaphysical ideologies, such as the postulation of God's just and omniscient role in ordering the universe and its bodies. In other words, there was no way of preserving the privileged status of reason if it could not be identified as exclusively human - even the presence of language, as we have seen, might not in the end prove enough about rationality within the dualist thesis. Pierre Bayle, who gave an extensive account of the debate about animal souls in the 'Rorarius' entry in his *Dictionnaire historique et critique*,[374] seems to have been aware of the problem; and, although he offered no solution, the aspects which he chose to emphasise, as we shall soon see, concerned in part the logical fallacies of the arguments offered by the various participants up to his own day.

The characters in the story Bayle told have the status of protagonists involved in a crisis without an escape route in sight,[375] since, after Descartes, it seemed impossible to reconcile the special status of human rationality with the notion that even in animals the presence of a sensitive soul, made manifest by something like voluntary movement, might signal the presence of some sort of intellective or deliberative faculties. As I have tried to show, the crisis took place in an atmosphere of puzzlement, or rather was itself an instance of acute puzzlement about the consequences of basing certain knowledge on introspectively acquired self-reference.[376] Because Descartes put forward what looked like an extreme position -

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de la connaissance (Paris, 1995), pp. 133-152. See also La Forge, *Œuvres*, ed. Clair, p. 355, n. 3, and the reference to Jacques Rohault's identification of Cartesian extension with Aristotle's notion that 'Quantitas est coaeva materiae.'

[374] Pierre Bayle, *Dictionnaire historique et critique* (first published Rotterdam, 1697, 4 vols.; here, Paris, 1820-24, 16 vols.), XII, pp. 588-622. Jérôme Rorarius was an apostolic nuncio at Ferdinand of Hungary's court; his treatise on animal minds, upholding the thesis that animals were deprived of reason, was written in 1547, though not published until 1648. See also the entry 'Péreira' in Bayle's *Dictionnaire*, XI, pp. 546-564, not as lengthy as 'Rorarius' but substantial; Gomez Pereira was a Spanish physician who sustained that beasts were machines. According to Bayle, pp. 547-548, his real name was Georgius Gomez. He was the author of *Antoniana Margarita, in quâ omnium penè morborum discursus proponuntur* (Medina, 1554, 1587) and of *Nova veraque Medicina Christiana ratione comprobata* ((Medina, 1558). See also Gaukroger, *Descartes*, p. 271.

[375] Tocanne, in *L'idée de nature*, p. 64, calls it 'un drame métaphysique'.

[376] Pascal Engel, in the introduction to his *Philosophie et psychologie*, pp. 26-27, gives a similar account of what is commonly taken to be the effect of the Cartesian 'cogito' on the development of psychology after the scholastic will and intellect were no longer there to separate man from animal: 'à partir de Descartes', he writes, 'c'est la conscience, et non pas l'intelligence et la rationalité, qui devient le critère de définition du mental. L'esprit, du point de vue cartésien, est le domaine de ce qui est accessible à l'introspection. Descartes inclut parmi les propriétés propres à l'esprit la sensation, et

though there is good reason to believe that he would have preferred not to uphold it but felt constrained to do so by his own system[377] - responding to him was a useful exercise. The objections to the beast-machine thesis contributed, it is true, to forming the slightly caricatured picture of Descartes as its unqualified defender;[378] but more importantly, read together with the objections to the *Méditations métaphysiques*, they constitute a body of elaborate arguments in which the connection between metaphysics and physics was repeatedly tested.

The basic problem was that of establishing what faculties animals possessed, what could be inferred from the abilities they displayed in nature and on what basis such inferences could be considered true accounts. How might the wedge which divided us from them be preserved if their behaviour was at all understandable by us? How could they remain 'other' if they were at once objects of theoretical speculation and models upon which to base the study of the human body? Above all, what was the rationale for stating, as Descartes had, that the laws of mechanism alone sufficed to constitute an adequate causal account of the types of behaviour animals visibly engaged in? Descartes's tight system clearly caused a mess, from which he and later, mitigated Cartesians had trouble extricating themselves. This mess, as we have seen, consisted in the anxious need to determine which causal laws could be said to operate in the realm of biology. It was necessary to provide an accurate description of how mind and body interacted now that they had been redefined as ontologically separate, differing substances, and to determine which of

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en exclut les animaux, qui ne peuvent authentiquement sentir. Car toute forme de sensation humaine, selon Descartes, comprend un élément spirituel plutôt que matériel, la conscience. Cette redistribution des rapports entre l'esprit et le corps place l'âme dans une position séparée: elle cesse d'être la "forme" et la propriété du corps pour devenir substance, et il s'avère donc possible de l'étudier à part du corps, à partir des propriétés révélées à la conscience. La sphère du sujet devient dissociée de celle des choses matérielles.'

[377] See Descartes, 'Au Marquis de Newcastle', 23 November 1646 in Descartes, *Œuvres*, ed. Alquié, III, pp. 695-696: 'On peut seulement dire que, bien que les bêtes ne fassent aucune action qui nous assure qu'elles pensent, toutefois, à cause que les organes de leurs corps ne sont pas fort différents des nôtres, on peut conjecturer qu'il y a quelque pensée jointe à ces organes, ainsi que nous expérimentons en nous, bien que la leur soit beaucoup moins parfaite'; and his letter to Henry More, 5 February 1649: 'quoique je regarde comme une chose démontrée qu'on ne saurait prouver qu'il y ait des pensées dans les bêtes, je ne crois pas qu'on puisse démontrer que le contraire ne soit pas'. Malebranche picked up on the rarity of the occasions on which Descartes actually *said* that beasts did not feel anything: see Malebranche, *Recherche*, in *Oeuvres*, III: VIIe preuve, 'Eclaircissement XV', p. 233. See also Gaukroger, *Descartes*, pp. 269-290.

[378] See, e.g., Thierry Gontier, 'Les animaux-machines chez Descartes: modèle ou réalité?', *Corpus*, 16-17, 1991, pp. 3-16.

the causal modalities of their union could account for perceptual cognition in man and beast alike.[379] In his *Traité de l'esprit de l'homme*, Louis de La Forge wrote:[380]

> What else can that imaginative [*fantastique*] part of the soul - which is not the body though it is similar to the body - be but the confused thoughts of the imagination, which are not bodily since they are operations of the mind, though they are similar to the body because they represent and depend on it? And what else is that sensible part of the body which is almost mind because it cannot exist without the soul, but that *ignea vis*, or the animal spirits which would have no power to make us feel anything if he who has unified soul and body had not also attached our thoughts to the forms they adopt.[381]

La Forge insisted, just as Descartes had, on a 'difference between the species of the imagination and the ideas of the understanding',[382] hard to distinguish for most people because of the common assumption present from childhood that bodies were capable of knowledge just as minds were,[383] and because one tended to confuse ideas in the mind, immediately perceived, with the material, 'corporeal kinds, which serve the imagination and the senses'.[384] Already in the preface, however, he took care to emphasize the Augustinian sources of the Cartesian doctrine: Descartes's notion of a thinking substance, he wrote, should be understood to mean, as Augustine suggested

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[379] Gaukroger, in *Descartes*, p. 287, suggests, quite problematically, that for Descartes there were 'two levels of description appropriate to accounting for perceptual cognition' in both animal and man, without the need for any 'reference to the intellect' - namely the 'causal-mechanical' level and the level 'appropriate to describing the exercise of higher-order functions'. He notes: 'it is because the causal-mechanical process occurs that the significatory process occus: we cannot treat the latter as if it were independent of the former, but nor can we ignore the fact that being fitted out with the right reponsive mechanisms - the right innate capacities - is necessary for the former process to yield the latter'. As he explains, pp. 287-288, the automaton was simply a 'self-moving thing'; the animal automaton must have been 'unlike mechanical constructions such as clocks and organs in that they are able to have genuine perceptual cognition, in the form of a grasp of representations of perceptual stimuli, something which requires nothing over and above corporeal organs'. This explains, in his view, that Descartes believed that the 'thoughts and experiences' of animals 'are not like ours, not that they do not have any thoughts and experiences at all'.

[380] See above, p. 88, n. 53.

[381] La Forge, *Traité*, in *Œuvres*, ed. Clair, p. 97: 'Quelle peut-estre cette partie fantastique de l'Ame qui n'est pas Corps mais semblable au Corps, si ce ne sont les pensées confuses de l'imagination qui ne sont pas Corps, estant des operations de l'Esprit: Mais toutesfois semblables au Corps, parce qu'elles le representent, & qu'elles en dependent? Et quelle peut estre cette partie sensitive du Corps, qui est presque esprit, parce qu'elle ne peut-estre sans l'Ame, sinon cette *ignea vis*, ou les esprits animaux, qui n'auroient pas le pouvoir de nous faire rien sentir si celuy qui a uny l'Ame au Corps n'avoit aussi attaché nos pensées aux formes qu'ils prennent.'

[382] Ibid., p. 159: 'une difference entre les especes de l'Imagination, & les Idées de l'Entendement'.

[383] Ibid., pp. 157-158: 'la pluspart des Hommes s'imaginent que les Corps en sont capables [de connaissance] aussi bien que les Esprits, & s'accoûtument tellement peu à peu à concevoir l'acte de la connoissance à la manière des accidents de la matiere, qu'il est tres-difficile apres cela de leur en faire former une autre idée'.

[384] Ibid., p. 158: 'l'on confond presque tousiours les Idées ou Notions que l'Esprit aperçoit immediatement, avec les Especes Corporelles qui servent à l'imagination & et aux sens'.

in *De quantitate animae*,[385] that God had created a substance endowed with reason - and not anything like air, fire, earth or water; and Augustine had meant reason, said La Forge, in the sense, not that it was reasonable, but that the thinking substance ruled the body by thinking and perceiving: 'Reason, he says, is the sight [*vue, aspectus*] of the spirit with which it gazes upon truth; but reasoning is reason's search [for truth]; this is why reason is necessary for seeing, and reasoning for searching.'[386]

Moreover, 'reason' encapsulated far more than 'reasoning': it was 'that perception on whose account all the operations of the mind are thoughts'; and the thinking substance was 'a substance which takes note of all of its actions and passions, and generally of all that takes place in itself, immediately rather than reflectively'.[387] La Forge conflated the Augustinian, psychological and the Cartesian, syllogistic versions of the demonstration that reason was self-knowledge, or, more specifically, self-consciousness - the introspectively acquired certainty that our thinking nature was an 'intelligent substance'. Higher cognitive operations, on such an account, were embedded within the very phenomenon of consciousness. Thinking was the very mark of awareness; Descartes's *intelligere* and Augustine's *cogitare* denoted one and the same activity, which partook both of the understanding and of

[385] Ibid, p. 81: 'S. Aug. a crû que l'Ame humaine estoit une substance qui pense, immaterielle, immortelle, qui pense tousiours &c. dans le mesme sens, que Monsieur Descartes l'a establi. Pour vous le prouver, lisez premierement ce que S. Augustin a escrit dans le livre de la quantité de l'Ame en ces termes; Vous devez entendre de quoi Dieu ait creé l'Esprit de l'Homme, il est pourtant d'une certaine substance qui ne tient rien de l'air, ny du feu, de la terre, ny de l'eau; si nous ne voulons croire que Dieu a bien pû accorder à la Terre qu'elle ne fust rien que Terre, mais non pas à l'Esprit de n'estre qu'Esprit. Que si vous voulez qu'on vous le definisse, & si vous demandez ce que c'est, il est aisé de répondre, que c'est une certaine substance doüée de raison, propre à régir le Corps.' The passage from *De quantitate animae* is at ch. 13, § 22: 'Intelligendum est enim quamquam deus fecerit animum, habere illum certam substantiam, quae neque terrena, neque ignea, neque aeria sit, neque humida: nisi forte arbitrandum est deum terrae dedisse ut nihil aliud sit quam terra, et non dedisse animo ut nihil aliud quam animus sit. Si autem definiri tibi animum vis, et video quaevis quid est animus; facile respondeo. Nam mihi videtur esse substantia quaedam rationis particeps, regendo corpori accomodata.'

[386] Ibid.: 'La Raison, dit-il, est la veuë de l'Esprit, par laquelle de luy-mesme il regarde la verité; Mais le raisonnement c'est la recherche qu'en fait la raison; C'est pourquoy celle-cy est necessaire pour voir, & celuy-là pour rechercher.' He reproduces the Latin version in a footnote: 'Ratio quidem est animi aspectus, quo per se ipsum verum intuetur; ratiocinatio verò est rationis inquisitio; quare ista opus est ad videndum, illa ad inquirendum.' The passage from *De quantitate animae* is at ch. 27, § 53: 'non enim sana mens agit hoc semper, cum semper habeat rationem; sed recte ista fortasse ratiocinatio nominatur; ut ratio sit quidam mentis aspectus, ratiocinatio autem rationis inquisitio, id est, aspectus illius, per ea quae aspicienda sunt, motio.'

[387] Ibid., p. 82: 'on ne peut le prendre que pour cette perception, qui fait que toutes les operations de l'Esprit sont des pensées, parce qu'elle se rencontre en toutes. Lors que j'ay expliqué ce que c'est qu'une subtance qui pense, j'ay dit que c'est une substance qui s'aperçoit de toutes ses actions & passions, & generalement de tout ce qui se passe en elle immediatement, & non par reflexion.'

the will, indeed defined the respective remit of the two. Conscious perception, thought - cogitation - and self-awareness were thus the attributes of reason. Moreover, to prove its existence was to prove its separation from the body and from knowledge acquired immediately through the senses and the imagination:[388] 'it would not be dignified for a reasonable mind even to suggest that what reason lets us see is similar to what our eyes discover', wrote La Forge.[389] This was the reason which was above the minds of beasts, according to him and to his reading of Augustine and the Augustinian Descartes.[390] We perceived, and obtained accurate, true perception, thanks to the soul and to its mutually entwined, though traditionally separate, faculties of sense and will. The incorporeal soul conferred life on the body - not vegetative, but sensitive life, in that the soul felt and reasoned inside the body - and was endowed with 'Memory, Reason, Understanding and Immortality'.[391]

This formidable, praiseworthy, voluntaristic *reason* was defined by La Forge in such a way that it drew a thick, theologically necessary boundary between the realm of the human and the realm of beasts, identifying reason with will - following faculty psychology, for which will was one aspect of the intellective soul - and, as the Oratorian sympathizer[392] emphasised in his preface, with what was explanatory of man's privileged relation to God. With Augustine, one could in fact claim that reason both proved and was the proof of the immateriality of the soul: the soul cannot occupy any space, wrote La Forge, paraphrazing Augustine, 'but just as heat is in fire without occupying any space in it, so the soul is in the body', which possesses it '*non mole sed intentione*, that is, not by virtue of the extension of its substance but by the application of its thoughts'.[393] For all its theological sensitivity, this was the sort of

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[388] Ibid., pp. 83-86.

[389] Ibid., p. 85: 'ce seroit une chose indigne d'un Esprit raisonnable de dire seulement que ce que la raison nous fair voir seroit semblable aux choses que nos yeux découvrent'.

[390] The view that Descartes's central doctrines regarding the metaphysics of body and soul had their roots, or at least antecedents, in Augustine, was shared by others, including Mersenne, Bayle (as we have seen) and the Oratorian Father Nicolas Poisson. Emmanuel Faye has recently published and studied a commentary by Poisson, written in the form of a letter, which took partial issue with the 1675 act forbidding the teaching of Cartesianism in the universities, and which was entitled *Sur la philosophie de Descartes*. See 'Un inédit du P. Nicolas J. Poisson, *Sur la Philosophie de Descartes*', *Corpus 37: Cartésiens et augustiniens au XVIIème siècle* (Paris, 2000), pp. 91-130, at p. 105.

[391] La Forge, *Traité*, in *Œuvres*, ed. Clair, p. 89.

[392] On Oratorians in the context of other religious groupings and factions in France such as Jansenism, see, e.g., Brockliss, *French Higher Education*, pp. 247-258. For an evaluation of connections between Cartesianism and Jansenism, see Tad M. Schmaltz, 'What Has Cartesianism To Do with Jansenism?', *Journal of the History of Ideas*, 1999, 60, pp. 37-56.

[393] La Forge, Traité, in *Œuvres*, ed. Clair, p. 89: 'Mais comme la chaleur est dans le feu sans y occuper de place, l'Ame est de mesme dans son Corps. … elle le possede & luy est presente, *non mole*

definition of reason which had the unfortunate logical consequence of binding the enlightened, self-conscious thinker to a position such as that of Malebranche, in which it became possible to posit an equivalence between natural and artificial bodies, and from there, to end up with something like the beast-machine thesis. The alternative was a return to 'anthropomorphizing' beasts, in line with Montaigne and Charron. But to assume that the features of reasonable behaviour they exhibited were in fact the mark of the presence of a human-like reason was tantamount either to granting them a rational, and therefore immortal soul, or to denying that the rational soul of humans was immortal. If, wondered for example the Cartesian protestant Jean-Marie Darmanson, 'beasts are accorded the slightest degree of knowledge, joy, sadness, pleasure, pain, hate and love, and of all the other passions attributed to them', then they must have 'a soul as subject of all these operations, entirely separate from the body, which is absolutely incapable of them. But if [their soul] is mortal, as opinion will have it, then we are necessarily constrained to admit that ours is too.'[394]

But the point of holding on to an immortal soul was primarily to enforce accountability for actions in the present life. Beasts could not be allowed a free will and so could not either be held responsible for their actions. No just God would recompense or punish a creature who had willed nothing and been unaware of everything. Moreover, as Dilly argued in his pamphlet on the souls of beasts, the very fact that beasts felt pain and distress, that our violence towards them could be the cause of this distress, showed that they had no soul: why would God allow a creature endowed with a soul to suffer with no hope of redemption after death?[395] To

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sed intentione, c'est-à-dire, non par l'estendue de sa Substance, mais par l'aplication de ses pensées.' The passage he quotes is from Augustine, *De Genesi ad litteram libri duodecim*, VIII. 21: 'unde id, quod movendum est, inmitatur, cum anima non sit natura corporea nec locali spatio corpus inpleat, sicut aqua utrum sive spongiam, sed miris modis ipso incorporeo nutu commixta sit vivificando corpori, quo et inperat corpori quadam intentione, non mole'.

[394] Jean-Marie Darmanson, *La bête transformée en machine: Divisée en deux Dissertations prononcées à Amsterdam par J. Darmanson dans ses Conférences Philosophiques* (1684), p. 38: 'Il faut cependant accorder que si nous admettons dans les Bêtes le moindre degré de connoissance, de joye, de tristesse, de plaisir, de douleur, de haine et d'amour, et de toutes les autres passions qu'on leur attribue, il faut leur accorder une Ame qui soit le sujet de toutes ces opérations et qui soit entièrement distinguée de leur corps, qui n'en est nullement capable. Mais si elle est mortelle, comme l'opinion commune l'accorde, nous sommes nécessairement obligez d'avouer que la nôtre l'est aussi.' See L. C. Rosenfield, *From Beast-Machine to Man-Machine*, pp. 273-277. See also below, p. 124, n. 95.

[395] See Dilly, *De l'ame des betes*, p. 99: 'Mais pour les Bêtes nous sommes obligés d'avouer qu'elles souffrent sans l'avoir mérité, & sans aucune esperance de sortir jamis de l'état mal-heureux où elles sont, si ce n'est par la perte la plus épouvantable qu'on puisse concevoir, c'est à dire par l'anéantissement. Est-il bien possible que leur ame miserable toute innocente qu'elle est ressente des douleurs

ascribe to beasts an immortal soul, while denying them the free will allowed only to humans, seemed to make no theological sense at all.[396] Pierre Bayle did suggest an argument in favour of the notion that animals actually had free will: we punish animals, he wrote in his Rorarius article, just as we punish criminals; and we would not think of punishing a wrong-doer if we believed his actions were determined by some external necessity.[397]

It appears, then, that any alternative answer to the question of the presence or not of reason in beasts required a credible demonstration of the kind of cognitive apparatus which non-human living organisms could be presumed to have. To be convincing, it would have to be founded, as Dilly wrote, on a - Cartesian - 'clear and distinct reason', rather than on the common *a priori* assumption that beasts undoubtedly had 'des connoissances';[398] and it would have to lead to the establishment of some sort of proof,[399] which was hard to obtain if one did not want to resort to the naturalistic models of animal cognition of the Plinian tradition.[400] It might be allowed, for example, that reasonableness need not be solely an aspect of the kind of reason La Forge admired, bound as it was to the immortal, immaterial soul, but that it might itself be tied to the presence of both perception and voluntary movement in creatures deprived of an immortal soul. Was not reasonable behaviour proof of the existence of a commensurate faculty, intrinsic to the creature's very identity, just as language was in the case of humans? If so, something had to make it possible for enmattered creatures other than humans to behave reasonably. Those

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tres cuisantes, & n'ait point d'autre jour pour les voir finir que celuy auquel elle cessera d'être? ce qui est le comble de tous les mal heurs.'

[396] On the other hand, to deny a soul to animals was not - as some Aristotelians held - to deprive humans of an immortal soul, and thus to play into the hands of libertines: in response to the argument that if an animal can perceive and cognize without a soul, then it is perfectly possible to conceive of a perceiving, cognizing man-machine, one could reply, both Dilly and Pardies replied that by allowing animals a *material* soul, and not a rational one, we would not be threatened with this outcome. See L. C. Rosenfield, *From Beast-Machine to Man-Machine* generally for an exhaustive survey of the French debate about animal automatism.

[397] Bayle, 'Rorarius', in *Dictionnaire*, XII, pp. 604-605.

[398] Dilly, *De l'ame des betes*, pp. 4-6.

[399] In a science like astronomy, a distinction remained between observation and proof, in the sense that the mere observation of a phenomenon did not constitute proof of the truth of the hypothesis about its mechanism. See, for example, Tocanne, *L'idée de nature en France*, I. 2: 'Le nouvel univers', p. 28: 'Duhamel, alors secrétaire de l'Académie des Sciences …, rappelait la distinction classique entre l'astronome qui décrit et calcule les mouvements célestes, et le physicien qui seul décide de la vérité d'une hypothèse'. Jean-Baptiste Du Hamel was 'secrétaire perpétuel de l'Académie des Sciences' from 1666 to 1699.

[400] For a history of the notion of animal knowledge and language, see Serjeantson, 'The Philosophy of Animal Language'.

who wanted to believe in a qualitative, rather than quantitative, difference between the soul of man and the soul of beasts had to take a few steps away from both Cartesian dualism and Aristotelianism in order to make something more of what La Forge himself quoted Augustine as saying: that 'the state of being an animal is common to man and beast, although they are very different beings'.[401]

The twin relationship of commonality with and difference between man and beast was parallel, for Augustine as reported by La Forge, to that between feeling and knowing: the one denoted the cleavage between two modes of being, the other, between two corresponding modes of perceiving. Malebranche, too, pointed out the difference

> between the light of our ideas and the obscurity of our feelings; between knowing and feeling. … Anyone who has not given sufficient thought to this difference, ceaselessly believing that he knows clearly what he feels most strongly, can only get lost in the darkness of his own [modifications]. For ... man is not a light to himself. His substance, far from enlightening him, is itself unintelligible to him. His knowledge is due solely to the light of universal Reason which enlightens all minds [*esprits*], and to the intelligible ideas which it reveals to them in its entirely luminous substance.[402]

Singling out feeling as that which was common to man and beast solved the riddle but also posed a problem: on the one hand, it sanctioned the claim that the difference between humans and animals could be defined in terms of their respective cognitive functions; while on the other, it required a detailed examination of the particular features of human reason. This was a philosophical task, to be sure, but one which had to remain answerable to, and bound by, theological concerns. Malebranche's resort to the 'light of reason' bestowed on humans by God did not provide a fool-proof guarantee against the failure of occasionalism. Again, those who could not

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[401] La Forge, *Traité*, in *Œuvres*, ed. Clair, p. 90: 'estre animal est un genre commun à l'Homme & à la beste, quoy que ce soient deux estres fort differens'. The quotation from Augustine's *De quantitate animae* is at ch. 30, § 58: 15: 'quanquam sit aliud sensus, aliud scientia, illud tamen non latere utrique commune est; ut ipsi homini & bestiae, quamvis plurimum different, animal tamen esse commune est'.

[402] Malebranche, *Entretiens sur la métaphysique, sur la religion, et sur la mort* (first published Paris, 1688; here, Paris, 1711, reprinted 1994), '3ème entretien', p. 253: [la différence] 'entre la lumière de nos idées et l'obscurité de nos sentiments, entre connaître et sentir; et qu'il est nécessaire de s'accoutumer à la distinguer sans peine! Celui qui n'a point fait assez de réflechir sur cette différence, croyant sans cesse connaître fort clairement ce qu'il sent le plus vivement, ne peut qu'il ne s'égare dans les ténèbres de ses propres modifications. Car … l'homme n'est point à lui-même sa propre lumière. Sa substance, bien loin de l'éclairer, lui est inintelligible elle-même. Il ne connaît rien que par la lumière de la Raison universelle qui éclaire tous les esprits, que par les idées intelligibles qu'elle leur découvre dans sa substance toute lumineuse.'

commit to extreme dualism but who understood the need to relinquish the Aristotelian psychological model had to find a theologically acceptable and logically plausible way of positing that mind and body were united in a mode which allowed that matter somehow might participate in the making of the active, willing, perceiving mind.

This was no mean task. For a metaphysical knot surely lay behind the rather vague notion, expressed for example by the Jesuit Père Daniel[403] and reported by an ironic Bayle in his *Rorarius* article, that, just as Descartes's spirit was 'a substance that thinks and reasons', the soul of beasts was 'a substance capable of sensation'. It was able, as Bayle glossed, 'to see, hear, etc.', and yet was 'neither matter nor spirit, but a being between the two, not capable of reason or thought, but only of perception and sensation'.[404] What such a creature might actually be, defined as it was by that which it lacked rather than by that which it possessed, was not entirely clear. Generally speaking, it was easy enough to accept that the ability to recognize a sensation and to examine it was an aspect of rational enquiry and the foundation of some sort of self-awareness. Hence, as Dilly explained, if animals have sensations but nothing like our reason, they might not be capable of knowing that they have any sensations at all, and thus might not actually feel anything, or at any rate nothing one could identify with human sense-experience.[405]

For Malebranche, the human awareness of the limitations of our sense-perception[406] went hand in hand with the possibility, thanks to mathematics - the

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[403] Gabriel Daniel was historiographer to Louis XIV. His *Voyage du monde de Descartes* (Paris, 1690), where he refuted Descartes's vortex theory, was well known. See also below, p. 194.

[404] Bayle,'Rorarius', in *Dictionnaire*, XII, p. 606. 'La définition de l'âme de la bête, *une substance capable de sensation* [Daniel, *Suite du Voyage du Monde de Descartes*, p. 75], c'est-à-dire de voir, d'entendre, etc., est aussi claire que la définition cartésienne de l'esprit, une substance qui pense et qui raisonne [p. 84]. Ce sont les paroles du P. Daniel: il les prouve ensuite aussi bien qu'on puisse. Un peu auparavant il avait dit [pp. 82, 83] que l'âme des bêtes n'est ni matière ni esprit, *mais un être mitoyen entre les deux*, qui n'est pas *capable de raisonnement ni de pensée, mais seulement de perception et de sensation*.'

[405] Dilly, *De l'ame des bêtes*, pp. 115-136, at, e.g., p. 121.

[406] Tocanne, in *L'idée de nature*, p. 20, refers to the earlier scepticism of Marin Mersenne and to the following passage in *Questions théologiques, physiques, morales, et mathematiques* (Paris, 1634), in Mersenne, *Questions inouyes. Questions harmoniques. Questions théologiques. Les méchaniques de Galilée. Les préludes de l'harmonie universelle* (Paris, 1985), 'Question 2', p. 217:'Car l'on peut dire que nous voyons seulement l'écorce, et la surface de la nature, sans pouvoir entrer dedans, et que nous n'aurons jamais autre sciene que celle de ses effets exterieurs, sans en pouvoir penetrer les raisons, et sans sçavoir la maniere dont elle agit, jusques à ce qu'il plaise à Dieu de nous delivrer de cette misere, et nous dessiller les yeux par la lumiere qu'il reserve à ses vrays adorateurs.'

product and practice of reason if anything was - of positing the existence of an infinitely small world. 'Our vision is very limited', he wrote:

> but it should not limit its object. The idea it gives us of extension has extremely narrow bounds; but it does not follow that extension does. It is undoubtedly infinite, in one way; and this small part of matter, hidden from our eyes, is capable of harbouring a world in which one might find as many things, although in smaller proportions, as one finds in this big world in which we live. … We have obvious and mathematical demonstrations of the infinite divisibility of matter.[407]

The newly available notion of the infinitesimal bore only a superficial resemblance to the much older notion of the 'infinite spheres' of the divinely created universe, or even to the boundless universe Gassendi took over from Epicureanism.[408] If it provided a proof that our senses could not yield full knowledge of the world, it also established positively the capacity for reason to evaluate, calculate and imagine what the senses could not see. As we shall see in Part II, the demonstration that invisible worlds existed justified the use of abstract concepts such as extended and thinking substances to denote components of the divinely created universe whose existence seemed to make physical, psychological and theological sense. Such concepts were themselves 'universals', exclusively the products of reason, and tools for verbal thought which animals were surely not capable of forging. If the status of animals lay somewhere between matter and spirit, the conditions under which their soul and body were connected must differ from the complex modalities of mind-body interaction in humans, which Malebranche, for one, tried to unravel along dualist lines but also according to the patently true fact that 'man is not a pure spirit'.[409] His occasionalist

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[407] Malebranche, *Recherche*, in *Œuvres*, I, pp. 80-82 (I, vi, 1): 'Notre vue est tres-limitée; mais elle ne doit pas limiter son objet. L'idée qu'elle nous donne de l'étendue, a des bornes fort étroites; mais il ne suit pas delà, que l'étendue en ait. Elle est sans doute infinie en un sens; & cette petite partie de matière, qui se cache à nos yeux, est capable de contenir un monde, dans lequel il se trouveroit autant de choses, quoique plus petites à proportion, que dans ce grand monde dans lequel nous vivons. … Nous avons des démonstrations évidentes & Mathématiques, de la divisibilité de la matière à l'infini.'

[408] See Tocanne, *L'idée de nature*: 'Le nouvel univers', pp. 25-43, esp. pp. 38-42. For an analysis of Epicurus's ideas on space and the void, see Andrew Pyle, *Atomism and its Critics* (Bristol, 1995), pp. 64-79. On Gassendi's theory of matter, see,e.g., Margaret Osler, *Divine Will and the Mechanical Philosophy* (Cambridge, 1994), esp. pp. 171-200.

[409] Malebranche, *Recherche*, II, p. 139 (V, ii): 'c'est une des loix de l'union de l'ame avec le corps, que toutes les inclinations de l'ame, même celles qu'elle a pour les biens qui n'ont point de rapport au corps, soient accompagnées des émotions des esprits animaux, qui rendent ces inclinations sensibles; parce que l'homme n'étant point un esprit pur, il est impossible qu'il ait une inclination toute pure sans mélange de quelque passion petite ou grande. Ainsi l'amour de la vérité, de la justice, de la vertu, de Dieu même, est toujours accompagné de quelques mouvemens d'esprits qui rendent cet amour sensible, quoiqu'on ne s'en apperçoive pas, à cause qu'on a presque toujours d'autres sentimens plus

theory plugged the causal gap, so to speak, between matter and spirit, but its reliance on God's agency created new problems.[410]

Furthermore, within the framework of dualism and for defenders of the orthodox Cartesian thesis, to posit that animals were equipped with reason of any kind at all, as did Gassendists,[411] could lead to the destruction of our foundations of certainty and to the establishment of an all-devouring scepticism before which the human capacity to know anything at all about the physical world was shattered. Thus, Dilly asserted that 'the Pyrrhonians will have won' if reason is attributed to beasts, simply because to do so is to contradict the notion that matter cannot think, hence to claim that contradictions are possible, and so that there are no clear and distinct foundations for knowledge.[412] Those clear and distinct foundations, for him, began with the Cartesian understanding of thought as necessarily conscious and intransitive with regard to its objects.[413] Knowledge of a circle, on the one hand, and the feeling of heat, on the other, he wrote, differed 'only with regard to their object and to their manner of representing them',[414] while they are immediately perceived by the thinker. Thoughts, like mirrors, were clear to us even when their objects seem obscure; and it was in the nature of thought to make us immediately certain of its presence as soon as it was produced.[415] The properties of a given substance followed from its nature; so, just as it was in the nature of water to have small, shiny and flexible parts,[416] the nature of mind consisted in the faculty of thought alone.[417] This was a direct reference to Descartes's definition of thought as 'self-aware mental

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vifs: de même que la connoissance des choses spirituelles est toujours accompagné de quelques traces du cerveau qui rendent cette connoissance plus vive, mais d'ordinaire plus confuse.'

[410] For an analysis of Malebranche's occasionalism, see above, p. 70, n. 137.

[411] See, e.g., Sylvia Murr, 'L'âme des bêtes chez Gassendi', in *Corpus*, 1991: *L'âme des bêtes*, pp. 37-63.

[412] Dilly, *De l'ame des betes*, pp. 102-105, at p. 103: 'Enfin si l'on reçoit ce principe, nous n'avons plus de certitude dans la science humaine, les Pyrrhoniens ont gagné, & il n'est point de proposition si éloignée du bon sens, que l'on ne puisse impunement soûtenir.'

[413] As Rorty put it in *Philosophy*, p. 58, Descartes used 'indubitability' as the mark of 'consciousness. Whereas previous philosophers had more or less followed Plato in thinking that only the eternal was known with certainty, Descartes was substituting "clear and distinct perception" - that is, the sort of unconfused knowledge gained by going through a process of analysis - for "indubitability" as a mark of eternal truths. *This left indubitability free to serve as a criterion of the mental*.' (Rorty's italics.)

[414] Dilly, *De l'ame des betes*, pp. 10-13, at p. 11: 'ces deux pensées ne sont differentes que par raport à leurs objets & par la maniere de les representer'.

[415] Ibid., p. 14.

[416] Ibid., p. 25.

[417] Idid., pp. 19-20, 25. For an account of this view, see James, *Passion and Action*, pp. 87-89.

activity',[418] which Locke later would qualify by suggesting that the 'capacity for thought' sufficed to define the essence of mind,[419] and that thought stood 'to the Soul, what motion is to the Body, not its Essence, but one of its Operations'.[420] Since Descartes and his followers understood sensation as a kind of thought, and insofar as for them there was no sensation to speak of that was not actually *experienced* and thus conscious in some sense, one can understand why they put such a premium on establishing self-reflexivity as intrinsic to the act of thinking.[421]

It was this constraint on the definition of thought, however, which, applied as it was to all forms of conscious cognition, led the Cartesians in the first place to deny animals sensation, feeling and so on.[422] If 'matter does not think' - and they made sure that it could not[423] *per definitionem* - and sensations were themselves thoughts, then there was no justification at all for assigning sensation to a physical creature deprived of an immaterial, necessarily immortal, 'thinking substance', which in effect was the 'rational soul' now revamped to include some of the features originally attributed to the Aristotelian 'sensitive soul'.[424] The radical separation of both reason and sense-experience from the body thus left an explanatory gap at the heart of the living, sentient human organism. Questions around this gap regarding the definition of the human could only be posed indirectly, that is, through direct enquiries about how to define the sort of knowledge *animals*, rather than man, seemed to possess and to be capable of acquiring. Instinct could be defined against reason, and reason against instinct. In the next chapter we shall encounter some of the arguments that were used to establish the differences between the two.

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[418] Descartes, *Principes de la philosopie*, I, 9, in *Œuvres*, ed. Alquié, III, p. 95: 'Par le mot de penser, j'entends tout ce qui se fait en nous de telle sorte que nous l'apercevons immédiatement par nous-mêmes; c'est pourquoi non seulement entendre, vouloir, imaginer, mais aussi sentir, est la même chose ici que penser.' See also 'A Regius', May 1641, in ibid., II, pp. 332-336, at 333: 'l'intellection est proprement la passion de l'âme, et l'acte de la volonté son action'; and 'A Arnauld', in ibid., III, June or July 1648, pp. 854-857, at 855: ''il est nécessaire que l'âme pense toujours actuellement parce que la pensée constitue son essence'. See Woolhouse, *Concept of Substance*, p. 152

[419] See Woolhouse, *Concept of Substance*, p. 153, who paraphrases Locke, *Essay*, II, i, §10: 'I confess my self, to have one of those dull Souls, that doth not perceive it self always to contemplate Ideas, nor can conceive it any more necessary for the Soul always to think, than for the Body always to move'.

[420] Woolhouse, *Concept of Substance*, p. 153.

[421] See Rorty's similar treatment of this issue in *Philosophy*, p. 53, n. 23.

[422] See La Forge, *Traité*, in *Œuvres*, ed. Clair, pp. 118-119.

[423] La Forge, ibid., p. 120, showed that thought and extension must necessarily differ in their respective attributes, for 'il y aurait de la contradiction à dire qu'ils se puissent ressembler dans une chose, dans laquelle ils sont formellement opposez: L'on ne sçauroit donc sans contradiction attribuer aucune Pensée au Corps, ny aucune Estendüe à l'Esprit'.

[424] As Rorty put it in *Philosophy*, pp. 53-54: 'Once mind is no longer synonymous with reason, then something other than our grasp of universal truths must serve as the mark of mind.'

3. The beast-machine controversy: reason, instinct and the causality of motion

> *La maniere de naistre, d'engendrer, nourir, agir, mouvoir, vivre et mourir des bestes estant si voisine de la notre, tout ce que nous retranchons de leurs causes motrices, et que nous adjoustons à nostre condition au dessus de la leur, cela ne peut aucunement partir du discours de nostre raison.*[425]

> *… où est l'homme qui oserait dire qu'il n'y a que lui qui pense, et que tous les autres sont des machines? Ne le regarderait-on pas comme un personnage plus extravagant que ceux qu'on enferme dans les Petites Maisons, ou que l'on séquestre de toute société humaine? Cette conséquence du dogme cartésien est un fâcheux rabat-joie: elle est semblable aux pieds du paon; c'est une laideur qui mortifie la vanité que le brillant du plumage avait inspirée.*[426]

> *… some deserving very ill of themselves, have affirmed the Souls of Man and the Beasts only to differ in degrees of Perfection.* [427]

By defining the self-conscious human organism in terms of two substances, and these substances in terms of their essential properties, the Cartesian system narrowed the playing field in which it was possible to identify operations of cognition. As I shall explain in this chapter, it did so by extending the operational range of reason to a realm not bound by sense-perception. Given the logical and metaphysical constraints internal to the orthodox Cartesian version of this system, it is not surprising that Descartes's successors and disputants had a hard time trying to reshape what, for the majority of them, was the problematic beast-machine.[428] Pierre Bayle understood the issues, for example calling the scholastic alternatives to granting beasts a rational soul 'muddled and impenetrable verbosity', useless to those who wanted to 'avoid the alarming consequences' of assigning to animals a sensitive soul and who were anxious to 'establish a specific difference' between the human and animal soul.[429] We shall see how this 'verbosity', which is apparent in the more recondite arguments

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[425] A note on Lucretius by Montaigne: see Screech, *Montaigne's Copy of Lucretius*, p. 351

[426] Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 606: 'where is the man who would dare to say that he alone thinks, and that all others are machines? Would we not look upon him as someone more extravagant than those we enclose in the Petites Maisons, or shut away from all human society? This consequence of the Cartesian dogma is an unwelcome kill-joy: it is similar to the peacock's feet; it is an ugly trait which mortifies the vanity induced by the brilliant feathering.'

[427] Thomas Willis, *De anima brutorum* (London, 1672), p 1.

[428] On Descartes's Aristotelian adversaries, see Leonora Cohen Rosenfield, 'Peripatetic Adversaries of Cartesianism in 17th-Century France' and her bibliography, in Vere Chappell, ed., *Essays on Early Modern Philosophers: Cartesian Philosophers* (New York, 1992), pp. 14-39.

[429] Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 589: 'Il y a longtemps qu'on a soutenu que l'âme des bêtes est raisonnable. Les philosophes de l'école se trompent fort, si en rejetant cela, ils se persuadent qu'ils éviteront les suites fâcheuses de l'opinion qui donne aux bêtes l'âme sensitive. Ces messieurs ne manquent ni de distinctions, ni de hardiesse à décider que les actes de cette âme ne passent jamais certaines bornes qu'ils leur prescrivent: mais tout ce verbiage confus et impénétrable ne sertde rien pour établir une différence spécifique entre l'âme humaine et celle-là.'

used in the case for or against animal reason, showed up the limitations of mechanistic as well as scholastic causal accounts of animal and human willed action. It indicated a sense that no one had explained properly what it was that enabled animals to behave in the ways that they did, to make nests, remember locations, and so on; but it also pointed out the complex, at times worrying implications of accounting for human action together with animal action. I shall begin by describing how thinkers who explicitly embraced the modern, corpuscularian philosophy discussed the difficulties of ascribing minds and intentionality to beasts, before going on to analyse the confusions which arose from attempts to describe the putative functions of these animal minds.

Augustine, whose presence, as we have seen, suffuses these debates, had suggested that the bodily pain experienced by beasts was the manifestation in them of a resistance to the body's division and corruption, and thus of an aspiration to unity; moreover, our awareness of the beasts' aspiration and pain showed us that God *was* a unity.[430] All living things were united in the pain they experienced as a result of the body's division from the soul. Beasts were imbued with a life spirit, a 'corporeal feeling of which the soul was the principle'.[431] This idea sufficed to account for the sentience of creatures deprived of reason, and it served to glorify the activity of contemplating God. It did not, however, constitute a solid enough basis for mechanistic theories of action. La Forge, in the Oratorian manner, had insisted on the Augustinian foundations of Descartes's metaphysics of matter;[432] but intrinsic to the shorter, less elaborate tracts which fuelled the controversy over the beast-machine thesis was a belief in the need to justify one's point of view in terms sympathetic to

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[430] See Fontenay, *Le silence des bêtes*, pp. 269-270. She refers to Augustine's *De libero arbitrio*, III, xxiii, 69: 'Dolor autem quem bestiae sentiunt animarum etiam bestialium vim quandam in suo genere mirabilem laudabilemque commendat. Hoc ipso enim satis apparet in regendis animandisque suis corporibus quam sint adpetentes unitatis. Quid est enim aliud dolor nisi quidam sensus divisionis vel corruptionis inpatiens? Unde luce clarius apparet quam sit illa anima in sui corporis universitate avida unitatis et tenax, quae nec libenter nec indifferenter sed potius renitenter et reluctanter intenditur in eam passionem corporis sui qua eius unitatem atque integritatem labefactari moleste accipit.'

[431] Fontenay, *Le silence des bêtes*, pp. 270-271, citing a passage in Augustine's *The City of God Against the Pagans*, XIII, xxi, where Augustine discusses the concept of *pneuma* in the Septuagint and related concepts: 'Quid opus erat ut adderet *viventem* cum anima, nisi vivat, esse non possit? Aut quid opus erat ut adderet *vitae* cum dixisset *spiritum*? Sed intellegimus *animam viventem* et *spiritum vitae* scripturam suo more dixisse cum animalia, id est animata corpora, vellet intellegi quibus inesset per animam perspicuus iste etiam corporis sensus.'

[432] On La Forge's use of Augustine see, e.g., Henri Gouhier, *Cartésianisme et Augustinisme au XVII*^{e} *siècle* (Paris, 1978), pp. 58-68.

the 'modern philosophy'. The theological outcome of each theory, whose acceptableness one had to demonstrate in order to make a case, was secondary to the case itself. What was being developed in these discussions was a theory of knowledge which would take into account the importance of experimental natural philosophy; not a natural theology. Thus, Pardies found it viable to appeal to the notion of God's intentions, arguing how unfair to God it was to define his creatures as mere machines[433] - different from automata only in that they were built by nature, rather than humans - and how disrespectful we were to think of God as a puppeteer, when assuming that animals were puppets.[434] Dilly explicitly responded to Pardies and to his worry that God could not have given animals senses just for the sake of ornamentation,[435] using the epistemological rejoinder that the presence in beasts of operational sense-organs did not entail that they had *knowledge*, since sensation was corporeal, whereas all knowledge was spiritual.[436] Beasts, argued Dilly, did feel pain and distress, and our violence towards them could indeed be the cause of this distress. But this actually showed that they were deprived of a soul: surely God would not allow a creature endowed with a soul to suffer with no hope of redemption after death, just as he could not create creatures capable of loving, without giving them the possibility of loving God.[437] Moreover, Dilly – along with Pardies – rejected the notion put forward by orthodox Aristotelians that to deny a soul to animals was to deprive humans of an immortal soul, and thus to play into the hands of libertines.[438]

Since no one knew what sort of experience or knowledge animals had,[439] those for whom Cartesian 'clear and distinct ideas' alone provided a secure ground for any theory about the natural world were loath to presume anything about animal minds other than that they functioned according to the laws which prevailed in the mechanical philosophy.[440] Those like Cureau de la Chambre, Pardies or even Locke,

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[433] Pardies, *Discours*, pp. 222-224.
[434] Ibid., p. 228.
[435] Dilly, *De l'ame des betes*, pp. 106-110.
[436] Ibid., p. 118. Chapter 13, pp. 115-136, is entitled 'Où l'on répond aux raison du Pere Pardies, alleguées dans son Livre *de la connoissance des Bêtes*.'
[437] Ibid., pp. 99-100.
[438] Pardies, *Discours*, pp. 99-100; Dilly, ibid., pp. 110-114.
[439] Fontenay, *Le silence des bêtes*, p. 279, uses the term 'intropathie' to designate the - misguided - attempt to know beasts from within, rather than through the laws of physics.
[440] Jean Ehrard, in *L'idée de nature en France dans la première moitié du XVIIIe siècle* (Paris, 1963, reprinted 1994), p. 81, points out that Bayle, later on, wondered whether one could apply the notion of 'law' to inert matter, and he suggested that 'physical laws' only made sense with reference to something like the continuous creation conjectured on the occasionalist model. See Pierre Bayle,

on the other hand, for whom unknown entities were transformable into previously unimagined elements of natural history, could accept that the speechlessness of animals did not signify that they must be excluded from the map of cognizant creatures.[441] In doing so, they had to ascribe to animals intentionality - the capacity to represent to themselves memory, future actions or present objects - and to defend the case, for example, that foxes who put their ear to ice to check if it was thick enough to tread on were engaging in inferential reasoning, as Plutarch had assumed.[442] The precedents for such a conception extended back to Aristotle, for whom both humans and animals were moved by 'reasoning and *phantasia* and choice and wish and appetite. And all of these can be reduced to thought and desire. For both *phantasia* and sense-perception hold the same place as thought, since they are all concerned with making distinctions'. Moreover, 'wish and spiritedness and appetite are all desire, and choice shares both in reasoning and in desire'.[443]

In his *Essay Concerning Human Understanding*, Locke wrote that if beasts 'have any Ideas at all, and are not bare Machins (as some would have them), we cannot deny them to have some Reason. It seems as evident to me, that they do some of them in certain Instances reason, as that they have sence.'[444] The power and kind of these senses, however, varied from animal to animal: 'We may, I think, from the Make of an Oyster, or Cockle, reasonably conclude, that it has not so many, nor so quick Senses, as a Man, or several other Animals,'[445] wrote Locke. But it did possess the faculties that it needed - for 'would not quickness of Sensation, be an Inconvenience to an Animal, that must lie still, where Chance has once placed it'?

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*Continuation des pensées diverses, écrites à un Docteur de Sorbonne, à l'occasion de la Comète qui parut au mois de Decembre 1680, ou Réponse à plusieurs difficultez que Monsieur *** a proposées à l'Auteur* (Rotterdam, 1705; third edition, 1721), IV, ch. 111, pp. 252-264, at, e.g., p. 258: 'Donner des facultez efficientes & motrices à des corps qui ne peuvent jamais sçavoir qu'ils ayent ces facultez, ni quand, ni où, ni comment s'en servir, me paroît une contradiction dans les termes. Je conclu donc que le même Dieu qui a créé la matiere, & qui lui a donné les premieres impulsions est la cause qui continuë à mouvoir les corps, & qui execute les loix du mouvement qu'il a faites.'

[441] See Marin Cureau de la Chambre, *Traité de la connoissance des animaux, où tout ce qui a esté dit pour, & contre le raisonnement des bestes est examiné* (Paris, 1648), ed. Odile Le Guern (Paris, 1989), IV, 3: 'Du langage des bestes', pp. 269-314; at p. 291: 'le langage des Bestes n'est pas different du nostre, en ce qu'il vient de l'institution de Dieu et de la Nature, et que le nostre vient de l'institution des Hommes'.

[442] Plutarch, *De sollertia animalium* (translated as *Whether Land or Sea Animals are Cleverer*) and *Bruta animalia ratione uti* (translated as *Beasts are Rational*), in *Moralia*, 959-992, transl. Harold Cherniss and William C. Helmbold (Cambridge, Mass., 1957), XII, pp. 311-533.

[443] Aristotle, *De motu animalium*, 700b17-23, in Martha C. Nussbaum, *Text, with Translation, Commentary and Interpretive Essays of Aristotle's* De Motu Animalium (Princeton, 1978), p. 38.

[444] Locke, *Essay*, II, xi, 11, p. 160.

[445] Ibid., II, ix, 13, p. 148.

There were degrees of perceptual faculties, in man as much as in beast; and Locke went on to say that 'one, in whom decrepit old Age has blotted out the Memory of his past Knowledge, and clearly wiped out the Ideas his Mind was formerly stored with', as well as dulled all the senses, was not far removed 'in his Knowledge, and intellectual Faculties, above the Condition of a Cockle, or an Oyster'.[446] Furthermore, 'if a Man had passed Sixty Years in such a State, as 'tis possible he might, as well as three Days, I wonder what difference there would have been, in any intellectual Perfections, between him, and the lowest degree of Animals'.

Locke was also aware that, since 'we sort and name Substances by their *nominal*, and not by their real *Essences*'[447] and since we, rather than nature, were the ones to establish and categorize natural kinds,[448] the qualities we ascribed to species in order to define them and differentiate one from another tended to lead to confusions precisely because they did not reflect real boundaries between species. A deformed foetus, for instance, might be denied baptism, as Locke pointed out, on account of its failure to correspond to a certain definition of human essence. The existence of monsters was enough to confound us with regard to the applicability of instituted norms. Similarly, 'Some whereof, though of an approved shape, are never capable of as much appearance of Reason, all their Lives, as is to be found in an Ape, or an Elephant; and never given any signs of being acted by a rational soul.' On this account, even the definition of man as the rational animal appeared to be as partial a view of human essence as any other.[449] Still, Locke also had to show, and he did so explicitly, that beasts were not capable of reasoning, in the sense that they did not '*make complex* ideas' out of simple ones. Complex ideas were the starting point for the use of signs and words, which, he wrote, 'stand as outward Marks of our internal Ideas'. These in turn were generated through abstraction, of which no animal was capable: 'the having of general Ideas is that which puts a perfect distinction betwixt Man and Brutes'.[450] Locke was thinking here in terms of general capacities; but it is clear that he would have found abhorrent the possibility of running the *reasoning faculty*, the specifically human capacity for abstraction, together with the powers of intellection he found it possible to assign to some beasts.

[446] Ibid., II, ix, 14, pp. 148-149.
[447] Ibid., III, vi, 26, p. 453.
[448] Ibid., III, vi, 27, p. 454.
[449] Ibid., III, vi, 26, pp. 453-454.

With Locke, then, the need to draw a boundary between animal and man simply corresponded to the ongoing, earthbound project of setting out the nature of human intelligence, conceived as an entity or phenomenon to be analysed apart from the body. In considering the nature of reason in humans, Locke did not worry about God's intentions with regard to the fate of human or animal souls. He was aware of the problems inherent in determining boundaries between biological organisms; but he had no doubt that 'An animal is a living organized Body; and consequently, the same Animal … is the same continued Life communicated to different Particles of Matter, as they happen successively to be united to that organiz'd living Body.'[451] For Locke, knowledge was a function of the sharpness of perceptual faculties, since all creatures derived cognition from perception and all creatures, including man, were equipped with sense-organs; and it seemed fair to say that 'it is Perception in the lowest degree of it, which puts the Boundaries between Animals, and the inferior ranks of Creatures'.[452] Deliberations on the characteristics of the dual physical organism were thus not necessarily tied to discussions about the problems bred within the Cartesian system.

But there was in fact little formal space within the debate on animal souls for a mitigated reasoning capacity such as Locke could envisage,[453] given that he was concerned to establish the prior grounds of knowledge rather than to construct a systematic metaphysics. The Cartesian account of mind-body dualism, on the other hand, was conceived on the basis of a physics in which matter was endowed solely with local motion. It is worth noting again the sharp contrast between this conception of matter and the Aristotelian picture, where motion was identified with change. In *De anima*,[454] Aristotle had defined 'life' as 'self-nutrition, growth, and decay'. This implied that the living creature, unlike fire, for example, had 'a certain plasticity of behaviour',[455] more fundamental than motion or perception, which plants lacked although they too were living creatures. For Aristotle, the function of self-nutrition was the law-like pattern which overrode any other faculties in explanatory power and

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[450] Ibid., II, xi, 10, p. 159.
[451] Ibid., II, xxvii, 8, pp. 332-333.
[452] Ibid, II, ix, 15, p. 149.
[453] Bayle observed that 'Monsieur Locke s'est déclaré contre ceux qui ne donnent point aux bêtes le raisonnement'. See Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 614.
[454] Aristotle, *De anima*, 412a14-15; discussed by Nussbaum in 'Aristotle on teleological explanation', in her *Aristotle's* De motu animalium, p. 76.
[455] Nussbaum, *Aristotle's* De motu animalium, p. 77.

which characterized the 'first soul', since it was for its sake that the other faculties existed. However embodied it was, it had to be 'necessarily realized in some sort of suitable matter'.[456] This teleological account of living matter also exhibited Aristotle's central dictum that the soul was the form of the living body;[457] and it was the all-encompassing generality of this account which ensured both its staying power and the confusion which arose from discarding it.

Descartes's corporeal and spiritual substances represented too much of a break from faculty psychology for worries over the fate of substances to be set apart, as was the case with Locke, from preoccupations with the fate of the non-human soul. The Cartesian system demanded that any account of physics, physiology and the psyche be based on 'clear and distinct ideas'. These constituted the very foundation of self-knowledge - as well as its main tool - and the validation of the reasoning faculty as the means of knowing the world and controlling the self.[458] Rather than delimiting the boundaries within which it was safe to presume what qualities a substance could be said to possess, this requirement actually served to construct the boundary, to determine its nature, its shape and the territory on either side of it. Intrinsically exclusive of anything as messy as a desiring and willing sensitive soul, the Cartesian requirement served to plant a looking glass on the spot where the boundary had been drawn, through which animals failed to pass. Although for Descartes, an animal was a sensing organism, it could only belong to the physical, natural world insofar as mechanism alone sufficed to explain in what way it was indeed a sensing organism and an extended body. Only thus did it remain where it belonged, without menacing the hegemony of clear and distinct ideas - or the established power of humans and of God. A beast which crossed the boundary would

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[456] Ibid.

[457] Ibid., 146-148. Nussbaum notes, p. 146, that Aristotle's psychology, as stated in the *De Anima*, 'holds that soul is the form or functional organization of a certain kind of body and that the various "parts of soul" are functional states of matter.' See Aristotle, *De anima*, 412a-b. See also above, p. 31.

[458] Richard Popkin has defined the 'cogito' as that which 'reveals the long-sought standard or criterion of truth, and therewith the ability to recognize other truths, which in turns allows us to build up a system of true knowledge about reality. … By inspecting the one truth, the criterion of truth is found. … We are assured of the truth of the one case we are acquainted with solely because it is clear and distinct.' And with this criterion of truth, 'we can discover the premises of a metaphysical system of true knowledge, which in turns provides the foundation of a physical system of true knowledge. The metaphysical system will supply us with a justification or guarantee of the criterion. Not only are we such, that whatever we discover is clear and distinct we accept as true, but also it can be shown that, in reality, whatever is clear and distinct *is* true.' See Richard Popkin, *The History of Scepticism from Erasmus to Spinoza* (Berkeley, Los Angeles, London, 1979), pp. 184-185.

turn into a 'monster', capable, by becoming our equal, of wrecking the posited order of reason.[459]

Yet, in the eyes of someone like Malebranche who, remaining broadly within the Cartesian framework, wanted to glorify reason and its powers on the grounds that it was separate from the senses, Descartes had not succeeded in connecting the foundation of epistemological certainty in the 'cogito' with a convincing account of sense-perception. He had left both too much and too little to God: too much by using him to short-circuit any attempt at exploring in detail *how* the mechanistic physiology of the senses corresponded to the mind's conscious apprehension of sense-data and emotions;[460] and too little by not explaining *why* God constituted a guarantee against the encroachment of scepticism with regard to the reality of the objects of sense. Malebranche extended the Cartesian thesis in his effort to solve the formal problems inherent in Descartes's positing of a natural, although to many, inconceivable causal interaction between body and mind, between a material

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[459] Augustine suggests a thought-experiment in *De libero arbitrio*, I, vii, 16, asking whether 'a monstrous, very terrible animal of some sort, would, out of ferociousness, great size or highly developed sense, try to exert domination over man' just as man exerts domination over beasts. The answer is no, since man alone has reason, with which he may command beasts: 'Dic itaque mihi, cum saepe bestiae tantum, sed et animam ita homini subiugatam, ut voluntati, eius sensu quodam et consuetudine serviat - utrum tibi ullo modo fieri posse videatur, ut bestia quaelibet inmanis vel feritate vel corpore vel etiam sensu quolibet acerrima pari vice sibi hominem subiugare conetur, cum corpus eius seu vi seu clam mutae interimere valeant.' On the Augustinian tradition in the Middle Ages with regard to monsters and wonders, see Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150-1750* (New York, 1998), pp. 39-59. See also Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago and London, 1995), pp. 18-21, on the distinction between Aristotelian and Baconian 'monsters' and on the use of the word 'monstruosita' by the Jesuit mathematician Christopher Clavius, for whom the 'discrete events' of nature, as opposed to its ordinary manifestations, 'might be anomalous, "monstrous".' Monsters and marvels are revelatory of the complexity of the boundaries within which the natural world was considered legible. On marvels in the early modern period, see Daston and Park, *Wonders and the Order of Nature*, pp. 203-352; for a social and intellectual history of marvels and monsters, in particular through the case study of Mary Toft, who in the early eighteenth century claimed to give birth to seventeen rabbits, see Dennis Todd, *Imagining Monsters: Miscreations of the Self in Eighteenth-Century England* (Chicago and London, 1995), esp. pp. 38-139.

[460] In the *Sixième Méditation*, Descartes posited that there was 'no affinity nor relation' between, say, the emotion of the stomach called hunger and the desire to eat, nor between the sentiment of the thing which caused pain and the thought of sadness that it gave birth to. Nature had taught us how to associate the two kinds of experience, but the example of something like dreams or what we today call the 'phantom-limb' phenomenon had sufficed to show how untrustworthy 'judgements based upon external senses' were. Descartes, *Méditations métaphysiques*, in *Œuvres*, ed. Alquié, II, pp. 484-487, at pp. 485-486: 'Mais quand j'examinais pourquoi de ce je ne sais quel sentiment de douleur suit la tristesse en l'esprit, et du sentiment de plaisir naît la joie, ou bien pourquoi cette je ne sais quelle émotion de l'estomac, que j'appelle faim, nous fait avoir envie de manger, et la sécheresse du gosier nous fait envie de boire, et ainsi du reste, je n'en pouvais rendre aucune raison, sinon que la nature me l'enseignait de la sorte; car il n'y a certes aucune affinité ni aucun rapport (au moins que je puisse comprendre) entre cette émotion de l'estomac et le désir de manger, non plus qu'entre le sentiment de la chose qui cause la douleur, et la pensée de tristesse que fait naître ce sentiment.'

substance and an immaterial one. In suggesting that the causality was occasional - that movement in the one was actually the *occasion* for movement in the other - he chose to emphasize that the concordance of activity in mind and soul was ensured by God, just as his glory was attested in the bodies of creatures.

Malebranche thus associated the impulse to give souls to beasts with a dethroning of God. As he wrote in a chapter on the passions in *La recherche de la vérité*, to infer from the 'agility and ingenuousness' [*adresse et esprit*] of beasts' actions that they did have a soul, was 'by a strange neglect [*oubli*] of God, to attribute to the work the wisdom of the worker'[461] - in other words, to naturalize the universe. When, he continued, one examined in detail what was going on at each moment within the body of man and of animals, it was impossible to believe that a finite spirit could manage at once all its regulated motions. Moreover, beasts would be endowed with a far greater spirit than ours if one assumed them capable of regulating their inner machinery with the help of their so-called souls. The machinery of our body was such that it was impossible to know all of its movements, and 'our soul is not the true cause of those [movements] which follow from our will. We want to speak or sing, but we do not even know which muscles to move in order to do so.'[462] In the same way, a grain of wheat was ignorant of the processes by which it was able to grow and was another sign of God's wisdom. We should admire and adore this wisdom, he wrote, and watch out not to attribute to the works of nature, souls or chimerical forms, what belongs solely to the maker.[463] The existence of complex natural, mechanical processes, then, should call forth the human capacity for wonder, not only our scientific curiosity.

There followed a mechanistic account of passions reminiscent of Descartes's psychology, one which looked very much like an account of instinctive behaviour. But here mechanism was used to explain the physically visible signs of changes in

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[461] Malebranche, *Recherche*, in *Œuvres*, II, p. 152 (V, iii): 'Car en effet donner des ames aux bêtes, par cette raison que leurs actions marquent de l'adresse & de l'esprit, c'est par un étrange oubli de Dieu attribuer à l'ouvrage la sagesse de l'ouvrier.'

[462] Ibid.: 'Quand on examine en détail qui se passe à chaque instant dans le corps de l'homme & dans celui des animaux, on y découvre une si grande variété de mouvemens justes & reguliers, qu'on ne croit pas qu'un esprit fini puisse les connoître & les regler en un moment: & si l'ame prétenduë des bêtes faisoit & regloit le jeu de leur machine à la vûë des objets, assurément ils auroient de l'esprit infiniment plus que nous. Car sans compter les mouvemens infinis qui so font en nous, sans nous, nôtre ame n'est point la cause véritable de ceux qui suivent de nos volontez. Nous voulons parler ou chanter, mais nous ne sçavons pas seulement quels muscles il faut remuer pour parler ou pour chanter.'

emotional states, themselves triggered by a chain of reactions both to the vision of an object and to the force of the imagination. Humours were shaken up by the sensory nerves' response to a disturbing perception and flowed through the blood vessels into the heart, where they were fermented into animal spirits. From there, they travelled through nerves to all the viscera, including the liver, spleen and pancreas, and they 'express through their agitation the humours which these organs preserve for the needs of the machine'.[464] Variations in passions were due to differences in the kinds of agitation and fermentation the humours underwent; and these in turn were due to the varied action and force of nerves around the heart. Some 'nerves in the lung also distribute air to the heart, and by tightening or expanding the branches of the canal used for breathing, they regulate the fermentation of the blood according to the dominant passion'.[465] Other nerves which surrounded the arteries leading to the brain and to all the other organs in the body regulated the flow of spirits, and ensured that, if the brain was shaken by an unexpected sight, the movements of the passion could shift as required.[466]

Malebranche initially came across Descartes's *L'homme* in 1664 - the date of its first Paris edition, some thirty years after its composition in 1633. This work, as we saw, presented a similarly smooth mechanistic picture of physiology and psychology, for which 'movements are actions of the will; feelings [*sentimens*] are modifications of the mind; movements of the will are the natural causes of feelings of the mind; and these feelings of the mind in turn determine the movements of the will'.[467] One important aspect of this picture, apart from its genesis in Descartes's wish to make do without scholastic entities and qualities, was the room it afforded

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[463] Ibid., pp. 152-153.

[464] Ibid., p. 153: 'Un homme passionné ne pouvant sans une grande abondance d'esprits, produire ni conserver dans son cerveau une image assez vive de son malheur, & un ébranlement assez fort, pour donner au corps une contenance forcée & extraordinaire, les nerfs qui répondent au-dedans du corps de cette personne, reçoivent à la vûë de quelque mal les secousses & les agitations nécessaires pour faire couler dans tous les vaisseaux qui ont communication au cœur, les humeurs propres pour produire les esprits que la passion demande. Car les esprits animaux se répandans dans les nerfs qui vont au foïe, à la rate, au pancreas, & généralement à tous les viscères, ils les agitent & les secoüent, & ils expriment par leur agitation les humeursque ces parties conservent pour les besoins de la machine.'

[465] Ibid., p. 154: 'D'autres nerfs répandus dans le poûmon distribuënt l'air au cœur; en serrant & en relâchant les branches du canal qui sert à la respiration, & ils réglent de cette sorte la fermentation du sang par rapport aux circonstances de la passion qui domine.'

[466] Ibid.

[467] Ibid., p. 147: 'Les mouvemens sont des actions de la volonté: Les sentimens sont des modifications de l'esprit. Les mouvemens de la volonté sont les causes naturelles des sentimens de l'esprit; & ces sentimens de l'esprit entretiennent à leur tour les mouvemens de la voloné dans leur détermination.'

for involuntary action, for bodily movements which were appropriate to circumstance but not under the control of will and reason. The mechanistic physiology Malebranche developed had even more extreme consequences than did Descartes's, however; for, where Descartes allowed for the existence of sensations and passions in animals, Malebranche was happier to conclude from the usefulness of the automaton analogy that they had no sensations at all: a dog's cry on being hit was simply 'a necessary effect of the machine's construction', not a proof that it had a soul. To attribute to them a soul was to confuse the cause of our movements with a soul. It was an instance of our tendency to 'humanize all causes'; and since we had trouble conceiving of 'a soul that does not think, want and feel', it was easy to conclude from our dog's behaviour that it did think, want and feel.[468] But this was entirely misguided. After all, wrote Malebranche, 'a healthy man does not scream when wounded, and this shows that his soul resists the machine's operation': he would cry if he had no soul[469] because the body would be free to obey its impulse. It was the soul which stopped one recoiling when one was being bled, for instance.[470]

The human body was here treated as equal to the animal body (there was even room to acknowledge its inferiority to the animal body in some respects); and the rational faculty which accompanied it did not so much ennoble it as give humans the capacity *not* to scream when hurt, *not* to follow their senses. It was because it enabled humans to deny, in a sense, the body's reality that the rational faculty ensured the nobility of their status among God's creatures. Unlike reason, the body was invulnerable to 'intropathy':[471] as Malebranche believed, it could not know which muscles functioned, and we were not actually *aware* of the humours flowing through our blood and of animal spirits acting on our brains.[472] These things simply

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[468] Ibid., p. 151: 'Et parce que nous humanisons naturellement toutes les causes, & que d'ailleurs on ne sçait ce que c'est qu'une ame qui ne pense, ne veut & ne sent point, nous jugeons que nôtre chien nous connoît, nous aime, & sent quand on le blesse une douleur semblable à la nôtre.'

[469] Ibid., p. 150: 'Les chiens, dit-on, crient quand on les blesse: Donc ils ont une ame. Selon ce que je viens de dire, on en doit conclure qu'ils n'en ont point: car le cri est un effet nécessaire de la construction de la machine. Quand un homme en pleine santé ne crie point lorsqu'on le blesse, c'est une marque que son ame resiste au jeu de la machine. S'il n'avoit point d'ame, & que son corps fût bien disposé, certainement il crieroit toûjours quand on le blesseroit.'

[470] Ibid.: 'Chacun sent bien quand on le saigne que son bras se retireroit machinalement dans le moment qu'on le piqueroit, si l'ame n'y resistoit.' Malebranche is here referring, as Descartes had done, to what has since been called reflex action: the body acts without the action being caused by the soul's will. See Canguilhem, *La formation du concept de réflexe*, p. 153, n. 5.

[471] See above, p. 109, n.15.

[472] Malebranche, *Recherche*, in *Œuvres*, II, pp. 149-150 (V, iii): 'l'ame n'a point de part dans tout ce jeu de la machine … Il est vrai que les sentimens & les mouvemens de l'ame accompagnent toûjours

happened; and, in the dualist scheme, they had to happen in that way, or in a way like it, if the Cartesian 'cogito' - the thesis that we could be certain of anything *only* because we were certain of the existence of our reason - was to be maintained.

Once the possibility of dissociating reason's activity from sense-perception was enunciated in this way, it was reason's task to set the logical conditions whereby the definition of its remit might correspond to its now purified state. Given that beasts as well as man were capable of seemingly rational behaviour, it became important to explain the causes of this behaviour in animals and man in order to differentiate the two. If one was a Cartesian mechanist, it was impossible to call any animal behaviour 'rational'; but it then became necessary to establish why the fact of being an animal constituted enough of a justification for discounting reason as the cause of this animal's behaviour. Pardies, in his account of the Cartesian posistion, pointed out that no one denied that 'thinking' and 'reasoning' must entail one another,[473] and that thinking, in turn, entailed the capacity to deliberate and choose, in other words, to exert freedom of will:[474] the difficulty of attributing reason to animals was its association with voluntary action. Some forms of behaviour, Pardies told us, still in the name of Cartesians, were so well 'proportioned to an end'[475] that they seemed to entail rationality, although in fact they were instinctive - and no less admirable for that.[476] Instinctive behaviour provided the organism with a 'natural disposition'[477] to act and thus with a certain kind of knowledge. In man, however, natural disposition (say, to play the organ) needed to be supplemented by intelligent knowledge (here, the technique for playing an organ);[478] and it required the soul's *will* to move the limbs, without, let it be said, any knowledge of the physiology of motion.[479] But Pardies recounted this theory of animal action in order to show that the resort to

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les ébranlemens des fibres du cerveau & le cours des esprits animaux, mais ils n'en sont pas la cause. Car outre qu'on ne conçoit pas qu'un sentiment de l'ame puisse mouvoir un corps; il est certain que l'ame émûë de quelque passion, ne pense seulement pas qu'il y ait dans son corps des esprits animaux, des muscles & des nerfs, ni à leur usage.'

[473] Pardies, *Discours*, pp. 104-105.

[474] Ibid., pp. 105-106.

[475] Ibid., p. 118: 'à considérer la conduite des animaux, &leurs actions si bien reglées, & si proportionnées à une fin, nous sommes d'abord convaincus que tout cela procéde de quelque principe intelligent'.

[476] Ibid., pp. 109-112.

[477] Ibid., p. 113.

[478] Ibid., pp. 116-120.

[479] Ibid., pp. 121-125.

instinct was not sufficient to deny animals some form of intelligent knowledge.[480] The justification for denying reason to animals, it appears, was simply that they were animals. Any further justification of the Cartesian position was redundant, because those who adopted it made sure, implicitly at least, that accounts of animal action and accounts of rational action were two, entirely separate discourses.

This rigidity with regard to the mode of evaluating the 'other minds' of animals determined the nature of the arguments put forth by each of the two sides. The causal order of animal action was imagined, or affirmed, with the help of categories such as reason, instinct, sensation, knowledge; but these categories were themselves in need of definition. A quarter of a century before the Dilly-Pardies dispute, it occurred to a Protestant physician from La Rochelle, Pierre Chanet, to invoke the category of 'instinct' with a great deal of trepidation, claiming the superiority of its explanatory range, in response to a treatise by the established Marin Cureau de la Chambre. Bayle paid some, although scant, attention to the old quarrel[481] in which Cureau argued in favour of ascribing a kind of rationality to animals, in line with the tradition represented by Montaigne and Charron,[482] while Chanet, in *De l'instinct et de la connaissance des animaux*, tried to show that 'reason' in such cases was really 'instinct'. What is interesting here is that Chanet did all he could to deprive his notion of instinct of any naturalistic associations, moulding it instead, in a scholastic manner, into an abstract entity which suited his conceptual purposes.[483]

Chanet defined instinct as 'a direction of the first cause which carries and brings all secondary causes to their end, when they have no rational faculties to do so'.[484] All living creatures from plants to humans, but also all things, including those

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[480] Ibid., pp. 115-116.

[481] See Bayle, 'Rorarius', in *Dictionnaire*, XII, pp. 598-599: 'Un médecin de La Rochelle, ayant écrit contre Charron, fut réfuté à son tour par l'une des meilleures plumes qui aient écrit en français sur des matières de philosophie. Je parle de M. de la Chambre; médecin de M. Séguier, chancelier de France.'

[482] See above, p. 79. See Pierre Charron, *De la sagesse* (Paris, 1601), ed. Amaury Duval (Geneva, 1968), 3 vols., I (1, xxxv), pp. 203-223; on Montaigne, see above, pp. 80-81.

[483] I here treat Chanet's arguments; for an analysis of arguments put forth by Cureau de la Chambre, see, e.g., Odile Le Guern, 'Cureau de la Chambre et les sciences du langage à l'âge classique', in *Corpus*, 16-17, 1991, pp. 17-26.

[484] Pierre Chanet, *De l'instinct et de la connaissance des animaux. Avec l'Examen de ce que Monsieur De La Chambre a escris sur cette matiere* (La Rochelle, 1646), p. 1: 'l'Instinct est une direction de la cause premire qui porte, & conduit toutes les causes secondes vers leur fin, lors quelles n'ont pas les facultés naturelles pour y parvenir'.

deprived of 'life and sense',[485] were endowed with instinct, impulsion and drive. The purpose of instinct was not to take reason away from beasts, stated Chanet in the first pages of his tract, but rather to explain those motions which they would be unable to carry out even if they did have reason or any other natural faculty.[486] It was an explanatory category, a constant that accounted for the ability of animals to achieve the ends to which their very constitution predisposed them. Creatures had been created by God in such a way that they were both diverse and able to achieve these ends. On the one hand, however, they could not achieve these ends without knowing them, just as they could not know them without reason or without being 'more perfectly intelligent than are men';[487] on the other hand, if God had endowed all creatures with such an intelligence, he would have diminished the world's diversity. The solution to this dilemma was the distribution by God of instinct, which supplemented natural faculties where those did not suffice for the achievement of ends. The concept of instinct thus abolished the need to refer to rational knowledge to explain the abilities of beasts, but without depriving them of the sensation, memory, locomotion and imagination which they possessed by virtue of being endowed with vegetative and sensitive souls.[488] Instinct was natural in animals, since one noticed it as soon as they were born; it was hereditary in all individuals and was passed on within each species.[489]

Instinct explained such phenomena as the capacity for a sick animal to find a curative plant it would never approach in good health,[490] as well as a baby's ability to suck at its mother's breast. The concept operated, too, in the explanation of what caused a rock to fall to the ground in a straight line, and of the functioning of the heavens and elements.[491] Scholastic beliefs such as these were quite valid for Chanet, since they explicated those phenomena not accounted for by natural faculties and the presence in nature of reasonable behaviours performed neither freely nor through the

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[485] Ibid., p. 2 .
[486] Ibid, p. 4: 'Ainsi nous n'attribuons pas à l'Instinct toutes les actions des bestes … Nous ne nous en servons que pour expliquer certaines actions que les bestes ne sçauroient faire quand mesmes elles auroient de la raison.' See also p. 99.
[487] Ibid.: 'comme il estoit impossible qu'elles parvinssent à cette fin sans la cognoistre, il estoit aussi impossible qu'elles la cognussent sans estre raisonnables, & plus parfaitement intelligentes que ne sont les hommes'.
[488] Ibid., pp. 4, 33.
[489] Ibid., p. 9: 'l'Instinct ne peut qu'il ne soit naturel aux Animaux, puis qu'il est hereditaire en tous les individus, & qu'il se perpetuë avec leur nature & leur espece'.
[490] Ibid., p. 51.

agency of reason.[492] By 'nature', he meant 'the essential principles that constitute the nature of each thing'.[493] Natural faculties alone were the essential principles which composed the 'nature' of each thing, and in that sense instinct, whose role was to supplement natural faculties, was not 'natural'.[494] But nor was it miraculous: it was as much in the divine order of things as was the creation of our soul.[495] Instinct thus helped account for physical phenomena in terms of an ordinary, but divinely instituted quality which enabled bodies to act according to their nature. It allowed for the constancy of physical laws and made it possible to relate them to the remarkable efficacy and variety of animal action. But it was God's providence which allowed animals to behave in ways which surpassed their knowledge and which bore the mark of a wisdom higher than their natural faculties.[496] With arguments such as these, lists of the feats of animals in the Plinian or Plutarchan mode did not by themselves constitute a case for the causal efficacy of reason in animal action. Once instinct was posited as the force which enabled the world to function, intelligent behaviour in creatures deprived of an immortal soul ceased to be an enigma.

Chanet's comments on Cureau's arguments for the presence of deliberation and reason in beasts were rather sneering, but then so too was the latter's *Traité de la connaissance des animaux*.[497] It was written as a response to Chanet's book against Charron, itself a response to an earlier work by Cureau, *De la connaissance des bestes*.[498] Chanet countered Cureau's worry that endowing animals with the gift of instinct was in effect glorifying them at our expense by arguing that it made no sense to assign glory to an animal because it was served by God, just as it made no sense to regard as more perfect a blind boy who, on account of his infirmity, received more care from his father than did his sighted brother.[499] Chanet reported Cureau's belief

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[491] Ibid., pp. 11, 18-24.
[492] Ibid., pp. 7, 16.
[493] Ibid., p. 8
[494] Ibid., p. 9. Chanet qualified this by claiming that it *was* natural if one undestood 'natural' to mean what 'perfected' an agent's nature: 'naturel au sens que toutes choses sont dites etre naturelles, lors qu'elles perfectionnent la nature de quelque agent, qu'elles suppléent à ses defauts, qu'elles servent à l'accomplissment de ses actions, & qu'elles le portent vers sa fin naturelle'. Instinct was natural 'puisqu'il se remarque des la naissance de l'animal, hereditaire en tous les individus, se perpetue avec leur nature et leur especes'.
[495] Ibid., p. 10.
[496] Ibid., p. 32.
[497] See above, p. 110, n. 17.
[498] Marin Cureau de La Chambre, *De la connaissance des bestes*, published along with *Les caractères des passions* (Paris, 1645). See also above, p. 119, n. 57.
[499] Chanet, *De l'instinct*, p. 97.

that instinct had to be a product of the animal's faculties, most probably the imagination or appetite. Some knowledge was required for instinct to operate; and this knowledge would have to come from within, in the form of internal images stored in the memory, perhaps acquired at birth as natural species, before being activated on encountering similar external images.[500] For Chanet, this was nonsensical; he had never seen a fly avoid a place in which it had previously been struck.[501] Beasts had no knowledge of the past, nor of the future. Their only memory, if they had any, was a function of the material soul, of the senses and of motions of the imagination; moreover it was corruptible because it was lodged in a corruptible part of the brain.[502] Beasts had no estimative faculty, either: the swallow did not need natural knowledge of any kind to make its nest.[503] Nor did imagination have anything to do with instinct: the bird no more laid her eggs out of need than it was possible for an astrologer to incite a pregnant woman to wait for a better constellation under which to give birth.[504] Instinct alone explained why rats were afraid of cats at birth, or why the child of a learned father was not born erudite.[505] Unlike memory, it could not be forgotten by the animal: the swallow never forgot how to make a nest even after long years in captivity; but nor was it inherited: it was not present in the seed. Rather, it depended on a higher cause - God.[506]

Chanet used the argument that reason was too imperfect to account for nature's perfection. Bees needed no council, although their actions were always identical and perfectly accomplished: if this was taken to mean that they reasoned, then one would have to say that they reasoned better than us, which, obviously, could not be right.[507] Simply, the operations of instinct were much more certain than the knowledge we derived from natural species. Cureau, according to Chanet, accepted that such types of behaviour as the bees' pollination and the spider's capacity to spin a web were the product of instinct; but he saw deliberative reason in the predator's hesitation at chasing an overly distant prey.[508] Again, Chanet's counter-offensive was

[500] Ibid., pp. 38-39, 46-50, 63-72.
[501] Ibid., pp. 101-102.
[502] Ibid., pp. 47-48.
[503] Ibid., p. 46.
[504] Ibid., pp. 50-51.
[505] Ibid., p. 46.
[506] Ibid., p. 45.
[507] Ibid., p. 77.
[508] Ibid., pp. 48, 105.

to shrug off the idea that any reasonable action, like eating when hungry, entailed even implicit syllogistic thought. Not all knowledge was reasoning, nor did all reasoning consist in the progress from one piece of knowledge to another. Reasoning was not necessary for the achievement of ends; and reasonable behaviour did not require deliberation, either in man or in animals.[509] Indeed, to posit a reasoning faculty in animals led to the admission that theirs was 'more perfect than ours',[510] which was proof enough of the falsity of the claim. Chanet, in brief, defended the Cartesian view that animals could do everything they were known to do without reason, although he did so while preserving the Aristotelian notion that nature's creations were superior to what human reason could accomplish. His theory of knowledge acquisition was directly opposed to Cureau's belief in the possibility of basing all arguments on the principle that what *looked* reasonable was bound to *be* reasonable.[511] But Chanet's treatise was less a discourse on the presence or absence of souls in beasts than an argument for the plausibility of ascribing intentionality to all things, regardless of their mental content, and thus for the need to dissociate intentionality from biology.

A decade or so later, the part-Gassendist, part-Cartesian atomist and physician Walter Charleton also responded to the Rorarius thesis that animals were rational beings. In his *Immortality of the Soul*,[512] a dialogue between himself (as Athanasius) and John Evelyn (as Lucretius) set in the Luxembourg Gardens in Paris, he wrote that, just as through our intellect we could acquire knowledge of 'Corporeals', so our intellect was 'above Corporeity', since 'it comprehends also the very reason and forme of an Organ'. Once the intellect reflected upon itself, it became its 'own Object' and began to

[509] Ibid., pp. 112-114, at pp. 113-114: 'Le raisonnement n'est pas simplement un progres d'une connoissance à l'autre. Il ne nous a esté donné que pour inferer une chose moins cognuë par un autre qui l'est davantage. Il faut que la conclusion y doive son evidence aux veritez dont l'on se sert pour la prouver. Et dans les choses practiques, si les moyens paroissent aux sens; s'ils sont aussi evidents que la fin, & s'ils sont de la Nature de ceux dont les Bestes se servent hors de l'Instinct; il n'y a point de necessité pour le raisonnement.'

[510] Ibid., p. 85: 'Il n'y a point de difficulté que les raisonnements des Bestes ne soient plus parfaits que les nostres, s'il est vray qu'elles agissent par Raison.'

[511] In a slightly earlier work, *Considerations sur la sagesse de Charron* (Paris, 1643), Chanet argued against the scepticism of Charron and Montaigne (which informed the comparison they felt justified in making between man and beast), and for an Aristotelian acccount of sense-perception and reasoning. See p. 119, n. 57. See a short discussion of this in Popkin, *History of Scepticism*, pp. 118-120.

[512] Walter Charleton, *The Immortality of the Human Soul* (London, 1657, facsimile reprint, New York, 1985).

> know it self to be an Intellect, or thinking and discerning Nature. If therefore we well consider these Reflex Acts of the Understanding; we can no longer doubt its being Immaterial. That the Intellect doth thus reflect upon it self, and discern its own knowledge, needs no other testimony but that of a mans own Experience; it being impossible for any person living not to know, that he knows what he knows.[513]

The nod to Descartes (referred to along with Kenelm Digby) was explicit.[514] But this notion of self-reflection led the fictive participants to argue about the infamous corrolary that since souls of animals could not be immaterial, beasts must be deprived of such an intellect which reflected upon itself, and *therefore* of the ability to reason.[515] For Charleton, as well as for Descartes and, later, for Locke, the possession of reason entailed the ability to 'frame universals':[516]

> if we seriously reflect upon what we mean, when we say thus, *Every man hath two hands*; we shall soon perceive, that we therein expresse nothing, whereby one individual man is distinguished from another: though that very word Every, doth import that every single person is distinct from another; so that here is (as *Sir K. Digby* most wittily saith) *Particularity it self expressed in Common*. Now, this being impossible to be done, in any Corporeal representation whatsoever, it is a necessary consequence, that the Intellect, which hath this singular propriety of thus comprehending and expressing Universals, is it self Incorporeal.[517]

It followed that, since 'there is nothing else in a Dog (for instance), but only the Memory of singulars', we should not fear that our rational souls, in virtue of their being putatively identical to those of animals, are not 'Incorporeall' and immortal. There was no danger, thought Charleton, of 'degrading' the human soul 'from the

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[513] Ibid., pp. 100-101.

[514] Ibid., p. 103: Athanasius: 'Alas, *Lucretius*, this is so light an Objection, that I cannot but wonder, what it should retard your assent to a position of so much weight, as that, *that no Material thing can act upon it self*; especially since you have read the excellent discourses of *Monsieur Des Cartes*, and *Sir K. Digby*; wherein they have so clearly solved all the most seemingly rational actions of Beasts, by sensible motions and corporeal principles.' See also p. 106: '[Athanasius] I thought I had prevented your recourse to all Objections taken from the actions of Brute Animals, that carry a semblance of Reason in them; by remitting you to your remembrance of what you have read in the satisfactory Discourses of *Des Cartes*, and *Sir K. Digby* concerning them.' Charleton met Digby before the latter joined Evelyn and other scholars at the court in exile in France in 1649. See J. M. Armistead, Charleton, *Immortality* (New York, 1985), 'Introduction', pp. iii-ix, for a brief biographical study of Charleton and of the immediate context of his thought, which he describes, p. xiv, as a 'fusion of Baconian, Cartesian, and Epicurean perspectives into a science of probabilities that could probe both the physical and metaphysical secrets' of nature.

[515] Charleton, *Immortality*, esp. pp. 103-108.

[516] Ibid., p. 112.

[517] Ibid., p. 109.

divine dignity of her nature, to an equality with the souls of Beasts, that are but certain dispositions of Matter'.[518]

One consequence of denying reason to animals was a sense, again, that this would impute injustice either to nature or to God.[519] Both sides were engaged in a 'cruel war', in the words of Pardies,[520] because the battle involved so many fundamental beliefs; and, certainly in Pardies's description, it was one aspect of the painful process of absorbing the new philosophies, while rejecting the notion that ordinary sense-experience could be a guarantor of truth. To deny animals a soul on the basis that the functioning of their organism could be explained in mechanical terms gave power to mechanics and its physics, of course, but none to the notion of nature as a life-infused organism. It was easy to parody the beast-machine thesis: Pardies wrote that a wounded dog's screams were not the manifestation of pain, but simply the noise made by a wounded dog, akin to that of a drum or a badly oiled cart.[521] A dog jumping around at the sight of his long-absent master was not the manifestation of joy, either, but was simply the movement of a magnet towards the pole.[522] And the flow of blood in arteries was no more a mark of life than a watch's ticking.[523] The presence of instinct in animals meant that the will played no role in their actions, just as corporeal reactions in humans were due to the disposition of our organs and took place without the participation of the will.[524] Matter could not think, and animals were nothing but matter. It was perhaps a shame to massacre such marvellous machines; but, wrote Pardies, it was no more cruel to do so than it would be to rip apart a painting by Raphael.[525] Pardies thus devoted the first half of his

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[518] Ibid., pp. 112-114.

[519] See Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 593 and his quotation from the *Nouvelles de la République des Lettres*, March 1684, pp. 26-27: ' "Le Père Poisson, de l'Oratoire, a traité à fond de celui qui est fondé sur ce principe de saint Augustin, que Dieu étant juste, la misère est une preuve nécessaire du péché; d'où il s'ensuit que les bêtes, n'ayant point péché, ne sont point sujettes à la misère; or elles y seraient sujettes si elles avaient du sentiment; donc elles n'ont point de sentiment." Vous trouverez à la suite de ces paroles [*Nouvelles de la République des Lettres*, p. 28] l'extrait d'un livre [Darmanson, *La bête transformée en machine*] où l'on montre que si les bêtes ont une âme connaissante, *il s'ensuit, 1) que Dieu ne s'aime point lui-même; 2) qu'il n'est point constant; 3) qu'il est cruel et injuste*.' (Bayle's italics.)

[520] Pardies, *Discours*, p. 2 : 'C'est tout de bon qu'ils ont crû ce qu'ils disoient, & nous voions encore aujourd'huy, que l'on se fait une cruelle guerre; & que les uns traittent d'extravagant & de ridicule, ce que les autres estiment tres-conforme au bon sens & à la raison.'

[521] Ibid., p. 17.

[522] Ibid., p. 16.

[523] Ibid., p. 15.

[524] Ibid., pp. 126-133.

[525] Ibid., p. 17.

widely read pamphlet to demonstrating why it was possible to hold the view that animals possessed no form of knowledge. The second half was spent defending his own, somewhat vitalist view of nature,[526] which accorded animals all the subtleties of sensorial knowledge and imagination - and thus of a sensitive soul - without any need of the spiritual knowledge only humans had, thus accepting their similarity to humans.[527]

For Bayle, the question of whether it was legitimate or not to invoke reason in the case of animals seems to have been an open one. He did not accept the thesis expounded by Rorarius, who maintained 'not only that beasts are reasonable animals, but also that they use reason better than man'.[528] But nor did he seek to obfuscate the need to question seriously the fundamental premises of the beast-machine thesis. Cartesians, he wrote, were as annoyed as Aristotelians by Rorarius's point of view: Cartesians, because they denied that beasts had a soul at all; Aristotelians, because they ascribed to beasts sensation, memory and passions, but not reason.[529] It was a shame, Bayle thought, that Descartes's opinion should be so hard to uphold, given that it encouraged true faith - one reason, he believed, why some people would not let go of it. As for the scholastics, who thought they could assign to beasts a sensitive soul without in some way blurring the difference between man and animal, they were simply wrong, because the examples they used, many of them from sources such as Pliny the Elder and Plutarch, 'prove too much':[530] the phenomena of animal ingenuity they described could only be explained by reference to a rational soul, not a merely sensitive one. For example, it was difficult *not* to assume that a dog was using inferential reason when, upon throwing himself at a plate of food and being beaten up for it by his master, he thereafter restrained himself each time he saw his master wield a stick. If one could claim that what looked like the product of a rational soul was *not* exactly that, there was no need, as Bayle wrote, to believe that what looked like the product of the sensitive soul *was* actually what it looked like.[531]

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[526] See Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 594, on the suspicion in his own day that Pardies was in fact a Cartesian in hiding, so accurate was his description of the beast-machine thesis. See also L. R. Rosenfield, *From Beast-Machine to Man-Machine*, pp. 80-86. Fontenay briefly analyses the work in *Le silence des bêtes*, pp. 297-298.
[527] Pardies, *Discours*, pp. 169-178.
[528] Pierre Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 588.
[529] Ibid., pp. 588-589.
[530] Ibid., p. 591.
[531] Ibid.

Bayle attacked Descartes from the sceptic's perspective, pointing out that although the exclusive allocation of thought to an unextended, immortal spiritual substance was useful to religion, since it guaranteed that all thinking beings were immortal (on the assumption that what is indivisible cannot perish), it nonetheless had to be discarded by the philosopher in search of a plausible account of animal motion, sensation and action.[532] For if beasts were not automata, and were accorded a sensitive soul, then Cartesianism was of no use at all. What emerges out of Bayle's dithering, slightly ironic account is principally his scepticism as to the possibility of determining the status of animal intelligence on the basis of observation. He held the belief that to posit the existence in beasts of free will did not say anything about the essence of substances (as La Forge had argued).[533] Free will could, apparently, be associated with a sensitive soul.[534] Certainly, once it had been suggested, as Descartes had done, that there was no metaphysical basis to Aristotelian psychology, and that the case for mechanism was strong enough to pulverise the old order, no unthinking, naturalistic account of reason could any longer hold sway. There was by now a mismatch between souls as they had been defined in the scholastic tradition and the functions which corresponded to them but had not yet been replaced nor redefined. In a way, no common-sense notion of animal behaviour and no belief in the rationality of animal minds could seem logically coherent if mechanism was accepted in any form. Nevetheless, Bayle's scepticism as to the viability of engaging at all in the beast-machine debate was, in fact, partly informed by the same scepticism which had fuelled Descartes's search for certainty in the first place.

The resort to instinct as an explanatory category was, in this respect, ominous. If, as Chanet held, it was neither natural - in the sense that it was supplementary to the known order of causes in nature - nor miraculous, it could only be mechanical: it was intrinsic to the very organization of the organism performing the action; and, as he explained throughout the treatise, the very structure of the organs was a function of it. Chanet's world of instinctive behaviour also relied on a sceptical postulate: 'our Reason is anxious [*inquiete*], uncertain and variable', he wrote, and the order in the world could only have been 'established by a wisdom higher than ours'. There had to be 'a Reason which presides over the world and

[532] Ibid.
[533] See above, pp. 97-99.

which is higher than all Men'.[535] Instinct thus served to explain what was unintelligible in the terms which were then available. Only the resort to a *higher*, divine reason saved those who wanted to deny animals a reasoning capacity from naturalism; but the vagueness of this concept of higher reason meant that it merely fulfilled a semantic role, one complicated, moreover, by the baggage which came along with it. The human capacity for ratiocination, reflection and so on was both fallible and causally bound to the fact that our perceptions were imperfect. We can see, then, how, just as language was at times best understood through its inherent limitations, the realm of humans might at times be perceived as less perfect than that of beasts - either because their instinct could be deployed without the encumbrance of human thought, or because their reason, which, as Cureau tended to believe,[536] mastered perfectly the objects of their perceptions and, indeed, was more perfect than ours and even than that of angels.

Dilly's case for instinct over reason in his tract on animal minds is interesting for what it tells us about the explanatory shortcut provided by mechanism. Instinct alone could be made to explain, for instance, why bees buried their dead outside the hive. Their action, he wrote, came

> from the foul smell arising out of [the dead bodies], which drives the live bees to perform the movements necessary for that effect [of burying them outside], just as a greater or smaller amount of heat from the sun forces fruit to ripen early or late: for why should a watch ring its alarm at the time one wants if not because one has built it in that way? So there is no need, in the case of bees, to look for a cause which is different from the structure given them by the author of nature.[537]

It was possible to explain all actions performed by animals in terms of instinct, which for Dilly was identical to the mechanistic operation of animal spirits. So in man too,

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[534] Bayle, 'Rorarius', in *Dictionnaire*, XII, p. 604.

[535] Ibid,, p. 77: 'Nostre Raison est inquiete, incertaine et variable. Elle ne sçaurait se prescrire un ordre, une Police ou seulement une façon de bastir où elle ne voulust incontinent avoir innové quelque chose, ny qui soit absolument au gré des siècles vivants. De sorte que puis que l'ordre qui paraist au monde est tel, qu'apres y avoir bien pensé nostre Esprit est contraint d'y acquiescer: Il faut croire qu'il est estably par une sagesse plus grande que la nostre; & qu'il y a une Raison qui preside au monde qui est plus haute que celle de tous les Hommes.'

[536] Chanet, *De l'instinct*, p. 50.

[537] Dilly, *De l'ame des bestes*, p. 240: 'Ce soin qu'elles ont d'ensevelir les morts hors de leurs ruches provient de la mauvaise odeur qui en exale, laquelle determine celles qui sont en vie aux mouvemens necessaires pour cet effet, comme une plus grande ou une plus petite chaleur du soleil, oblige les fruits à meurir plûtôt ou plus tard: car pourquoy est-ce qu'une montre sonne le reveil à l'heure que l'on veut, si ce n'est, parce qu'on l'a montée d'une certaine façon? il n'est donc pas besoin de chercher dans les abeilles une cause différante de l'organisation que l'auteur de la nature leur a donnée.'

as he wrote, passions were 'only emotions of the soul which it brings to itself, caused and perpetuated by the movement of animal spirits'.[538] Pardies, in an analysis of the causes of action, and in the context of a critical examination of the nature of the Cartesian beasts' non-voluntary movements,[539] explained the difference (in Cartesian terms) between the phenomenon of fleeing from a snake and a child's attraction to an apple.[540] Involuntary movement occurred in the first case, he said, where one was acting according to instinct, being 'acted, and pushed to a necessary determination according to the relation of the object to the disposition of the body'. In the second instance, however, one was acting 'as a human being' [*c'est agir en homme*], that is, moving 'according to choice and through the determination of one's will'.[541] Not, he added, that thoughts and inclinations of the will were entirely absent from naturally instinctive actions; but in such cases they merely followed on from what had already been determined by the disposition of the body. This was the difference in us between 'acting naturally by instinct, and humanly by will'. Thus, when actions prevented thoughts and the determination of the will, they were '*animal* or *natural*'; when the empire of the will ruled over the body's actions, they were '*human* and *voluntary*'.[542] But this was descriptive rather than demonstrative; and Pardies would make room further on for the unproblematic presence in beasts of sensible knowledge, as well as for the notion that no spiritual substance was necessary for them to be sentient and capable of acquiring knowledge in the same way that humans did.[543]

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[538] Ibid., p. 280: 'les passions chez nous ne sont que des émotions de l'ame qu'elle rapporte à elle-même, causées et entretenues par le mouvement des esprits animaux'.

[539] Pardies, *Discours*, p. 127: 'elles [les Bestes] ne commandent point leur mouvement, puisqu'elles ne se déterminent nullement elles-mêmes, étant plûtost déterminées par les objets. Ainsi puisqu'en nous l'ame ne fait rien à l'égard du mouvement, que vouloir, se déterminer, commander; il est, ce semble, inutile de donner aux Bestes des ames, puisqu'elles ne veulent, ni ne se déterminent, ni ne commandent.'

[540] Ibid., p. 130.

[541] Ibid., p. 131: 'Agir de cette premiére maniére, c'est agir par instinct, ou plûtost c'est être agi, & poussé par une détermination necessaire, selon le rapport de l'objet, avec la disposition du corps. Mais agir de cette second maniére, c'est agir en homme, c'est à dire, se mouvoir par choix, & par la détermination de la volonté.'

[542] Ibid., p. 132: 'c'est la différence qu'il y a en nous, entre agir naturellement par instinct, & agir humainement par choix & par volonté: quelquefois les actions préviennent les pensées, & la détermination de la volonté; & pour lors elles sont *animales* ou *naturelles*; & quelquefois l'empire de la volonté précede les actions du corps, qui pour lors sont *humaines & volontaires.*'

[543] Ibid., pp. 214-215.

The examination of the nature of the beast-machine thesis and of the heuristic constraints which first led Descartes to formulate it cannot be separated from the wider philosophical issues surrounding the establishment of a plausible picture of 'other minds' - of animal souls, invisible to the gaze, and of the causality of physical, as opposed to mental, acts. If the debate about human free will, especially in its relation to mechanism and atomism, was rooted in an ongoing dialogue between man and God, nourished by theological precedent, the controversy over the nature of the will of animals translated the anxious need to determine the borders of the territory within which man stood alone in nature. Such discussions evolved in parallel with the enrichment of natural philosophy by data obtained through observation, although they depended less on an accumulation of empirical and anatomical knowledge, which had been ongoing since the Renaissance, than on changing notions about the status of such knowledge and on its limitations. They are thus central to the study of the role of discursive and scientific tools in providing definitions of the mind, where the mind is understood as the set of operations and modalities which enable living systems to know and act upon the world. In the following section, I shall focus at first on arguments about scepticism and teleology put forward by natural philosophers, physicians and theologians, before trying to establish what picture of reason and will emerged from these various theories of sense-perception.

II

TELEOLOGY, SCIENCE AND SCEPTICISM

II. Teleology, Science and Scepticism

> *We love, we hate, we joy, we grieve: passions annoy us, and our minds are disturb'd by those corporal æstations. Nor yet can we tell how these should reach our unbodyed selves, or how the Soul should be affected by these heterogeneous agitations. … Our most industrious conceits are but like their object, and as uncertain as those of midnight.*[544]

One justification for calling the seventeenth century 'revolutionary' is that there arose during that period a need to interpret in an adequate manner the newly revealed - rather than merely imagined - microscopic and macroscopic dimensions of nature. There was an ongoing, thorough revision of the boundaries between the visible and the invisible. The relationship between reason and perception and their respective roles also underwent a new kind of scrutiny, now conditioned in part by the possibility of resorting to the Cartesians' austere conception of mentality. Scepticism, as we shall see, was concurrently a strong presence in the metaphysics which developed alongside and within early modern scientific discourse. Moreover, the idea in the post-Baconian era that the programmatic investigation of the physical world could be justified by pointing to the divine origin of nature, or to nature as a manifestation of divinity, fit awkwardly with efforts to assign a non-teleological, explanatory role to mechanistic causal laws.

But it was this very idea, and the increasingly problematic presence of God - as attested particularly in mid-century England, but also in later discourses of physico-theology in both France and England - which largely determined how to unravel the puzzling relation between the perceiving, willing human creature and the non-human natural realm. If the human capacity for rational and empirical enquiry was also revelatory of divine purpose in some way, what was the place of human reason in the created universe, and how could its role be ascertained? What status could be assigned to the rational observer of nature, to human enquiry itself, now that bodies in the observable world were no longer mainly defined in - Aristotelian - terms of intrinsic function?[545] And how did assessments of the human mind's

[544] Joseph Glanvill, *The Vanity of Dogmatizing* (London, 1661), 'The Preface', sig. A3.

[545] For example, see Aristotle, *Parts of Animals* (645b14-21): 'since every instrument (*οργανον*) is for the sake of something, and each of the parts of the body is for the sake of something, that is to say, some action, it is clear that the body as a whole arose for the sake of some complex action. Just as the saw came to be for the sake of sawing, and not sawing for the sake of the saw… so the body exists for the sake of the soul in a way and the parts of the body for the sake of the functions that each of them naturally fulfils.' G. E. R. Lloyd quotes the passage in his *The Revolutions of Wisdom: Studies in the*

capacity for cognition bear upon the formation of criteria for determining what might constitute a scientifically credible observation? These are the questions that underlie the progressive separation of epistemology - construed from Locke onwards as the abstracted problematization of the modalities of human knowledge - from psychology - construed as a practical guide to the ethical regulation by reason of the passions of body and soul.[546] Following on from these introductory pages, which present the argument in general terms, I shall consider, in Chapter 1, the role played by scepticism in the construction of responses and alternatives to Cartesian psychology. I shall then look, in Chapter 2, at the interplay between natural philosophy and the metaphysics of teleology, and, in Chapter 3, at theories of sentience and volition in living organisms in relation to this interplay.

In *The Metaphysical Foundations of Modern Science*, published in 1932, Edwin Burtt gave a lucid account of what it took, in the hands of Copernicus, Kepler and Galileo, for the initially Platonizing mathematization of the physical world to replace the qualitative definitions of scholasticism which had prevailed until then. Some of the starting assumptions of this account - that in order to understand the point reached by epistemology in the present, one must return to its foundations - are, in my view, still relevant.[547] As he wrote, But Burtt interpreted this shift as one in which man as a *sensing* creature became wholly divorced from a universe made up of mathematical relations between geometrical objects and objective primary qualities, and in which secondary qualities figured only as the unquantifiable features of subjective experience. This clear-cut picture of a progressive separation of man from the world constitutes what, along with Steven Shapin,[548] one may describe as the

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Claims and Practice of Ancient Greek Science (Berkeley, 1987), pp. 189-190, to illustrate 'the general doctrine of the adaptation of the parts of living creatures to ends'.

[546] See Rorty, *Philosophy*, p. 51, for a discussion of what 'made epistemology central to philosophy', and pp. 137-147, where he analyses Locke's ambiguous definition of thought: 'to think of knowledge which presents a "problem", and about which we ought to have a "theory", is a product of viewing knowledge as an assemblage of representations - a view of knowledge which', in Rorty's view, 'was a product of the seventeenth century'. Rorty's insight has been a useful one; although, by leaving natural philosophy out of his account, his picture of the seventeenth century falls short of explaining what it took for dualism to become entrenched within the very practice of modern philosophy.

[547] Burtt, *Metaphysical Foundations*, p. 2: 'The central place of epistemology in modern philosophy is no accident; it is a most natural corollary of something still more pervasive and significant, a conception of man himself, and especially of his relation to the world around him.' See also p. 15: 'We inevitably see our limited problem in terms of inherited notions which ought themselves to form part of a larger problem.'

[548] Steven Shapin, *The Scientific Revolution* (Chicago and London, 1996), p. 168.

traditional strand in the historiography of the scientific revolution, for this very separation is one of the revolutionary aspects of the changes which occurred in the seventeenth century. But this 'heroic' conception of a Baconian leap from the reign of dogma to bright empirical knowledge has undergone considerable revision since Burtt's book - along with other synthesizing works aimed at identifying the origins of modern epistemologies - was published.[549]

Recently, Catherine Wilson has analysed the relationship between the philosophical construction of the foundations of knowledge, on the one hand, and notions about the senses, their physiology, the role of sense-experience and technologies in the acquisition of knowledge, on the other. She suggests that 'the distance imposed by the need to conceptualise what could not be seen was not something at which Descartes had ever been aiming'.[550] Descartes's philosophical project gave birth to an epistemology that had little to do with the framework within which he devised it, and was 'a substitute for an experimental science that failed'.[551] Mechanistic and corpuscularian programmes, she says, were not necessarily reductionist with regard to human sense-perception and the 'Burttian', post-Galilean world of mathematical relations. This may help to explain why the dual organism, as I tried to show in Part I, was a methodological tool rather than a plausible replacement for Galenic physiology and psychology. It was not a system validating the positive reduction of the human organism to mechanism but the outcome of an *a priori* programme whose aim was to devise a complete explanation of the physical

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[549] For a general account of this historiography and its bibliography, see Shapin's helpful indications in his 'Bibliographic Essay', ibid., 167-211. See in particular Arthur O. Lovejoy , *The Great Chain of Being: A Study in the History of an Idea* (Cambridge, Mass., 1936), delivered as the William James lectures in 1933; Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore and London, 1957). For an analysis of the historiography of the concept of a scientific revolution see I. Bernard Cohen, *Revolution in Science* (Cambridge, Mass. and London, 1985). See also the more recent volume by David C. Lindberg and Robert S. Westman, ed., *Reappraisals of the Scientific Revolution* (Cambridge, 1990).

[550] Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope* (Princeton, 1995), p. 21. See also John Sutton, *Philosophy and Memory Traces: Descartes to Connectionism* (Cambridge, 1998), pp. 50-54; see esp. p. 52 for his references to further treatment of the matter of Descartes's conception of 'the relations between metaphysics and scientific practice'. See also Dennis Des Chesne, *Physiologia: Natural Philosophy in Late Aristotelian and Cartesian Thought* (Ithaca and New York, 1996), p. 2: 'the profoundest and historically most effective part of Descartes's project has to do neither with method (whose relation to Descartes's practice is at times tenuous, and which was in any case not the most significant part of his legacy), nor with the geometrization of nature (a means, not an end), nor yet with experiment (which Descartes did not make central to his strategies of persuasion, as Boyle and the Royal Society did later), but with constructing, from prime matter upward and from God downward, a functional equivalent to the Aristotelian philosophy of nature'.

world. Biological and anatomical descriptions of living organisms were testable hypotheses rather than contributions to the establishment of complete theories of life,[552] in that they emerged out of the practice of a natural philosophy founded on the use of the visual sense, assisted both physically, by instruments like microscopes, and by a proper methodology, such as the one Thomas Sprat described for the Royal Society.[553] The adoption of sceptical postulates about the relationship of human senses to knowledge, on the one hand, and to reason, on the other, thus went along with the development of mechanistic and atomistic interpretations of natural phenomena.[554]

Locke himself was explicit about the boundaries within which a gentleman should study natural philosophy, writing in *Some Thoughts Concerning Education* that

> Natural philosophy, as a speculative science, I imagine we have none, and perhaps I may think I have reason to say we never shall. The works of nature are contrived by a wisdom, and operate by ways too far surpassing our faculties to discover, or capacities to conceive, for us ever to be able to reduce them into a science. Natural philosophy being the knowledge of principles, properties, and operations of things, as they are in themselves, I imagine there are two parts of it, one comprehending Spirits with their nature and qualities; and the other Bodies.[555]

The first, he went on, is known as metaphysics, and should be studied before the second, 'not as a science that can be methodized into a system, and treated of upon principles of knowledge; but as an enlargement of our minds towards a truer and fuller comprehension of the intellectual world, to which we are led both by reason

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[551] Wilson, *Invisible World*, p. 21.
[552] See ibid., ch. 2, for an account of the ways in which the corpuscularian and atomist philosophy of nature, in the form it took, with the advent of microscopes, as an empirical practice, was an hypothesis rather than an 'original paradigm of scientific objectivity', p. 69.
[553] Thomas Sprat, *A History of the Royal Society of London for the Improving of Natural Science* (London, 1667).
[554] For a systematic exploration of seventeenth-century scepticism in Britain, see Henry G. Van Leeuwen, *The Problem of Certainty in English Thought, 1630-1690* (The Hague, 1963) and Robert M. Burns, *The Great Debate on Miracles: From Joseph Glanvill to David Hume* (London, 1981), esp. chs. 1 and 2. Burns suggests that the 'via media' promulgated by members of the Royal Society between 'Dogmatism' and 'Scepticism' supposed a critical stance towards both Scholasticism and Cartesianism, each, as he writes, p. 20: 'guilty of bringing unwarranted a priori assumptions to their investigation of experience which warped their capacity for discovering the truth'.
[555] John Locke, *Some Thoughts Concerning Education* (first published London, 1693), § 190, in John Locke, *The Works* (London, 1823), 10 vols.: IX, pp. 182-183.

and revelation'. Revelation must take precedence over reason,[556] since it imparts 'the clearest and largest discoveries we have of other spirits'.[557] Spirits and 'immaterial beings, "in rerum natura"', must be allowed to account for those things which 'mere matter and motion' cannot explain:[558] the new science does not disturb the hierarchy of knowledge established by revealed religion.[559] Wilson writes that Locke's scepticism with regard to the power of natural philosophy to yield proper knowledge, that is, knowledge more substantial than what would be merely 'convenient and necessary to be known to a gentleman',[560] came from his attachment to 'mathematical demonstration, in which agreement of ideas is secured through logical connection - through entailment relations'. His doubt, she writes, was 'fed by the properly philosophical Pyrrhonian skepticism of the early seventeenth century, with the dialectic of reality and appearance converted into a dialectic of surface and interior'.[561] What, she says, led him to distrust metaphysicians like Descartes, 'who did not seek a secure grounding of their concepts in experience', was also what led him 'to retreat to the level of sensory immediacy' instead of 'formulating an epistemology of experimental science'.[562] Data about the natural world were yielded by testimony, rather than by revelation; but it was revelation alone which dictated what relationship humans and particularly 'gentlemen' should have to empirical knowledge.

The point is an important one. Locke's faith in 'spirits', and his belief that knowledge of the invisible must be prior to empirical knowledge, does indeed correspond to an undermining of the significance of new theories of matter. As an educational programme, it is at once moralizing and theologically neutral: it constitutes a claim that knowledge of the realm of matter can remain quite separate from that of the realm of spirits, without either realm having any transformative impact on the other. The epistemological project founded by Locke in the 1690s, so

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[556] On the use by Locke of arguments for the necessity of the existence of God, see J. J. MacIntosh, 'Locke and Boyle on miracles and God's existence', in Michael Hunter, ed., *Robert Boyle Reconsidered* (Cambridge, 1994), pp. 191-214, at pp. 191-197.
[557] Locke, *Some Thoughts*, § 190, in *Works*, IX, p. 183.
[558] Ibid., § 192, p. 184.
[559] For an in-depth analysis of this issue, see J. J. MacIntosh on 'Robert Boyle's epistemology: the interaction between scientific and religious knowledge', *International Studies in the Philosophy of Science*, 6, 1992, pp. 91-121.
[560] Locke, *Some Thoughts*, § 193, in *Works*, IX, p. 186.
[561] Wilson, *Invisible World*, p. 238.
[562] Ibid., pp. 243-244.

it appears, was born out of the assumption that materialistic explanations of natural phenomena could not possibly be exhaustive of the reality of the external world or of human perception. This, however, does not so much betray scepticism - the rhetorical and programmatic bedrock, so to speak, on which post-Baconian scientific enquiry was founded - as amount to a dismissal of any need for investigating the bases of human knowledge in the *concrete* terms allowed by this new science.[563] Locke may have been perplexed enough by the views of nature afforded by the microscope, as used by Robert Hooke and Anton van Leeuwenhoek, to acknowledge the infinitesimal as plausible; and he was, up to a point, interested in the fact that microscopes revealed worlds hidden from the naked eye. As he reported in the *Essay concerning Human Understanding*:

> Blood to the naked Eye appears all red; but by a good Microscope, wherein its lesser parts appear, shews only some few Globules of Red, swimming in a pellucid Liquor; and how these red Globules would appear, if Glasses could be found, that yet could magnify them 1000, or 10000 times more, is uncertain.[564]

But, as Wilson suggests, the existence of this realm did not, for him, transform in any way the views he developed with regard to the functioning of human perception and cognition.[565] There might be hidden worlds, which it was the mission of the natural sciences to uncover; but what mattered to Locke was that such new sights 'would produce quite different *Ideas* in us': with any alteration of our senses 'the appearance and outward Scheme of things would have quite another Face to us; and I am apt to think, would be inconsistent with our Being'.[566] Hidden worlds could unsettle our gaze and our position in the naturally knowable world. A purely physicalist account of our own higher mental functions was therefore not only inconceivable ontologically, since one could not map a non-physical substance in such a way, but,

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[563] See Rorty, *Philosophy*, p. 137: 'This project of learning more about what we could know and how we might know it better by studying how our mind worked was eventually to be christened "epistemology". But before the project could come to full self-consciousness, a way had to be found of making it a *nonempirical* project. It had to be a matter of armchair reflection, independent of physiological discoveries and capable of producing necessary truths. Whereas Locke had retained the new inner space of research - the workings of the newly invented Cartesian mind - he had not been able to hold onto Cartesian certainty. Locke's "sensualism" was not yet a suitable candidate for the vacant position of "queen of the sciences".'
[564] Locke, *Essay*, II, xxiii, §11.
[565] Wilson, *Invisible World*, pp. 240-241.
[566] Locke, *Essay*, II, xxiii, §12, in *Works*, IX, p. 302.

even if it were possible to do so, it would also be ethically repugnant from the philosopher's perspective,[567] because 'inconsistent with our Being'.[568]

The precise delimitation of what humans could perceive, and the establishment of criteria for what could count as scientific knowledge, was thus contingent on the posited bounds within which human knowledge was deemed generally possible. These bounds, however, shifted along with empirical discovery; and so, as Wilson argues, theories of human knowledge were also a function of the accumulation of data garnered by empirical observation and repeated experiment. The interplay between scepticism and the construction of positive knowledge was an openly reciprocal one, in the sense that they determined one another.[569] Debates about the nature or structure of the human mind and of mind-body interaction in humans and animals thus took place at the intersection between, on the one hand, the theological, rhetorical and methodological need to preserve the sceptical basis of the new science, and, on the other, the notion that our reason, limited as it was, could be analysed separately from the physical organism of our body. Descartes, as we have seen, had constructed his system on the basis of total doubt in order to arrive at total certainty via the 'cogito'; but in doing so he expelled human reason from the physical body, relying on God as its guarantor - while also relying on introspection in order to be assured of God's existence.[570] Sceptical doubt was now a liminal function

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[567] Burns, *Metaphysical Foundations*, p. 24, quotes Boyle, *The Works of the Honourable Robert Boyle*, ed. Birch (London, 1744), 6 vols.: I, p. 182: 'The conclusions of a moral demonstration are the surest that men aspire to, not only in the conduct of private men's affairs, but in the government of states, and even of the greatest monarchies, and empires…moral demonstration…may…be, as it were, made up of particulars that are each of them but probable'.

[568] See Daniel Dennett, 'When philosophers encounter AI', *Daedalus* 117, 1988, pp. 283-295, reprinted in his *Brainchildren: Essays on Designing Minds* (Cambridge, Mass. and London, 1998), pp. 265-276, at p. 267, on the notion that to accept the model of artificial intelligence (AI) for the human mind might be 'aesthetically repugnant' and not only 'repugnant to reason', in,.

[569] See Luce Giard, 'Le devoir d'intelligence ou l'insertion des jésuites dans le monde du savoir', in Luce Giard, ed., *Les Jésuites à la Renaissance: système éducatif et production du savoir* (Paris, 1995), pp. xi-lxxix, esp. pp. xxxviii-xli, on Alexandre Koyré; at p. xli : 'toute théorie scientifique doit son existence à la philosophie, on ne pense en science qu'en pensant philosophiquement. En ce sens, une innovation scientifique naît seulement d'un bouleversement des catégories épistémiques'. She cites Koyré, *Etudes d'histoire de la pensée scientifique* (Paris, 1973), p. 399: 'la science, celle de notre époque, comme celle des Grecs, est essentiellement *theoria*, recherche de la vérité, et que de ce fait elle a, et a toujours eu une vie propre, une histoire immanente, et que c'est seulement en fonction de ses propres problèmes, de sa propre histoire qu'elle peut être comprise par ses historiens'.

[570] Descartes, *Méditation troisième* in Descartes, *Œuvres philosophiques*, ed. Ferdinand Alquié (Paris, 1967), II, pp. 430-454. For a provocative analysis of the extent to which it is accurate to say Descartes is a foundationalist with regard to epistemic justification see Ernest Sosa, 'How to resolve the Pyrrhonian problematic: a lesson from Descartes', at http://www.stir.ac.uk/departments/arts/philosophy/cnw/webpapers/sosa1.htm, p. 7: 'Descartes will not settle for mere cognitio, not even for *internalist, a priori*, reason-derived cognitio, as attained by the atheist mathematician. Descartes wants

of reason, defining its ambit. And, while sceptical arguments had become formalized in the course of the sixteenth century, their role, even for non-Cartesians, inevitably shifted - as I shall attempt to explain in this section - in the new context of a mechanized, atomized natural world which it was possible to observe and dissect but which also continued to be envisioned as God's creation.[571]

This mitigated scepticism, however, could also be understood as a version of the 'explanatory gap'.[572] I shall try to show in the following pages how this concept can now be understood as an essential element in the integration of a broadly dualist ontology of man - though not necessarily a Cartesian one - with the new theories of matter which developed in early modern science.

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reflective, enlightened scientia. It is *this* that sets up the problem of the Cartesian Circle.' The article was originally published in *Philosophical Studies*, 135, 1997, pp. 229-49.

[571] Roger, *Sciences de la vie*, pp. 198-203, also points out how important sceptical prudence was in French circles; in this sense the French were more prone to emulate their English colleagues than to look for Cartesian criteria of clarity and certainty.

[572] This concept was discussed in the Introduction, esp. pp. 14-16, and referred to above, p. 106.

1. Other worlds: the science of knowledge

> *Adam needed no spectacles. The acuteness of his natural Opticks (if conjecture may have credit) shew'd him much of the Cœlestial magnificience and bravery without a Galilæo's tube: And 'tis most probable that his naked eyes could reach near as much of the upper World, as we with all the advantages of art. It may be 'twas as absurd even in the judgement of his senses, that the Sun and Stars should be so very much, less then this Globe, as the contrary seems in ours; and 'tis not unlikely that he had as clear a perception of the earths motion, as we think we have of its quiescence.*[573]

> *Neither do I think that the Aged world stands now in need of Spectacles, more than it did in its primitive Strength and Lustre: for howsoever though the faculties of the soul of our Primitive father* Adam *might be more quick & perspicacious in Apprehension, than those of our lapsed selves; yet certainly the Constitution of* Adam*'s Organs was not divers from ours, nor different from those of his Fallen Self, so that he could never discern those distant, or minute objects by Natural Vision, as we do by the Artificial advantages of the Telescope and Microscope.*[574]

The conception of rationality as the beacon of conscious life, bequeathed to us by Descartes and Locke, is foundational to what became modern philosophy itself. It is inscribed in the practice of enquiring into the conditions under which 'ideas' - in the sense of the concept forged in early modernity to designate conscious, verbally communicable items of human knowledge, rather than in the Platonic sense - constitute knowledge of something in the world. In this sense, for 'realists' as well as for 'idealists', the verbal, theoretical activity that is philosophy - as opposed to the practical activity of modern science - departs from and tends to return to an investigation into that to which it owes its very existence, self-conscious reason. Because the recognition of our capacity to observe our own 'experience' is at the core of modern philosophy, it also presupposes a recognition of what appears to be a phenomenal cleavage between word and thing, mind and world, mediating reason and immediate, physically manifest sensation, second-order self-consciousness and first-order thought. Given this, it makes sense to argue that an 'explanatory gap' must be inherent in the very act of giving an account of the human mind.[575] Theories of cognition would then amount to so many questions around this putative gap, rather than contributing to the - seemingly impossible - bridging of the gap. Within the framework of seventeenth-century dualism, it was the explanatory gap itself -

[573] Joseph Glanvill, *The Vanity of Dogmatizing*, p. 5.
[574] Henry Power, *Experimental Philosophy, In Three Books: Containing New Experiments Microscopical, Mercurial, Magnetical. With some* Deductions, *and Probable* Hypotheses, *raised from them, in Avouchment and Illustration of the now famous* Atomical Hypothesis (London, 1664), 'The Preface', sig. A3v.
[575] See above, Introduction, esp. pp. 14-16; p. 38; p. 106.

equivalent to the acknowledgement of a substantive difference between verbal, human explanation and mute, created world - which could be said to delineate the mind's sphere. The thinking substance, the higher level of cognition, was defined by its very essence as a substance, different in kind and not only in mode from the body: a gap between the two was inherent in the very conception of the mental. What shall be investigated here are consequently the varied ways in which both practitioners and theoreticians of early modern natural philosophy tended to identify, define, use, transcend or ignore this conceptual gap.

The hypothesis of the Anglican clergyman Joseph Glanvill (1636-1680)[576] that the prelapsarian Adam might not have needed spectacles is a good starting-point. It was beautifully defended in *The Vanity of Dogmatizing*, the first of three versions of his discourse on scepticism, aimed primarily at attacking the scholastic philosophy that was still practiced at Oxford when the text was published in 1667. Three years earlier, in 1664, the then relatively young Glanvill had been elected to the Royal Society, where he would play a role not unlike that of Sprat in publicly articulating its mission.[577] The postulation of pre-lapsarian omniscience, of which the '*literal Adam*' was an '*Allegory*', was clearly related to the notion of a universal language,[578] in that it was an 'hypothesis', as Glanvill put it,[579] about the possibility of an unmediated, transparent knowledge, provided by unbounded, undifferentiated senses. This, he wrote, is how we imagine God's vision; and, as such, it is an unquestionable justification for the sceptical stance. We are functionally, constitutionally unable to perceive the universe as God sees it - as it was created. Therefore, what characterizes human knowledge is the recognition of its intrinsic limitations and incompleteness. The fact that we are able to conceive of the difference between divine and human knowledge is also the precondition and starting-point for the latter, and for its

[576] For a general account of Glanvill's life and thought, see, e.g., Van Leeuwen, *The Problem of Certainty*, pp. 71-89.
[577] Van Leeuwen, p. 72, and Burns, *The Great Debate on Miracles*, p. 47.
[578] On the role of an Adamic language in the thought of Leibniz, see Marcelo Dascal and Elhanan Yakira, ed., *Leibniz and Adam* (Tel Aviv, 1993), especially Hans Aarsleff, 'Genesis, Language, and the Angels', pp. 169-195, at p. 170, on Descartes and the 'world of epistemological transcendence he sought to enter'; and Geneviève Brykman, 'Locke's Adam: An assault on natural signification', pp. 197-209. See also Hans Aarsleff's 'An Outline of Language-Origins Theory Since the Renaissance', *Annals of the New York Academy of Science*, 280, 1977, pp. 4-13.
[579] Glanvill, *Vanity*, 'Preface', sig. B2v. (Glanvill's italics.)

reliance on ideas like those imagined by Locke.[580] Glanvill's justification for such a position was theological - God 'adorn'd that creature [Adam] which was a transcript of himself, with all the perfections its capacity could bear'.[581]

But the view itself was offered as the resolution of all epistemological quandaries: it set up the hypothetical conditions for perfect knowledge, and by doing so defined existing human knowledge in terms both of a lack and of an imagined ideal.[582] (In this, it was parallel to the debates regarding the presence of reason, knowledge and language in animals.)[583] Yet, it was based on a claim to (metaphysical) realism about the world of matter as natural philosophy imagined it; and it posited materialistic accounts of perception as workable - although incomplete - explanations, appropriately enough for one who considered himself a promoter of science.[584] There was nothing magical or miraculous about the kind of perception Glanvill ascribed to Adam, whose knowledge of natural phenomena was due to his ability to perceive all their mechanical causes. Adam did not need to engage in the practice of natural philosophy, since he already had full and accurate knowledge of all causes and all correlated effects.[585] As Glanvill wrote, 'to me it appears to be most reasonable, that the circumference of our *Protoplast*'s senses, should be the same with that of natures activity: unless we will derogate from his perfections, and so reflect a disparagement on him that made us'.[586]

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[580] See Stephen Medcalf, 'Introduction' to Joseph Glanvill, *The Vanity of Dogmatizing: The Three 'Versions'* (Hove, 1970), pp. xx-xlvi.
[581] Glanvill, *Vanity*, p. 7.
[582] In *The Emergence of Probability* (Cambridge, 1975), Ian Hacking singles out Glanvill as the first writer to identify the 'problem of induction' in an embryonic form, by establishing a modern conception of evidence; see pp. 31-33, and, on induction, pp. 176-185.
[583] Cureau de la Chambre, in *Traité de la connaissance des animaux, où tout ce qui a esté dict pour et contre le raisonnement des animaux a esté examiné* (Paris, 1648 ; here, Paris, 1989), p. 291, suggested that 'le langage des bêtes est semblable en ce point, à celui que l'Homme reçut de Dieu à la naissance du monde'. Odile Le Guern cites the passage in her article 'Cureau de la Chambre et les sciences du langage à l'âge classique', *Corpus*, 16-17, 1991: *L'âme des bêtes*, pp. 17-25, at p. 23; and she sees it as an attempt to note the similarity between animal language and the language of passions in humans, learned before the acquisition of any other form of expression.
[584] Glanvill, *Vanity*, 'The Epistle Dedicatory', sig. A3r: 'But I have no design against Science: my indeavour is to promote it. *Confidence* in uncertainties, is the greatest enemy to what is certain; and were I a *Sceptick*, I'de plead for *Dogmatizing*: For the way to bring men to stick to *nothing*, is confidently to perswade them to swallow all things.' Burns, in *The Great Debate*, p. 22, associates Glanvill's position with that of Boyle: they both advocated 'the most extreme caution and "diffidence" combined with a fundamental affirmation of the cognitive value of well-founded theories'.
[585] Glanvill, *Vanity*, p. 6: 'the accuracy of his knowledge of natural effects, might probably arise from his sensible perception of their causes'.
[586] Ibid., pp. 8-9.

The idea of a lost perfection, modelled on divine perfection,[587] found its justification in a familiar appeal to the necessity of fallen man's religiosity. Worship here buttressed the case for the natural philosopher's heuristic need to conceive of a physical, sensing organism endowed with the capacity for direct knowledge of the physical world. Glanvill's affecting rhetoric - which he would tone down in *Scepsis Scientifica*, the second version of the *Vanity* - also helped to lock together, as it were, natural theology and natural philosophy, wonder[588] and explanation, doubt and understanding, ignorance and knowledge.[589] Whatever mechanisms could be found to be at play in nature's bodies, at the heart of our capacity to reconstruct them was a recognition, not that the structure of living beings was forged in heaven, but that our fall - the result of human curiosity - turned it into a secret; so that whatever could be found out about it would be only indirect, mediate, worryingly unreliable. There might be a key to the secret, but its shape was ill-defined, unless one held a belief akin to that of the Danish, Hermeticist chemist and historian Ole Borch, that chemistry's ancient origin meant that its practice could return us to beholding 'prisca sapientia'.[590] But for someone like Glanvill, kowledge was not a matter of getting back to origins, and it was all the more unobtainable in the case of the soul, which might perhaps be

> seen, as other things, in the Mirrour of its effects, and attributes: But, if like children they'll [those who ask 'what the *soul* is'] run behind the glass to see its naked face, their expectation will meet with nothing but vacuity & emptiness. And though a pure Intellectual eye may have a sight of it in reflex

[587] In the revised version of the *Vanity*, *Scepsis Scientifica: Or, Confest* Ignorance, *the way to* Science; *In an* Essay *of The Vanity of Dogmatizing, and* Confident *Opinion* (London, 1665), which was prefaced by a eulogy of the Royal Society, Glanvill no longer mentions Adam, although he does still use the notion of a primeval condition, pp. 1-2: 'whatever disorders have since befallen them, all things were at first disposed by an *Omniscient Intellect* that cannnot contrive ineptly; and our selves exactly formed according to the *Idea's* of that *Mind*, which frames things consonantly to the Rules of their respective Natures'.

[588] See Katharine Park and Lorraine Daston, *Wonders and the Order of Nature* (New York, 1998); Guido Giglioni, 'Dalla meraviglia dei sensi alla meraviglia dell'intelletto. Note sul concetto di automa nel XVII secolo', in G. Galli, ed., *Interpretazione e meraviglia, XIV colloquio sulla interpretazione, Macerata* (Pisa, 1994).

[589] For an interpretation of Glanvill's revisions, see Medcalf's 'Introduction' to *Vanity*. For the context in which Glanvill's (and Sprat's) praise of the experimental science as a glorification of God's work could be branded as 'enthusiast', see Michael Heyd, *"Be Sober and Be Reasonable": The Critique of Enthusiasm in the Seventeenth and Early Eighteenth Centuries* (Leiden, New York, London, 1995), especially Chapter 5.

[590] On Ole Borch, see for, e.g., Ferdinando Abbri, 'Alchemy and chemistry: chemical discourses in the seventeenth century', in *Early Science and Medicine*, 5, 2000, pp. 214-226, at pp. 218-222.

> discoveries; yet, if we affect a grosser touch, like Ixio we shall embrace a cloud.[591]

The interaction of immaterial soul and material body was equally, commensurately mysterious.[592] The phenomenon was 'as hard to apprehend, as that an empty wish should remove Mountains: a supposition which if realised, would relieve *Sisyphus*'.[593] The mind-body dualism Glanvill adopted was thus a starting-point for a rich, poetic wonder, rather than a positive theory in which God would be made to play the rather more Cartesian role of guarantor of clear and distinct ideas about what constitutes certain knowledge. Because Glanvill's version of substance dualism neither left any room for a solution such as occasionalism, for example, nor questioned its own metaphysical foundations, it was actually rather more dogmatic (in the modern sense of the word) than doubting: he was sceptical about the powers, but not about the definition of reason.[594]

A prosaic gloss on Glanvill might be that substance dualism, though to him obviously true, did not make sense of either the pre- or post-lapsarian human organism any more than spectacles could either help us understand the heavens they made more visible, or give us information about the soul's origins. Our 'wretchedness' as sinners was that we were both naked to ourselves and ignorant of the world.[595] Scepticism remained here fully inscribed within a theodicy, while the depiction of the difficulty of conceiving how mentality could possibly be deduced from physical motion prodded the reader to embrace the sceptic's assumptions:[596]

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[591] Glanvill, *Vanity*, p. 18. Zeus punished the king Ixion for his love for Hera by binding him to an eternally revolving wheel in Tartarus.

[592] Ibid., p. 20: 'How should a thought be united to a marble-statue, or a sun-beam to a lump of clay! The freezing of the words in the air in the nothern climes, is as conceivable, as this strange union. That this active spark, this συμφυτον πνεὺμα [as the Stoicks call it] should be confined to a Prison it can so easily pervade, is of less facill apprehension, then that the light should be pent up in a box of Crystall, and kept from accompanying its source to the lower world: And to hang weights on the wings of the winde seems far more intelligible.'

[593] Ibid., p. 22: 'that we are a Compound of beings distant in extreams, is as clear as Noon. But how the purer Spirit is united to this clod, is a knot too hard for fallen Humanity to untie.' See also p. 25: 'Much as 'the soule is the principle of direction', how it 'should be the Directrix' of the body's motions is as 'unconceivable … as that a blind man should manage a game at Chess'.

[594] Van Leeuwen, in *The Problem of Certainty*, p. 74, writes that Glanvill 'does not, as Descartes's method would demand, deny the existence of mind, memory, and matter, but only denies that any claims to knowledge about them are justified. The existence of mind, body, sensation, memory, and so on, he takes as unquestioned. The fact that there are so many instances of error and ignorance makes any claims of understanding the world pretentious dogmatism'.

[595] Glanvill, *Vanity*, p. 10.

[596] Ibid., p. 30.

curiosity about this riddle did not amount to the project of 'unridling Nature'.[597] Rather, it led to the partial dismissal of Descartes's animal 'spirits' and of Kenelm Digby's theory of 'corporeal exuviæ'[598] as viable explanations for mental operations such as memory.[599] (As for Aristotelian psychology, it was a 'superannuated conceit' which we need neither remember nor try to understand.)[600] Glanvill's rather rudimentary objections to Descartes tended to appeal to a mechanical, non-theoretical picture of the brain as a simplistic container; he did not trouble himself with the subtleties someone like Locke paid attention to.[601] Certainly the soul directed 'the *Spirits* for the motion of the Body according to the several animal exigents';[602] but that this 'regulating efficiency … is performed by meer *Mechanisme*, constant experience confutes; which assureth is, that our spontaneous motions are under the Imperium of our Will.'[603] These objections consisted in the mainly rhetorical subversion, through their interrogation, of known affirmations about the workings (though not the existence) of particles, atoms and the like. But they did eventually give way to the tentative adoption, on the lines of Henry More (to whom he often referred), of a Platonizing version of Cartesian accounts of sense-perception.[604]

Imagined particles in action were precisely the building-blocks of the post-Galilean universe. As Hooke put it,

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[597] Ibid., p. 33.

[598] Ibid. Glanvill explains Digby's theory, 'a summary of which is, That things are reserved in the memory by some corporeal *exuviae* and material Images; which having impinged on the Common sense, rebound thence into some vacant cells of the Brain, where they keep their ranks and postures in the same order that they entred, till they are again stirr'd up; and then they slide through the *Fancy*, as when they were first presented.' On Digby's theory of memory in its relation to both Glanvill and Hooke, see Sutton, *Philosophy and Memory*, pp. 133-144.

[599] Glanvill, *Vanity*, pp. 32-40; at p. 32: 'Memory is a faculty whose nature is as obscure, and hath as much of Riddle in it as any of the former; It seems to be an Organical Power, because bodily distempers often marr its Idea's, and cause a total oblivion: But what instruments the Soul useth in her review of past impressions, is a question which may drive Enquiry to despair.'

[600] Ibid., p. 37.

[601] See Sutton, *Philosophy and Memory*, esp. pp. 138-141.

[602] Glanvill, *Vanity*, p. 24.

[603] Ibid., p. 25.

[604] Ibid., pp. 200-201, and pp. 213-223. There is a chapter in between in which Glanvill takes up the cause of Kenelm Digby's celebrated weapon-salve cure, pp. 202-212; see Kenelm Digby, *A Discourse made in a Solemne Assembly of Noble and Learned Men at Montpellier in France, by Sir Kenelme Digby, Knight &c., Touching the cure of wounds by the powder of sympathy*, 2nd edition (London, 1658). Glanvill, in line with the Cambridge Platonists, such as Henry More, with whom he was associated, accepted the possibility of action at a distance. On More, see, e.g., D. P. Walker, 'Medical Spirits and God and the Soul', *Spiritus*, 1983, pp. 223-244, esp. pp. 235-241; John Henry, 'A Cambridge Platonist's Materialism: Henry More and the Concept of Soul', *Journal of the Warburg and Courtauld Institutes*, 49, 1986, pp. 172-195.

> all things in the Universe that become the objects of our senses are compounded of these two (which we will for the present suppose distinct essences, though possibly they may be found hereafter to be only differing conceptions of one and the same essence) namely, *Body*, and *Motion*[605]

And so, if the operations of the 'material soul' were to be explained materialistically, then to reject atoms and animal spirits as agents of internal and external senses would effectively be to reject either the new science or the notion that the material soul was a recognizable entity. This, of course, would be contrary to the very goal Glanvill aimed at in constructing a sceptical stance, whose role, as we shall see, was not to dismiss the mechanical philosophy as true but rather to limit the truth-claims of human rationality to criteria of evidence based on empirical scrutiny. In this, Glanvill, unsurprisingly enough, enacted exactly Bacon's definition of the natural philosopher's mission: Bacon's anti-dogmatic, anti-Aristotelian philosopher, straddling, like 'the more ancient Greeks (whose writings have perished), … a more prudent mean, between the arrogance of dogmatism, and the despair of skepticism',[606] knew that the senses were the best tool for the provision of empirical evidence. (Arnauld and Nicole, in their Port-Royal *Logique*, likewise referred to 'the stupid vanity which makes us ashamed of recognizing our own ignorance', at the root of the proclivity, typical of Aristotelians, to invent causes merely by identifying the events they were meant to explain.)[607]

Clearly, mechanical explanations of matter in motion were effective for Glanvill; and he gave quite a precise account of the operations of memory and

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[605] Robert Hooke, *Lectures De Potentia Restitutiva, or Of Spring. Explaining the Power of Springing Bodies. To which are added somes Collections...* (London, 1678), sig. B3v. Facsimile reprint in *Early Science in Oxford*, ed. R. T. Gunther (Oxford, 1931), 15 vols., VIII: *The Cutler Lectures of Robert Hooke*, pp. 331-356.

[606] Francis Bacon, *The New Organon or True Directions for the Interpretation of Nature* (London, 1620), 'Preface', in Francis Bacon, *The Works*, trans. Basil Montague (Philadelphia, 1854), 3 vols., III, p. 343. In a more recent translation: 'The earlier Greeks however (whose writings have perished) took a more judicious stance between the ostentation of dogmatic pronouncements and the despair of *lack of conviction* (*acatalepsia*);' see Francis Bacon, *The New Organon*, ed. Lisa Jardine and Michael Silverthorne (Cambridge, 2000), p. 27.

[607] Antoine Arnauld and Pierre Nicole, *La Logique ou l'art de penser* (Paris, 1662), ed. Pierre Clair and François Girbal (Paris, 1981, using Paris, 1683 edition), pp. 246-247: 'la sotte vanité qui nous fait avoir honte de reconnoître notre ignorance. Car c'est de là qu'il arrive que nous aimons mieux nous forger des causes imaginaires des choses dont on nous demande raison, que d'avouer que nous n'en savons pas la cause, & la maniere dont nous nous échappons de cette confession de notre ignorance est assez plaisante. Quand nous voyons un effet dont la cause nous est inconnue, nous nous imaginons l'avoir découverte, lorsque nous avons joint à cet effet un mot general de vertu ou de faculté, qui ne forme dans notre esprit aucune autre idée, sinon que cet effet a quelque cause, ce que nous savions bien avant que d'avoir trouvé ce mot.' See also Hacking, *Emergence*, p. 76.

imagination.[608] But he remained uncertain of the status of such explanations, because they did not seem to describe how we could engage in willed actions without being at all aware that we were doing so. Mechanism did not entirely account for voluntary movement;[609] and its workings were not available to our knowledge through introspection.[610] He was certain that only the intellect could possibly grasp what, on the dualist view, were the operations of the soul. What was less certain was what an account of such operations could possibly consist in. Glanvill did not believe one could obtain 'a scientificall account even of our Senses, the most knowable of our faculties. Our eyes, that see other things, see not themselves.'[611] The body merely conveyed sense-impressions to the soul, which alone was responsible for sense-experience;[612] and it was impossible to explain 'how the pure mind can receive information from that, which is not in the least like it self, and but little resembling what it represents'. Cartesianism, plainly, would not do;[613] indeed, it qualified, along with scholasticism, as one manifestation of dogmatism.[614] At the centre of the functioning, conscious, fallen, dual human being, lay full ignorance of what it was that constituted it into consciousness. The limitations of sense, however, were precisely what warranted the pursuit of natural philosophy and the practice of experiment. We might be born into error, and might easily be the victims of, say, visual illusion (as when a staff appears crooked in water); but we were also capable of remedying perceptual distortions, through the use of reason and its applications, for example in geometric and mathematical calculations, and through the observation of nature, sometimes assisted and enhanced by technological contrivances.[615]

There was, then, an epistemically realist background to the notion that it was possible to extend the boundaries of what could be considered perceivable and, as Hooke wrote, to discover 'some Properties of Bodies, of which we have now no

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[608] Glanvill, *Vanity*, pp. 30-40, 82-83.
[609] Ibid., p. 37: 'all the philosophy in the world cannot make it out to be purely Mechanicall'.
[610] Ibid., p. 26: 'this is a kinde of knowledge, that we are not in the least aware of', and there is 'some secret Art of the Soul, which to us is utterly occult, and without the ken of our Intellects'.
[611] Ibid, p. 27.
[612] Ibid., pp. 27-28: 'the soul is the sole Percipient, which alone hath animadversion and sense properly called'; the body 'is only the receiver and conveyer of corporeall impressions'.
[613] Ibid., p. 28.
[614] See Burns, *The Great Debate*, p. 20.
[615] Glanvill, *Vanity*, pp. 70-72; see also Van Leeuwen, *The Problem of Certainty*, pp. 80-81.

more Notion, than one born blind has of Colours, or one deaf of musical Sounds'.[616] The difference between those who possessed knowledge generated from such a project and those who did not might turn out to be equivalent to that between humans and beasts, as Hooke wrote some twenty years earlier in the dedicatory preface to the *Micrographia*[617] (published the year he became, in John Aubrey's words, 'Curator of Experiments of the Royall Society' on Boyle's recommendation).[618] In other words, to become familiar with newly visible realms was to acquire, not merely new physical data, but a whole new mode of apprehending the world, comparable in its difference from the existing one to that of animals. It was, in effect, to become endowed with a new cognitive and perceptual framework for knowledge. To support this claim, Hooke here brought to bear the familiar sceptical arguments about the inferiority of the senses of humans to those of animals, the inadequacy of our perceptual capacities to the 'vast extent of Nature' in its microscopic and macroscopic dimensions, and the imperfection of human memory. One could ascribe the unreliability of reason - 'the errors of the *understanding*' - to this deficiency of senses and memory, since reason was 'answerable' to them. For Hooke - just as for Glanvill and Boyle - presumption, dogmatizing and ignorance resulted from these human limitations. The new natural philosophy was thus beset with difficulties not only in virtue of its subject matter, but also because the human mind itself was inclined to 'conspire to betray us'.[619] It was in this sense that it presupposed not only a metaphysics but also a theory of mind prior to the investigation of a material world renewed, surprising, at times literally wonderful.[620]

Questions about the dependence of realism about the physical world on scepticism about the power of senses to convey true information could be taken to

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[616] 'Experiments and Observations for the Improvement of the Barometer, by Dr. Hook, read before the Royal Society, Feb. 3, 1685-86', in Robert Hooke, *Philosophical Experiments and Observations*, ed. William Derham (London, 1726; facsimile reprint London, 1967), p. 171. In the 'Discourse concerning Telescopes and Microscopes' published in the same volume, p. 261, Hooke deplores the lack of interest in using the microscope for serious purposes, 'now reduced almost to a single Votary, which is Mr. Leeuwenhoek', because 'the Opinion prevails, that the Subjects to be enquired into are exhausted, and no more is to be done'.

[617] Robert Hooke, *Micrographia Or Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses. With Observations and Inquiries Thereupon* (London, 1662).

[618] John Aubrey, 'An Apparatus for the Lives of our English Mathematical Writers': 'Mr. Robert Hooke M.A.', in *Brief Lives* (London, 1680; reprinted London, 2000), p. 395.

[619] Hooke, *Micrographia*, 'The Preface', sig. A3v.

[620] On the rise of physico-mathematics see Peter Dear, *Discipline and Experience: The Mathematical Way in the Scientific Revolution* (Chicago, 1995), ch. 8: 'Barrow, Newton, and the Constructivist Experiment', pp. 210-243, esp. 226-232.

constitute the very root and process of philosophy, as well as the pre-condition for knowledge acquisition and information processing. It certainly came into dynamic play in the establishment of modern natural philosophy. Bernard le Bovier de Fontenelle, who in 1697 became the Secretary of the Académie des Sciences in Paris (remaining in the post until his death, aged 100, in 1757), wrote a bestseller called *Entretiens sur la pluralité des mondes*. The book was a synthesis of the main tenets of the new philosophy for the benefit of a wide - rather than academic - audience, first published in 1686,[621] some twenty five years after Glanvill's *Vanity*; and he prefaced it with the remark that 'nothing should interest us more than to know how this world in which we live is made'. As Francis Godwin,[622] Cyrano de Bergerac,[623] Pierre Borel[624] and John Wilkins[625] had done,[626] in the vein of a genre encouraged by the earlier publication of Galileo's *Sidereus Nuncius*,[627] Fontenelle here engaged in the old debate, playfully but with a serious intent, about whether there were other similar worlds, and whether such similar worlds would also harbour creatures like, or comparable to ourselves.[628] In imagining this and in a number of remarks throughout the book about the limitations of sense, imagination and reason, Fontenelle injected the existence of dubitability into the very project of measuring the validity of

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[621] Bernard le Bovier de Fontenelle, *Entretiens sur la pluralité des mondes* (Paris, 1686). A further thirty-three editions would follow in France alone, as well as numerous translations (two English editions came out within two years of the first edition, the second one a translation by Aphra Behn, published in 1688). The *Entretiens* continued to be published frequently well after Fontenelle's death in 1757. For the book's publishing history see the edition by Alexandre Calame (Paris, 1966), used here: 'Introduction', pp. vii-xiii.

[622] Francis Godwin, *The Man in the Moone: or A Discourse of a Voyage Thither by Domingo Gonsales thy Speedy* Messenger (London, 1638).

[623] Savinien de Cyrano de Bergerac, *L'autre monde ou Les estats et empires de la lune* (Paris, 1657), ed. Madeleine Alcover (Paris, 1977).

[624] Pierre Borel, *Discours Nouveau Prouvant la pluralité des Mondes, que les Astres sont des terres habitées, & la terre une Estoile, qu'elle est hors du centre du monde dans le troisieme Ciel, & se tourne devant le Soleil qui est fixe, & autres choses tres-curieuses* (Geneva, 1657). Borel, who was a doctor to the King, had actually written the text by 1648, dedicating it to Kenelm Digby and proclaiming his affinity to Montaigne by p. 3. He also wrote a biography of Descartes: see Antonella del Prete, 'Introduction', in Pierre Borel, *Discours* (facsimile reprint, Lecce, 1998), pp. vii-xvii, at p. viii.

[625] John Wilkins, *The Discovery of a World in the Moone* (London, 1638). See Barbara Shapiro, 'Introduction' to the reprint (New York, 1973), pp. v-x.

[626] See Calame, 'Introduction', in Fontenelle, *Entretiens*, p. xxxv. For a history of the genre itself, including an analysis of Fontenelle within the context of the Cartesian universe, see Steven J. Dick, *Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant* (Cambridge, 1982).

[627] Galileo Galilei, *Sidereus Nuncius* (Venice, 1610).

[628] Fontenelle, *Entretiens*, p. 5: 'Il semble que rien ne devroit nous interesser davantage, que de sçavoir comment est fait ce Monde que nous habitons, s'il y a d'autres Mondes semblables, et qui soient habités aussi.'

cosmological hypotheses with (mainly) Cartesian physics. But the very possibility of wondering about other worlds[629] - about unknown perspectives from which to view familiar dimensions, and about the revealing presence of unfamiliar worlds within the visible realm - was related to the process of doubt at the heart of the Cartesian method, worthy in ambition of the Socratic project of philosophical enquiry itself.[630]

In England and in the hands of the young John Wilkins, this exercise had also served, earlier, as a stepping stone to the integration of the Baconian enterprise into official intellectual life (via its institutionalization as the Royal Society in 1662), and as a means of redefining the use of probability in the pursuit of empirical knowledge: 'I promise onely probable arguments for the proofs of this opinion' [that there might be other worlds apart from our own], wrote Wilkins, 'and therefore you must not looke that every consequence should be of an undeniable dependance, or that the truth of each argument should be measurable by its necessity.'[631] The notion of probability was important in France as well. The Académie Bourdelot, for instance, modelled itself to an extent on the Royal Society, with Huygens writing in a letter of 1661 that one must 'endeavour to engage in experiment more than in reasoning'.[632] Prudence in the elaboration of hypotheses mattered, and reasonings remained conjectural, however necessary they otherwise were.[633] Malebranche, too, would emphasize how crucial it was to make do with plausibility - though here, it was for the pragmatic sake of expedience - in 'morals, politics, medicine, and in all the

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[629] See Dick, *Plurality*, esp. ch. 5: 'Cartesian vortices, the infinite universe, and the plurality of solar systems', pp. 106-141. See also the essays by William R. Shea, 'Le monde ou le beau roman de la physique de Descartes'; Jean-Charles Darmon, 'L'épicurisme et les fables du monde: remarques sur Gassendi et Cyrano'; Jean Dagen, 'Réflexions sur les mondes de Fontenelle'; François Duchesneau, 'Leibniz et le meilleur des mondes', in Bernard Beugnot, ed., *Littératures Classiques*, 22: *La notion de 'monde' au XVIIe siècle* (Paris, 1994).

[630] On Descartes's own attitude to the issue of other worlds, see Dick, *Plurality*, pp. 111-112,.

[631] Wilkins, *Discovery*, 'Epistle to the Reader', p. 2.

[632] Christiaan Huygens, letter to Jean Chapelain, 14 July 1661, in Christiaan Huygens, *Œuvres complètes* (The Hague, 1890), 22 vols. , III: *Correspondance 1660-1661*, letter 873, pp. 294-295: 'Vous scavez quel est le dessein de ces Messieurs la [members of the Royal Society], a scavoir de s'attacher plus a faire des exeriences que des raisonnemens, en quoy vous me mandez, et je m'en resjouis, que chez Monsieur de Montmort on commence aussi a s'appliquer. Ils ont une personne entre autres qui travaille avec grand zele a l'establissement de l'academie et qui en est comme l'ame: c'est le Chevalier Morray. Il est bien aupres du Roy d'Angleterre, et ne cessera pas jusqu'a ce qu'il ait obtenu de Sa Majeté un fonds et revenu certain pour servir aux frais que dans l'assembreel'on fera aux experieces. car jusqu'icy eux mesmes y ont fourny. J'y rencontray de ceux que je connoissois par renommee, le Chevalier Digby, Monsieur Boile, Milord Brouncker, Monsieur Wallis, Messieurs Neale, Wren et Wilkins…' Cited in Henri Busson, *La religion des classiques* (Paris, 1948), p. 88, n. 1 and by Roger, *Sciences de la vie*, p. 198. Huygens had been called to Paris from The Hague by Colbert, but he returned to Holland in 1681.

[633] See Roger, *Sciences de la vie*, pp. 199-203.

practical sciences'. In these fields, he wrote, 'one is forced to be content with verisimilitude,[634] not for ever, but for a while; not because it is satisfying for the mind, but because there are pressing needs; and because if one only acted when guaranteed of success, the occasion, often, would be lost'.[635]

Arguably, the matter of 'other worlds' was from the beginning set up in a way quite similar to that of 'other minds'. To posit as a fact the unreliability of data provided by the senses was to warrant wonder about the textures and nature of dimensions hidden to unassisted human senses, but whose existence must nevertheless be presumed probable, and plausibly, although not necessarily true. It was possible to imagine technology becoming adequate to the task of devising 'helps for the eye … such as which we may perhaps be able to discover *living Creatures* in the Moon, or other Planets', in Hooke's words, as well as 'the figures of the compounding Particles of matter, and the particular *Schematisms* and *Textures of Bodies*'.[636] New theories erected as responses to this formalized wonder, as Fontenelle explained, could then be tested against the existing 'systèmes',[637] according, and thanks to which the physical universe began to be legible to the natural philosopher. The variety and variability of the universe could be imagined as potentially infinite, as well as potentially 'computable', on the assumption that a system did not have to be finite in order to be quantified and understood - although

[634] See Hacking, *Emergence*, p. 34 and his helpful distinction between 'evidence' and 'verisimilitude': the first 'is a matter of inferring one thing from another thing', and the second, 'a matter of one thing being, or not being, what it seems or pretends to be'.

[635] Malebranche, *La Recherche de la Vérité: Où l'on traite de la nature de l'esprit de l'homme et de l'usage qu'il en doit faire pour éviter l'erreur dans les sciences*, (Paris, 1674; here, *Œuvres complètes*, ed. Geneviève Rodis-Lewis, Paris, 1962), I, p. 63 (I, iii, 2): 'dans la Morale, la Politique, la Medecine & dans toutes les sciences qui sont de pratique, on est obligé de se contenter de la vraisemblance, non pour toujours, mais pour un temps: non parce qu'elle satisfait l'esprit, mais parce que le besoin presse; & que si l'on attendait pour agir qu'on se fût entierement assuré du succès, souvent l'occasion se perdroit'. For an analysis of the connection binding occasionalism to scepticism, see Steven Nadler, 'Knowledge, Volitional Agency and Causation in Malebranche and Geulinck', *British Journal for the History of Philosophy*, 7, 1999, pp. 263-274.

[636] Hooke, *Micrographia*, sig. b2v.

[637] Fontenelle, *Entretiens*, p. 23: 'Il fut question … de deviner comment toutes les parties de l'Univers devoient être arrangées, et c'est-là ce que les Sçavans appellent faire un Sistême', and see the editor's footnote to this sentence. Clearly, only those systems which, as Boyle put it, offered statements of 'general principles (almost like the hypotheses of astronomers) to assist men to explicate the already known phaenomena of nature' were deemed useful, or tolerable, by people like Boyle; but not systematizers of a scholastic bent. See Robert Boyle, *Certain Physiological Essays* (written 1657, published 1661), in M. B. Hall, *Robert Boyle on Natural Philosophy* (Bloomington, Ind., 1965), pp. 119-131, at pp. 122-123.

there was still no mathematical theory to support the notion that numerical computations could integrate infinity.[638]

In his *Entretiens*, Fontenelle transposed to other worlds the very multiplicity of theories of knowledge, turning differences between views of the mind into spatial relations, and so mirroring the interplay of scepticism and experiment in the enactment of the playful, childlike fantasy of populating the unknown, unbound universe. Down here, he wrote, 'we use voice, there, one only speaks with signs; farther away one doesn't speak at all. Here, reasoning is entirely based on experience; elsewhere, experience adds little to reasoning; further still, the elderly know nothing more than children.' We on earth worry about the future, rather than the past, while elsewhere it is the other way round, and further away, 'one worries about neither'; and he added, 'it could be that we lack a sixth sense, which would teach us many things of which we are ignorant. Apparently this sixth sense is in another world, where they lack the five senses we have.' All in all, wrote Fontenelle, 'our sciences have bounds which the human mind has never been able to transcend'.[639] It was possible to imagine entire worlds - environments and populations - where the sensory capacities we have, and our sense of space, time and causality, simply did not apply.

Knowledge of the world, then, was relative to the knower, although some universal laws - those revealed within the new physics - remained as the central point of reference for all possible perspectives. Different bodies and different cognitive structures resulted in different social organizations, too. To imagine other living entities and organizations would serve the - Swiftian - purpose of criticizing present political orders, just as the resort to zoological anecdotes in the Plinian tradition had

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[638] See, e.g., Francoise Monnoyeur, ed., *Infini des mathématiciens, infini des philosophes* (Paris, 1992) and *Infini des philosophes, infini des astronomes* (Paris, 1995) Norman Kretzmann, ed., *Infinity and Continuity in Ancient and Medieval Thought* (Ithaca, NY and London, 1982); Carl B. Boyer, *The History of the Calculus and its Conceptual Development* (New York, 1949); G. Donald Allen, *The History of Infinity*, at http://www.math.amu.edu/~don.allen/ history/infinity.pdf.

[639] Fontenelle, *Entretiens*, pp. 96-97: 'Ici, par éxemple, on a l'usage de la voix, ailleurs on ne parle que par signes; plus loin on ne parle point du tout. Ici, le raisonnement se forme entierement par l'expérience; ailleurs l'expérience y ajoîte fort peu de chose; plus loin les Vieillards n'en sçavent pas plus que les Enfans. Ici, on se tourmente de l'avenir plus que du passé, ailleurs on se tourmente de passé plus que de l'avenir; plus loin on ne se tourmente ni de l'un ni de l'autre, et ceux-l`a ne sont peut-être pas les plus malheureux. On dit qu'il pourrait bien nous manquer un sixiéme Sens naturel, qui nous apprendroit beaucoup de choses que nous ignorons. Ce sixiéme Sens est apparemment dans quelqu'autre Monde, où il manque quelqu'un des cinq que nous possédons. … Nos Sciences ont de certaines bornes que l'Esprit humain n'a jamais pû passer, il y a un point où elles nous manquent tout-à-coup.'

been a useful tool for the morally inflected critique of given social and emotional realities. The question that arises out of this is whether, given a different set of sensory modalities, a creature would even be able to embrace the measured exercise of doubt as a device with which to delimit the ambit of reason's work and worth; for it seems that curiosity about the natural, 'other' world could only be pursued outside the confines of any hard-set definition of how cognitive structures were embodied in living organisms.

Physical enquiry began with an assumption of necessary ignorance of what exactly the enquiry would reveal about the interpretable system; and reason alone could be relied on to interpret the new data obtained through systematic, empirical, technologically assisted investigation. Not that there was a real consensus even within the body of Royal Society scientists about the ways in which this analysis of data obtained through empirical procedures could ultimately result in certain knowledge.[640] A clear-cut theory about the role of perception in the genesis of rational thought might have established some ground for such a consensus in that particular context. But, to be sure, no one thought at this point of turning the rational mind itself into a *quantifiable* micro-universe in order to study its motions and relations. It remains that the initial push to enquire about the nature of knowledge by first showing why certainty might seem out of reach operated in both, arguably separate, realms - inside our heads and beyond our world. Moreover, it was possible to conjecture, from a less theoretical perspective, that the mind was adapted to perceiving what the physician Henry Power (1623-1668), in his *Experimental Philosophy*, called 'middle proportionals'. Neither the universe nor atoms were

[640] As Michael Hunter notes: 'Late seventeenth-century scientists, particularly in England, were profoundly Baconian in their insistence on the need for proof of novel theories rather than mere plausibility. They rightly saw that some new views of the workings of the world, including Descartes's, were in danger of being as a priori as the old scholastic theories which they attacked, and Boyle pilloried the 'thought' experiments that abstract theoreticians often devised to back up their ideas, asking (of a suggestion by Blaise Pascal) how an experimenter was supposed to stay twenty feet under water to make the precise readings that he postulated. This led to some strain in English scientific circles, for some were more Baconian than others. Thus Henry Power, the Halifax doctor and naturalist, friend of Thomas Browne, Fellow of the Royal Society and typical exponent of its experimental philosophy, supporter of Gassendist atomism and, like his colleagues, admirer of Harvey, displayed an enthusiasm for Cartesian systematization that Boyle regarded as premature, seeing the real danger that excessive deductive rationalism might prove as stifling a dogma as the old scholasticism which the new science was superseding.' See *Science and Society in Restoration England* (Cambridge, 1981), p. 17. *Experimental Philosophy* was Power's only book, and contained the first accounts of the use of the microscope before Robert Hooke published the *Micrographia*.

visible merely with 'natural Opticks', he wrote, simply because these were not of much use to us: we could not perceive microscopic and macroscopic dimensions because we were not really meant to.[641]

From this, however, there arose the probability that much of the physical realm lay beyond our perceptual capacities.[642] The order of nature's 'Genuine and Proxime Causes', as Walter Charleton wrote in the chapter on 'Occult Qualities made Manifest' of his *Physiologia Epicuro-Gassendo-Charltoniana*, and 'the Reason and manner of its perception by that Sense, whose proper Object it is', were such that 'the *Sensibility* of a thing doth noe way præsuppose its *Intelligibility*'. Knowledge of effects did not presuppose knowledge of causes, just as 'the *Insensibility* of a thing' did not signify its '*Unintelligibility*' to reason.[643] Merely to imagine what we could not see was already to engage in natural philosophy, based on a form of probabilistic reasoning which was itself based on assumptions about hidden causes in nature. But it also cast a theory about the relation between the rational mind and the senses: conjecture saved the appearances, as it were. In a marginal annotation to Malebranche's *Recherche de la vérité*, Leibniz similarly derived from the dependence of perceived size on relative proportion the conclusion that 'sight cannot know size'.[644] For example, 'men look at insects and other small things - small in relation to them - as absolutely small and then as contemptible'; but our senses cannot tell us much about the relation of bodies to ours, since it shifts according to distance.[645] And earlier, Robert Hooke, still in the preface to the *Micrographia*

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[641] Locke took a similar view: see above, pp. 136-138.

[642] Power, *Experimental Philosophy*, 'The Preface', sig. B1r: 'And as those remote objects [the Planets] were beyond the reach of his natural Opticks, so doubtless the Minute Atoms and Particles of matter, were as unknown to him, as they are yet unseen by us: for certainly both his and our Eyes were framed by providence in Analogie to the rest of our senses, and as might best manage this particular Engine we call the Body, and best agree with the place of our habitation (the earth and elements we were to converse with) and not to be critical spectators, surveyors, and adæquate judges of the immense Universe: and therefore it hath often seem'd to me beyond an ordinary probability, and somthing more than fancy (how paradoxical soever the conjecture may seem) to think, that the least Bodies we are abler to see with our naked eyes, are but middle proportionals (as it were) 'twixt the greatest and smallest Bodies in nature, which two Extremes lye equally beyond the reach of humane sensation'.

[643] Walter Charleton, *Physiologia Epicuro-Gassendo-Charltoniana: or a Fabrick of Science Natural, upon the Hypothesis of Atoms* (London, 1654; facsimile reprint New York and London, 1966), pp. 341-2.

[644] See Susan James, '*Grandeur* and the Mechanical Philosophy', in Jill Kraye and Martin F. W. Stone, ed., *Humanism and Early Modern Philosophy* (London, 2000), pp. 172-192.

[645] See André Robinet, *Malebranche et Leibniz: relations personnelles* (Paris, 1955), an annotation made by Leibniz to his copy of Malebranche, *La recherche de la vérité* (Paris, 1678), I (I.6). p. 161: 'Dieu pourroit faire [*de*] d'une portion de matiere de la grosseur d'une balle un ciel et une terre et des

(published four years after the *Vanity of Dogmatizing*), would suggest, in opposition to Glanvill, that enquiry into natural phenomena could help rectify the human tendency to error. Labour was to be expended not so much on uncovering the modalities of the mind-body relation as on:

> rectifying the operations of the Sense, the Memory, and Reason, since upon the evidence, the strength, the integrity, and the right correspondence of all these, all the light, by which our actions are to be guided, is to be renewed, and all our command over things is to be establisht.[646]

Glanvill, as we have seen, shared the view that some version of materialistic accounts of sense-perception and physics must be right. But he was less optimistic than Hooke - he was not a natural philosopher - and he did not engage systematically - as a metaphysician would - in an enquiry, say, about the role of the material soul in animal cognition, or of the consequences for beasts of Descartes's automaton thesis. Instead, Glanvill worked on the assumption that reference to our fallen state might constructively feed into a psychological and ethical account of human nature.

This assumption, typical of Christian scepticism, was described a little earlier in a highly suggestive way by the physician Thomas Browne, in his *Religio Medici* (published in 1642).[647] For him, 'we are all monsters, that is, a composition of man and beast, wherein we must endeavour to be as the Poets fancy that wise man *Chiron*, that is, to have the Region of Man above that of Beast, and sense to sit but at the feet of reason'.[648] Obvious as it might seem at first, it is worth pointing out the difference between edifying, religious talk about the soul - 'that immortall essence',[649] in Browne's words - as the *raison d'être* of human exception and

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hommes sur cette terre, avec les mêmes proportions qui sont observées dans ce grand monde. Ou bien pensons que Dieu ait fait une terre infiniment plus vaste, le tout dans la même proportion, les hommes de ce monde pourroient estre plus grands, qu'il y a d'espace entre nostre terre et les estoiles les plus eloignées. Ils auroient les mêmes idées que nous quoyque les choses soyent incomparablement plus grandes. C'est pourquoy la veue ne sçauroit faire connoistre la grandeur. Les hommes regardent les insectes et autres choses petites à leur egard, comme petites absolument et ensuite comme meprisables. Nos sens même ne [sont] nous sçauroient apprendre exactement les rapports des corps au nostre car cela change selon l'eloignement'.

[646] Hooke, *Micrographia*, 'The Preface', a1r.

[647] Thomas Browne, *Religio Medici*, in *Sir Thomas Browne: The Major Works*, ed. C. A. Patrides (London, 1977), pp. 59-161. See Van Leeuwen, *The Problem of Certainty*, p. 73, n.68, and the notion that Glanvill was 'a transitional figure, linking the ages of Thomas Browne and Robert Boyle'.

[648] Browne, *Religio* (I. 55), p. 129.

[649] Ibid. (I. 51), p. 125.

morality,[650] and the analysis of the status of our reason in terms of the origin of voluntary movement, speech and consciousness. The first type of discourse could be said to stand in a continuum with humanist rhetoric; while the second corresponded in part to the injection of a new concept of factuality[651] - the growth of a 'modern' curiosity - into the necessarily, perennially dual, Christian human entity. Browne was attracted, in *Religio Medici*, to the old conception of man as microcosm,[652] as 'that great and true *Amphibium* whose nature is disposed to live not onely like other creatures in divers elements, but in divided and distinguished worlds; for though there bee but one to sense, there are two to reason; the one visible, the other invisible'.[653] Browne's invisible world of spirits and angels was as mysterious, however, as the creation of this amphibian - rather than dual - creature. As he wrote, 'The whole Creation is a mystery, and particularly that of man'; once God had 'raised the wals of man, he was driven to a second and harder creation of substance like himselfe, an incorruptible and immortall soule'.[654] It was, evidently, an 'inorganicall' soul, though it could only operate organically. Yet, as he pointed out, the body was the instrument of sense, which itself functioned with the help of reason. The fabric of the body might be an object of study, but Browne was unable to find any

> Organe or instrument for the rationall soule; for in the braine, which wee tearme the seate of reason, there is not any thing of moment more than I can discover in the cranie of a beast: and this is a sensible and no inconsiderable argument of the inorganity of the soule, at least in that sense we usually so receive it. Thus we are men, and we know not how, there is something in us, that can be without us, and will be after us, though it is strange that it hath no history, what it was before us, nor cannot tell how it entred in us.[655]

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[650] See also Glanvill, *Vanity*, pp. 62-63: 'The Weakness of humane understanding, all will confess: yet the confidence of most in their own reasonings, practically disowns it … for while all complain of our *Ignorance* and *Error*, every one exempts himself.'

[651] On the early modern notion of 'fact', see, e.g., Barbara J. Shapiro, *Probability and Certainty in Seventeenth-Century England: A Study of the Relationships between Natural Sciences, Religion, History, Law, and Literature* (Princeton, 1983) and *A Culture of Fact: England, 1550-1720* (Ithaca, NY and London, 2000); Lorraine Daston, 'Strange Facts, Plain Facts, and the Texture of Scientific Experience in the Enlightenment', in Suzanne Marchand and Elizabeth Lunbeck, ed., *Proof and Persuasion: Essays on Authority, Objectivity and Evidence* (Turnhout, 1996), pp. 42-59.

[652] Browne, *Religio* (I. 34), p. 103; (II. 10) p. 152; (II. 11) p. 153.

[653] Ibid. (I. 34), pp. 103-104.

[654] Ibid. (I. 36), pp. 105-106.

[655] Ibid., pp. 106-107.

The precise pinpointing of mystery and invisibility, then, could be as powerful an inducement to find out, for example, how and when the immortal soul entered 'these wals of flesh'[656] as a sermon would be to encourage and justify worship. The category of 'rational soul', which denoted an invisible entity now bereft of the support of ordered, scholastic definitions, but which still partook and conceived of the divine, was thus as malleable as it was immaterial. Though its relation to the body remained a source of perplexity, this malleability was, inevitably, echoed in accounts of the physics, causality and finality of living bodies. Knowledge of the body depended, in a sense, on an awareness of the 'explanatory gap' that was the soul.

The inconceivability of ascribing any sort of materiality to the rational soul - to thought and consciousness - was of course radicalized by Descartes. But the question remained as to *what sort* of non-subjective thing the thinking, self-conscious soul - the *res cogitans* - was. Early on, Mersenne, for one, had already pointed out in his objections to Descartes's *Meditations* the impossibility of dismissing out of hand the idea that this thinking thing could be 'a body which, through its various movements and encounters, engages in this action which we call thought'.[657] Irrespective of what it would have taken then and thereafter for such an idea to be tenable, the *question* about the nature of thought itself remained. It could take the form of a puzzlement, expressed, for example, by Bayle in his tract against the superstitious interpretation of the appearance of comets, about what orderly function could be ascribed to the human soul, characterized by a 'monstrous disorder' insofar as it was excluded from the mechanical order of material things.[658]

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[656] Ibid. (I. 37), p. 107. Browne here quotes Isaiah, 40.6, '*All flesh is grasse*'.

[657] Mersenne, *Les Méditations: Secondes Objections*, in Descartes, *Œuvres Complètes*, II, ed. Alquié, pp. 541-549, at p. 542: 'Et que savez-vous si ce n'est point un corps qui, par ses divers mouvements et rencontres, fait cette action que nous appelons du nom de pensée?' And he goes on: 'Car encore que vous croyiez avoir rejeté toutes sortes de corps, vous vous êtes pu tromper en cela que vous ne vous êtes pas rejeté vous-même, qui êtes un corps. Car comment prouvez-vous qu'un corps ne peut penser, ou que des mouvements corporels ne sont point la pensée même? Et pourquoi tout le système de votre corps, que vous croyiez avoir rejeté, ou quelques parties d'icelui, par exemple, celles du cerveau, ne peuvent-elles pas concourir à former ces mouvements que nous appelons des pensées? Je suis, dites-vous, une chose qui pense; mais que savez-vous si vous n'êtes point aussi un mouvement corporel ou un corps remué?'

[658] Bayle, *Pensées diverses sur la comète* (Paris, 1682), ed. A. Prat (Paris, 1984), II, pp. 74-75: 'Il importe plus qu'on ne pense, de faire sentir à l'homme jusqu'où va sa depravation, et surtout de lui faire bien connoître le monstrueux desordre où il est plongé, qui fait qu'il agit continuellement contre ses principes, et contre les preceptes de la Religion qu'il croit avoir receuë de Dieu … parce que si on prend garde que tout le reste du monde est sujet à certaines loix de Méchanique qui s'observent reguliérement, et qui nous paroissent trés-conformes à l'idée que nous avons de l'ordre, on conclurra

What emerges is that just as the 'other minds' problem addressed a question also posed in that of 'other worlds', so the seemingly unbridgeable gap between matter and mind matched that between immaterial, divine creator and material creation. This is the deep sense in which mitigated scepticism was - textually, at least - embedded in the very process of redescribing the universe on the basis of new information. As Fontenelle wrote:

> We want to evaluate everything, but are always standing at the wrong place. We want to judge ourselves, we are too close to do so; we want to judge others, we are too far away. Anyone who was between the moon and the earth would be in the right place to see them well. One should simply be a spectator of the world, not an inhabitant.[659]

The acknowledgement of the impossibility of "seeing right" what was too close or too far, too small or too big, too familiar or too foreign, justified the natural philosopher's sceptical stance (akin, as we saw, to the Cartesian philosopher's method of doubt) towards his own capacity to identify accurately nature's proximate mechanisms and causes. Such a stance, as Bayle wrote in the same treatise on the comet, was a protection, too, against looking for the mechanisms and causes of alleged natural events before ascertaining that they truly existed.[660] The realms of physics and of biology thus overlapped in the very difficulty of ascribing the right causal story to the story of life on earth and in space (and of the earth's life).[661] In each case, what might be an adequate view of the role that natural - as opposed to divine - causes played in the genesis of human life and in the phenomenon of thought

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necessairement, qu'il y a dans l'homme un principe qui n'est pas corporel. Car si l'hommme nétoit que corps, il seroit necessairement soûmis à cette sage et reguliére Méchanique qui régne dans tout l'Univers, et il n'agiroit pas d'une maniére si contraire à l'idée que nous avons de l'ordre. Il y a donc dans l'homme une ame, qui est une substance distincte du corps, et plus parfaite que le corps, puis que c'est celle qui rend l'homme raisonnable. … la Nature des choses a voulu que le monde se gouvernast par de belles loix. Mais si elle l'a voulu pour le corps, pourquoi n'a-t-elle point voulu que l'ame de l'homme fust sujette à l'ordre? …'

[659] Fontenelle, *Entretiens*, 'Second soir: Que la lune est une terre habitée', pp. 50-51: 'Nous voulons juger de tout, et nous sommes toûjours dans un mauvais point de vûë. Nous voulons juger de nous, nous en sommes trop près; nous voulons juger des autres, nous en sommes trop loin. Qui seroit entre la Lune et la Terre, ce seroit la vraye place pour les bien voir. Il faudrait être simplement Spectateur du Monde, et non pas Habitant.'

[660] Bayle, *Pensées diverses sur la comète*, I, p. 137.

[661] Speculations about the earth's age and the study of geology and fossils abounded. See the empirical creed professed by Agostino Scilla in *La vana speculazione disingannata dal senso: Lettera risponsiva circa i Corpi Marini, che Petrificati si trovano in varij luoghi terrestri* (Naples, 1670), ed. Marco Segala (Florence, 1996), and the introduction by Paolo Rossi, pp. 5-24. See also Paolo Rossi, *I segni del tempo: storia della Terra e storia delle nazioni da Hooke a Vico* (Milan, 1979); Claudine Cohen, 'Leibniz's Protogaea: Patronage, Mining, and Evidence for a History of the Earth', in Marchand and Lunbeck, *Proof and Persuasion*, pp. 124-143.

was a subject for extensive debate, which could involve speculation about the role of spirits and supernatural phenomena.[662]

Glanvill's examination of the extent to which empirical evidence could be trusted amounted to an effort at establishing how it might yield truths resistant to the scientist's sceptical starting point. However, in a spirit profoundly different from that of Bayle, he did so in order to establish the validity of believing in spirits, as is manifest particularly in *Saducismus Triumphatus*.[663] To make his case, he had to allow room for a continuum between evidence, testimony and proof; this entailed balancing out the need for - anti-dogmatic - scepticism by separating testimony from mere opinion.[664] There was, he thought, a direct relationship between the availability of hidden aspects of the physical world to revelation through empirical scrutiny, and the reliability of the undogmatic - sceptical[665] - observer's testimony. Scientific knowledge was a function of this constant relationship between world and viewer, in which any claims to certainty could only be upheld as a 'provisional assent',[666] proportional to 'the degrees of Evidence'.[667] Within the Royal Society, it was taken

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[662] See Henry More, *The Immortality of the Soul, So farre forth as it is demonstrable from the Knowledge of Nature and the Light of Reason* (London, 1662), ed. Alexander Jacob (Dordrecht, 1987). The anthropocentric observation of cosmological phenomena at least relied on observation, though here observation itself was interpretation: for the earlier case of Cardano, see, e.g., Anthony Grafton, *Cardano's Cosmos: The Worlds and Works of a Renaissance Astrologer* (Cambridge, Mass., 1999).

[663] Joseph Glanvill, *Saducismus Triumphatus: Or, Full and Plain Evidence concerning Witches and Apparitions. In Two Parts The First treating of their Possibility; The Second of their Real Existence.* (London, 1681; reprinted 1682, 1688, 1689). It was first published in 1666 as *A Philosophical Endeavour towards the Defence of the Being of Witches and Apparitions*; but most copies were destroyed in the Great Fire. Another edition appeared in 1667 as *Some Philosophical Considerations Touching the Being of Witches and Witchcraft*, and another in 1668 as *A Blow at Modern Sadducism in Some Philosophical Considerations about Witchcraft*. See Coleman Parsons's introduction to a facsimile reprint of the 1689 *Saducismus Triumphatus* (Gainesville, Fla., 1966), pp. xix-xxii; this edition of the book was preceded by 'An Account of the Second Edition of Saducismus Triumphatus' by Henry More.

[664] See Burns, *The Great Debate on Miracles*, ch. 3: 'Glanvill, Boyle and Locke on Miracles', esp. pp. 47-51, and his quotation (p. 49) of Glanvill's point on p. 87 of *Saducismus* that 'a *single relation* for an *Affirmative*, sufficiently confirmed and attested, is worth a thousand *tales* of *forgery* and *imposture*, from whence an *universal Negative* cannot be concluded'.

[665] As Van Leeuwen rightly points out, Glanvill was a sceptic in the 'constructive' sense, rather than in the 'destructive', Pyrrhonian sense, insofar as he thought the Royal Society sceptical, 'namely in reservation of judgment until all evidence has been considered - a cautious prudence in giving assent'; and that he believed 'that the inner structure of nature really cannot be known and thus that scientific knowledge at best is only probably true': *The Problem of Certainty*, p. 82.

[666] Ibid.

[667] Glanvill, 'To the Learned Thomas Albius', prefatory letter to 'Scire|i tuum nihil est', p. 52; and see 'Of Scepticism and Certainty', in *Essays on Several Important Subjects in Philosophy and Religion* (London, 1676), p. 46; reference in Van Leeuwen, *The Problem of Certainty*, p. 84.

as a given that the observer's credibility depended,[668] as Hooke put it, on 'a *sincere Hand*, and a *faithful Eye*, to examine, and to record, the things themselves as they appear'.[669] Hooke believed that:

> the best and utmost we can do towards the discovery of them [Causes, Principles, and Operations … far removed from the reach of our Senses], is only accurately to observe and examine all those Effects produced by them, which fall within the Power of our Senses, and comparing them with like Effects produced by Causes that fall within reach of our Senses… and so from Sensibles to argue the Similitude of the nature of Causes that are wholly insensible.[670]

This amounted to a precise resolution, through the apposite use of inductive reasoning, of the epistemological doubt triggered by the awareness that true causes might be mysterious. It was the natural philosopher's job to ensure that as much of nature as possible be demystified - without divorcing mechanistic laws from their divine origins.

In this context, the point of scepticism was to justify the need for boundaries within which the natural philosopher's discovery of hypotheses amounted to - indubitable, but not infallible - scientific knowledge.[671] As I have suggested earlier, the definition of what constituted a plausible fact,[672] unlike the establishment of any such fact, was prior to empirical research, especially if empirical research was to be viewed as a defendable methodology for the acquisition of knowledge so defined,

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[668] On the establishment of criteria of credibility in England see Barbara J, Shapiro, *A Culture of Fact: England, 1550-1720* (Ithaca, NY and London, 2000). See also Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago, 1994) for the notion that these criteria were socially constructed and relied on notions of gentlemanly status and conduct. Shapin believes they produced 'a temperate probabilism', as Mordechai Feingold put it in his critical, dissenting review of the book, 'When Facts Matter', *Isis* 87, 1996, pp. 131-139, at p. 131. See also Metcalf, 'Introduction', in Glanvill, *Vanity*, p. xviii, where he suggests that, in the early 1660s, Boyle was developing a sceptical position with regard to the status of experimental data which was similar to that of Glanvill.

[669] Hooke, *Micrographia*, 'Preface', sig. a2v.

[670] Hooke, *Posthumous Works*, p. 165; and see John Henry, 'Robert Hooke, the Incongruous Mechanist' in Michael Hunter and Simon Schaffer, ed., *Robert Hooke: New Studies* (Woodbridge, 1989; London, 1998), pp. 149-180, at p. 163. He points out, pp. 169-170, that 'occult' qualities are those that are beyond the senses, that is, beyond the reach of Aristotelian sensationist epistemology … any artificial means of harnessing natural laws was a magical, not a natural philosophical, enterprise', and 'natural processes can be understood by analogy with the artificial operations of mechanical devices' - a premiss of the mechanical philosophy.

[671] For use of this distinction, see Van Leeuwen, *The Problem of Certainty*, pp. 34-38, 59.

[672] See Roger, *Les sciences de la vie*, p. 47: Roger describes the birth of 'l'esprit critique' in France, 'qui sait refuser un fait au nom de la vraisemblance'.

and as a justification for this externalist view of epistemology.[673] It is perhaps worth noting, however, that Glanvill's belief in the existence of witches was prior to his attentiveness to empirical data, so much so, indeed, that he had no problem in finding his belief sustainable.[674] The espousal of one particular methodology was knotted into the metaphysics it came wrapped up in; and this held for enthusiasts and practitioners of the new sciences everywhere.[675] The premise that it was the world's unknowability that set the boundaries within which we could be deemed to have any true (that is, verifiable) knowledge was also an excuse, one might say, not to fill in the gap between the visible and the invisible, or, in the Cartesian terms of the 'cogito', between metaphysically necessary self-knowledge and other minds or worlds. The human mind was defined by its very capacity to know other minds and discover other worlds without confusing them with itself - without, for instance, resorting to anthropocentric metaphors. For those like Hooke whose closeness to the Neoplatonist tradition was allied with a physics somewhat marked off from the Cartesian system, we could define ourselves within the known biological universe in terms of a progression

> beginning with fluidity, or body without any form,… till we arrive at the highest form of a brute Animals Soul, making the steps or foundations of our Inquiry, Fluidity, Orbiculation, Fixation, Anguliazation, or Crystallization Germination, or Ebullition, Vegetation, Plantanimation, Animation, Sensation, Imagination.[676]

Arguably, the very acceptance that a specific, and therefore properly 'scientific', language was necessary for knowledge of worlds and subjects defined and epistemologically stabilized by their very status as 'other' was a major component of the new philosophies of the seventeenth century. 'Certainly this World

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[673] See Sosa, 'How to resolve'; for a defence of externalism, see his 'Philosophical scepticism and epistemic circularity', *Proceedings of The Aristotelian Society*, Supp. Vol. 68, 1994, pp. 263-290. See also Marcia Cavell, 'Notes toward a Theory of Thinking', forthcoming, *Journal of the American Psychoanalytic Association* (I thank Marcia Cavell for sending me a draft of this paper); Brian Loar, 'Phenomenal Intentionality as the Basis of Mental Content', at http://www.nyu.edu/gsas/dept/philo/courses/concepts/loar.html.

[674] See Dear, *Discipline*, ch. 1: 'Induction in Early-Modern Europe', esp. pp. 26-31.

[675] See Tocanne, *L'Idée de nature*, p. 68.

[676] Hooke, *Micrographia*, p. 127; see also John Henry, 'Robert Hooke', in Hunter and Schaffer, ed., *Robert Hooke*, pp. 149-180, for a discussion of Hooke's use of the notion of 'occult' qualities. Henry writes, pp. 169-170, that these occult qualities were beyond the senses and beyond the reach of Aristotelian sensationist epistemology: 'any artificial means of harnessing natural laws was a magical, not a natural philosophical, enterprise', and 'natural processes can be understood by analogy with the artificial operations of mechanical devices'.

was made not onely to be Inhabited, but Studied and Contemplated by Man', Henry Power wrote; there was nobility in pursuing the work of rationally based enquiry:

> How few are there in the World that perform this homage due to their Creator? Who, though he hath disclaimed all Brutal, yet still accepts of a Rational Sacrifice; 'tis a Tribute we ought to pay him for being men, for it is Reason that transpeciates our Natures, and makes us little lower than Angels: Without the right management of this Faculty, we do not so much in our kind as Beasts do in theirs, who justly obey the prescript of their Natures, and live up to the height of that instinct that Providence hath given them.[677]

Physical systems based on the evocation of the primary constituents of the universe - atoms, vortices - or of the body - humours, spirits - could thus remain theoretical tools, usable by reason and adapted to human rational faculties, insofar as they served explanatory purposes by appealing to stable, objective structures, at least initially (as was the case for Descartes, too),[678] created by God as part of a coherent package.[679] It followed that if one endowed atoms with self-moving power or identified the causal efficacy of bodily humours with a non-material, extra-physiological agency, then physical and biological theories ran the danger of stretching beyond the bounds of theological decency, into the frightening realm of radical naturalism,[680] on the one hand, and sensualism, on the other. Such an outcome

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[677] Power, *Experimental Philosophy*, 'The Conclusion', p. 183.

[678] Descartes, *Le monde*, 6-7, in *Œuvres Complètes*, ed. Alquié, I, pp. 349-364. The notion that God had only thrown in the initial elements, and rested thereafter, as it were, became ammunition in the hands of anti-Cartesians: see, for example, Pardies, *Lettre d'un philosophe à un cartesien de ses amis* (Paris, 1672), p. 54: 'que Dieu ait fait toute la matiere: qu'il l'ait divisée en de petites parties à peu prés égales; c'est à dire, en de petits cubes ou des parties quarrées, comme des dez: qu'il les ait agitées en divers sens chacune en son propre centre, & plusieurs d'elles autour d'un centre commun. Voila tout ce que Dieu fasse: aprés quoy, Dieu peut demeurer en repos: il n'a que faire de se mesler davantage de la conduite du monde: les choses se feront d'elles-mesmes.'

[679] See Robert Boyle, *A Free Inquiry into the Vulgarly Received Notion of Nature* (London, 1686), ed. Michael Hunter and Edward Davis (Cambridge, 1996) and the editors' 'Introduction', p. x: 'By denying "Nature" any wisdom of its own, the mechanical conception of nature located purpose where Boyle believed it belonged: over and behind nature, in the mind of a personal God, rather than in an impersonal semi-deity immanent within the world'. Boyle believed it was inappropriate - scientifically and theologically - to speak of 'Nature' doing anything at all, and considered more intelligible the mechanistic view of a world made up of matter acting according to properties and powers given to it by God. There is an important distinction between the laws regulating the universe, of divine origin, and the actual objects in the universe, created according to these laws but not by God.

[680] See Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Harvard, 1982). Mayr quotes Boyle, p. 313: 'This philosophy… teaches that God, indeed, gave motion to matter. But that in the beginning, he so guided the various motions of the parts of it, as to contrive them into the world he designed they should compose, and established those rules of motion, and that order amongs things corporeal, which we call the laws of nature. Thus, the universe being once formed by God, and the laws of motion settled, and all upheld by his perpetual concourse, the general providence. The same philosophy teaches that the phenomena of the world are physically

could be avoided with an appeal, like Glanvill's, to autonomous spirits, identifiable only through their putative actions. Hooke, too, believed in the existence of such entities, along with Boyle;[681] and, as we have seen, so did Locke. But naturalism could also be skirted internally, so to speak, if one left to God the authorship of the world's general design and basic motion, while identifying in terms of physics - mechanics or chemistry - the specific natural laws governing relationships between inert objects and conferring life on human bodies.[682] We have seen, in the chapter on animal minds, and in particular through Bayle's account of the issue, how the drawing of too firm a cleavage between soul and body menaced the integrity of such physics-based explanatory systems. By leading to extravagant, counter-intuitive claims about animals, they invalidated themselves, and eventually would damage the contiguous existence of soul and God. In the end, they would even leave us with living automata - non-human creatures, or, more strongly put, extra-human products of a very human imagination.

To summarize so far, we can see that the problems Cartesian dualism posed for the formation of a proper psychology integrated into the new science - which I examined in Part I - led to the wider question of determining what exactly this new kind of account of the physical world consisted in. Arguments about teleology and the 'visibility' of purposefulness and causes in nature - in seemingly 'intelligent' animal behaviour, for example - amounted to the determination within causal explanatory structures of a place for the human perceiver, and hence to the indirect evaluation of what it was that *made* humans into perceivers and knowers, within what limits and for what purpose.[683] Questions about nature were also questions about the nature of human life (with the moral and theological connotation of purpose and value), because definitions of the rational, immaterial human soul depended on varying,

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produced by the mechanical properties of the parts of matter; and that they operate upon one another according to mechanical laws.'

[681] See John Henry, 'Robert Hooke', in Hunter and Schaffer, ed., *Robert Hooke*; see also John Henry, 'Occult Qualities and the Experimental Philosophy: Active Principles in Pre-Newtonian Matter Theory', *British Journal for the History of Science*, 24, 1986, pp. 335-381.

[682] See, e.g., Gaukroger, *Descartes*, pp. 146-152, for an account of the emergence of early seventeenth-century mechanism out of Renaissance versions of naturalism.

[683] For an account of the ways in which the bodily awareness of natural philosophers in England played a role in their devising experiments and building theories of physiology, see Simon Schaffer, 'Regeneration: The Body of Natural Philosophers in Restoration England', in Christopher Lawrence

unstable conceptions of humans as one component of perceivable, so to speak 'biodegradable' nature. Man-made hypotheses and instruments were the only means available for the investigation of 'secondary qualities', and knowledge of the natural world amounted to credible, empirical evaluations of these hypotheses and indirect data.[684] But to posit them, as we have seen in this chapter, was also to mediate through scepticism the relation of man to the world and the intrinsic knowability of the ultimate constituents of matter. Nature as such was described by theologically minded natural philosophers (and not just by oft-ridiculed proponents of natural theology) as God's realm. It was also, however, the realm within which our actions both must and, yet, ultimately, might not make moral sense. To be an object of empirical investigation, humans would have to be unproblematically a part of nature. As, again, this could only be the case on pain of paganism or naturalism, the focus was instead on *what type of relationship* to our own knowledge of nature we could take ourselves to have, given our self-description as fallen, fallible, embodied[685] agents endowed with free will, senses and reason, as well as passions, deceiving imagination and imperfect memory. It is to this question that I now turn.

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and Steven Shapin, *Science Incarnate: Historical Embodiments of Natural Knowledge* (Chicago and London, 1998), pp. 83-120.

[684] John Henry, 'Robert Hooke, The Incongruous Mechanist', in Hunter and Schaffer, ed., *Robert Hooke*, p. 163, quotes Hooke, *Posthumous Works*, p. 165: 'the best and utmost we can do towards the discovery of them [Causes, Principles, and Operations … far removed from the reach of our Senses], is only accurately to observe and examine all those Effects produced by them, which fall within the Power of our Senses, and comparing them with like Effects produced by Causes that fall within reach of our Senses… and so from Sensibles to argue the Similitude of the nature of Causes that are wholly insensible'.

[685] For a description of the notion of embodiment in the seventeenth century, see Jonathan Sawday, 'Self and Selfhood in the Seventeenth Century', in Roy Porter, ed., *Rewriting the Self: Histories from the Renaissance to the Present* (London and New York, 1997).

2. Understanding function: the organs of cognition in animal and man

Messieurs, Au lieu de vous promettre de contenter vostre curiosité, touchant l'Anatomie du Cerveau; je vous fais icy une confession sincere & publique, que je n'y connois rien.[686]

Attempts to map the corporeal soul were made by many seventeenth-century physicians, anatomists and natural philosophers in England as well as France, Italy, Germany and Holland.[687] They provided their students and colleagues in academies and universities detailed descriptions of dissections they had either conducted, watched or read about. But, as we shall see in this chapter, the interpretive lines along which such descriptions were put down - whether outright materialist or more safely mitigated in their interpretation of the modern, post-Aristotelian world - did not so much display an empirical theory of mind as trace the framework within which observation could be taken to make theoretical sense. Inevitably, such maps turned out to suit their makers and the theories of the soul they deemed most sensible. Intended as mirrors of the corporeal soul - viewed as both psyche and soma - the physicians' manuals thus do not make sense of the dualist cleft: instead, they provide an insight into the writers' own beliefs, as rational investigators of the 'animal' aspect of human behaviour. Acceptance of Cartesian physiology was clearly limited among these clinicians. Few of them, however, questioned the prevalent methodologies of anatomical research, based as it was on functionalist assumptions.

There reigned in France, in the medical fields, a confusion rather than a clear-cut opposition between traditionalists and modernists, conservatives and reformers or innovators, enemies or defenders of the theory of blood circulation.[688] To manifest a radical discontent with established anatomical beliefs did not signify alienation from the scientific or lettered community. On the contrary, someone like the Leiden-trained Danish anatomist, Niels Steensen, better known as Nicolaus Steno (1638-

[686] Nicolaus Steno, *Discours sur l'anatomie du cerveau. A Messieurs de l'Assemblée de chez Monsieur Thevenot* (Paris, 1669), p. 1: 'Gentlemen, instead of promising to satisfy your curiosity regarding the anatomy of the brain, I here make the sincere and public confession to you, that I know nothing about it.'

[687] On anatomical research, see, e.g., for the case of Leiden, Gerrit A. Lindeboom, 'Dog and Frog: Physiological Experiments at Leiden during the Seventeenth Century', in T. H. Lunsingh Scheurleer and G. H. M. Posthumus Meyjes, ed., *Leiden University in the Seventeenth Century: An Exchange of Learning* (Leiden, 1975), pp. 278-293.

[688] Jacques Roger showed this extensively in *Sciences de la vie*; see also Antoine Picon, *Claude Perrault ou la curiosité d'un classique* (Paris, 1989), pp. 35-37.

1687), a pupil of Sylvain de la Boé, was much admired by his contemporaries for the independence of mind and impeccable discipline with which he sought a new methodology for the precise execution and correct interpretation of dissections. He was interested in ensuring the plausibility of theories of physiological function, whether his object of study was the heart or the brain.[689] He would be missed by his Parisian colleagues after he left the capital, where hehad practiced dissections for a year or so, in the mid-sixties.[690] His posthumous influence on the general course of neuroanatomy was not as great as that of his contemporary, Thomas Willis (1621-1675), a star physician and anatomist on both sides of the Channel,[691] though Willis himself praised the Dane, and Steno's work on the heart would be taken up by other physicians of note, including, for example, Jean-Baptiste Denis in 1673.[692] What marks him out is his rejection of the use of systems as explanatory devices, too often abused, he thought, by anatomists who sought to cut corners; and he distinguished himself by basing his criticism of Descartes's notion that the soul was lodged in the pineal gland on straightforwardly anatomical considerations.

Some time between November 1664 and February 1665,[693] Steno gave a lecture on the anatomy of the brain in Melchidesec Thevenot's Paris academy, one of the salons where natural philosophers and men of letters, including members of the Académie Montmor, met before Colbert instituted the Académie des Sciences in 1666.[694] It was published four years later, first in Latin, then in French, as the

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[689] See Kenneth Dewhurst, 'Willis and Steno', in Gustav Scherz, ed., *Steno and Brain Research in the Seventeenth Century* (Oxford, 1968), pp. 43-48, at pp. 44-45. Steno was also active as a geologist; see, e.g., Gustav Scherz, ed., *Dissertations on Steno as Geologist* (Oxford, 1971).

[690] See the review of Steno's *De musculis & glandulis observationuum specimen* (Paris, 1665) in the *Journal des Sçavans*, 1665, pp. 139-142, at p. 141: 'Ce sçavant Danois est presentement à Paris, où il fait tous les iours des dissections, en presence de beaucoup de personnes curieuses; & il en a fait dans l'Escole de Medecine, où il s'est fait admirer de tout le monde par ses nouvelles découvertes: car il a cela de particulier, qu'il rend la plus-part de ces choses si sensibles, qu'on est obligé d'en demeurer convaincus, & d'admirer qu'elles ayent pû eschapper à tous les Anatomistes qui l'ont precedé'. Willis's *Cerebri Anatome. Cui accessit nervorum descriptio & usus* (London, 1664) was reviewed in the same volume of the newly founded journal, pp. 16-19. See also Troels Kardel, 'Stensen's Myology in Historical Perspective', in Troels Kardel, ed., *Steno on Muscles* (Philadelphia, 1994), pp. 1-57, and facsimile reprints of Steno's works on muscles, with translations, pp. 59-228.

[691] The reviewer of *Cerebri Anatome* in the *Journal des Sçavans*, 1665, p. 16, begins by describing the book as 'plein d'esprit, & remply de tant de nouvelles descouvertes'.

[692] See Lionello Negri, 'Il contributo di Niccolò Stenone al progresso delle scienze anatomiche', in *Niccolò Stenone, 1638-1686* (Florence, 1988), pp. 53-65, at p. 62.

[693] See J. Schiller and J. Théodoridès, 'Sténon et les milieux scientifiques parisiens', in Scherz, ed., *Steno and Brain Research*, pp. 155-170, at p. 159.

[694] Melchisédec Thevenot (c. 1620-1692), traveller and aristocratic patron, was a friend and supporter of Steno, as well as of Jan Swammerdam, who was in Paris in 1664, and with whom he had a lengthy

Discours de Monsieur Stenon, sur L'Anatomie du Cerveau. A Messieurs de l'Assemblée, qui se fait chez Monsieur Thevenot. The French edition was dedicated to Cureau de la Chambre;[695] we have met him earlier, in the context of the polemic around animal minds. Beginning with the declaration, quoted at the beginning of this section, that he knew nothing about the brain, Steno made a solid case for the usefulness of deploying a common-sense scepticism in the pursuit of information about brain function. The brain, he wrote, was undoubtedly 'the main organ of our soul, and the instrument with which it executes admirable things'. But as he went on, in terms not unlike those used by Willis (and close, too, to those of the Epicurean and 'libertin' physician Guillaume Lamy),[696] while this very soul of ours felt capable of knowing everything about the world, 'when it returns to its own house, it is unable to describe it, and fails to know even itself'.[697] Knowledge of the rational soul was therefore an epistemic problem, and not a moral or theological issue, nor a premise for faith. The moralist's deliberation, the preacher's sermon or the Cartesian theologian's universe (Malebranche, for one, expressed the view that 'Reason alone enlightens us about the fact that we are not a light onto ourselves')[698] were not of much help to the natural philosopher.

Steno was not happy about the 'assurance' with which anatomists, seeking public admiration at the expense of good faith,[699] usually described the brain. It was,

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correspondence. He is the author of a *Recueil de voyages* (Paris, 1682). See also above, Part I, Chapter 2, p. 84, n. 40.

[695] See above, p. 79.

[696] Guillaume Lamy, *Discours anatomiques, Avec des Reflexions sur les Objections qu'on luy a faites contre sa maniere de raisonner de la nature de l'Homme, & de l'usage des parties qui le composent* (Rouen, 1675), henceforth *Discours anatomiques*, in Anne Minerbi Belgrado, ed. (Paris and Oxford, 1996), *Guillaume Lamy: Discours anatomiques*; *Explication méchanique et physique des fonctions de l'âme sensitive*: 'Sixième Discours', and note 1, p. 95: 'Non, Messieurs, l'âme, qui connoit toutes choses, ne se connoist point elle-mesme. Elle, qui veut conter les estoiles, mesurer les cieux, sonder la profondeur de la mer, découvrir ce qu'elle a de plus caché dans ses abysmes, et trouver ce que la terre enferme dans ses entrailles; elle, dis-je, ne sçait plus ce qu'elle est. Plus elle fait des efforts pour se connoistre, plus elle s'embarasse'.

[697] Steno, *Discours*, p. 3: 'Il est tres certain que c'est le principal organe de nostre ame, & l'instrument avec lequel elle execute des choses admirables: elle croit avoir tellement penetré tout ce qui est hors d'elle, qu'il n'y a rien au monde qui puisse borner sa connaissance: cependant, quand elle est rentrée dans sa propre maison, elle ne la sçaurait décrire, & ne s'y connoist plus elle-mesme'. The book was reviewed in the *Philosophical Transactions of the Royal Society*, 1669, pp. 1034-1037.

[698] Malebranche, *Entretiens sur la métaphysique*, IIIe Entretien, article X, p. 258: 'nous ne sommes point notre lumière à nous-mêmes, ni nulle intelligence à aucune autre. Vous verrez clairement si ce fondement est solide, lorsque vous cesserez de m'entendre moi, et que dans votre cabinet vous consulterez attentivement la vérité intérieure'.

[699] Steno, *Discours*, p. 4: 'ceux, qui préferent l'admiration du public, à la bonne foy'.

he wrote in terms that Lamy would use,[700] 'as if they had been present at the composition of this marvelous machine, and as if they had penetrated all the designs of its great Architect'.[701] They simply refused to acknowledge that methods of dissection were such that very little could actually be understood from the resulting observation of the brain;[702] and this was true whether one used the method of slicing the brain, unfolding it, or also separating grey from white matter.[703] Steno himself would have favoured tracing the path of the nerves through the brain substance, but that was difficult to achieve.[704] His explicit pragmatism coexisted with a deeply held religiosity (he converted to Catholicism - in Münster, on 30 November 1651 - and eventually became a bishop);[705] and he drew on a familiar natural theological argument when suggesting that those who believed that 'the white substance [of the brain] is but a uniform body like wax, devoid of any hidden artifice' - like nerves - actually held 'too low an opinion of nature's finest masterpiece. We are assured that wherever in the body there are fibres, they everywhere adopt a certain arrangement among themselves, created more or less according to the functions for which they are intended'.[706] Yet, to admire a natural object for its complexity, and to see beauty in natural complexity, had little to do with the actual programme Steno proposed. Unlike Boyle, who considered the mechanistic laws of the corpuscularian philosophy

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[700] Lamy, *Discours*, 'Réflexions de Monsieur Lamy sur les objections qu'on luy a faites', p. 125. See below, p. 216, n. 63.

[701] Ibid., p. 2: 'Ces gens qui ont l'affirmative si prompte, vous donneront l'histoire du cerveau, & la disposition de ses parties, avec la mesme asseurance, que s'ils avoient esté presens à la composition de cette merveilleuse machine, & que s'ils avoient penetré dans tous les desseins de son grand Architecte'.

[702] Ibid., pp. 38, 41.

[703] Ibid., pp. 7-8, 22.

[704] Ibid., p. 8: 'Pour moy, je tiens que la vraye dissection seroit, de continuër les filets du cerveau, pour voir par où ils passent, & où ils aboutissent'.

[705] See *Niccolò Stenone nella Firenze e nell'Europa del suo tempo*, catalogue of an exhibition, ed. Stefano de Rosa (Florence, 1986), p. 39, mentioning a letter from Steno to Malpighi, dated 24 Novembre 1671, in which Steno elaborates on the relationship between faith and scientific research; he refers, among others, to Spinoza and Dutch Cartesians.

[706] Steno, *Discours*, p. 4: 'Car de dire que la substance blanche n'est qu'un corps uniforme, comme seroit de la cire, où il n'y a point d'artifice caché, ce seroit avoir un sentiment trop bas, du plus beau chef-d'œuvre de la nature. Nous sommes assurez, que par tout où il y a des fibres dans le corps, par tout elles observent une certaine conduite entr'elles, plus ou moins composée, selon les operations ausquelles elles sont destinées'. The translation is from Edwin Clarke and C. D. O'Malley, *The Human Brain and Spinal Cord: A Historical Study Illustrated by Writings from Antiquity to the Twentieth Century* (Berkeley and Los Angeles, 1968), p. 584. Clarke and O'Malley note that Willis took up Steno's suggestion to study the brain's white matter by following 'the nerve filaments through the substance of the brain to find out where they go and where they end'; there is an account of exactly such an experiment in Chapter IV of Willis's *De anima brutorum* (London, 1672), or *Two Discourses Concerning the Soul of Brutes, Which is that of the Vital and Sensitive of Man* (London, 1683); I shall henceforth refer to the English version of the work.

to be at once autonomous, specific to the natural (rather than the divine) realm, and a manifestation of what initially had been a divine orchestration,[707] Steno set aside from his considerations any sense of divine order or law. In a way that might at first seem anti-theoretical, he focused instead on the pragmatic aspects of, and the real physical obstacles to, an effective anatomy of the brain. In this, too, differed, from Thomas Willis, in that he had no ambitions either for psychology - defined as the mapping out of the soul[708] - or for psychiatry - understood as the ætiology of the soul's ailments.

Visible and analysable as were grey matter, white matter, nerve extremities, and ventricles, it was easy, as Steno realized, to pass over errors of interpretation for the sake of offering to students and colleagues descriptions which fitted earlier, text-based presuppositions that, usually, had not been verified empirically.[709] So, for example, some considered brain ventricles to be the home of the spirits, while for others they were the receptacles of the brain's 'excrement'; the spirits might originate in the vessels one could discern in the ventricles or, alternatively, in the brain itself. But no one, wrote Steno, was capable of telling exactly either from where they came, or where they exited.[710] Animal spirits might be the blood itself, or 'a specific substance separated from the chyle in the glands of the mesenterium'; perhaps they came from the 'serosities'. According to some, they could be compared to 'wine spirit'; but others 'might wonder whether they are not the very stuff of light'.[711] Accounts of brain function thus differed in the very details that constituted them; but there existed no solid basis for believing one thing rather than another, just as there was little basis for deriving with any certainty physiology and function, the 'micro' realm, from anatomy, the 'macro' realm. Moreover, there were plenty of divergences with regard to the actual significance one might attach to the variations in accounts of the relation of 'macro' structures both to function and to the 'micro'

[707] See above, p. 162, n. 107.
[708] See above, p. 84.
[709] Steno, *Discours*, pp. 33-34: 'Mais ceux qui font les dissections, ont toûjours voulu paroistre consommez en cette science; pas-un d'eux n'a voulu confesser combien il restoit de choses à y apprendre, & pour cacher leur ignorance, ils se sont contentez de faire les demonstrations, de ce que les Anciens ont écrit'.
[710] Ibid , pp. 5-6.
[711] Ibid., pp. 6-7: 'On voit encore moins de certitude, sur le sujet des esprits animaux. Est-ce le sang? seroit-ce une substance particuliere separée du chyle dans les glandes du mesentere? les serositez n'en seroient-elles point les sources? Il y en a qui les comparent à l'esprit de vin, & l'on peut douter si ce ne seroit point la matiere mesme de la lumiere?'

structures responsible for function. Steno was remarkably distrutful of theories of brain localization, both the ventricular one favoured by the 'ancients', and that of Willis himself, who, in assigning the common sense to the corpus striatum, the imagination to the corpus callosum and memory to the grey matter,[712] had advanced hypotheses which, in Steno's view, one would be hard put to confirm.[713] He observed that the striata were actually not discontinuous between grey and white matter, and that they even entered the spinal chord via the corpus callosum - itself 'so unknown to us that with some imagination one can say anything one likes about it'. It followed that there was no obvious reason for operations such as those described by Willis to actually happen in these bodies.[714]

The idea that the relation between form and function must be presumed unresolved precisely *because* form was hard to identify correctly is rarely found in other authors as explicitly as in Steno. Unsurprisingly, he thought well of Descartes's decision to describe the human body by resorting to a machine capable of performing human actions: it established function as the starting point of anatomical investigations,[715] and expressed a salutary modesty on Descartes's part with regard to the possibility of understanding the human body.[716] What disturbed Steno, precisely, was the abuse of this system by those who believed Descartes's automaton to be an exact replica of the living organism and a realistic depiction of the human body's 'most hidden' elements, which it certainly was not, for Descartes, in spite of his extended practice of dissection, was no great anatomist.[717] On this basis, Steno could safely question Descartes's individual observations without undermining his systematizing philosophy as such. Steno patiently showed how a correct analysis of a correctly performed brain dissection proved that the pineal gland could not possibly function in the way Descartes imagined. Although it did adjoin the passage between

[712] Ibid., pp. 10-11. See Willis, *The Soul of Brutes*, pp. 38-40.
[713] See Clarke and O'Malley, *Human Brain and Spinal Cord*, p. 159.
[714] Steno, *Discours*, pp. 11-12, at p. 12: 'Certes, le corps calleux nous est si inconnu, que pour peu qu'on ayt de l'esprit, on en peut dire tout ce qu'on veut'.
[715] Ibid., p. 21: 'Les amis de Monsieur des Cartes qui prennent son Homme pour une machine, auront sans doute, pour moy la bonté de croire, que ie ne parle point icy contre sa machine, dont j'admire l'artifice'.
[716] Ibid., p. 13.
[717] Ibid.; p. 14: 'Je me serois contenté de l'admirer avec quelques-uns, comme la description d'une belle machine, & toute de son invention; si ie n'avois rencontré beaucoup de gens qui le prennent tout autrement, & qui le veulent faire passer pour une rélation fidele, de ce qu'il y a de plus caché dans les ressorts du corps humain'. And p. 22: 'mais ceux qui entreprennent de demontrer que l'homme de

the third and fourth ventricles, the pineal gland was not placed within either the one or the other - contrary to what Descartes had assumed. To show this, it was only necessary to

> remove the cerebellum, or little brain, and one of the eminences of one of the tubercules of the third pair, or both of them if you want, without touching the ventricles; if you have done this carefully, you will see the posterior part of the gland, completely uncovered, and with no sign of a passage through which air or any sort of liquour could enter the ventricles.[718]

The reason why Descartes and even Willis were unable to make sense of dissections in this way was, of course, the intrinsic difficulty of observing the brain and of drawing it properly. Wren's figures for Willis's *Cerebri Anatome* were, thought Steno, 'the best we have had until now', but even they contained errors, which Steno pointed out one by one.[719] A good dissection technique, drawing skills, and the interpreter's expert attention to detail were all necessary for a plausible account of brain anatomy and function. Results depended to a great extent on how one prepared the brain for analysis; and the names of structures were often based on the flawed interpretation of confusingly dissected brains.[720] As Steno rightly claimed, anatomists had always tended to be medical practitioners - doctors or surgeons - who could afford neither to allocate much time to pure research, nor to confess how little they knew of the subject, filling in the gaps with the texts of the ancients.[721] This was so in part because medicine was a liberal art: to dirty one's hands would have been inappropriate.[722] If anatomists were not medical practitioners, they taught medical students - and, to paraphrase Steno here, their interest in anatomy was skin-deep.[723] Anatomy, in other words, and as Steno made clear, was a non-discipline. There had

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Monsieur des Cartes est fait comme les autres hommes: l'experience de l'Anatomie leur fera voir que cette entreprise ne leur sçauroit reüssir'.

[718] Ibid., p. 17: 'Et pour cela, il n'y a autre chose à faire, qu'à oster le cerebellum, ou le petit cerveau, & une des éminences d'un des tubercules du troisiéme pair, ou toutes les deux si vous voulez, sans toucher aux ventricules; car la chose ayant esté faite adroitement, vous verrez la partie posterieure de la glande toute découverte, sans qu'il y paroisse aucun passage, par où l'air ou quelque liqueur puisse entrer dans les ventricules'. The description continues until p. 21.

[719] Ibid., pp. 23-26.

[720] Ibid., pp. 22-31.

[721] Ibid., pp. 34-38. See also Roger, *Sciences de la vie*, pp. 25-29.

[722] Antoine Picon makes the point in *Claude Perrault*, p. 36. One can also place this view of anatomy in the context of questions about variations in its epistemological status, from Hippocrates onward. Nancy Siraisi's account of Cardano's case is apposite: see her *Girolamo Cardano and Renaissance Medicine* (Princeton, 1997), p. 103.

[723] Steno, *Discours*, pp. 34-35.

been all too few occasions or possibilities for any revision of established assumptions to occur.

Such a revision was nevertheless necessary. Anatomists had contented themselves with observing 'movements' of the brain and constructing whole 'systems' on the basis of these observations alone. They had been oblivious to the notion that 'the same thing can be explained in a number of ways and that only the senses can assure us that the idea we have of it corresponds to what it is in nature'.[724] The brain, Steno pointedly wrote, was a machine; and as with any machine, the only way to understand it was either to have its maker explain the 'artifice' - that is, the functioning - of the whole, or to undo it piece by piece, and to examine each one in turn before looking at the way in which the pieces fit all together.[725] One could not understand the whole without understanding the parts, he claimed.[726] Proper, empirical research could not even be methodical, because nothing about the brain's divisions and functions could be assumed *a priori*.[727] Steno insisted on this latter point, using his own knowledge and experience to back up his view that there was no use at all for mere 'reasoning' in the pursuit of the understanding of anatomy, especially of such a malleable organ as the brain. Ancient anatomy could, of course, be of some help, but only indicatively;[728] too much reliance on it actually hindered the possibility of revision.

Steno was aware of, and precise about the ways in which the very process of dissection could distort the brain,[729] create parts and divisions between parts where they did not exist, and vice versa. He wanted to suggest a method which would define and delimit the impact of the experimenter as well as the role of ancient authorities, and thus ensure greater accuracy of observation, representation and interpretation. He proposed to 'follow the laws of Philosophy, which teach us to look

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[724] Steno, *Discours*, p. 32: 'Ils n'ont pas consideré, qu'une mesme chose peut estre expliquée de differente maniere, & qu'il n'y a que les sens qui nous puissent assurer, que l'idée que nous nous en sommes formée, est conforme à la nature'.

[725] Ibid. 'Il n'y a que deux voyes, pour parvenir à la connoissance d'une machine; l'une, que le maistre qui l'a composée nous en découvre l'artifice; l'autre de démonter jusqu'aux moindres ressorts, & les examiner tous séparément, & ensemble'. Leibniz made a similar point: 'Pour expliquer une machine, on ne sçaurait mieux faire que de proposer son but et de montrer comment toutes ses pièces y servent': see *Suite de la réponse à Nicaise*, and Jacques Roger, *Sciences de la vie*, pp. 230-231, for quotation and full reference, as well as further observations on the way in which the machine model in life sciences was integral to preserving the notion of final causes, and thus of God's handiwork, in nature.

[726] Steno, *Discours*, p. 53.

[727] Ibid., p. 37.

[728] Ibid., pp. 47-48.

for truth while doubting its certainty, and never to content ourselves with it before the evidence of demonstration has confirmed it'.[730] Exact figures were an important tool, especially for those whose aversion to blood, for example, meant that they never saw the dissected organ itself. For this reason, the absence of figures was preferable to the presence of false ones.[731] But there was no shortage of imperfect images of the brain, precisely because it always tended to collapse before one had managed to draw it properly.[732] Moreover, anatomists were all too keen to attribute a function to a part without even understanding its structure properly, replacing observation with the claim that 'God and nature do nothing in vain'.[733]

That belief in itself was not in question, in Steno or in anyone else who practiced anatomy at this level. But it did not provide any answers, either, about what it was exactly that had been fabricated, by God or nature, with such a regard for ends. Nor did it say much about the best intellectual mechanisms and practical methods to employ for finding out how all natural structures cohered, as they were alleged to do. The only way forward, thought Steno, in a continuum with the methods established throughout the sixteenth century and culminating with Vesalius, was to go on practicing comparative anatomy.[734] As he wrote: 'one should dissect as many heads as there are different species of animals, and different states [sic] within each species'.[735] Brains 'which have been changed by some illness' were also useful, since such changes indicated what it took for normal functioning to be possible, and what correlations there might be between abnormal behaviour and anatomical or physiological incidents.[736]

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[729] Ibid., pp. 43-45.
[730] Ibid., p. 49: 'je tâche de suivre les loix de la Philosophie, qui nous enseignent à chercher la verité en doutant de sa certitude, & à ne s'en contenter pas, avant qu'on se soit confirmé par l'évidence de la demonstration'.
[731] Ibid., p. 51.
[732] Ibid., pp. 52-53.
[733] Ibid., p. 53.
[734] For a study of Vesalius's use and applications of comparative anatomy, see Nancy Siraisi, 'Vesalius and human diversity in De humani corporis fabrica', in *Journal of the Warburg and Courtauld Institutes*, 57, 1994, pp. 60-88: 61-62.
[735] Steno, *Discours*, p. 54: 'ce que je crois qu'on doit faire, pour avoir quelque connoissance du cerveau; car il faudroit pour cela dissequer & examiner autant de testes, qu'il y a de differentes especes d'animaux, & de differents estats dans chaque espece'.
[736] Ibid.: 'Dans les Foetus des animaux, on voit comment le cerveau se forme, & ce que l'on n'auroit point veu dans le cerveau sain, & en son entier, on le verra dans les cerveaux, qui ont esté changez par quelque maladie.'

There was no doubt in the minds of those, like the architect, theorist and natural philosopher Claude Perrault (1613-1688), who practiced the dissection of animals and elaborated theories of the animal soul, that healthy organisms tended to behave in a goal-directed manner and that a mechanism had been put in place - by God or nature - to ensure the correct operation of the structure-function correlation. Organs were built in such a way that they were adapted to their functions. In a proposal which Perrault submitted in early 1667 for the anatomical programme of the then newly founded Académie des Sciences, he made a clear distinction between truths 'de fait', derived from the observation of the structure of dissected organs, and those 'de droit', discovered through the experimentally and rationally acquired understanding of their function and action.[737] The nerves, for instance, were similar for each sense organ, but they differed in sensitivity and thus functioned appropriately to their respective roles, because their covering was specific to each one.[738] In this sense, teleology, or finalism,[739] was assumed to be explanatory of the mechanisms that made up living bodies; but the fact that an organ was present did not signify that its function was clear. Thus, espousing a version of the thesis that perceptual cognition was not bound to a specific sense, Perrault thought it best to posit the existence in insects of a universal sense, admittedly invisible, to explain their extraordinary perceptual capacities, for example the ability of ants to find sugar

[737] Perrault, 'Projet pour les expériences et observations anatomiques', read on January 14, 1667, in *Procès-Verbaux de l'Académie des Sciences*, *Archives de l'Académie des Sciences*, I, pp. 22-30. Quoted and discussed by Picon, *Claude Perrault*, pp. 44-46; he understands this distinction as one between anatomy and physiology.

[738] Claude Perrault, *Essais de physique ou Recueil de plusieurs traitez touchant les choses naturelles*, III: *De la mechanique des animaux* (Paris, 1680): henceforth, *Mechanique*, p. 25: 'Or les nerfs estant presque tous pareils dans les organes des sens, ils sont principalement rendus propres à chaque sens par la difference de cette couverture qui est appropriée à chacun des objets, en sorte qu'à proportion que le mouvement dont chaque objet est ébranlé lors qu'il devient sensible, est different par la force ou par la foiblesse, ou enfin par la maniere particuliere de se remuer'.

[739] I here take the term finalism, until Darwin the equivalent of teleology, in both the senses - distinct but closely related - identified by Anna Minerbi Belgrado in the introductory essay to her edition of Lamy's anatomical writings, p. 12: on one, Aristotelian view, nature tends toward the realization of inbuilt ends, as if she were aware of them; on the other, Galenic view, nature is rather identifiable as a machine, operating according to mechanistic laws whose ends are intended only by the creator. By the second half of the seventeenth century, the first view was usually affirmed rhetorically rather than held in a literal sense, as Belgrado notes too; but it pointed to a general need to ensure a connection, in natural philosophy, between the pursuit of causal explanation and the precise identification of natural purposefulness. On the distinction between the two kinds of finalism, however, see also Roger, *Sciences de la vie*, pp. 74-79. On Aristotelian notions of teleology see Martha C. Nussbaum, 'Aristotle on Teleological Explanation', in Nussbaum, *Text, with Translation, Commentary and Interpretive Essays of Aristotle's* De Motu Animalium (Princeton, 1978), pp. 59-106.

from a great distance.[740] In describing the ordinary, goal-oriented actions of living creatures, he accepted that final causes were inherently explanatory of such actions, but also maintained that actions which could be physically observed did not by themselves give an indication of what the correlated mechanisms at the 'micro' level might be.[741] His postulation of a universal sense in insects such as flies and bees did not rest on the observation of an organ for it - whatever such a thing might look like. It relied instead on two assumptions: first, that goal-directed actions were essentially cognitive and in general could be accomplished thanks to perceptual mechanisms peculiar to the organism in question; second, that specialized organs had developed for the sake of these specific perceptual functions, but that we knew more about what the functions were than we did about how they actually worked.[742] As he wrote, we could understand how a telescope was made - that it consisted of a long blackened tube, lenses of various sizes and so on - and why it was made the way it was, given its intended function; yet, this did not mean that we knew why the lenses themselves functioned in the way that they did, what it was about the tubes that stopped light entering from the sides and so on.[743] In the same fashion, it was impossible 'for us to discover what it is about the skin of the hand that makes it sensitive in one particular way, and the skin of the tongue in another way: because these organs do not function according to a composition known to us'.[744] Between micro and macro there was an invisible link: we knew what the structural differences amounted to experientially, but we did not know what it was in the structure that resulted in such different sensations.

Empirical investigations into the character and function of sense organs thus went along with a belief in the importance of imagining biological structures not

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[740] Perrault, *Mechanique*, pp. 17-20.
[741] Ibid., pp. 16-22.
[742] Dennis Des Chene suggests, in *Physiologies: Natural philosophy in late Aristotelian and Cartesian Thought* (Ithaca and New York, 1996), p. 181, that, since Descartes had no more tools than Aristotelians to explain animal actions (such as 'raising their young, building webs or nests, looking for food, and fighting or avoiding their enemies') 'in terms of the dispositions of animal bodies', it followed that any explanation had to 'take into account the ends to which those actions are directed'. In this way it was possible to explain the independence of actions of animals 'from immediate stimuli, the coordination of their actions, the flexibility in their means'. It did not, writes Des Chesne, answer the question of 'whether animals were guided by reason or merely by instinct', but 'in either case it was necessary to appeal to ends'.
[743] Perrault, *Mechanique*, p. 44.
[744] Ibid.: 'Ainsi il ne nous est pas possible de découvrir ce qui fait que la peau de la main est sensible d'une certaine maniere; & que celle de la langue l'est d'une autre façon: parce que ces organes ne font point ces fonctions en vertu d'une composition qui nous soit connuë'.

ordinarily visible to us, while accepting that these might be ordinary, natural, and necessary to physical life. At the same time, the process of investigating the make-up of such structures did not so much wipe out any lingering intuition of finalism as help to flesh out a new use for it, one compatible with the injection of scepticism into the process of scientific enquiry. All this was part of the continuing assessment of the role of rational deliberation in the new, empirical sciences of life - the very set of issues we began analysing in the preceding chapter.[745] If the body of a telescope was related to its function in the way that the human body was to cognitive and perceptual processes, then establishing the grounds for a proper understanding of the latter - for a plausible way of deriving conclusions from observation - was bound to be a confusing process. Finalism helped to clarify the picture by ensuring a constancy in the structure-function relationship.

Still, the observation of anatomical structures was not close to shattering older assumptions about cognitive processes. No one could afford to question the division of the soul into, broadly, at least a cognitive - sensorial - and a rational part. Willis took up this dual theory, without, nonetheless, jumping whole-heartedly onto the Cartesian bandwagon, which, as we shall see, was not of direct use to physiological or anatomical work. A member of the Oxford group of Harveian experimentalists set up after the Civil War from which would grow the Royal Society, of which he became a Fellow, as well as a Fellow of the College of Physicians, a royalist and Sedleian Professor of Natural Philosophy at Oxford (notably to Wren, Lower and Locke, among others) Willis described his research as a way to 'unlock the secret places of Mans Mind and to look into the living and breathing chapels of the Deity'. This justified neurological enquiry in terms far less pragmatic than Steno employed, in response to those who regarded it 'as a certain Mystery and Schoolhouse of Atheism'.[746] Willis dedicated his *Cerebri Anatome* - which is still considered the foundational text of the anatomy and physiology of the

[745] Antoine Picon, in *Claude Perrault*, p. 36, formulates the questions posed by Catherine Wilson in slightly different, but similar terms, suggesting that the revision of the status of traditional, antiquarian medical knowledge and practice led to interrogations about the role of reasoning, systems and experiment, about what exactly medical knowledge was, and about whether, and how, a 'science of life' was possible. It was now - especially, as he notes, after Dionis was nominated 'demonstrator' of human anatomy on the 'pro' side of blood circulation, in 1672 - that medicine began to be redefined as neither a liberal nor a mechanical art, and to become more 'interventionist' and 'technicalist', as he puts it.

[746] Dedication of *Cerebri Anatome*: *Dr. Willis's Practice of Physick* (London, 1684), p.50. Cited by Dewhurst, 'Willis and Steno', in Scherz, ed., *Steno and Brain Research*, p. 45.

nervous system - to his patron, Gilbert Sheldon, the Archbishop of Canterbury, proposing to look into nature as if he were looking into the Bible. The need to avoid a conflict between fact and revelation, in this instance, was prior to any questioning of the assumption that anatomical research was indeed a 'Schoolhouse of Atheism'. The onus here seemed to be on the prevention of conflict, and the theological validation of his enterprise,[747] rather than on the establishment of a research method with which to set the practice of natural philosophy apart from any theological concern.[748] Such a concern, however, was embedded in the very adoption by Willis of a dualistic theory of mind, moderated by the Gassendist notion that the sensitive and rational souls were continuous with one another, according to a scheme described in great detail in the later *De anima brutorum*, or *The Soul of Brutes*.[749] Willis's ideas crossed the channel quite speedily, thanks in part to Daniel Duncan (1649-1735), who published a work based on them in 1678.[750]

Willis combined the physician's expert anatomical sophistication with the fluent use of an interpretive apparatus that see-sawed between novelty and tradition, Galenism and Gassendist atomism, iatrochemistry and mechanism.[751] He developed a sophisticated physiology which derived authority from ancient sources and credibility from the application of up-to-date corpuscularianism to the atomist and Stoic theories of mind which filled the gap left by Cartesian dualism.[752] It was the very diversity of opinions about the soul, he wrote at the beginning of *The Soul of*

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[747] See Adrian Johns, *The Nature of the Book* (Chicago, 1998), p. 393.

[748] Quoted from *Cerebri Anatome* by Scherz, in Dewhurst, p. 51: 'These I desire, that all mine may be tryed and approved, no less by the demonstration of Piety and Canons of the Church, than by the Rule of Experience and Knowledge'.

[749] See above, n. 21, p. 168. On Gassendi's notion that the soul is a 'Certain Flame, or a Species of most thin fire' which is both 'Intelligent' and Artificial', and for Willis's comment that Gassendi never explains how such an 'inkindled and dilated' flame 'can be able to produce the Acts of the animal Faculty', see p. 4. The rest of the book is devoted to explaining these phenomena.

[750] Daniel Duncan, *Explication nouvelle et mechanique des actions animales. Où il est traité des fonctions de l'ame. Avec une methode facile pour démontrer … les parties du cerveau, sans couper sa propre substance. Et un discours sur sa formation* (Paris, 1678).

[751] For a good account of this, see Audrey Davis, *Circulation Physiology and Medical Chemistry in England 1650-1680* (Lawrence, KA, 1973).

[752] See, e.g., Margaret J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingeny and Necessity in the Created World* (Cambridge, 1994); 'Baptizing Epicurean Atomism: Pierre Gassendi on the Immortality of the Soul', in Margaret J. Osler and Paul Lawrence Farber, ed., *Religion, Science, and Worldview: Essays in Honor of Richard S. Westfall* (Cambridge, 1986), pp. 163-183; Robert Kargon, Walter Charleton, Robert Boyle, and the Acceptance of Epicurean Atomism in England', *Isis*, 55, 1964, pp. 184-192, reprinted in Vere Chappell, ed., *Essays on Early Modern Philosophers from Descartes and Hobbes to Newton and Leibniz* (New York, London, 1992), pp. 232-240. On Willis's preference, as a physician, for the chemical to the

Brutes, that showed 'that she understands all things but her Self' and that the proliferation of new data about the bodies of animals and of man did not guarantee that such information was used to best effect. 'Nevertheless', he went on,

> in this Age, most fruitful of Inventions, when that so many admirable things not before thought on, as it were another Ancient World unknown, are discovered, about the building of the Animal Body, when new Creeks are daily found out, new humours spring up, and altogether another Doctrine than what hath been delivered by the Ancients, concerning the use of many of the Parts, hath been instituted; why may we not also hope, that there may be yet another disquisition concerning the Soul, and with better luck than hitherto? Therefore, however the thing may be performed, I shall attempt to Philosophise concerning that Soul at least, which is Common to Brute Animals with Man.[753]

This was the 'Corporeal Soul', 'which seems to depend altogether on the Body, to be born and dye with it, to actuate all its Parts, to be extended thorow them', and the knowledge of which would ensure a better understanding of 'the Ingenuity, Temperament, and Manners of every Man', including those 'belonging rather to the Soul, than to the Body', such as madness and melancholy. An understanding of this corporeal soul would enable us to delimit its 'bounds' and differentiate it from 'the Rational Soul, Superior and Immaterial'.[754] The immateriality of the rational soul was *proved* by the very impossibility of deducing its possible location from observation: the brains of humans and of dogs or sheep, say, did not differ greatly as to their structure.[755]

Willis thus applied comparative anatomy - as Steno had recommended, in line with predecessors from Vesalius back to Galen - to his investigation into the nature and operations of the all-important, complex corporeal soul, present in humans as well as in 'brutes', as he made very clear from the outset. And crucially, he did not untie anatomy from physiology - the observation of form from the

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mechanical philosophy, see Andrew Wear, 'Continuity and union in medical practice', in French and Wear, ed., *Medical Revolution of the Seventeenth Century*, pp. 294-320, at pp. 296-298.

[753] Willis, *The Soul of Brutes*, p. 1

[754] Ibid.

[755] Ibid., p. 44: 'As we have shewn, by comparing the Corporeal Soul of the Brute, with the Rational of Man, what vast difference there is between them, perhaps it might be to the purpose, to compare the Brains of either, and to observe their differences. But … we have noted little or no difference, in the Head of either, as to the Figures and Exterior Conformations of the Parts … from hence we concluded, the Soul Common to Man with the Brutes, to be only Corporeal, and immediately to use these Organs'. See also William Bynum, 'The Anatomical Method, Natural Theology, and the

investigation of function - thus not effecting any real revision of the methodology used to arrive at an understanding of function. His analysis of the human nervous system was rather meant as a contribution to the idea that it was possible for an anatomist to find out *how* the corporeal soul operated, while also understanding ourselves as uniquely rational creatures, whose superior functions, because they were intrinsically immaterial and not physically manifest, remained outside the anatomist's field of investigation. We could see ourselves as a 'two-soul'd Animal',[756] the 'amphibian' creature Thomas Browne had described, which appears here bearing all its theological and humanist pedigree - with Willis's reference, for example, to a gloss by 'the most Learned Divine, our *Dr Hammond*' on St Paul's first 'Letter to the Thessalonians' (5.23):[757]

> man is divided into three parts, to wit, First into the body, which is the Flesh and Members: Secondly, Into an Animal Life, which also being Animal and Sensitive, is common to Man with the Brutes; And Thirdly, into Spirit, by which is signified the rational Soul, at first Created by God,which being also Immortal, returns to God. … Man is made, as it were an Amphibious Animal, or of a middle Nature and Order, between Angels and Brutes, and doth Communicate with both, with these by the Corporeal Soul, from the Vital Blood, and heap of Animal Spirits, and with those by an intelligent, immaterial, immortal Soul.[758]

It was 'Reason' which persuaded us that the animal faculties could not be performed by the rational soul, 'because the Acts and Passions of all the Senses, and Animal Motions are Corporeal, being divided and extended to various Parts; to the performing which the immediately, the incorporeal and indivisible Soul seems unable, so that it would be finite'.[759] The scholastic belief that the sensitive soul was 'subordinate' to the rational one had, for Willis, the consequence of turning the former into 'a mere Quality'; and if one said that the latter bestowed 'Life and Sensation, then Man doth not generate an animated Man, but only an inform Body,

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Functions of the Brain', *Isis*, 64, 1973, pp. 445-458, esp. pp. 453-454, where he quotes the passage here and discusses its implications.

[756] Willis, *The Soul of Brutes*, p. 41: 'That Man is made, as it were an Amphibious Animal, or of a middle Nature and Order, between Angels and Brutes, and doth Communicate with both, with these by the Corporeal Soul, from the Vital Blood, and heap of Animal Spirits, and with those by an intellgient, immaterial, and immortal Soul'. See also Bynum, 'Anatomical Method', pp. 449-450.

[757] Presumably Henry Hammond (1602-1660), a highly reputed divine, archdeacon of Chichester from 1643, made canon by Charles I, at Christ Church in Oxford in 1644/45, author of the successful *Practical Catechism* (London, 1644). See entry in *Dictionnary of National Biography*, VII-VIII, pp. 1126-1130.

[758] Willis, *The Soul of Brutes*, pp. 40-41.

or a rude lump of Flesh'.[760] The 'Powers' of the rational, or 'Superior Soul', meanwhile, were primarily discussed as that which humans use 'expeditiously and freely; they included 'Intellect, Judgment, Discourse, and other Acts of Reason'. The objects of the corporeal soul were merely 'sensible things'. Its 'Knowing Faculty' was 'Phantasie or Imagination'; that 'of the human mind' was 'every Ens, whether it be above, or sublunary, or below the Moon, Material or Immaterial, true or fictitious, real or Intentional'. Though 'degrees of Knowledge' such as 'Apprehension, Enunciation, and Discourse' were common to both souls, the powers of the rational soul were, of course far superior to those of the corporeal one.[761]

Concerned with giving a convincing picture of the relationship between the two souls, Willis held on to the Galenic notion that animal spirits were instrumental in the operations of the corporeal soul, identified throughout as a 'fiery' substance.[762] These were 'procreated wholly', he believed, 'in the Cortical or Barky substances of the Brain and Cerebel'; and they descended 'by and by into the middle or marrowy parts, and there are kept in great plenty, for the business of the Superiour Soul'.[763] This scheme allowed him to attribute to animals a 'Council, or a certain Deliberation' and to reduce the 'most Intricate Actions of Brutes, which seem to contain Ratiocination … into Competent notions of the sensitive soul'.[764] In this way he bypassed the inextricable controversies which we have seen were inherent in a theological or ethical approach to the issue of animal cognition. Ethical soundness was here guaranteed by the conjecture that the rational soul was a substance which, 'as it were presiding, beholds the images and impressions represented by the sensitive soul, as in a looking Glass, and according to the conceptions and notions drawn from thence, exercised the acts of reason, judgment and will'. Animals did not need immaterial, immortal souls to have similar faculties; and their most 'Intricate Actions', even those which seemed to entail some sort of rationality, 'may be explained, and reduced into Competent notions of the sensitive Soul'.[765] He compared the difference between man and animal to that between the musician and

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[759] Ibid.
[760] Ibid.
[761] Ibid., p. 38.
[762] Ibid.: Chapter II, pp. 4-7, is entitled 'That the Soul of the Brute is Corporeal and Fiery'.
[763] Ibid., p. 24, and the whole of chapter IV: 'Of the Parts or Members of the Soul of the Brutes'.
[764] Ibid., p. 38.
[765] Ibid.

the tune. On the one hand, our rational soul 'disposes and orders at its pleasure, the faculties of the inferiour soul'; on the other,

> the soul of the brute, being scarce moderatrix of its self, or of its faculties, institutes, for ends necessary for itself, many series of actions, but those (as it were tunes of harmony produced by a water organ, of another kind) regularly prescribed by a certain rule or law, and almost always determined to the same thing.[766]

A powerful theory about the nature of organic, autonomous, generated animal life could thus be deployed on the basis of the analysed function and status of physical organs - in those which were common to beast and to human. Willis tried to understand how the animal spirits - information carriers, in a sense - travelled within the organism, *given* the observed, and then carefully rendered structures of the brain. In this sense, the sorts of operations Willis depicted were more complex than those Descartes imagined from the hypothesis that the pineal gland was the seat of the rational soul. The corporeal soul 'actuated' both 'the Vital Liquor' - the blood, circulating in 'Heart, Arteries, and Veins'- and the 'Animal Liquor or Nervous Juyce', which flowed 'within the Brain and its Appendixes'.[767] It was 'a certain fire or flame', he wrote. For Descartes, it must be noted, animal spirits, the smallest particles in the blood, had been, variously, 'un certain air ou vent très subtil',[768] 'un vent ou une flamme très subtile',[769] 'un certain vent très subtil, ou plutôt une flamme très vive et très pure',[770] capable, on account of their small size, of reaching the brain and entering the pineal gland, which was inaccessable to larger particles. Willis's corporeal soul, on the other hand, lay 'hid in the Blood, or Vital Liquour', and was spread throughout the body, exercising its faculties of motion and sense 'in every one of the divided members'. It had been shown that 'Worms, Eels, and Vipers, being cut into pieces, move themselves for a time, and being pricked will wrinkle up themselves together'.[771] Pardies, whom we met in Part I, used the data as well,[772] to

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[766] Ibid., p. 34.
[767] Ibid., p. 22.
[768] Descartes, *Les passions de l'âme*, Art. 7, in *Œuvres*, ed. Alquié, III, p. 957; see also Art. 10, pp. 958-959. See André Pichot, *Histoire de la notion de vie* (Paris, 1993), pp. 363-369.
[769] Descartes, *L'homme*, in *Œuvres*, ed. Alquié, I, p. 399
[770] Ibid., p. 388: 'Pour ce qui est des parties du sang qui pénètrent jusqu'au cerveau, elles n'y servent pas seulement à nourrir et entretenir sa substance, mais principalement aussi à y produire un certain vent très subtil, ou plutôt une flamme très vive et très pure, qu'on nomme les *Esprits animaux.*'
[771] Willis, *The Soul of Brutes*, p. 5.
[772] Pardies, *Discours de la connaissance des bestes* (Paris, 1672; facsimile reprint, New York and London, 1972), pp. 74-75.

show, in the first half of his book, that the material soul was diffused throughout the body.[773]

The distinction between forms of knowledge was continuous with the more Gassendist than mechanistic postulation of a corporeal soul, thanks to which animals - as Pardies also believed - had no spiritual cognisance but were capable of a sense-based knowledge. Since animals showed evidence of memory, reason and so on, they must have a primitive, corporeal soul. In humans, the immortal, rational soul controlled the corporeal one, and the dissection of animal and human bodies yielded knowledge of the latter. Moreover, as Perrault himself wrote, the observation of animals - dead or alive - was eminently justifiable as a way of showing our 'recognition' of the debt we owed to God for creating so many, and such diverse creatures, as our chief inheritance.[774] The ease with which it was possible to study beasts justified the natural philosopher's cataloguing endeavours, and the pursuit of observation and dissection.[775] Arguably, it was not the zoological curiosity underpinning such research that eventually came to reveal the mechanistic nature of animal function: on the contrary, curiosity was from the onset a key feature of our humanity, and of our difference from the animals we were so good at studying. With a nod to the 'historical' method of surveying the 'richness and variety'[776] of the animal kingdom, Perrault thus merrily placed man alongside the foxes, swallows and worms, the flies and horses, bats and vipers, monkeys, grasshoppers and bears, together comprising a set classifiable according to modes of locomotion and

[773] Ibid., p. 69: ''Si un Animal a une ame qui ait la faculté de sentir & d'appercevoir, il faut que cette ame soit répandüe par tout le corps en telle sorte, que le même principe qui voit soit aussi le même que celui qui entend; que le même principe qui sent au pied, soit le même que celui qui sent à la tête & à toutes les autres parties du corps';

[774] Perrault, *Méchanique*, pp. 9-10: 'en sorte qu'on se peut promettre que la nature a dequoy donner à jamais de l'employ à cette noble curiosité, qui doit sembler dautant plus raisonnable que les animaux estant le principal heritage dont Dieu a mis l'homme en possession aprés l'avoir crée, il est juste que nous soyons informez de la nature & de la quantitez des biens qui nous appartiennent; & ce nous est même un devoir que de rendre au premier autheur de tous nos biens du moins cette espece de reconnoissance, que de ne vouloir pas ignorer en combien de differentes manieres nous sommes redevables à sa bonté, qui a bien voulu pour orner & enrichir ses dons, y employer sa puissance & sa sagesse infinie'.

[775] Ibid., pp. 8-9: 'il n'y a guere que celles [les causes naturelles] des actions des animaux qui puissent estre connuës bien clairement, la nature y employant des machines qui se peuvent demonter par le moyen de la dissection qui en fait voir toutes les pieces distinctement & separement: au lieu que l'analyse des autres estres ne fait jamais rien voir que de confus'.

[776] Ibid., p. 13.

nutrition, for example, but also according to the respective animal's main characteristics.[777]

Natural history was, in this sense, metaphysically uncomplicated. After all, the observation of anatomical form was an age-old practice, and the scientific curiosity which led to it needed no justification. In turn, however, it did lead to difficult questions about the causes, origins and functions of anatomical structures, reflected, for example, in the frequent combination of 'rationalist' (Galenic) with empirical medical theory. Where the causes of symptoms could not be observed empirically, as someone like Thomas Sydenham thought they should be, they had to be inferred; humoural theory, in such cases, had great explanatory power.[778] In the realm of anatomical and physiological, rather than medical enquiry, these difficulties with regard to the relationship of form to function were exactly what a treatise such as Perrault's *Mechanique des animaux* aimed to address. His goal, he wrote, was to

> explain through mechanism the main functions [i.e. movement, sensation and vegetative functions] of animals, by showing how nature gave each one, according to its species, different means of finding out, through their senses, what is good or bad for them; of going after or fleeing those things, through motion; and of staying alive through nutrition.[779]

And so, to the question that he himself posed, of *why* the sense of touch was different for each organ, and was harder to understand than were telescope lenses, he answered by positing a functional symmetry between, in this case, the machines's lenses and the eyes of a living creature: 'what the lenses do in the telescope, the humors do in the eye', he wrote:

> The tube, blackened within, acts like the choroid, which is a black membrane built in such a way that it stops light from the sides; the diaphragm is pierced with a hole smaller in diameter than the tube, and has the same effect as the edge of the choroid, which makes up the pupil'.

Even the capacity of the telescope to be lengthened or shortened according to the distance of the object under observation was similar to the way in which the eye's

[777] Ibid., pp. 11-13.
[778] See Wear, 'Continuity and union', in French and Wear, ed. *Medical Revolution*, pp. 294-320.
[779] Perrault, *Méchanique*, p. 15: 'expliquer par la mechanique les principales fonctions des animaux, en faisant voir comment la nature a donné à chacun selon son espece des moyens differens de connoistre ce qui leur est propre ou contraire par les Sens; de le chercher ou de le fuïr par le Mouvement; & d'en entretenir leur vie par les actions de la Nourriture'.

muscles, by contracting or relaxing, could set the distance between retina and crystalline, according to need.[780]

Mechanistic accounts of perception were useful because they were reductionist in form; furthermore, they integrated teleological principles and were self-justifying. Mechanical processes, wrote Perrault, consisted 'of two things: either they facilitate the movement of bodies, or they delay it when needed'. The perception of sound, for example, operated through both of these processes[781] - Perrault would devote the entire second volume of his *Essais de physique* to the matter of sound, enquiring into its nature, the modalities of its perception and the structure of the ear.[782] Similarly, the quality of vision in animals seemed to depend on how dark the environment of the eye was; and this in turn had something to do with the density of blood, itself a function of the amount and opacity of solid particles (of food and other substances) it harboured.[783] In instances such as this one, a mixture of corpuscularianism, iatrochemistry, mechanism and traditional Hippocratic-Galenic medicine helped derive theories of function from the observation of disparate features of anatomy and physiology. These features had to be read within a finalist framework, that is, within a picture of the body as an intelligently designed, organic entity whose every part must fit with the others - anatomizing the body in order to understand it made sense only insofar as it could be put together again. The same applied to the brain: the determination of brain function depended on assumptions about the material basis of cognition in such a way that finalism was intrinsic to the picture. This is why Steno's point that we had to acknowledge the depths of our ignorance about souls and brains before even thinking of moving forward was so remarkable. But Perrault, too, was aware that the very nature of the subject made

[780] Ibid., p. 45: 'Car ce que les verres font dans les Lunettes, les humeurs le font dans l'œil. Le tuyau noircy par le dedans tient lieu de la choroïde, qui est une membrane noire faite pour empescher la lumiere collaterale; le diaphragme percé d'un trou plus petit que le tuyau, fait le mesme effet que le rebord de la choroïde qui forme la prunelle; le ligament Ciliaire qui soustient le Crystallin est au lieu de la virolle qui soustient le verre. Enfin la disposition que l'on donne à la Lunette pour estre alongée & acourcie selon l'éloignement different des choses que l'on veut voir, n'est que l'imitation de la faculté qu'a l'œil estant alongé par la compression de ses muscles, ou acourcy par leur relaschement, d'aprocher plus ou moins le Crystallin de la retine, pour le mettre dans la distance requise pour faire que le foyer du Crystallin se rencontre à la surface de cette tunique'.

[781] Ibid., pp. 29-30; and p. 46: 'Car comme toute la Mechanique consiste en deux choses qui sont ou de rendre le mouvement des corps plus aisé, ou de le retarder quand il en est besoin; nous voyons que pour la sensation de l'organe de l'ouïe, la nature employe l'un & l'autre de ces moyens'.

[782] Perrault, *Essais de physique, Ou Recueil de plusieurs traitez touchant les choses naturelles*, II: *Du bruit* (Paris, 1680). Henceforth, *Du bruit*.

[783] Perrault, *Mechanique*, pp. 33-35.

many people reticent to pay attention to scientific accounts of the 'functions of the soul's sensitive powers'; as he saw it, these seemed available to introspection, and not really explainable on the same level as the objects of physics.[784]

The established, *a priori* starting position with regard to sense perceptionwas that spirits became agitated upon the reception of nerve-mediated signals from external objects and communicated this agitation to the appropriate parts of the brain. There were variations on the theme, of course, according to the dominant school of thought. But the model, which measured its success in terms of a new kind of realism, was in itself the product of a complex, fragile mix, neither properly 'modern' nor purely 'ancient', at once fixed and evolving. Perrault accepted that, since 'the soul is united with the body, it has its main seat in the most important parts'. This meant that, lodged in the brain, the soul saw to

> the functions of the internal senses, because that part [the brain] is connected to all the organs of the external senses via the nerves, which ensure that the emotion caused in the organ by the objects is communicated to the brain, either through canals of sorts through which the light and mobile substance of the spirits transports this same emotion which the nerves received in the organs: or the very webs which make up the nerves, after having been agitated by the objects, cause a similar emotion in the brain.[785]

The relation between a cognitive event and a presumed, corresponding event at the 'micro' level was here posited with graphic literalness. The anatomist was not searching for the spirits, just for proofs of their passage. These proofs could be found both in the mental and physical events they caused, and in the brain's well-analysed anatomical structures. Again, they would not by themselves *establish* how the former and the latter were related. It was an - implicit - given from the outset that the relation between the two was on some level causal, and that analysing the one shed light on the other. Perrault argued, on the basis of detailed observation, that the very

[784] Perrault, *Du bruit*, p. 261: 'personne ne presume qu'on luy puisse rien dire de nouveau touchant ce qui appartient aux fonctions des puissances sensitives de l'ame, sur lesquelles on est persuadé que chacun peut aisement en peu de temps, faire toutes les reflexions necessaires à l'entiere & parfaite connoissance qu'il est possible d'en avoir'.

[785] Ibid., pp. 262-263: 'L'opinion commune est que l'ame estant unie avec le corps, elle a son siege principal dans les parties les plus importantes, & que dans le cerveau elle vaque aux fonctions des sens interieurs, parce que cette partie a liaison avec tous les organes des sens exterieurs par les nerfs, qui font que l'émotion causée dans l'organe par les objets, se communique au cerveau, soit comme par des canaux par lesquels la substance legere & mobile des esprits porte au dedans cette mesme émotion que les nerfs ont reçuë dans les organes: soit que les filets mesmes dont les nerfs sont composez, aprés avoir esté ébranlez par les objets causent une pareille émotion dans le cerveau'.

ability of internal and external senses to respond to stimuli also meant that they could protect themselves against impacts that were excessively strong or inappropriate. Nature had 'invented' means - 'machines', as he put it - which ensured the right balance between the sensitivity of the sense organs and their safety.[786] To this was added the impressive way in which organs were specialised and built to execute their respective function. Sight and hearing remained separate from the other three senses in that their 'objects are such that it is not necessary for their species to be united, because, since all the parts of the object are similar, it does not send different species, and each part of the species contains the entire species of the object'.[787]

Sense objects were what they were, objects of the senses, specifically because the organs of sense were designed to modulate impacts from the outside through a modality each time adapted to both the object and the organ.[788] They were what made the world knowable, or, to put it in other words, they were inherent in the world's knowability. The measure of the capacity of animals and humans to perceive their environment was, precisely, the structure of their sense organs. The very possibility of investigating sense organs and anatomical structures entailed the belief that an initial scepticism about the capacity of the senses to provide true information was not necessary for the establishment of epistemological certainty, as it had been for Descartes, and could only remain a theoretical premise. It was thus observation, rather than introspection, that undermined the use an anatomist might have for the exercise of Cartesian doubt. At the same time, the notion that living bodies were perfectly, divinely adapted to their environment was posited *a priori* - and therefore proven, rather than revealed, by observation. The very existence of the world and the uniformity and complexity of nature could be, to a convinced atomist like Walter Charleton for example, proof enough that they were a divine creation.[789] While the action of one body upon the other must necessarily be caused by 'Mediate, or

[786] Perrault, *Mechanique*, p. 43.
[787] Ibid., p. 50: 'ces deux sens sont differens des trois dont les objets sont tels qu'il n'est pas necessaire que leurs especes soient reünies, parce que toutes les parties de l'objet estant semblables il n'envoye point des especes differentes, & chaque partie de l'espece contient toute l'espece de l'objet'.
[788] Ibid., p. 46, where Perrault talks of 'la maniere par laquelle les organes de la vüe rendent ses objets sensibles'.
[789] See Robert Hugh Kargon, 'Introduction', in Charleton, *Physiologia Epicuro-Gassendo-Charltoniana: Or a Fabrick of Science Natural, Upon the Hypothesis of Atoms, Founded, Repaired, Augmented by Epicurus, Petrus Gassendus, Walter Charleton* (London 1654; facsimile reprint reprint New York and London), 1966, pp. xiii-xxv, at p. xx.

Immediate' contact,[790] the complexity of the atomistic universe quite simply entailed the lingering presence of the divine artificer. This is an instance and a source of the tension between a very modern, objectifying, 'scientific' attention to biological detail on the one hand, and the continuing belief that such data, however extraordinary, must necessarily have their place within a divinely created natural order, on the other. The resort to mechanistic explanations of movement and perception fit very well within a definition of nature as perfectly regulated. Natural mechanisms remained safe even where the wonder of nature surprised; and so, however intolerable might seem Descartes's identification of beasts with automata, it did not really contradict the basic assumptions of those who rejected that conclusion but who were nevertheless inclined to refer to the bodies they studied as - admirable - 'machines'.[791]

It was very useful to believe in the - respectably seasoned - idea that to study the body, one had to understand it as a machine. Descartes had explicitly defined his automaton as a model. But those, like Willis, Duncan, Perrault and Fontenelle, who actually identified nature with the best sort of artifice or machine, and God with the best architect, were in possession of a good alibi for their very real ignorance of how the body and brain functioned - as Steno had lucidly pointed out, though without rejecting the idea of the machine analogy. This alibi, by facilitaing the validation and perpetuation of mechanistic accounts of the functions of the corporeal soul, would eventually be used in the case of functions - the exercise of reason and free-willed action - traditionally allocated to the rational soul and, up until then, considered mainly within the ambit of ethical or theological treatises, though associated, too, with the brain. In such cases, as we shall see, there emerged near-materialistic theories of the soul, for which it was acceptable to use *dispositional* accounts of intentional action without embracing Cartesian dualism in its pure state.[792]

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[790] Charleton, *Physiologia*, p. 343.

[791] See, e.g., Guido Giglioni, 'Automata Compared: Boyle, Leibniz and the Debate on the Notion of Life and Mind', *British Journal of the History of Philosophy*, 3, 1995, pp. 249-278.

[792] For Descartes and Cartesians, animal action was a function of the 'disposition' of organs: see above, pp. 92, 175. Mary Midgley, in her *Beast and Man: The Roots of Human Nature* (London, 1979, revised 1995), pp. 210-212, attacks Descartes's automaton thesis, his belief that the organs' disposition could suffice to explain action, and his reduction of animal action to organic disposition, arguing that reasons must precede causes in an account of intentional action. Reason might well be a universal tool, but, she writes, 'to have a universal tool is, of course, not the same thing as using it universally'.

Comprehension of how animal spirits travelled in the blood was bound to depend on an understanding of how the networking of veins and arteries was configured, given the direct correspondence between anatomical vision and physiological function. These animal spirits were usually explanatory of most functions of the corporeal soul; but their relation to the organs - such as veins, arteries and brains - in and through which they acted was far from clear. Willis had explained the function of the so-called arterial anastomosis, a circular group of arteries at the base of the brain, later named after him: it was in charge, as he established, of ensuring blood supply to the brain, and for long it had been confused with the *rete mirabile*, present, as it turned out, in all but human brains, and first described by Herophilus, before Galen integrated it into his physiology.[793] In Willis's time, though slightly earlier, it had been analysed in further detail by the Swiss anatomist, physician and pharmacologist Johann Jakob Wepfer (1620-1695).[794] Close attention, after Harvey, to the circulatory system, helped make sense of the observable anatomy of cerebral structures and derive some grounded hypotheses about their physiological functions. And after Steno, the notion that the white matter was in fact replete with micro-structures helped Willis suggest precise trajectories for the animal spirits, and thus served as a direct basis for his theory of the relation between imagination, memory and common sense.[795]

Yet, while the notion prevailed that the body's motor and sensory activities must correspond to localized activities at the 'micro' level, in specific parts of the body, and especially the brain, it did not help elucidate what an *explanation* of these activities of the corporeal soul might look like. This is why Willis's insistence on ascribing specifically defined mental functions - those pertaining to the rational soul - to specific parts of the brain was upsetting to Steno. Willis, like him, had rejected the Cartesian notion that the rational soul was housed in the pineal gland, on the grounds that it was large in beasts, who were devoid of such a soul.[796] Yet, as we have seen, he simply transferred it elsewhere in the brain, associating its functions to

[793] See Edwin Clarke and Kenneth Dewhurst, *An illustrated History of Brain Function* (Oxford, 1972).
[794] See Clarke and O'Malley, *Human Brain and Spinal Cord*, pp. 769-779: pp. 775-779 for relevant sections from Willis's *Cerebri Anatome*, and pp. 770-775 for selected passages from Wepfer's *Observationes anatomicae ex cadaveribus eorum quos sustulit apoplexia* (Schaffhausen, 1658).
[795] See Johns, *Nature of the Book*, p. 395. But Willis's ideas are here discussed without any reference to Steno's influence.
[796] See above, pp. 166, 170-171; and see Bynum, 'Anatomical Method', p. 456.

those of the imagination, which in his view was located in the corpus callosum, as Steno had reported. Daniel Duncan gave different, but equally straightforward anatomical reasons for rejecting Descartes's thesis: the *septum lucidum*, he wrote, was delicate, and thus

> more susceptible to the motions that the nerves or spirits, once struck by objects, must impart to that part in which lies the soul; whereas the pineal gland, attached as it is to the extended marrow by a large number of vessels, is incapable of such motions.[797]

And he spoke of the 'pineal gland, rotten and as big as a nut, that, in Montpellier, I saw being taken out of the head of a woman who had reasoned perfectly well until her death',[798] proof enough that the pineal gland had nothing at all to do with reason. The inference seems rather paradoxical - if the pineal gland had nothing to do with reason, then its physical state would not reveal anything about the state of a person's rational soul in the first place - but it illustrates vividly how the idea of associating a mental function with a physical location ended up highlighting the extent to which the actual functions one could attribute to the rational soul were ill-defined.

According to William Bynum, this resulted in part from Willis's functionalism with regard to anatomy: 'the kind of structure/function analysis which Willis used', he writes, 'could not accommodate (in the absence of unique neurologic structures) the qualitative physiological differences which he postulated to exist between men and animals',[799] since there were 'no unique structures in the human brain in which the peculiar human capacities of language, reason, and moral judgment could be located'.[800] There were few visible differences between human and other mammalian brains. The cerebellum, especially, was revealed by Willis's dissections to be relatively constant in form from one animal to the other, and from human to animal; he therefore thought that it probably corresponded to faculties which did not involve free will. The cerebrum varied more and was thus more likely to be the seat of higher, human mental functions. But these functions turned out in

[797] Duncan, *Explication nouvelle*, pp. 26-27: 'la délicatesse du *septum lucidum* le rend plus susceptible de tous les divers ébranlemens, que les nerfs ou les esprits frapez par les objets, doivent imprimer à cette partie qui est le siège de l'âme; au lieu que la glande Pineale estant attachée à la moële alongée par quantité de vaisseaux, est incapable de ces ébranlemens'.
[798] Ibid., p. 27: 'la glande Pinéale pourrie & grosse comme une noix, que j'ay vû tirer à Montpellier de la tête d'une femme qui avait fort bien raisonné jusques à sa mort'.
[799] Bynum, 'Anatomical method', p. 458.
[800] Ibid., p. 453.

Willis's system to be conditioned in part by the association of the cerebrum with imagination and memory, and thus dependent on the sensitive soul, which alone was amenable to anatomical observation and physiological analysis: 'as to all its Powers and Exercises of them', he wrote, it was 'truly within the Head, as well as in the nervous System, meerly Organical, and so extended, and after a manner Corporeal'.[801] Man's rational functions, in this picture, had no clear allocation and were postulated rather than identified - they both separated man from beast and ensured a continuity between the two. The assumption remained, as Bynum has stressed, that the nervous system of humans, though close to that of many animals, was sufficiently different to suggest the existence of some physiological basis for the rational soul; and this assumption posed difficulties for the theologically necessary, but contradictory, hypothesis that the rational soul had no material basis. The criticism levelled from the very beginning at Descartes's dualism - that an immaterial soul could hardly have a material home and interact with the physical body - became the very source of difficulties for anatomists who sought to steer a commonsense course between dogmatic system and empirical method.

Speculations about the functioning of living organisms thus relied on the Galenic notion that form and function were correlated. Man-made machines such as the one Descartes had imagined in his *Traité de l'homme* were characterized by a transparency of function. His automaton allowed Descartes to feel justified in relying on what seemed an exhaustive, mechanistic account of the artificial, 'zombie'-like body[802] in order to claim that our understanding of function could be entirely derived from both visible and invisible form.[803] Finalism with regard to structure was inherent within the mechanized, man-made automaton's body: it was precisely what drove its design. By contrast, living creatures, created by God, were not entirely transparent to the human gaze, and if they were necessarily perfect in design, this perfection could only be *ascribed* to them. The space left for the natural philosopher's speculations about the functioning of the body was thus as great as that filled by these mechanistic accounts, and, as we have seen so far, the one determined the shape of the other.

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[801] Willis, *The Soul of Brutes*, p. 27.
[802] See above, p. 83.
[803] See Thierry Gontier, 'Les animaux-machines chez Descartes: modèle ou réalité?', *Corpus*, 16-17: *L'âme des bêtes* (Paris, 1991), esp. pp. 6-8.

What one finds, then, in the accounts of dissections and of the corporeal soul discussed here is a general acknowledgement that a gap remained between observable form, on the one hand, and motor and sensory functions, on the other. Observation yielded information about form, but did not guarantee a constant correlation with presumed function because no direct interpretation of visible organs was available. Senses and movements might be mechanizable, and partly explicable via chemistry, physics, and humoural theory. Yet, however identifiable, such mechanisms did not fit in with accounts of action and cognition whose purpose was to place the otherwise obvious connection between active body and willful, conscious soul onto a descriptive rather than metaphysical plane. The teleological subtext of the investigation of the body remained, in that anatomical structures continued to be understood *a priori* as the work of a divine designer. But teleology was no longer a helpful tool in the actual disciplines of anatomy and physiology. While the inherited, and deeply rooted, notion that function supervened on form would not simply vanish into thin air, the realization grew that there were no criteria - external to observation itself - with which to guarantee the truth-value of the attribution of sensory or motor function to organ.[804] It became clear to the physicians and experimentalists at the forefront of work in the new sciences that arguments from natural theology had rhetorical rather than explanatory value with regard to the natural creatures whose perfect anatomies they praised. It was fine to admire how functional, say, the eyes were. But that was not really the point of anatomy, which - according to a *Journal des Sçavans* reviewer of a 'modern' medical treatise by one John Rogers - at its best might show what 'actions happen inside our body' as much for the sake 'of the propagation of the species as for the conservation of the individual'.[805] Finalism played a minor part in the elucidation of what a specific organ was 'for', simply because whatever connection existed between secondary and final causes had only a limited purchase on properly 'scientific' activities - whether

[804] See Bynum, 'Anatomical Method', pp. 445-447.
[805] *Journal des Sçavans*, 1665: review of *Analecta inauguralia, sive disceptationes medicae Doctoris Ioannis Rogersis* (London, 1664), pp. 65-66. John Rogers's attraction to novelty, thought the reviewer, might seem suspect. Yet, he wrote (p. 66), 'il faut avoüer que ce livre est docte, sçavant & subtil … traite des actions qui se font dans notre corps; tant pour la propagation de l'espece, que pour la conservation de l'individu'. Rogers adopted elements from Harvey, Glisson, Descartes and Regius in his explanation of the body's concocting activities, which included 'chylosis', 'chymosis', 'haematosis', 'pneumatosis', and 'spermatosis'.

these partook of the mechanistic or the iatrochemical school, and whether one favoured Gassendi over Descartes, or the other way round.[806]

Certainly, the eye continued to look for order in anatomized bodies - one which could be validated by testimony and reproduced two-dimensionally, or diagrammatically - where only the mess of tissue, organs and blood was discernible.[807] The living human body obeyed laws of physics, just like any other body. In the words of the (anti-Royalist) physician Thomas Sydenham, it 'is so framed by Nature, that by reason of a continual flux of Particles, and the force of external things, it cannot always continue the same'.[808] But faced with this constantly changing body - ageing, pregnant, ailing, gasping, sweating - its secretions and humours, animal spirits and sundry liquours, the hands-on physician could not have found much use in the automaton analogy, which, in the end, was as regular, clean and disembodied as were the criteria it was supposed to set for a new, scientific definition of life.[809] It was clear that 'speculative theorems doe as little advantage the physick as food of men', as Sydenham put it, since 'true knowledge grew first in the world by experience and rationall operations'.[810] And indeed, once one had chosen to focus on the body's fluid contents rather than on its solid structure,[811] and on the 'particles' responsible for bodily events and cognition, the notion of the automaton ceased to be of any use at all. To resort to an artificial model of cognitive processes, as did Descartes, in order to pave the way towards a new science of man, was exactly what the professedly sceptical natural philosopher could not afford to do: nature

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[806] For an analysis of the survival and role of final causes in the seventeenth century, and in particular in Gassendi, see Margaret J. Osler, 'Renaissance humanism, lingering Aristotelianism and the new natural philosophy: Gassendi on final causes', in Kraye and Stone, *Humanism and Early Modern Philosophy*, pp. 193-208.

[807] See Steno, *Discours sur l'anatomie*, pp. 51-52, on the necessity of establishing 'des figures justes & fideles' of the parts of the brain revealed by dissections when these are properly executed. For a reliable outline of the history of anatomical illustration, see K. B. Roberts and J. D. W. Tomlinson, *The Fabric of the Body: European Traditions of Anatomical Illustration* (Oxford, 1992), p. 248, which shows convincingly that 'theories of use can impose an interpretation on anatomical structures', but also that 'the idea of progress in anatomy is not a whiggish interpretative imposition on the history of that science, not an opinion, but a reality, demonstrable by comparison of illustrations with the actual structures to be seen in dissection'.

[808] Thomas Sydenham, *The Whole Works* (London, 1696), 'Author's Preface'.

[809] See Sawday, *The Body Emblazoned*, p. 130, for a similar point about the inability of any model of the body, mechanical or Galenic, to be of use 'to a practical anatomist when he stood before a corpse, fresh from the gallows, surrounded by an expectant audience'. The body, quite simply, decomposed too quickly for the increasingly detailed investigations of anatomists to be carried out.

[810] Sydenham, *De arte medica* or *Ars medica* (London, 1669), in *Dr. Thomas Sydenham (1624-1689): his Life and Original Writings*, ed. Kenneth Dewhurst (London, 1966), pp. 79-84, at p. 81.

[811] See Dewhurst's 'Introduction to 'Sydenham's Original Writings', ibid., p. 74.

itself remained his realm of investigation.[812] To Sydenham, disease, for example, was 'but a confused and disordered effort of Nature thrown down from her proper state, and defending herself in vain'.[813] Descartes's model of mind, as we have seen, had been expressly designed as a solution to the sceptic's metaphysical doubt; but it was of no assistance to those who spent more time looking at the visible physical body, including the brain's structures, than speculating about the soul's invisible functions. Sydenham, a gout sufferer, knew all too well that a disease must be observed via the cataloguing of particular symptoms; principles were of little help.[814] He condemned in 'proud man' the inclination

> to penetrate into the hidden causes of things, lay downe principles and establish maximes to him self about the operations of nature, and then vainely expect that Nature, or in truth God him self, should proceede according to those laws his maximes had presribed him.[815]

Moreover, while it was possible to stipulate that action, sensation and movement were correlated with thought and higher mental functions, a credible theory was needed with which to derive these functions - on an ocular basis alone - from a spatially extended organ like the brain. It would have to be an alternative to Cartesian mentalism, since, even on a functionally, let alone ontologically, dual picture of soul or self, introspective thought could not be the sole basis for knowledge of the physical dimension of movement, perception and general representations. A system such as the Cartesian one could, however, still be of use to anatomists to the extent that it provided both a metaphysical framework and an epistemological methodology for enquiry. In his 'Eloge de Monsieur Tauvry', for example, Fontenelle praised the physician Tauvry (who had been inducted by Fontenelle into the Académie des Sciences before his untimely death, aged just over 31, in 1701) for the 'great knowledge he had of Anatomy, to which was allied the

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[812] The automaton analogy, however, has its roots in the earlier 'homunculus', itself a product, from Aristotle onwards, of the relationship between 'art' and 'nature'. The fortune of the homunculus is well analysed in William Newman, 'The Homunculus and His Forebears: Wonders of Art and Nature', in Anthony Grafton and Nancy Siraisi, ed., *Natural Particulars: Nature and the Disciplines in Renaissance Europe* (Cambridge, Mass. and London, 1999), pp. 321-345.
[813] Quoted by Dewhurst in *Dr. Thomas Sydenham*, 'Theoretical Influences', p. 63.
[814] See R. T. Gunther, *Early Science in Oxford*, 15 vols., III, Part I: *The Biological Sciences* (Oxford, 1925), 'Sydenham on Gout', p. 53.
[815] Sydenham, *De arte medica*, pp. 81-82.

talent to imagine successfully the use of structures; and in general he had a gift for system'.[816]

Nevertheless, it remained true that the use of a metaphysical or methodological system in the processing of data yielded by observation-based experiment was much less attractive than the praise for the actual activity of investigating nature's profound complexities. Cartesianism was vulnerable to criticism precisely because it was a system.[817] Perrault preferred to combine systems, moderating the dogmas of mechanism while steering clear of what he considered the hypocritical professions of ignorance of those who, no less dogmatically, opposed the new philosophy.[818] Nature's beauty consisted in its very diversity, he wrote, and just as a garden would not be more worthy of admiration for containing only roses, so

> the value of a variety of systems, some of which might be more probable than others, is higher than that of one sole, highly probable system; for there is no one system that is probable enough to resolve all the difficulties encountered in the course of investigating nature's secrets'.[819]

What one system could not explain might be explained by another, he went on, which in turn might require the hypotheses of yet another, and so on, for 'systems will succeed one another as long as the world lasts, and as long as considerations brought about by different phenomena generate new systems'.[820] Perrault was well aware of the boundary within which hypotheses and theories were valid; but to him

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[816] Fontenelle, 'Eloge de Monsieur Tauvry', in *Histoire du renouvellement de l'Academie royale des Sciences en 1699, et les éloges historiques de tous les académiciens morts depuis ce renouvellement, avec un discours préliminaire sur l'utilité des mathématiques et de la physique* (Paris, 1708), p. 78: 'A la grande connaissance qu'il avait de l'Anatomie, il joignait le talent d'imaginer heureusement les usages des structures, & en general il avait le don du Systême'.

[817] This is explicit, for example, in the stylishly ironic critique of Descartes, *Voyage du monde de Descartes* (Paris, 1691), by the Jesuit Gabriel Daniel - appointed by Louis XIV to write the history of France (the work, first published during the early eighteenth century, eventually comprised seventeen volumes).

[818] Perrault, *Mechanique*, pp. 3-4.

[819] Ibid., p. 6: 'Que la beauté de cette Philosophie & mesme que celle de la Nature consiste dans la diversité; & que comme on n'estimeroit pas davantage un jardin pour n'avoir point d'autres fleurs que des roses, on peut dire que plusieurs Systemes probables les uns plus que les autres, valent mieux que le plus probable tout seul; car enfin il n'y en sauroit avoir qui le soit assez pour resoudre toutes les difficultez qui se rencontrent dans la recherche des secrets de la nature'.

[820] Ibid.: 'il faut necessairement pour satisfaire ce desir de savoir qui nous est si naturel, que ce dont on ne sauroit trouver la raison dans un Systeme s'explique par ujn autre, dans lequel il est impossible qu'il n'y ait encore des choses incapables d'estre éclaircies que par les hypotheses d'un troisiéme; & ainsi supposer que tant que le monde durera, les Systemes se succederont, selon que les reflexions faites sur des differens Phenomenes donneront occasion à en inventer de nouveaux; sans que l'on puisse esperer de jamais découvrir le veritable'.

their circumscribed nature seems to have been a logical rather than a metaphysical fact. That theories were by nature incomplete did not have to hold back enquiry. On the contrary, it was only by acknowledging such incompleteness that enquiry could make any sense and that theories, indeed, could be made use of as theories at all.

On both sides of the Channel, the scientific academies of the post-1660s embodied a new, mid-way position between, on the one hand, Cartesianism or atomism, and, on the other, the scepticism discussed in the preceding chapter, according to which nature's mechanical laws coexisted quite straightforwardly with the unaccounted mysteries of creation. At the purely pragmatic level of offering a viable explanation for puzzling biological facts - like the capacity of ants, to take Perrault's example again, of finding sugar from a great distance - the analysis of anatomical structures avowedly did little. At another, more general level, it remained a given that our epistemic relation to the natural world was not exhausted by our capacity to infer natural causes from observed natural phenomena. The great Dutch naturalist and physiologist Jan Swammerdam (1637-1680) - not himself a member of any of the French or English academies - wrote, in the conclusion to *The Book of Nature; Or, The History of Insects*, that:

> God's works are governed by the same rules; and as the true and primitive origins of them are infinitely beyond the reach of our comprehension, so that we cannot be said to know more than the bare outlines of that infinite Being's image, to whom they owe their existence; so I may hence, for certain, conclude, that all the knowldege and wisdom of philosophers, consists merely in an accurate perception of these elegant appearances or effects, which are produced by first causes, and are often themselves, in their turn, the causes of other effects.[821]

The notion prevailed that the regularity of nature's laws and the infinite variety of its creations were manifestations of divine construction. There was also an infinite grandness to causality and the finite order of reasons, as well as a necessity for man's boundless ignorance of final causes. As an exponent of empiricism in the medical arts, Sydenham was, unsurprisingly, a firm defender of the notion that the scholastic

[821] Jan Swammerdam, *The Book of Nature; Or, The History of Insects: Reduced to distinct Classes, confirmed by particular Instances, Displayed in the Anatomical Analysis of many Species, and illustrated with copper-plates, including the generation of the frog, the history of ephemerus, the changes of the flies, butterflies, and beetles; with the original discovery of the milk-vessels of the cuttle-fish, and many other curious particulars. With the life of the author by Herman Boerhaave,*

love of totalising systems bred ignorance.[822] The search for proximate mechanisms - within the realm of what we would term 'life sciences' - could thus go along with the abandonment of natural theological arguments as useful tools for the immediate investigation of nature, causal processes and the order of reasons. This, as we saw in Part I, Chapter 2, did not mean that the natural theological 'tendency' disappeared, since mechanistic explanations themselves could point to God's greatness. To Fénelon, for example, 'the whole of nature demonstrates the infinite art of its author. When I speak of an art, I mean the assemblage of means chosen on purpose for the accomplishment of a precise end'. The universe most clearly must have been designed by 'an infinitely powerful and industrious cause',[823] not by blind, necessary chance; and this idea of a divine architect of nature was, of course, widespread. But the reverse was not true: the investigation of nature and of the human body did not necessarily illustrate or bolster a finalist metaphysics. God had created the universe but secondary causes - the physician Daniel Sennert, a contemporary of J. B. Van Helmont, had already suggested as much in his *Hypomnemata physica* of 1636[824] - were not ruled directly by divine law. The study of movement, perception and cognition therefore had to rely explicitly on a dissociation of visible bodies from the higher, specifically human, immaterial, immortal soul. Comparative anatomy - the cross-species studies of organs, which had already been invaluable to Harvey's

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M.D., trans. from the Dutch and Latin by Thomas Flloyd (London, 1758); the original work was published in Utrecht, 1669.

[822] In what can easily be read as a plea against any form of 'dogmatic' knowledge, Sydenham wrote in *De arte medica*, p. 82: 'Whereas his [man's] narrow weake facultys could reach noe farther then the observation and memory of some few effects produced by visible and externall causes but in a way utterly out of the reach of his apprehension, it being perhaps noe absurdity to thinke that this great and curious fabrique of the world the workmanship of the almighty cannot be perfectly comprehended by any understanding but his that made it, man still affecting something of a deity laboured to make his imagination supply what his observation failed him'. See also Jacques Roger, *Les sciences de la vie*, pp. 252-253.

[823] Fénelon, *Traité de l'existence et des attributs de Dieu* (Paris, 1820), p. 5: 'Mais enfin toute la nature montre l'art infini de son auteur. Quand je parle d'un art, je veux dire un assemblage de moyens choisis tout exprès pour parvenir à une fin précise: c'est un ordre, un arrangement, une industrie, un dessein suivi. Le hasard est tout au contraire une cause aveugle et nécessaire, qui ne prépare, qui n'arrange, qui ne choisit rien, et qui n'a ni volonté ni intelligence. Or je soutiens que l'univers porte le caractère d'une cause infiniment puissante et industrieuse. Je soutiens que le hasard, c'est-à-dire le concours aveugle et fortuit des causes nécessaires et privées de raison, ne peut avoir formé ce tout'.

[824] See Jacques Roger's discussion in *Sciences de la vie*, pp. 106-111.

work[825] - could be practiced precisely because it made sense to believe that nature was created in a unified way, by one creator.[826]

But, as we have seen, comparative anatomy played an increasingly crucial role in the functional analysis of precise bodily structures. Dissections were highly fashionable in the Paris, London, Leiden and Florence of the latter half of the 1600s, though the minute observation of the natural realm was also considered by Cartesians like Fontenelle and Fenelon, as well as Robert Boyle[827] and John Ray, to be something of a moral or religious, and consequently social or political, *duty*. It remained, though, that the knowledge yielded by empirical study was discrete, and only secondarily, if at all, systematizable. Looking at the dissected body did not in itself yield a fully agreed-on picture of how heart, lung, brain and muscle functioned, of what it was that flowed within the folds and parts of tissue that constituted them, or of what travelled within the nerves that seemed to connect those parts. As Walter Charleton put it, fellows of the London Royal College of Physicians, through their dissection practices,

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[825] For an authoritative study of the subject see F. J. Cole, *A History of Comparative Anatomy* (London, 1944). On the issue discussed here see also Roger, *Les sciences de la vie*, pp. 209-210, and Bynum, 'Anatomical Method', who writes, p. 451, that Harvey tended to use comparative anatomy mostly as 'an elaboration of what he could show from a single species', rather than as a way of correlating 'the differences in function with interspecific variations in the structures of analogous parts'.

[826] It is worth quoting this statement of Fontenelle from the 'Preface sur l'utilité des mathematiques et de la physique, et sur les travaux de l'Academie des Sciences' which precedes his *Histoire du renouvellement de l'Academie royale des Sciences*: 'Si la difference étonnante des mœurs & des opinions des Peuples, est si agréable à considerer, on étudie aussi avec un extrême plaisir la prodigieuse diversité de la structure des differentes especes d'Animaux par rapport à leurs differentes fonctions, aux élements où ils vivent, aux climats qu'ils habitent, aux alimens qu'ils doivent prendre, &c. … la Physique suit & démêle, autant qu'il est possible, les traces de l'Intelligence & de la Sagesse infinie qui a tout produit … Ce grand Ouvrage [l'Univers] toûjours plus merveilleux à mesure qu'il est plus connu, nous donne une si grande idée de son Ouvrier, que nous en sentons nôtre esprit accablé d'admiration, & de respect. Sur tout l'Astronomie, & l'Anatomie sont les deux Sciences qui nous offrent le plus sensiblement deux grands caracteres du Createur, l'une son immensité, par les distances, la grandeur, & le nombre des Corps celestes; l'autre, son intelligence infinie, par la Mechanique des Animaux. La veritable Physique s'éleve jusqu'à devenir une espece de Theologie'. Roger, in *Sciences de la vie*, refers to it as well, p. 232.

[827] Ernst Mayr, in *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Mass., 1982), p. 313, quotes Boyle: 'This philosophy… teaches that God, indeed, gave motion to matter. But that in the beginning, he so guided the various motions of the parts of it, as to contrive them into the world he designed they should compose, and established those rules of motion, and that order amongs things corporeal, which we call the laws of nature. Thus, the universe being once formed by God, and the laws of motion settled, and all upheld by his perpetual concourse, the general providence. The same philosophy teaches that the phenomena of the world are physically produced by the mechanical properties of the parts of matter; and that they operate upon one another according to mechanical laws'.

> may come to know, what is perfectly naturall, what preternatural, what rare and monstrous among the parts of them; And also what resemblance there is betwixt the Conformation of the parts in the body of Man, and those in the bodies of other Animals, ordained by Nature to the same, or like and equivalent uses. So that it will be hard for any man to bring thither any Fish, Bird, or Insect, whose Entrails these genuine Sons of Democritus are not already intimately acquainted with.[828]

The acknowledged difficulty of inferring with any certainty the 'micro' realm of physiology and function from the 'macro' realm of anatomy was an instance of the changing status, role and procedures of anatomical observation, indeed of the observation of nature generally. It was also a mark - in the context of prevailing versions of 'atomism' or 'corpuscularianism' - of the absence of any definite or defining account of the exact nature of 'atoms' and their equivalents. Surely, particles of various descriptions played certain roles, such as assuming the responsibility for the motion of all bodies and the sense perception of living organisms. But again, this was a postulate which did not actually bridge the gap between observation and theory.[829] Sprat, pointedly, would make clear in his *History of the Royal Society* that 'the substantial' of its meetings 'consists in *Directing*, *Judging*, *Conjecturing*, *Improving*, *Discoursing* upon *Experiments*'.[830] As we saw earlier, it was only by positing hypotheses that experimental data could be assigned any coherent meaning. While it was quite obvious that the presence of a structure implied a correlated function, not everyone agreed that functions could be safely or reasonably presumed to exist where structures were invisible.[831] The answer to whether they did or not was bound to be theoretical rather than empirical. But this answer inevitably - and here we return to the themes discussed in Part I, Chapter 2 - determined the sort of position one held with regard to the nature of the soul and of cognitive functions in living organisms other than humans, and therefore with regard to the very definition of life.

The move from the establishment of metaphysical foundations to anatomical modelling - and from the latter to the former - was ridden with conceptual difficulties. The body, once explained, could not reveal the secrets of the rational

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[828] Charleton, *Immortality of the Soul*, pp. 34-35.
[829] For an assessment of the sources and nature of early modern Democritean doctrine, see Christoph Lüthy, 'The Fourfold Democritus on the Stage of Early Modern Science', *Isis*, 91, 2000, pp. 443-479.
[830] Sprat, *History*, p. 95.

soul, packed with metaphysical baggage as the latter was. Nor was it ever assumed to do so, especially if one considered, as did Claude Perrault, that the soul which *could* be studied empirically was the very principle thanks to which animals, as well as humans, were capable of life (I shall return to this in the next chapter).[832] What was assumed, and what the anatomist was supposed to reveal, was a direct, causal correlation between basic motor, perceptual, or cognitive acts (including memory) and animal spirits - material substances whose movements provided a medically usable explanation of action and emotion. This explanatory scheme, however, did not amount to a belief in the complete reducibility of such acts to matter. The higher, essentially immaterial, non-cognitive functions associated with the rational soul could not themselves correspond to the activity of the atomists' corpuscles. The human body stood between the visible and the invisible; and it was as such an equivocal object of investigation that it was studied. Perrault believed that it was easier to know animal bodies than the heavens, for they lent themselves to precise study more readily than the inanimate objects considered by the other sciences.[833] Indeed, as he wrote,

> the admirable functions of animals are produced by instruments we can see, whose workings are known to us by experiments which, being for the most part of a mechanistic kind, are not equivocal and uncertain as are all the other ones used to guess the causes and behaviours of other beings.[834]

But for him, it was definitely a soul, invisible to the gaze, which governed the movements of, and the relations between, the organs that made up the corporeal 'machine' of both animals and humans.[835] This conception of the generically animal body as an admirable machine whose parts could be studied in detail suggests one reason why Galenic medicine survived ongoing developments in conceptions of the soul: it was a somatic theory that provoked no metaphysical uncertainties. Instead,

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[831] See Bynum, 'Anatomical Method', p. 453.
[832] Perrault, *Mechanique*, 'Avertissement', p. 1.
[833] Ibid., p. 7.
[834] Ibid., p. 8: 'les fonctions admirables des animaux sont produites par des instrumens que nous pouvons voir, & dont nous savons la maniere d'agir par des experiences, qui n'estant la pluspart prises que de la Mechanique, ne sont point equivoques et incertaines comme toutes les autres que l'on employe pour deviner les causes & la façon d'agir des autres Estres'.
[835] Ibid., p. 1.

relying on finalist assumptions with regard to the relation between function and structure in living organisms, it constituted a positive body of usable knowledge.[836]

The specifically 'modern' practitioner of anatomy, meanwhile, poised as he was between old traditions and new trends, between metaphysical concerns and scientific empiricism, had to posit as unknown some relations between form and function. This was similar to the way in which optical devices, revealing new astronomical and botanical worlds, helped to re-conceptualize what lay between the seen and the unseen, the known and the unknown. Fontenelle, who described this so well in the *Dialogue* discussed in the previous chapter, would also write in the 'Preface' to his *Histoire du renouvellement de l'Académie des Sciences*, at the turn of the century, that physics, 'which studies an object of boundless variety and fertility, will always find something to observe and occasions to enrich itself, and it has the advantage of never being a complete science'.[837] The body here came under the jurisdiction of physics (which could 'rise to become a kind of theology').[838] The human soul did not; but, as shall see now, naturalism was insidiously transforming it.

[836] The teleological tendency at its core was absent from the corpuscular, Epicurean school of biology. See Rob Iliffe, 'Rational artistry', *History of Science*, 36, 1998, pp. 329-357, at p. 334.
[837] Fontenelle, 'Preface sur l'utilité', in *Histoire*: 'la Physique qui contemple un objet d'une varieté & d'une fecondité sans bornes, trouvera toûjours des observations à faire, & des occasions de s'enrichir, & aura l'avantage de n'être jamais une science complette'.
[838] See full quotation above, p. 197, n. 141.

3. From sense to soul: God, reason, and human will

> *e purtuttavia le macchine fabbricate dall'uomo sono banali e affatto rudimentali, se paragonate agli organi della natura ed alla mobilità del senziente.*[839]

If there exists a specifically post-Cartesian theory of mind and cognition, one might describe it as an incidental outcome of a cross between the new, corpuscularian sciences, remnants of Aristotelianism and Hippocratic Galenism, humanist scepticism and the first whiffs of modern materialism. In an era for which 'neurologie'[840] was only tangentially a possible key to the analysis of mental functions, the relationship between ideas about human nature and the observation of the human (and animal) body was extremely confusing, and dependent upon the continued relegation of the rational soul to the realm of non-observable objects. It was also, inevitably, and as we have seen throughout these pages, a function of the view of nature prevalent among natural philosophers according to which *motion* was not inherent in matter, but was instead granted to it by God. Vitalist or proto-vitalist, and generally anti-Cartesian alternatives to this view, as formulated for example by John Ray, Nathaniel Culverwell[841] or the Cambridge Platonists Henry More and Ralph Cudworth, would only develop in France in the eighteenth century.[842] What was being established as a 'science of mind' bore little connection to a metaphysics for which, as was apparent for example in the debate on the souls of beasts, the examination of the relationship of the human soul to God served mainly to discuss the nature of substance and establish types or hierarchies of mind in nature. I shall attempt to show in this chapter that it was impossible to divorce the function of

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[839] Marcello Malpighi (1628-1694), 'Osservazione anatomica sull'organo esterno del tatto', in Marcello Malpighi, *Opere scelte*, ed. L. Belloni (Turin, 1967), pp. 129-152, at p. 142: 'and yet, man-made machines are banal and indeed rudimentary, if one compares them with the organs of nature and the mobility inherent in sentient beings.'

[840] Willis's spelling, at the end of *Cerebri Anatome* (Amsterdam, 1664), in the English translation, *The Anatomy of the Brain*, in *Dr. Willis's Practice of Physick, Being the whole Works of that Renowned and Famous Physician* (London, 1684), p. 111: 'we shall proceedto the remaining Task of our *Anatomy*, to wit, the *Neurologie* or of the *Nerves* in particular'; see also p. 148: 'To describe all the several pairs of the spinal Nerves, and to rehearse all their branchings, and to unfold the uses and actions of them, would be a work of an immense labour and trouble; and as this Neurologie cannot be learned nor understood without an exact knowledge of the Muscles, we may justly here forbear entering upon its particular institution'.

[841] Nathaniel Culverwell, *An Elegant and Learned Discourse Of The Light of Nature, With several other Treatises* (London, 1652), ed. Robert A. Greene and High MacCallum (Toronto, 1971).

[842] See Roger, *Sciences de la vie*, pp. 418-434, and in particular, from p. 419, his account of Jean Le Clerc, friend of Locke and in touch with Cudworth's daughter, Lady Masham, who abridged Ralph Cudworth's *True Intellectual System of the Universe* (London, 1678).

thinking from the immaterial, divinely instituted *res cogitans* without rejecting the notion of ultimate purposefulness in nature, and without adopting a naturalistic functionalism. A fully materialistic theory of mind - and thus an atheist form of the explanatory gap - like the one espoused, as we shall see, by Lamy, required exactly such a rejection.

There was ample room within this area of enquiry, however, for traditionally philosophical questions to flourish about the relationship of conscious awareness to the absence of it, of sense-perception to judgement, of automatic to willed action, of doubt to certainty, of emotional states to the reign of reason - and about the nature of rationality in general. To some extent, animal spirits helped to give materialistic accounts of most functions which could be identified as pertaining to an activity of the supposedly corporeal soul. But if the motions, emotions and very life of an organic, mortal body belonged to the realm of matter, no analysis of the corporeal soul, however strong the teleological slant, was able to mask successfully the explanatory gap left by the identification of the uniquely human with the rational, contemplative, thinking soul. The corporeal soul was simply made to work too hard, and the rational soul too vaguely, for these respective categories to be sustainable once functional analysis was under way. Since the relation between the mental and corporeal realms was, in this sense, pre-established, treatises on the behaviours typical of living organisms, and on the human organism in particular, should be read as instances of the accommodation of reported phenomenal experience (dreams, sensation and so on) to the constraints of clear explanatory depiction (the anatomized body and its mechanisms). To read these treatises in the inverse way - that is, as instances of the accommodation of theoretical certainty to empirical evidence - would only impede our understanding of what sort of conceptual work the slow accumulation of such evidence was effecting, at a time when there was no perceived need to identify as a problem the relationship of observed bodily and mental structures to the existence in humans of higher level consciousness or free will.[843]

[843] Consciousness was not a subject of investigation. By the end of the century, however, Lockeian preoccupations with epistemology would lead the physician, philosopher and Cambridge Platonist sympathizer Richard Burthogge (c. 1638-1700) to write a treatise on issues surrounding the definition of consciousness. As he put it in his *Essay upon Reason and the Nature of Spirits*, dedicated 'To the Learned Mr. John Lock', Burthogge wanted 'to reconcile the Experimental, or Mechanical, with the Scholastic Method', and his purpose was to enquire into the foundations of conscious knowledge in

Descartes used the term 'thought' to designate a range of mental activities he presumed were immediately self-conscious, in which he included understanding, willing, imagining and feeling.[844] It surely would have made sense to believe that these functions are interrelated in some important ways. But, as Richard Rorty observed over twenty years ago, by relating them all to the function of a single, immaterial *res cogitans* - indeed by circumscribing the singular human thinking soul to the domain previously occupied by a hierarchy of souls - Descartes created a new sort of division between mind and body.[845] It now no longer consisted in 'the Aristotelian distinction between reason-as-grasp-of-universals and the living body which takes care of sensation and motion', but in 'one which we call that "between consciousness and what is not consciousness".'[846] For Descartes, the objects of understanding, willing, imagining and feeling - as we saw earlier on[847] - were such only insofar as they were present to thought, to the thinking self, 'that is, my soul, by which I am what I am'.[848]

Although potentially localizable, these aspects of mental life were no longer *functions* ascribable to the activity of the rational soul, which, in Galenic faculty psychology, processed sense-data via the *sensus communis*, producing successively reasoning, imagination and memory. Instead, these mental operations became inherent in the very configuration, role, and self-aware existence of the rational soul as a *substance*.[849] The immortal and immaterial soul, in its Augustinian guise, was always behind the capacity of humans, unique among God's creature, to grasp universals. But now, as Rorty noted, while the rational soul continued to have that

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terms of ideas, and by focusing on the nature of thought, rather than on the physical modalities of cognition. In his words, 'Sensation is Conscious Perception' and 'Conception is a Modification of Mind'; it followed that 'Cogitation is Conception with the Consciousness of it' and that 'Consciousness of Conception is a sense of the Actuation made in the Mind by that Conception (of which it is conscious)', in Burthogge, *Philosophical Writings*, ed. M. Landes (Chicago and London, 1921), p. 51.

[844] Descartes, *Principes de la philosophie*, I, 9, in *Œuvres*, ed. Alquié, III, p. 95. See also Rorty, *Philosophy and the Mirror of Nature*, p. 48, n. 17.

[845] See also above, p. 86.

[846] Rorty, *Philosophy and the Mirror of Nature*, pp. 51-52. He goes on: 'This was not a distinction between human faculties but a distinction between two series of events, such that many events in one series shared many characteristics with many events in the other, while nevertheless differing toto caelo because one was an event in extended, and the other in nonextended, substance. It was more like a distinction between two worlds than like a distinction between two sides, or even parts, of a human being.'

[847] See above, pp. 73-74, 86.

[848] Descartes, *Méditations*, in *Oeuvres*, ed. Alquié, II, 'Méditation sixième', p. 488: 'ce moi, c'est-à-dire mon âme, par laquelle je suis ce que je suis'.

function in Descartes, he added to the list of its functions those listed above, bracketed off as so many forms of *thought*. By doing so, Descartes created a conflation of the notion of awareness with that of reasoning,[850] which in the end amounted to a confusion between the unity of perception - effected, as ever, by the *sensus communis*, now located by him in the pineal gland - and self-aware rationality.[851]

This interconnectedness of perception and imagination allowed by the dualistic scheme also meant that the operations of the senses had to be understood not only in mechanistic, but also in physiological and moral terms - which accounted for the 'physical' and 'moral' passions. Descartes himself believed, in a Stoic fashion, that reason could inflect the passions, active as these *accidentia animae*[852] were within and through the body.[853] Indeed, in sixteenth- and seventeenth-century theories of the passions, emotions were passions of the soul because they were 'actions' that the *body* exerted upon the passive soul - in the language bequeathed by Aristotle via Augustine and Thomas Aquinas, but rooted in the ground of Stoicism and Epicureanism. In that sense, reason had the same relationship to passion as it did to body. Studies of the emotions, however, differed from the analysis of perception. In the form of treatises on the passions, the first included those of Jean-Farnçois Senault and Edward Reynolds[854] and informed the religious writing of Pierre Nicole, for instance.[855] They were inscribed in a long-running tradition of popular guides to moral excellence which was still particularly vibrant in the first half of the seventeenth century, with the likes of Guillaume du Vair and Jean Senault in France

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[849] See above, pp. 93-94.
[850] See Rorty, *Philosophy and the Mirror of Nature*, pp. 53-54, n. 23.
[851] See also Pascal Engel's similar account, quoted above, in p. 95, n. 79. For a clarifying analysis of this issue, and a defence of the point that Descartes did indeed include sentience in his definition of thought, see Emanuela Scribano, 'La nature du sujet. Le doute et la conscience', in Kim Sang Ong-Van-Cung, *Descartes et la question du sujet* (Paris, 1999), p. 49-66. Lancelot Law Whyte, in *The Unconscious before Freud* (London and New York, 1960; ed. 1978), wrote of Descartes's 'view that conscious mentality should be separated from everything else' (p. 28), ending the chapter 'Conscious and Unconscious' with the well turned thought that: 'No difficulties have been so profound or so persistent as those which reason has made for itself by its hasty separation of the conscious self from everything else.The impatience to order has here led to disorder' (p. 29).
[852] Nancy Siraisi mentions use of this expression in the context of her exposition of sixteenth-century medical theories of passions, in her *Taddeo Alderotti and his Pupils* (Princeton, 1981), ch. 7: 'Mind and Sense', pp. 226-236.
[853] See Descartes, *Les passions de l'ame*, in *Œuvres*, ed. Alquié, III, esp. Art. 45-50, pp. 988-996.
[854] Edward Reynolds, *A Treatise of the Passions and Faculties of the Soule of Man* (London, 1658); Jean-François Senault, *De l'usage des passions* (Paris, 1641).
[855] Pierre Nicole, *Essais de morale* (Paris, 1671 and 1675), ed. Laurent Thiroin (Paris, 1999).

or Thomas Wright in England.[856] Analyses of perception, on the other hand, which were likely to accompany those on the passions,[857] were meant to partake of the new scientific discourse (although the explanatory tools were not so new) and so caused breaches in the Aristotelian or Platonic theories about the constitution of the soul. Descartes - and, infamously, Hobbes - had wanted to show that emotions, the internal world of the human subject, could be described in the same terms as those used to describe the physical world and our optical and auditory modes of access to it. They also wanted to show that new moral systems could arise out of such descriptions; in order to do this, however, they used the traditional format of treatises on the passions.[858]

In the *Principes de la philosophie*, the *Passions de l'ame* and throughout his correspondence, especially in his letters to Princess Elisabeth, Descartes presented the view, broadly, that virtue was the highest good in life and that it was the duty of ethics to define both what this virtue was and the means, given our dual nature, to attain and live by it.[859] As he stated in the Preface to the *Principes de la philosophie*, ethics, along with medicine and mechanics, was the topmost branch of the tree of

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[856] Guillaume du Vair, *De la sainte philosophie* (Paris, 1600); *La philosophie morale des Stoïques* (Paris, 1599-1603); Thomas Wright, *The Passions of the Minde in generall* (London, 1604). See Anthony Levi, *The French Moralists: The Theory of the Passions 1585-1649* (Oxford, 1964); Susan James, *Passion and Action* (Oxford, 1997).

[857] See, e.g., Hobbes, *Leviathan, or the Matter, Forme, & Power of a Common-Wealth, Ecclesiasticall and Civill* (London, 1651), ed. C. B. Macpherson (London, 1981), I, 6-8, pp. 118-147; Willis, *Two Discourses*; Antoine Arnauld and Pierre Nicole, *La Logique ou l'art de penser*; Malebranche, *Recherche de la vérité*; Margaret Lucas Cavendish, Duchess of Newcastle, *Grounds of Natural Philosophy* (London, 1668).

[858] Hobbes, *Leviathan*, 'Introduction', p. 81: 'Nature (the art whereby God hath made and governes the World) is by the art of man, as in many other things, so in this also imitated, that it can make an Artificiall Animal. For seeing life is but motion of Limbs, the beginning whereof is in some principal part within, why may we not say that all Automata (Engines that move themselves by *Springs* and *Wheels* as doth a watch) have an artificiall life? For what is the *Heart*, but a *Spring*; and the *Nerves*, but so many strings; and the *Joynts*, but *Wheels*, giving motion to the whole body, such as was intended by the Artificer?'.

[859] See Descartes, *Principes*, 'A la Sérénissime Princesse Elizabeth', in *Œuvres*, ed. Alquié, III, pp. 87-88; 'A Elizabeth', 28 June 1648, in ibid., p. 48: 'je crois qu'il est très nécessaire d'avoir bien compris, une fois en sa vie, les principes de la métaphysique, à cause que ce sont eux qui nous donnent la connaissance de Dieu et de notre âme'; *Les passions de l'âme*, Art. 212, in ibid., p. 1103: 'l'âme peut avoir ses plaisirs à part. Mais pour ceux qui lui sont communs avec le corps, ils dépendent entièrement des passions: en sorte que les hommes qu'elles peuvent le plus émouvoir sont capables de goûter le plus de douceur en cette vie. Il est vrai qu'ils y peuvent aussi trouver le plus d'amertume lorqu'ils ne les savent pas bien employer et que la fortune leur est contraire. Mais la sagesse est principalement utile en ce point, qu'elle enseigne à s'en rendre tellement maître et à les ménager avec tant d'adresse, que les maux qu'elles causent sont fort supportables, et même qu'on tire de la joie de tous.' See also Gaukroger, *Descartes*, pp. 308-309, 398-404.

philosophy, whose roots were metaphysics, and whose trunk was physics.[860] He described the physical nexus of emotional life by identifying knowable emotional events with knowable physiological ones. In this way, he brought to the old tradition of treatises on the passions the novel idea that the medical sciences were crucial to understanding, and therefore controlling, this nexus: 'experience shows', he wrote, 'that those most agitated by their passions are not those who know them best, and that they [these passions] are among those perceptions which are confused and obscured by the narrow union of soul and body'.[861] Animal spirits, however, remained the components underlying the physiology of emotion, as he explained at length in *L'homme* and in the *Passions de l'âme*, since they were endowed with the lightness and vivaciousness which enabled them to travel speedily towards the brain through arteries from the heart. They produced passions independently of the will's command; the body thus had rules of its own that medicine, specifically, could reveal and act upon.[862]

It might seem notable that the only ethical system Descartes ever attempted to build relied on an old-fashioned physiology. Explicit as his rejection was of both Aristotelian and Galenic finalism, the somatic theories current in the 'old' tradition could be recycled in the new science. Certainly, the outdated, scholastic conceptual apparatus, replete with useless causes, had to be discarded for the sake of the new philosophy and if one were to achieve the ultimate aim of medicine, that of 'healing, alleviating suffering, and extending life'.[863] Only in this way could medicine become instrumental in the realization of moral soundness.[864] But just as the association of passion with illness, for example, had always supposed a hierarchical view of the

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[860] Descartes, *Lettre-Préface de l'édition française des Principes*, in *Œuvres*, ed. Alquié, III, pp. 779-780.

[861] Descartes, *Passions*, ibid., p. 974: 'Car l'expérience fait voir que ceux qui sont les plus agités par leurs passions ne sont pas ceux qui les connaissent le mieux, et qu'elles sont du nombre des perceptions que l'étroite alliance qui est entre l'âme et le corps rend confuses et obscures'.

[862] Descartes, *L'homme*, in *Œuvres*, ed. Alquié, I, pp. 379-391; *Les passions de l'âme*, in ibid., III, pp. 955-973. See also above, p. 83.

[863] Steven Shapin, 'Descartes the Doctor: Rationalism and its Therapies', *British Journal of the History of Science*, 33, 2000, pp. 131-154, at p. 133. Shapin's article offers an excellent analysis of Descartes the 'philosopher as doctor'.

[864] See Descartes, *Discours de la méthode*, VI, in *Œuvres*, ed. Alquié, I, pp. 634-635: 'car même l'esprit dépend si fort du tempérament, et de la disposition des organes du corps que, s'il est possible de trouver quelque moyen qui rende communément les hommes plus sages et plus habiles qu'ils n'ont été jusques ici, je crois que c'est dans la médecine qu'on doit le chercher'.

soul, it also did so with Descartes.[865] The Galenic tradition on which medicine and psychology were grounded was hard to replace precisely because it provided a satisfactory, and highly usable, account of mind-body interaction - one which allowed for the participation of this hierarchy of souls in its operations, and which helped make sense of the dependence of normative ethics on somatic theory.[866] So a person able to refrain from following passions was healthier and nobler than one unable to resist being compelled into action by inevitable appetites and desires - the begetters of passions - and was capable of proper, measured, good judgement and conduct. The very process of formulating how physical and moral beings could regulate their behaviour so as to accommodate needs and duties to each other relied on a view of the rational soul as participating in the activities of the appetitive and sensitive souls - and vice versa. The basic mind-body duality inherent in this view was obviously not Descartes's invention. Nevertheless, Descartes transformed the terms of the division between reason and embodied emotion by uniting the mappable, analysable, anatomized body - the main actor in the field of the passions - with his ethical, moderately Stoic programme, while continuing to stipulate both the disembodied nature of the rational soul and its capacity to affect the body's passions.[867]

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[865] See Roy Porter, *Mind-Forg'd Manacles. A History of Madness in England from the Restoration to the Regency* (London, 1987). Porter recounts the evolution of the pathologization of mental disturbance within that of medical dogmas generally, and of their dependance upon shifts in the criteria of interpretation of apparent symptoms, p. 61: 'Strict Cartesianism had few English followers', he writes, and 'even pro-Cartesian physicians did not deny those integrative mind-body interactions which traditional physic and common experience alike attested: instead what Cartesianism did was to provide exclusively mechanical explanations for them in place of humoural ones. The attraction of Descartes's strategy in designating reason as disembodied consciousness, however, was that it removed the risk that enquiry into the brain and its links with the senses would implicate the transcendental soul itself in disorder or disease.' But the replacement of humoralism by neurology, the relocalization of effective sites from the gut to the brain, would take longer than did the initial identification of disease with mechanism. If humoralism (p. 176) 'prevailed amongst physicans and laymen' up until the mid-seventeenth century, 'its capacity to provide satisfying explanations of disturbed thoughts and actions fell under a cloud' in the favour of theories, such as those of Thomas Willis, 'more consonant with the chemical or mechanical philosophy'.

[866] Johns, in *Nature of the Book*, puts this well, pp. 398-399, in reference to Thomas Browne's definition of man as a 'great and true amphibian' (see above, pp. 155-156), and comments: 'Each person was a soul forced to live in the alien environment of the body. It was therefore reasonable to consider the experiences, achievements, and anxieties of such a creature in terms of this disjunction. The discourse of the passions did just that.' Shapin, in 'Descartes the doctor', elaborates the point about normative ethics, suggesting, p. 153, that: 'It was not only *good for you* to follow medical advice counselling moderation; it was just *good* to do so', and that 'those traditions of medical practice were so resistant to change' because 'revolutionary change in these practices would be just as difficult to achieve as social and cultural revolution'.

[867] Descartes, *Passions*, in *Œuvres*, ed. Alquié, III, Art. 50, p. 994; Art. 148, p. 1064.

Inversely, the passions inflicted by the body on the soul could also affect perception and cognition in general. This is why, in accounting 'for the construction of knowledge from perceptions', as has recently been observed, 'one needed an appreciation of the "affections" attendant upon the human constitution'.[868] It is also why Willis, especially in the *Two Discourses*, paid such close attention to ailments of the psyche.[869] As we have seen, animal spirits in the *sensus communis* continued to play a central role with Willis, both in the cerebrum and the cerebellum. (A little later the spirits would be replaced by 'talk of nerves', which 'keyed experiences of disorder into the soma, and hence pre-empted imputations of mere malingering, imagination, or a pathological state of the will itself'.)[870] In this way passions and emotions were correlated with movements of the body, just as they were for Descartes;[871] and Malebranche suggested a similar operation, central, in his case, to the doctrine of occasionalism.[872] Such assumptions of a correlation between behaviour, physiology, emotions and bodily movements, whether mechanistic or iatrochemical - or both, as in Willis - connoted a relatively clear, and widely popular explanatory scheme. But the question of what means to use in order to establish reason's true *nature* - given the avowedly all-important role of reason in controlling the passions - was left unadressed. It emerges that no account of reason's actions upon the passions could offer an exhaustive explanation of the relation between affect and reason, sensation and knowledge.

The mechanico-physiological account of emotion was based on the same functionalist view of organic structure as that which Descartes, and later Willis, used to explain the body's motions. How motion was produced in the body, on a mechanistic view, did not differ at all from the way in which it took place in the universe. Mechanistic physics could explain the connections between heart and brain, as well as the sources of voluntary and involuntary action. Moreover, it was on

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[868] See Johns, *Nature of the Book*, p. 392.

[869] Johns goes on to analyse this point. Willis puts it for example thus, in *Two Discourses*, 'The Preface': 'That the Corporeal Soul doth extend its Sicknesses, not only to the Body, but to the Mind or rational Soul, which is of an higher linage, and that it often-times involves it with its failings and faults, I think is clear enough in our Pathology or Method of Curing'. See also Porter, *Mind-Forg'd Manacles*, pp. 177-178.

[870] Porter, *Mind-Forg'd Manacles*, p. 181.

[871] See Descartes, *Passions*, in *Œuvres*, ed. Alquié, III, p. esp. Art. 13-27, pp. 962-974.

[872] For the case against any notion that Descartes, too, might have propounded something like occasionalism, see David Scott, 'Occasionalism and Occasional Causation in Descartes' Philosophy', *Journal of the History of Philosophy*, 38, 2000, pp. 503-528.

the ground of his conception of mechanistic physics that Descartes had refused to agree with Harvey's view of the heart as a muscle.[873] The very same position was taken up by Guillaume Lamy in his *Discours anatomiques*, published in Paris in 1674. There, as Anna Minerbi Belgrado has observed,[874] he opposed Aristotelian teleology with Cartesian tools, avoiding the idea of a self-propelling muscle. Where he did adopt Harvey's picture of the heart - say, as dilating when full of blood - the carrier of animal spirits - he preferred to have a different conception of what in the heart was active and causally efficient,[875] never suggesting that its contraction might *cause*, rather than simply be contemporaneous with, arterial dilation. This interpretation of anatomical structure relied as much on functionalist assumptions as did Willis's approach.[876] But along with this functionalism, where the search for the cause of function relied on the analysis of structure, Lamy also promoted an anti-finalism more strident than Descartes's and more extreme than that of later Cartesians.[877] Such anti-finalism would certainly have been intolerable to those, like Fénelon, Fontenelle or Perrault, or who had mitigated Descartes's 'faith in mechanism'[878] by identifying mechanistic laws with a mysteriously designed order. Lamy simply saw no point in ever resorting, even rhetorically, to a notion of higher purpose, or of seeing perfection in nature as the sign of its divine origin.[879]

In Minerbi Belgrado's view, Lamy - described by Pierre Bayle, she notes, as an 'épicurien outré'[880] - used Descartes's methodology in physics, which was based on an 'epistemological prudence', in order to conceal within it his own atheism and

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[873] See above, pp. 63-64.

[874] Minerbi Belgrado, 'Introduction' to Lamy, *Discours*, pp. 11-12. Belgrado's introduction and edition of Lamy constitute an excellent analysis and *mise en contexte* of this *libertin*.

[875] Lamy, *Discours anatomiques*, ed. Belgrado, pp. 80-81.

[876] For an analysis of Lamy's reliance on Willis, see Minerbi Belgrado, 'Introduction' in Lamy, *Discours*, pp. 24-27.

[877] Tocanne, in *L'idée de nature*, p. 71, singles out Lamy's defence of antifinalism as particularly 'aggressive et violente', and 'exceptionnel à l'époque'.

[878] Roger, *Sciences de la vie*, pp. 223-224. See also pp. 228-229, where he defines 'une certaine catégorie de savants mécanistes, qui mettent Descartes au service d'Epicure' - such as, in Leiniz's view, Hobbes and Spinoza - and which explain why 'Voltaire sera fondé à dire, après beaucoup d'autres, que Descartes conduit à l'athéisme'.

[879] For an account of the popularity of finalist discourse in the second half of the seventeenth century, see, e.g., Roger, *Sciences de la vie*, pp. 224-254.

[880] See Pierre Bayle, *Nouvelles de la République des Lettres*, March 1684, in *Œuvres diverses de Mr. Pierre Bayle, Professeur en philosophie, et en histoire, à Rotterdam* (The Hague, 1727; facsimile reprint, Hildesheim, 1964), 6 vols., I, 'Article II', p. 9: 'Qu'on nie tant que l'on voudra, avec un Médecin de Paris, nommé Lami, Epicurien outré, que l'homme ait sur les animaux aucun autre empire, que celui que l'adresse ou la force lui procurent, il sera toûjours vrai, & ce Médecine n'a pas

along with it, his materialism with regard to nature and to the nature of the mind.[881] He discarded not only teleology, in line with Descartes, but also the use of a human immortal soul - quite unlike Descartes. The soul he talked about consisted for the most part of those bits of soul, or animal spirits, contained in the brain.[882] On this reading, Lamy becomes a significant example of the ways in which the new science bore within it the seeds of a novel sort of materialism; and this is why I shall examine his views in some depth. That said, the science he deployed was not entirely 'new'. It remained reliant on anatomical models difficult to revise with the limited tools available at the time; and, on the surface at least and in its very structure, it also remained compatible with - indeed, based on - a recognizable theodicy. Lamy made it clear that the relation of the human soul to God was a matter for theologians, not natural philosophers, physicians and anatomists:

> Faith teaches us that in man, besides the soul which dissipates in death, like that of beasts, there is an immaterial and incorporeal one, which is directly borne out of the hands of divinity and which is united to the body through the spirit of which I spoke. That soul is the principle of all our reasonings, and carries within itself the inclination, natural to all men, to recognize a Divinity; but as it is known with certainty only by faith, it is the role of Theologians to tell us what we should believe about its nature; and so I return to the sensitive soul, whose main functions are those of sensation and movement.[883]

As a physician, Lamy felt justified in stating that disquisitions on 'the principle of all our reasonings' were not his province, nor even tangential to his discourse. He believed that this - admittedly central - aspect of human nature was best left to be what it was, a *principle*. But his apparent lack of interest in metaphysics did not preclude an examination of various manifestations of 'reasonings', whichever their principle might be. In this sense, Lamy seemed to want to caricature the dualist

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osé le nier, que Dieu a permis à l'homme après le Déluge de tüer les bêtes pour s'en nourrir. C'est lui avoir accordé un empire assez étendu, pour conserver à l'objection des Cartésiens toute sa force.'

[881] Minerbi Belgrado, 'Introduction', in Lamy, *Discours*, pp. 14-15; p.14: 'Le point de vue qui lui permet de traduire, tout au long des Discours, la prudence épistémologique de Descartes en une libre pensée athée est en effet fourni par son anti-théodicée'.

[882] Lamy, *Explication mechanique et physique des fonctions de l'ame sensitive* (Paris, 1676), in Lamy, *Discours*, ed. Minerbi Belgrado, p. 176.

[883] Lamy, *Discours*, p. 106: 'Dans l'homme, outre cette ame qui se dissipe dans la mort, comme celle des bestes, la foy nous enseigne qu'il y en a une immaterielle & immortelle, qui sort immediatement des mains de la Divinité, & qui est unie au corps par le moyen de l'esprit dont j'ay parlé. C'est elle qui est le principe de nos raisonnemens, & qui porte en soy-mesme cette inclination naturelle à tous les hommes, de reconnoistre une Divinité, mais comme elle n'est connuë certainement que par la foy; c'est aux Theologiens à nous dire de sa nature ce que nous devons croire; & ainsi je retourne à l'ame sensitive, dont les principales fonctions sont le sentiment & le mouvement.'

stance: for while he could declare that the 'immaterial, immortal', Cartesian 'principle' of higher thought and contemplation must remain out of sight and out of investigative bounds, he nevertheless engaged in the study of functions whose connection to the so-called corporeal soul was unclear. Not that he was interested in pursuing an explicit examination of the status and nature of these higher 'reasonings' - it was Locke who did this, thus bestowing on epistemology the role previously held by traditional, medically mediated psychology.[884] But, as we shall see, Lamy's *Discours anatomiques* were more concerned with metaphysics than one would infer from reading the statement quoted above at face value.

Lamy's view of the sensitive soul was no less a hybrid of old and new than that of Willis or Perrault or, for that matter, Descartes. On many issues, such as blood circulation, but also, notably, reproduction, in the context of the raging debates about ovism, he even tended to favour the theories which at the time were considered least 'modern'.[885] This, however, did not stand in contradiction to his clear-cut denunciation of the recourse to finalist assumptions, which, he said, echoing Descartes, undermined a proper understanding of natural forms.[886] There was no point, according to him, in looking for divine intention in nature, and no ground to the anthropocentric view that nature had been designed to suit human needs perfectly. Nature could be harmful as well as useful to us; and while our reason was indeed superior to that of beasts, it also seemed

> less certain. Beasts manage, with the little reason they have, to find without study and without error what they need for their happiness; man's reason can err in a thousand ways which cause him, more often than not, to make himself miserable through his very effort to become happy.[887]

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[884] But see John P. Wright, 'Locke, Willis, and the Seventeenth-Century Epicurean Soul', in Margaret J. Osler, ed., *Atoms, Pneuma, and Tranquillity: Epicurean and Stoic Themes in European Thought* (Cambridge, 1991), pp. 239-258, for a suggestion that Locke's conception of man's essence is similar to Willis's corporeal soul.

[885] Jacques Roger, for one, concentrated on this aspect of Lamy's thought in *Sciences de la vie*; see pp. especially pp. 271-283 for his excellent account.

[886] Descartes, *Principes*, III, 2, in *Oeuvres*, ed. Alquié, III, p. 222: 'Qu'on présumerait trop de soi-même si on entreprenait de connaître la fin que Dieu s'est proposée en créant le monde'. For an analysis of Descartes's critique and use of teleology, see Alison Simmons, 'Sensible Ends: Latent Teleology in Descartes's Account of Sensation', *Journal of the History of Philosophy*, 39, 2001, pp. 49-75.

[887] Lamy, *Discours*, p. 52: 'Sa raison est veritablement beaucoup plus universelle & capable d'un plus grand nombre de connoissances que celle des brutes; mais aussi semble-t-il qu'elle est plus incertaine. Avec le peu que les bestes en ont, elles trouvent sans étude & sans erreur, ce qui est nécessaire à leur felicité; & celle de l'homme est sujette à mille égaremens, qui font que tres-souvent il se rend miserable, par la peine qu'il se donne pour devenir heureux.'

Reason was the least useful of nature's gifts to us. While such a statement might look like a standard formulation of mitigated scepticism out of Montaigne's 'Apologie de Raimond Sebond', and similar to the arguments we examined earlier against the beast-machine hypothesis, in Lamy's case it was not used in the service of faith, or as a preamble to a guide to the passions. His point, instead, was that we were not so well designed that finalism had much credibility. He began the first of the *Discours* with a reference to the absence of a *rete mirabile* in humans, suggesting at the same time that man's preeminence over other creatures, although not visible in anatomical terms, was due to 'the invisible spirit which animates and governs him, and which faith tells us is of a different, much nobler, nature than that of beasts, although its appearance is deceptive enough that its condition seems hardly different'.[888]

Views about how to determine what an organ might be *for*, given the natural order of things, depended on assumptions about the status of scientific investigation in a world created by God, but in which secondary causes alone were visible. And these views, in turn, inflected beliefs about what mental functions were, and which ones could be observed. Treatises on the 'corporeal' or 'sensitive' soul bear witness to the fact that quite a few aspects of the human mind were deemed analysable in other than theological or moral terms. But the visibility of this soul was not a given: it depended on a set of beliefs about the perceptual gifts that humans, and thus natural philosophers, could be deemed to possess and to be capable of using. In other words, the post-Cartesian 'mind', no longer soul-like, was a function of the reciprocal dependence, on the one hand, of the observability of the natural order and, on the other, of the shifting configuration of the visible mental order. What a human mind was capable of conceiving, how its perceptions were true perceptions, and why dream-experiences seemed so similar to wakeful ones, for example, were among those questions for which a new, but confined, naturalism provided materialistic answers. It did not provide, however, the means for curtailing the growth of a gap

[888] Ibid., p. 53: 'Cette partie que Galien nomme admirable, & qui est un industrieux lacis de veines & d'arteres, qui se rencontre dans le cerveau de quelques animaux, ne se voit point manifestement dans celuy de l'homme, & la difference qu'il y a dans l'arangement ou le nombre des parties, ne luy est pas toûjours avantageuse. Sa preéminence vient principalement du costé de l'esprit invisible qui l'anime & qui le gouverne, que la foy nous enseigne estre d'une nature differente, & beaucoup plus noble, que celuy des bestes; quoyque par une apparence trompeuse il nous semble d'une condition peu éloignée.'

between old souls, unknown to themselves as they were acknowledged to be, and new minds - between contemplative humans and scurrying, microscopic, diligent animal spirits.

This gap grew in spite of the effort to bridge it, or rather to cover it up with a teleology in which secondary causes remained a manifestation of divine power, and so where the analysable workings of the mind were signs, too, of God's perfection, and of his stamp on our higher, contemplative souls. As I have indicated earlier, this attachment to finalist discourse became increasingly rhetorical, simply because its actual usefulness was rapidly decreasing.[889] Lamy gave it its due, when stating, early in the first of the *Discours anatomiques*, that in contemplating the intricacy of the human organism, students of anatomy would 'recognize the power of the Sovereign Being, who, just by willing it, produced the various particles of matter, along with movements, by the necessity of which were formed machines embellished by the presence of so many articulations'. But, as he went on, it might seem terribly arrogant to want to penetrate the secrets of these machines, and search out the reasons for their existence, given that it was impossible to analyse how they were put together even though they were there for everyone to see. It was for this reason that he decided to focus only on the uses and functions of the parts which constituted the body.[890]

The search for the correlation between form and function, as we made clear in the preceding chapter, presupposed a one-to-one relationship between the two. In the medical field, what counted as explanatory of symptoms was identified as a substance, as Gaston Bachelard suggested many years ago in *La formation de l'esprit scientifique*. Form - organic structure - was thought to 'directly realize', as he put it, the identified function; an 'active principle would create substance'.[891] Humoural

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[889] See above, p. 209.

[890] Lamy, *Discours*, pp. 53-54: 'Alors sans doute vous reconnoistrez la puissance du Souverain Estre, qui par un seul vouloir a produit les differentes Particules de la matiere, avec des mouvemens, par la necessité desquels sont formées des machines embellies de tant de ressorts: Et faisant reflexion que vous ne pouvez appercevoir leur enchaînement, ny les démesler, quoy qu'ils soient devant vos yeux; vous avouerez que c'est une temerité insuportable de vouloir penetrer ses secrets, & chercher, s'il m'est permis de parler ainsi, le pourquoy de ses ouvrages. Pour vous engager dans ces sentimens, j'employeray tous mes soins à vous dire les usages des parties, & à vous expliquer leurs fonctions, suivant les opinions anciennes & nouvelles; & en vous les démontrant on vous fera voir exactement, leur situation, leur composition, leur figure, & leur connexion, avec beaucoup d'adresse.

[891] Gaston Bachelard, *La formation de l'esprit scientifique: Contribution à une psychanalyse de la connaissance* (Paris, 1938; reprint. 1993), p. 109: 'Cette curieuse pensée qui veut que tout principe actif crée de la substance est très symptomatique. Elle nous semble désigner nettement la tendance à la

theory survived, in this picture, as one manifestation of the need to transform qualities into substances, and effects into essences. When Lamy - avowedly following 'the opinion of the ancient authors' - allocated the 'parts used for the animal functions, that is, sensation and voluntary motion' to the head, he was identifying the actual, physical place with the actual, physical cause of sensation and voluntary motion. The same held, of course, for the chest, which 'houses the tools for vital functions, that is, the pulse and breathing which are the two essential signs for distinguishing a living from a dead animal', and for the abdomen, which 'contains the parts used for the natural functions, that is, nourishment and reproduction'.[892] But for Lamy, and as I shall attempt to show, the localization of function was not explanatory of how the soul worked in quite the same way that it had been under faculty psychology.

In some respects, it took little conceptual work to undermine Galenic teleology, given that this was a time when practical concerns with the modalities of empirical investigation, and with quantifying methods in physics, were no longer bound up with the definition of qualities.[893] Lamy, for one, resorted to quite similar arguments to those used, for example, by Hobbes against Aristotelian forms. According to Hobbes, these forms explained natural phenomena such as heaviness by attributing to them the cause of their result: 'so that the cause why things sink downward, is an endeavour to be below: which is as much to say, that bodies descend, or ascend, because they do'.[894] Lamy was equally ironic in dismissing as invalid the tendency of Galenists to explain all things as resulting from the 'intention' of nature, which they believed they fully understood: 'one can ask why the eyes are not on the heel, the ears on the stomach, the nose on the shoulder', and

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réalisation directe, tendance que nous prétendons caractériser comme une déviation de l'esprit scientifique'.

[892] Lamy, *Discours*, p. 55: 'Les principales parties qui servent aux fonctions animales, sçavoir au sentiment & au mouvement volontaire, sont contenuës dans la teste. La poitrine enferme les instrumens des fonctions vitales, c'est à dire du poux & de la respiration qui sont les deux marques essentielles pour distinguer l'animal vivant d'avec le mort. Le ventre contient les parties qui servent aux fonctions naturelles, sçavoir à la nourriture et à la génération; ce qui se doit entendre suivant l'opinion des anciens autheurs'.

[893] I am grateful to Daniel Andersson for a helpful discussion on this issue.

[894] Hobbes, *Leviathan*, p. 678, quoted in Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton, 1985), p. 93.

so on.[895] In opposition to the Galenists, he set up the followers of 'Democritus, Hippocrates, Epicurus, Lucretius', for whom motion inhered in matter: the parts of bodies depended upon the configurations of matter and of its necessary, rather than divinely imposed motions. Bodies were constrained to be what they were from the atomic level upwards, just as the sum total of three dice must figure between three and eighteen. The function of bodies, in turn, resulted from these forms to which atoms, seed-like, gave birth. Their parts 'were formed by the blind necessity of matter's motions without being destined for any end; rather, their use derives from their disposition, and from the tasks of the animal that uses them.'[896] And so it was that, as he put it, echoing Lucretius,[897] 'one should not say that eyes were made for seeing but that we see because we have eyes'.[898] An organ might do a particular job because of its particular configuration, while another might be more flexible, like 'teeth, feet, hands'. But the organ's function could not possibly precede the formation of its structure. Anti-Galenists agreed, wrote Lamy, that 'when something is built for an end, one has to have known the end before it exists; for example, we have built beds in order to rest, but we knew what rest was before building bed.' Similarly, 'it is impossible that we knew what seeing was before eyes existed, what hearing was before ears existed; and so eyes are not there for us to see, nor ears for us to hear, but rather eyes and ears have found the uses they have by necessity.'[899]

Clearly, the rejection of teleological discourse did not in itself contradict the working hypotheses of post-Aristotelian natural philosophers, for whom the analysis

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[895] Lamy, *Discours*, pp. 59-60: 'Car, Messieurs, on peut demander pourquoy les yeux ne sont pas au talon, les oreilles au ventre, le nez sur l'épaule, ou en d'autres lieux, & ainsi successivement pour la situation de toutes les parties.'

[896] Ibid., pp. 60-61: Et que comme trois dez roulés sur une table font de necessité quelqu'un des nombres, qui sont depuis trois jusqu'à dix-huit, sans pouvoir faire ny plus ny moins; de mesme les particules de la semence font indispensablement quelque homme, sans pouvoir produire un corps d'une autre espece. Or toutes ces parties estant ainsi formées par une aveugle necessité des mouvemens de la matiere, elles ne sont destinées pour aucune fin; mais trouvent, disent-ils, leurs usages, conformément à leur disposition, & à l'industrie de l'animal qui s'en sert.

[897] Lucretius, *De natura rerum*, IV, 822-823: 'Lumina ne facias oculorum clara creatæ. / Prospicere ut possimus, & ut preferre viai.' Nicolas Malebranche would quote this passage from Lucretius in order to contradict this view, in *Recherche de la vérité*, II (I, 4, § III), ed. Rodis-Lewis, I, p. 209.

[898] Ibid., p. 61: 'Ainsi selon ces Philosophes, il ne faut point dire que les yeux soient faits pour voir; mais nous voyons parce que nous avons des yeux.' Antoine Picon, in *Claude Perrault*, also cites the sentence in the context of his account of the debate about finalism, p. 53.

[899] Ibid.: 'Car, disent-ils, quand une chose est faite pour une fin, il faut qu'on ait connu la fin, avant qu'elle fust; par exemple, on a fait des lits pour se reposer: mais on sçavoit ce que c'estoit que le repos, avant qu'on fist des lits. On a fait des armes pour combattre: mais on connoissoit les combats avant qu'on fist des armes. Or il est impossible qu'on ait sçeu ce que c'est que voir avant qu'il fust des

of individual organic form was a prerequisite to the understanding of organic function. Again, Lamy was close to Descartes, as well as to what actual empirical enquiry required, in thinking that final causes, whether presumed of bodies or as an aspect of the enquirer's research programme, were 'useless', since knowledge of what a part was for sufficed.[900] One should not speak 'as if one had been God's confident and had read the book of all his plans'.[901] Steno, it will be recalled, had subscribed to the same credo.[902] Efficient causes were explanatory of complex organic structures and mechanisms without having to refer to the ends towards which they seemed to work; and, inversely, the end of a willed action was not explanatory of its efficient cause, either in animals or, indeed, in man.[903] As for man, he was too sorry and too unhappy a creature to be considered perfect, especially when one compared him to animals. Montaigne's arguments against the legitimacy of human pride are clearly behind Lamy's Epicurean views on the origins of life.[904] Final causes, moreover, were 'always uncertain, because those believed to be most evident are very doubtful', Lamy wrote, 'and because God's mind, infinite as it is, sees infinite ends we do not see'.[905] Final causes did exist, insofar as God existed. But there was no need to take them into account in anatomical enquiry, or in the physician's practice. They were best considered absent from nature as we humans experienced and saw it, for they could lead to absurd conclusions: 'if there ever was to be a new world with winged men, and Galen were also to be resurrected, he would undoubtedly write a large book on the usefulness of wings'.[906]

Foremost in Lamy's mind, then, was the need to secure a plausible theory of matter which would account at once for its genealogy and for its actual, multiple,

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yeux; ce que c'est qu'oüir avant qu'il fust des oreilles, & ainsi les yeux ne sont point faits pour voir, ny les oreilles pour oüir: mais les yeux & les oreilles ont necessairement trouvé les usages qu'ils ont.'

[900] We have seen repeatedly the extent to which the notion of an organ's disposition was central to Cartesian physiology. See above, pp. 92-94, 125, 129, 168, 175, 187.

[901] Lamy, *Discours*, 'Réflexions de Monsieur Lamy sur les objections qu'on luy a faites', p. 125: 'Car c'est assez de connoître l'usage d'une partie sans inférer qu'elle soit destinée pour cette fin, et sans parler toujours comme si on avoit esté du conseil de Dieu et qu'on eust leu le livre de tous ses desseins'.

[902] See above, p. 168.

[903] On this issue see Des Chene, *Physiologies*, pp. 179-186.

[904] See also Minerbi Belgrado's comment in Lamy, *Discours*, p. 64, n. 14.

[905] Lamy, *Discours*, 'Réflexions', p. 125: 'Elles sont toujours incertaines, parce que celles qu'on prétend les plus évidentes sont très douteuses…; et que l'esprit de Dieu, estant infini, voit des fins infinies que nous ne voyons pas, et qu'il a pu se proposer malgré la présomption que nous avons d'avoir découvert la véritable'.

[906] Lamy, *Discours*, p. 64: 'S'il se faisoit, Messieurs, un monde nouveau avec des hommes aislés, & que Galien ressuscitast de mesme, il feroit sans doute un gros Livre de l'utilité des aisles.'

functional forms. The ancient atomists, he reported, had developed just such a theory: natural selection, in their view, had operated on what were initially randomly shaped organisms, produced, like everything else in the universe, by 'the blind necessity of the movements of matter'.[907] At first these creatures might be deprived 'of eyes, or of a mouth, or of reproductive organs', but these 'perished because unable to feed, or to reproduce by mating'.[908] Better equipped species, on the other hand, survived, and they were those extant in our day:

> Those equipped with feet walked, those with wings flew, those with neither feet nor wings swam in the sea or crawled on the ground, those with teeth chewed, the strongest or most agile became masters of the others, in such a way that there is no need to look for ends in those kinds of principles.[909]

While noting that the original Epicurean view was in clear opposition to religion, Lamy nevertheless seems to have adopted it even in its ancient, non-Christianized, that is, pre-Gassendian, state. Humans were too imperfect to be the culmination of God's work that Galenists supposed they were. Such a God, furthermore, would be inappropriate, for it was unlikely that he should have exhausted all his resources in the creation of man.[910] The parts of an organism belonged to the whole, and the whole was created not only by but also for the 'Author of nature', who had laboured entirely for his own pleasure, creating matter and particles, the motions of which produced an infinitely varied array of shapes. The changes of matter, Descartes had written in *Le monde*, were attributable to the 'laws of Nature', rather than to God himself.[911] All the natural philosopher could study were the particles which composed matter.[912] The machine analogy held here too, as a by-product of turning the

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[907] Ibid., p. 62: 'soumettant tout à l'aveugle nécessité des mouvemens de la matière'. See also Picon, *Claude Perrault*, pp. 53-54, for a consideration of Lamy's rather contrarian anti-finalism.

[908] Lamy, *Discours*, p. 62: 'il se produisit, par les différens arrangemens des atomes ou particules de la matière, un très grand nombre d'animaux de diverses espèces, les uns sans yeux, les autres sans bouche, les autres sans parties propres pour la génération … et qui ainsi périrent d'abord, faute de pouvoir se nourrir ou se multiplier par l'acouplement'.

[909] Ibid.: 'Le reste qui se trouva bien disposé, se conserva, & ce furent les especes de ceux que nous voyons aujourd'huy. De cette maniere chacun s'est servy des parties qu'il a euës aux usages où elles estoient propres. Ceux qui ont eu des pieds ont marché, ceux qui ont eu des aisles ont volé; ceux qui n'ont eu ny pieds ny aisles ont nagé dans la mer, ou rampé sur la terre, ceux qui ont eu des dents ont mâché; ceux qui ont été les plus forts ou les plus adroits, se sont rendus maistres des autres: de façon qu'il n'y a point de fin à chercher dans ces sortes de principes.'

[910] Ibid.

[911] Descartes, *Le monde*, in *Œuvres*, ed. Alquié, I, p. 350: 'et les règles suivant lesquelles se font ces changements, je les nomme les lois de la Nature'.

[912] Lamy, *Discours*, pp. 64-65, at p. 65: 'Or, l'Autheur de la nature est la première cause de toutes ces différences'.

organism into an object of study, crafted by its creator, but held together in virtue of physical laws and of the individual organism's natural habitat. Lamy's naturalism with regard to the design of creatures worked in parallel to his rejection of the teleological amalgamation of perfection with necessity and purposefulness. In his case, however, it is hard to say which one, the naturalism or the rejection of teleology, came first.

The consequence of denying any heuristic value to the notion of ultimate purposefulness in nature was that, unless one accepted the Cartesian postulation of an immaterial, immortal *res cogitans*, it was no longer possible to read function into structure on the basis of a metaphysical stance. This left the soul in the lurch. Writing in Gassendist mode,[913] Lamy pointed out, appealing to Seneca, that everyone agreed 'that we have a soul that governs us'. But no one could 'clearly say what it is. One person thinks it is a spirit; another, a harmony of all parts of the body; another, a divine virtue and a particle of divinity; another, a very subtle air; another, an immaterial power. Some even say it is blood or heat'.[914] In brief: according to some, the soul was incorporeal, while to others, it was corporeal. The soul obviously had some sort of connection to the brain; and it made sense to allocate mental functions to parts of the brain. But, for Lamy, neither localization, nor the identification of the soul with substances such as blood or fire, nor, even, the recourse to observable functions or faculties, helped define what sort of thing the soul was.

This view might be clarified with the help of an observation made some fifty years ago, that 'there is no *logical* connection between cerebral localization and materialism. The former only asserts a topical connection between mind and brain and is actually silent on the nature of their relationship.'[915] Lamy, then, did not contradict the received notion that the soul was housed mainly in the brain, 'where it exerts its most noble functions'. Brain injury, for example, usually went along with disorders in mental functions; and it took just a little opium, or a few glasses of wine,

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[913] See Minerbi Belgrado in Lamy, *Discours*, n. 12, p. 99.

[914] Lamy, *Discours*, p. 99: 'Tout le monde, dit Sénèque, demeure d'accord que nous avons une âme qui nous gouverne, mais personne ne peut dire clairement ce que c'est. L'un pense que c'est un esprit; l'autre, une harmonie de toutes les parties du corps; un autre, une vertu divine et une particule de la divinité; un autre, un air très subtil; un autre, une puissance immatérielle. Il y en a mesme qui disent que c'est le sang ou la chaleur'.

[915] Anne Harrington, *Medicine, Mind, and the Double Brain: A Study in Nineteenth-Century Thought* (Princeton, 1987), p. 9, n. 2, referring to Walther Riese and Ebbe C. Hoff, 'A History of the Doctrine of Cerebral Localization: Sources, Anticipations, and Basic reasoning', *Journal of the History of Medicine and Allied Sciences*, 5, 1950, pp. 50-71.

for the soul to follow in the body's weakness.[916] These facts showed that the reasoning faculty was not based in the heart, contrary to what Epicurus had affirmed.[917] There simply was no doubt that mind and body interacted and affected each other, and thus that the soul must be material in some way. Descartes's extreme dualism was 'a chimera he has conceived with the purpose of seeing how the world would react to it, or for some other reasons which can easily be guessed at.'[918] Moreover, to say, as Descartes had done, that the soul was a thinking substance, was merely to state the obvious; it said nothing about what *sort* of thing this thinking substance was.[919] What we see, however, is that once Lamy had asserted the necessary interconnection between cognitive functions and matter - in part against Descartes's opposition of the two - no theory about the localization of the soul's various functions was of help in explaining in what way the soul was indeed a substance.[920] This, in turn, was due to the rejection of a teleological understanding of function.

Lamy's affirmations about soul function appeared above all in another treatise of his, *Explication mechanique et physique des functions de l'ame sensitive*, written a year after publication of the *Discours*, as a response to attacks on that work.[921] The brain, he said in the *Explication*, was only the 'source' of the soul, which flowed from there into the nerves present in sense organs. What we perceived with our senses was communicated to the brain by these flowing bits of soul. The functions of the *sensus communis* were identical to the various impressions 'caused in the soul by the action

[916] Lamy, *Discours*, p. 96.
[917] Ibid., p. 98: 'Voilà, Messieurs, ce que j'avois à dire du cerveau, que l'on pretend estre le lieu où elle exerce ses functions les plus nobles. En effet, cette opinion est plus vraysemblable que celle d'Epicure, qui a pensé que le raisonnement se fait dans le cœur. Car nous voyons que, quand le cerveau est offensé, quoyque le cœur n'ait aucun mal, les fonctions sont blessées.' The source for this is actually not in Epicurus but, as Minerbi Belgrado points out, in Lucretius, *De rerum natura* III, 140.
[918] Ibid., p. 104: 'et ainsi l'opinion de Descartes n'est qu'une chimère qu'il a faite à dessein de voir comme on la recervroit dans le monde, ou pour d'autres raisons qu'on peut bien deviner'.
[919] Ibid., pp. 102-103.
[920] In the *Journal des Sçavans*, June 1, 1672, pp. 152-155, at p. 153, the reviewer of Pardies's *Discours* commented that Cartesians could not conceive that 'cette Ame soit materielle, sans estre matiere; et substantielle, sans estre substance'.
[921] Nicolas Blondel, dean of the Paris faculty of medicine, was fervently opposed to Lamy, as emerges from the overly and ironically apologetic account the latter wrote to present the *Discours*, *Cinq Lettres du mesme Autheur, sur le sujet de son Livre*: see Lamy, *Discours*, ed. Minerbi Belgrado, pp. 35-50. Lamy met subsequent accusations of atheism with the caustic, confident but rather bitter *Réflexions de Mr. Lamy sur les objections qu'on luy a faites*, ibid., pp. 109-136.

of objects' on the animal spirits in the nerves.[922] What turned sense impressions into sense data was the same substance which allowed us to perceive anything in the first place. In other words, one could not account for the soul's functions simply by pointing to its seat. But, for Lamy, the claim that one should focus on its functional nature, rather than on its - all-too-evasive - essence, had no bearing on the hypothesis that the soul was best described in materialistic terms. In effect, Lamy did not shirk from identifying different sorts of matter with different bits of soul. Again, the soul he was interested in was the so-called 'corporeal', or 'sensitive' one, responsible for perception, sensation and motion. Yet, as I shall now explain, these faculties could not be accounted for in the absence of the *sensus communis*, identifiable with an overarching, self-representing faculty whose *functional* difference from the so-called 'rational soul' was bound to be merely formal:[923] this faculty was what allowed us to be aware of our feelings, of our memories, of our dreams, of the difference between dream and wakefulness, of the sense of time, and so on. Reason, as Descartes himself described it in the *Passions de l'âme*, actively participated in this capacity to be aware of one's own emotional and cognitive states.

Some twenty years previously, Walter Charleton, in his *The Immortality of the Soul*, had described just such a self-representing faculty, as we saw earlier on.[924] Earlier still, his friend Kenelm Digby also saw this faculty as the proof of the soul's incorporeality. In the second of his *Two Treatises*, Digby endeavoured to analyse the nature of the soul, stating from the outset that all 'mens writings and actions' flowed from 'the source of *single apprehensions* and even from one bare notion of *Being*:

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[922] Lamy, *Explication mechanique*, ed. Belgrado, pp. 152-153: 'ce qu'on appelle la fonction du sens commun n'est point distinguée de ces impressions différentes causées dans l'âme par l'action des objets, qui remuent actuellement les esprits animaux enfermez dans les nerfs et continus à l'âme comme les ruisseaux à leur source.'

[923] For a helpful discussion bearing on this point see John Sutton, 'Distributed Memory, Coupling,and History' in *Dynamical Cognitive Science: Proceedings of the Fourth Australasian Cognitive Science Conference*, ed. R. Heath et al. (Newcastle, New South Wales, 1999), and at http://psychology.newcastle.edu.au/~heath/cogsci97/57Sutt.PDF (password: cogsci97). Sutton argues here that Descartes's description of animal spirits in the operation of memory demonstrates that he believed memories to be 'motions, rather than separate atomic items'. Cartesian physiology of memory and representation, thinks Sutton, is an instance of a modern-day 'distributed' model of memory. The very notion that animal spirits could play the role of, say, neural nets, as Sutton puts it, suggests that 'a single abstract framework of patterns and transformations is shared by old and new distributed models of memory. Both critics who complain that connectionism is just a technology-driven fad, and connectionists who rest their case wholly on "neural plausibility" misunderstand the generality of this framework: neither biological neural nets nor massively parallel silicon architectures are essential to its psychological power.'

[924] Walter Charleton, *The Immortality of the Human Soul, Demonstrated by the Light of Nature. In Two Dialogues* (London, 1657; facsimile reprint New York, 1985). See above, pp. 121-122.

which is the root and principle, from whence all others derive their origine'. Human accomplishments were the products of 'resolutions', which derived from 'discourses', in turn made of 'judgements', themselves composed of those single apprehensions. The 'cause' of such apprehensions, thought Digby, could not possibly be of the same nature as the 'quantitative parts' which made up those things which we apprehended.[925] The fallacy of such reasoning had notably been observed by Mersenne, who, in the 'second objections' to Descartes's *Meditations*, suggested that one could very well have a thought without its cause existing in actuality in the place where the thought was formed.[926] In other words, one did not need to bear in mind the (homunculus-like) object of the thought in order to have that thought. Digby, however, based his 'proof' of the soul's immateriality on what seemed to him a rhetorical question: 'How shall the same thing be corporaelly [sic] in two, nay in two thousand places, at the same time?' Since the contents of our thoughts were not themselves material, they must be immaterial; and 'consequently, that what receiveth them, is immaterial: since every thing is received according to the measure and nature of what receiveth it'.[927] To defend the immateriality of mind, the place where sense-data were received and processed, was the only way of making sense of our capacity to harbour thoughts about the world: 'for who can perswade himself, that the very thing he apprehendeth, is in his minde?'[928] There was simply no room in the brain for all the things that it was capable of representing. Intentionality - in the sense of bearing in mind - was thus itself the sign of immateriality, whatever the processes at work in the organism which allowed for cognitive operations to function. This was so, for Digby, specifically because of the alchemical principle that 'every thing is received according to the measure and nature of what receiveth it'.[929] Cartesian principles, scholastic argumentation and alchemical theory were here combined to result in the surprisingly straightforward demonstration of a belief - however

[925] Sir Kenelm Digby, *Two Treatises: in the one of which, the nature of bodies; in the other, the nature of mans soule, is looked into: in way of discovery of the immortality of reasonable sovles* (London, 1645): 'The Second Treatise: declaring, the nature and pperations of mans soule; out of which, the immortality of reasonable soules, is convinced', p. 50.
[926] Marin Mersenne, *Secondes objections*, in Descartes, *Œuvres*, ed. Alquié, II, pp. 543-545.
[927] Digby, *Two Treatises*., 'The Second Treatise', p. 51.
[928] Ibid.
[929] Ibid.

fallacious the reasoning behind it - about the nature of our capacity to have meaningful knowledge.[930]

Whether the cause of human higher cognition was understood to be immaterial or material, what connects such very different theses as Digby's, on the one hand, and Lamy's, on the other, was an assumption that the soul's nature must be inferred from the functions identified with it. Particular qualities, then, were posited of the soul, a substance which was assumed to be the cause of our intellective capacities, but whose nature could not be identified precisely because the causality behind higher order thought was unintelligible. If, for Lamy, the ultimate nature of the soul was a matter for theologians, Digby regarded as his job to demonstrate why that should be the case; but in doing so he injected as many assumptions about the workings of our cognitive functions as would Lamy. The association of the rational soul with immortality, and thus with immateriality, still remained in Lamy's day; nor had the need to point to and remember our divine origin disappeared (the case of Lamy and other *libertins* aside).[931] But this dominant rational soul - which for Descartes, of course, was the only soul humans had and the one thing animals did not have - could also serve to obfuscate problems inherent in trying to understand cognitive mechanisms in terms of the conceptually plastic, but ultimately material, animal spirits. For these animal spirits were at one and the same time both 'real', physical entities and the liminal structures which tied together the domains of 'physical' and 'mental'. As we saw earlier,[932] they did all the work necessary for an organism's perceptual, cognitive, imaginative and emotive life, as well as being explanatory not only of the intimate bond between soul and body, but also of the ailments which affected them both. They were inherently mobile and, functionally at least, highly polymorphous. But their actions within the organism were also responsible for all possible ailments, from ordinary passions to the most gruesome pathologies. In Willis's scheme, spirits in the cerebellum could communicate with spirits in the cerebrum, so that involuntary vital functions like digestion, breathing,

[930] The elaboration of the 'proof' occupies the whole of Chapter V, pp. 50-62.
[931] See *L'âme matérielle, ou nouveau systeme sur les Faux principes des philosophes anciens et modernes et des nouveaux docteurs qui soutiennent son Immaterialité*, ms. Arsenal, Paris, 2239, ed. Alain Niderst (Rouen, 1969) and the 'Introduction' by Niderst, pp. 7-26, on the context, fate, possible origins and authorship of this anonymous 'libertin' text.
[932] See above, pp. 90-92.

blood circulation and so on could affect, and be affected by, the functions of the s*ensus communis*.[933]

Outside the sphere of systematizing philosophy, the activity of animal spirits and humours, wholly explanatory as it was of motions, emotions, changes within the body, thus often resulted in crude, sharply felt experience, digestive trouble, melancholia, fever, apoplexy, or even, in England, an excess of religious enthusiasm.[934] And undoubtedly, within Descartes's own system *qua* system, the animal spirits did not help to justify the presence of an immortal, thoroughly immaterial rational soul presiding over these all-too-physical operations.[935] For Descartes, since medicine was a branch of physics, it made sense to study physical bodies in terms of the system's principles and to extend the remit of philosophy into the realm of medicine - which, in traditional curricula, was a branch of natural philosophy.[936] Although Descartes was sure that he would eventually be able to act on the *reality* of illness and help prolong life, his study of the body, we remember, referred to an artificial, soul-less zombie-like creature rather than to an actual, soul-endowed, living one.[937] There was no place in this study for the immortal soul.

But if man - not the automaton - was capable of reason, and reason was disembodied, the nature of higher order thought could not possibly be explained by reference to anything other than the very introspection - the reflection of reason on its own nature - that Descartes, in the *Méditations*, had shown was the proof of mind-body duality. Thought could not be at one with corporeal movements, he had stated in the 'Réponses aux sixièmes objections' to the *Méditations*, although to comprehend this, one had to focus on 'intelligible', not 'imaginable', things. Ideas of a thinking substance were distinct from ideas of an extended one. However much one found thought and corporeal movement together in the same subject, 'one should not

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[933] Willis, *Soul of Brutes*, pp. 33, 35-6, 55-60, 77-78; and see Johns, *Nature of the Book*, pp. 395-397.

[934] Willis, *Soul of Brutes*, p. 46: 'Sometimes the Sensitive Soul receives the Superior Rational Passions, which we call Metaphysical; and solicitously busying it self concerning their Good and Evil, it either draws forth or shortens the Compass of its Expansion. For indeed, the Rational Soul relying on the help and familiarity of the Spirits dwelling in the Brain, aspires to Metaphysical Notions, which having more fully learnt, it not only falls upon higher Speculations, but also exerts a certain Superior Appetite, to wit, the Will, and implicates it with certain Affections, as it were inspired of God; the exercise of which sort of Sacred Affections are not performed by the mere Conceptions of the Mind: But their Acts being delivered from the Rational Soul into the Sensitive, do first employ the Brain with the Phantasie'.

[935] For a similar point, see Sutton, *Philosophy and Memory Traces*, p. 61.

[936] See Roger French, 'Harvey in Holland', in *The Medical Revolution of the Seventeenth Century*, ed. French and Wear, pp. 46-86: pp. 52-54. Shapin refers to the article in 'Descartes the doctor', p. 138.

for that matter suppose that they are the same thing in terms of a unity of nature, but only in terms of a unity of composition'.[938] Lamy, in his list of historical views about the materiality or immateriality of the soul, referred to the Aristotelian notion that the understanding was immaterial and incorroptible, but that the individual understanding was a corruptible 'form inseparably attached to matter'.[939] Descartes's notion of a 'unity of composition' here looks conceptually akin to the Aristotelian view of form inhering in matter. It is perhaps all the more important to note that, in Descartes, it was in virtue of this 'unity of composition' that phenomena such as passions could be comprehended. Caused as they were by the movement of spirits, the passions were 'feelings, because they are received within the soul in the same way as the objects of external senses, and are known by the soul in the same way'.[940] They were thus cousins of our will's actions, themselves 'emotions of the soul', caused by the soul and relating to it.[941] Alquié, in his edition of the *Passions de l'âme*, explained Descartes's scheme in this way: our thoughts, or states of consciousness, are either active or passive. Passive thoughts are perceptions, themselves either clear and distinct, when they are related to the understanding alone, or confused, as feelings are, because of the very union of mind and body. Feelings, in turn, are either sensations, related to external objects and devoid of affect, or replete with affect, in which case they pertain either to the body, as with pain, pleasure and so on, or to the soul, as with the passions.[942] Passions were thus a sort of perception, although knowledge of this perception depended on the work of reason.

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[937] I rely here on Shapin, 'Descartes the Doctor', pp. 137-138.

[938] Descartes, 'Réponses' in Descartes, *Œuvres*, ed. Alquié, II, pp. 864-865, at p. 865: 'tout autant de fois que nous les ['idées d'une choses qui pense, et d'une chose étendue ou mobile'] rencontrons ensemble dans un même sujet, comme la pensée et le mouvement corporel dans un même homme, nous ne devons pas pour cela estimer qu'elles soient une même chose en unité de nature, mais seulement en unité de composition'. Descartes was committed to the belief that the soul occupied all bodies whose organic structure was intact, whether the body was whole or mutilated. It was with the dissolution of this structure that the soul separated itself from it: see *Passions*, Art. 30, in Descartes, *Oeuvres*, ed. Alquié, III, pp. 976-977.

[939] Lamy, *Discours*, pp. 99-102, at p. 101; Aristotle, *De anima*, III.4.

[940] Descartes, *Passions*, Art. 28, in *Œuvres*, ed. Alquié., III, p. 974: 'On les peut aussi nommer des sentiments, à cause qu'elles sont reçues en l'âme en même façon que les objets des sens extérieurs, et ne sont pas autrement connues par elle.'

[941] Ibid., p. 975, Art. 29: 'elles [les passions] sont causées, entretenues et fortifiées par quelque mouvement des esprits, afin de les distinguer de nos volontés, qu'on peut nommer des émotions de l'âme'.

[942] Ibid., p. 975, n. 1. This sumarizes Descartes's own account, laid out in full in the letter to Elizabeth of 6 October 1644, in ibid., pp. 610-620, esp. 614-616.

This psycho-physiology was a lively, living companion to the automaton thesis, in which the will's confusions and the body's solidity could be generously accounted for, precisely by reference to a mind-body *pêle-mêle* and the rejection of the systematic use of traditional medical prescriptions, in favour of personal experience and introspected conviction. But, again, reason remained reified, ever the self-defined *res* reigning, given sufficient will-power, over and above our confusions, unsullied by its intimate kinship with our fragile perceptions and overpowering sensations. Descartes's psycho-physiology was not entirely consistent with the dualist scheme, but it was bound up with it. What it produced was an introspecting, philosophizing subject able to dream of refounding medicine on a sure, entirely revised basis, in accordance with the principle that our body, like all bodies, was a machine whose needs it was reason's duty to heed,[943] since reason could divert the course of illness and mood. On the whole, Descartes's ideas about medicine seemed to be standard, common-sense, Galenic, moderately sceptical fare. The advice can seem quite reasonable to a modern eye, insofar as the main principle on which it relied, plainly Juvenal's *mens sana in corpore sano*, remains hard to contradict.[944] But its explanatory framework was a fixed, linear physiological system, sustaining the tensions which we have seen explicitly fuelling the post-Cartesian debates on animal minds and which also, clearly, informed post-Cartesian theories of the human body and corporeal soul. These tensions were present within the constructions offered up as theories explaining the mind-body relation, and which I shall presently analyse in order to show how they skirted the functional problems at the heart of the definition of the human soul and of its capacity to have and doubt knowledge.

Within a properly pious framework, there was very little room for manoeuvre. It was impossible to think of humans as organisms whose development must be understood naturalistically, because higher cognition, discernment of truth and error, moral judgement and of course control over the passions were irremovable components of the definition of man.[945] The soul that was able to exert such control was precisely the one which, in Descartes's terms, and even more in those of a purist Cartesian such as Malebranche, had clear and distinct ideas, about extension for

[943] I here rely again on Shapin, 'Descartes the Doctor', p. 145, who in turn cites from Adrien Baillet's *La vie de Monsieur Descartes* (Paris, 1691), the first biography of Descartes.
[944] See Shapin, 'Descartes the Doctor, esp. pp. 149-151.
[945] See also Sydenham, *Theologia Rationalis*, ed. Dewhurst, pp. 145-159.

example: 'there is nothing in the objects of our senses that is similar to the perceptions [*sentiments*] we have of them', Malebranche had the interlocutor Ariste say in the *Entretiens sur la métaphysique et la religion*. 'These objects relate to ideas of them', he went on, 'but it seems to me that they have no relation to our perceptions. Bodies are merely extension, capable of movement and of taking on various shapes.'[946] Théodore's reply here was that, in order to know the properties of bodies, one had to consult 'the clear idea of the extension which represents their nature', rather than the senses.[947] Furthermore, our senses were 'false', and imprisoned us in a world of illusion. The visual sense was an exception, up to a point: our eyes, wrote Malebranche, speaking through Ariste, were 'given to us to throw light on all the movements of our body, in relation to those around us, solely for practicality's sake and for the preservation of life', which required us 'to have some sort of knowledge of sensible objects that somewhat approaches truth'.[948] Most crucially, however, our soul was joined with what Malebranche repeatedly called the 'divine Word' and 'universal Reason', even though our dependence on our bodies weakened this union.[949] Ideas were abstract and belonged to the realm of God. It was evidently the case, as Descartes insisted, that the existence of reason, and so the union of body and soul, depended on the existence of God; and to have an idea of God without having an idea, however indistinct, of final causes, was all the more unthinkable.[950] Indeed, a perfect universe in which everything had been created according to its purpose could only have been created by God, and having the idea of God entailed having the idea of perfection.

I have suggested that the *sensus communis* of the post-Cartesians must be functionally equivalent to higher, self-representing, conscious reason. For Malebranche, this could not possibly be true: a human reason defined by its

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[946] Malebranche, *Entretiens sur la métaphysique*, '3ème entretien', article XIII, p. 265: 'il n'y a rien dans les objets de nos sens qui soit semblable aux sentiments que nous en avons. Ces objets ont rapport avec leurs idées; mais il me semble qu'ils n'ont nul rapport avec nos sentiments. Les corps ne sont que de l'étendue capable de mouvement et de diverses figures. Cela est évident lorsque l'on consulte l'idée qui les représente.'

[947] Ibid.: 'Les corps, dites-vous, n'ont rien de semblable aux sentiments que nous en avons; et pour en connaître les propriétés, il ne faut pas consulter les sens, mais l'idée claire de l'étendue qui représente leur nature.'

[948] Ibid., '5ème entretien', article VIII, p. 303: 'Ils [nos yeux] ne nous sont donnez que pour éclairer tous les mouvemens de nôtre corps par rapport à ceux qui nous environnent; que pour la commodité et la conservation de la vie; & il est nécessaire pour la conserver que nous ayons des objets sensibles quelque espece de connoissance qui approche un peu de la vérité.'

[949] Ibid., '6ème entretien', article VII, p. 323.

participation in universal Reason seemed to require an absolute, external guarantor, independently of mundane sense organs.[951] The God-loving, God-knowing soul of man was at peace; truth was guaranteed: the accuracy of cognitive operations involving the *sensus communis* was a proof of that. Malebranche's stance did not actually stand formally in contradiction with the view, stated by Lamy himself, that the modalities of knowledge must be studied apart from theological concerns. For his own protection, Lamy knew how to distinguish the immortal soul from a unifying common sense. But, for him, as for most natural philosophers and physicians involved in the study of the corporeal soul, what mattered was that, without the self-representing function of the *sensus communis*, there would be only sensorial impact, and no constructed, imagined, distorted, remembered, recounted sense experience, indeed no *ideas* in the Lockeian, or Cartesian sense. Inversely, states of cognition, even when divorced from physiological activity, could not also be divorced from their contents, referents, or causes. These were psychological, or, to put it more bluntly, empirical facts, not theological propositions. The theological onus placed on the rational soul thus left the physical, mortal subject with little more than a cracked mirror in which to contemplate the marvellous, perfectly and divinely designed machine of his body.

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[950] See Descartes, letter to Mersenne, 15 April 1630, in Descartes, *Œuvres*, ed. Alquié, I, pp. 259-261.

[951] Nicholas Jolley, in *The Light of the Soul: Theories of Ideas in Leibniz, Malebranche, and Descartes* (Oxford, 1990), p. 97, makes a similar point. See also p. 112, where he frames Malebranche's notion of 'vision in God' thus: 'The items that I see in God are ideas, and ideas, as we have seen, are not psychological but logical; as Malebranche insists again and again, they are not modifications or modalities of mind. None the less, if these ideas are to be anything to us, they require corresponding mental modifications; in other words, as Malebranche emphasizes in the *Conversations chrétiennes*, we must have perceptions of the ideas in God's mind to which we are related'. Jolley identifies the doctrine Malebranche presents in the *Conversations chrétiennes* as one which offers a monist resolution to that presented in the *Recherche de la vérité*. He also suggests, p. 79, that Malebranche's association of ideas with 'the substance of God' actually turns Descartes's *res cogitans* 'into an abstract entity', which, he says, is 'inconsistent with the framework of Cartesian dualism'. Furthermore, 'Malebranche could have given up the pretence that his philosophy is dualistic; he could have admitted that his philosophy is really a version of trialism: in addition to minds and bodies, there is a third realm of abstract, logical entities.'

This was the source of tension.[952] For the living machine, in which mobile spirits corresponded to states of mind, mood and bodily health, was changeable, dynamic, in perpetual motion. What therefore needed explaining was how the fixed explanatory structure of invisible spirits could govern physical, memory and emotional mobility in a creature obligatorily endowed (partly by religious constraints) with free will and a degree of self-awareness. If the underlying, invisible mechanisms were too deterministic to account for dynamic functions ultimately regulated, via the centralizing role of the *sensus communis*, by the agency of the immaterial, immortal rational soul, then it was possible that the internal coherence of these very mechanisms was precisely what caused their conceptual remoteness from the immaterial soul. The embeddedness of perceptual cognition, sensation, motor functions and emotional life in physiological and chemical processes could be a perfect justification for a Cartesian sort of dualism; and conversely, it could also be the perfect justification for denying the explanatory relevance of an immaterial, immortal, rational soul. Someone like Lamy clearly understood that the 'reality of the biological object',[953] where the biological object was human, could not possibly have anything to do with processes defined in finalist terms: for a mechanist - and all the more so for a materialist - ultimate ends were heuristically irrelevant to a proper understanding of the living organism.

All animals were endowed with body and soul: that, *pace* Descartes and those who espoused the beast machine thesis, was not in question here.[954] But Lamy, in the *Explication des fonctions de l'âme*, qualified the intension of each concept in two

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[952] John Sutton, in 'Distributed memory', p. 5, formulates the essence of this tension, particularly with regard to memory, by asking: how 'can a dualist like Descartes have had a naturalistic account of memory at all? Don't all mental functions belong to the incorporeal soul, being thus unavailable to animals and to the automata or dreaming machines who are the ostensible subjects of the *Treatise on Man*?'. His answer is that 'Descartes takes memory to be not a *mental* function at all, but a life function', and that, although 'there could be no science of the (rational) mind for Descartes', he did have a 'science of memory. Since we don't share his restriction of the mental to conscious rational thinking, we are at liberty to treat his theory of memory in its own terms. So it's not quite true that, for Descartes, "there can be no science of animal psychology" [citing Margaret Boden, 'Introduction' to Boden, ed., *The Philosophy of Artificial Life* (Oxford, 1996), pp. 1-35: p. 21]: there may be no science of *reason*, but there are sciences of memory, perception, dreaming, and emotions.'

[953] In the words of the biologist Alain Prochiantz, *Machine-Esprit* (Paris, 2001), p. 168: 'Le sentiment de permanence qui habite l'individu humain, la conscience d'être qu'il associe à la possibilité de pouvoir se nommer, bref à dire ''je suis moi et tu es toi'', ne correspond donc pas à la seule réalité de l'objet biologique.'

[954] There is no need to trace here the debate on animal souls, examined in Part I, chs. 2-3, and the solution offered by a Gassendist *via media*. Lamy, again, tilted towards pure Epicureanism, while also managing, as Minerbi Belgrado explains in her introduction to Lamy, *Discours*, pp. 21-27, to avoid having to invoke a world soul or occult forces in nature, or to espouse any form of vitalism.

ways: first, functions did not arise out of Galenic 'faculties', in the sense that organs did not function in the way they did because endowed with an inbuilt, local 'consciousness';[955] and second, the soul had a variety of names, according to the area in which it was active. It was vision in the eye, smell in the nose, taste in the tongue, and so on.[956] Lamy spoke of the senses as those organs through which the sensitive or corporeal soul acted - as the means by which it 'knows its objects', or 'agitates the body' - and as what produced passion, sensation and voluntary movement.[957] There were as many kinds of sense as there were kinds of sensorial experience; and Lamy divided them, just as Descartes had,[958] into external and internal ones: the former consisted of the five senses, with the addition of thirst, hunger and love's pleasures, the three of which counted as 'a variety of perceptions whose organs are all different'.[959] The latter was 'the main portion of the sensitive soul', located in the brain and consisting of common sense, imagination and memory - those functions acquainted with 'absent objects'.[960] Lamy, like Steno, Perrault, and, as we have seen, any self-confessed opponent of dogmatic knowledge, preferred doubt to error,[961] claiming in the midst of his description of sense-perception that it was impossible to make progress in the explanation of how exactly the agitation of spirits produced the perception of particular objects, and what exactly was the disposition of certain objects that caused in us certain perceptions.[962] It was clear, however, that animal spirits, or a 'portion of the soul' in the nerves, were agitated by perceived objects, and that there followed a chain reaction of sorts in which the spirits reached the main part of the soul, located in the brain. In turn, traces of the object's impression left in the brain were enough for the impression to be reactivated even when the object was absent.

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[955] On Galenic faculties, see Roger, *Sciences de la vie*, pp. 74-79, and Minerbi Belgrado, p. 69.
[956] Lamy, *Explication mechanique et physique*, in Lamy, *Discours*, p. 139.
[957] Ibid, pp. 139-140: 'Il faut donc expliquer en combien de manières elle connoist ses objets, quels sentiments naissent à l'occasion de ses connoissances, et comment elle remue le corps pour satisfaire à ses sentimens; c'est à dire qu'il faut parler de la différence des sens, des diverses passions que l'animal ressent à leur occasion, et du mouvement volontaire qui les suit ou les accompagne'.
[958] See Descartes, *Principes*, IV, in *Œuvres*, ed. Alquié, 190, pp. 504-510.
[959] Lamy, *Explication méchanique*, p. 140: 'Car, outre les cinq dont tout le monde demeure d'accord, la soif, la faim et le plaisir de l'amour sont des perceptions diverses dont les organes sont différents'.
[960] Ibid., p. 140: 'les sens externes sont ceux qui ne ressentent que les objets présens et les internes connoissent les absens'.
[961] Ibid., p. 142.
[962] Ibid., p. 141.

External and internal senses were thus the sum of such motions of the soul and traces in the brain.[963] This mix of Cartesian physiology and Gassendist, atomist 'bits of soul' resulted in an account of perception where, while sensible qualities remained, as in Descartes,[964] features of our perceptual make-up rather than intrinsic to objects, sense-experience could nevertheless be explained with reference to the non-subjective, atomistic structure of all bodies, including our own. What made certain objects feel a certain way was a combination of their particular atomistic structure and of the particular way in which animal spirits responded to that structure. This held for touch as it did for lust, thirst and hunger, which were all perceptions. The perception of lust, for example, consisted in contact with 'seed', which agitated 'in a pleasant way the animal spirits contained in the nerves distributed throughout these parts; and this agitation is communicated to the soul, which traces it in the brain by virtue of the necessity of the movement it received.'[965] Intrinsic in Lamy's description, however, was the awareness of a categorical difference between the object's disposition to cause certain states in us, and the state itself: 'cold and hot bodies', for instance, caused in us certain perceptions or passions because they were endowed with certain 'movements and figures' which did so.[966] The description of what it took for an organism to be capable of perception thus required the identification of a gap between the causal account of perceptual mechanisms and the psychological account of perception itself. For Lamy, although it was clear that the sensitive soul was corporeal, descriptions of the sense organs themselves, or of the objects of sense, were irrelevant to understanding what was of interest to him, which was 'the manner of perception'.[967]

Yet he also admitted that the theory of animal spirits begged the question of *how* these substances became agitated in the nerves, of *why* the soul felt the object, and why the ensuing movement in the soul was a perception.[968] What was it that determined bodies to behave in certain ways, and why were not *all* bodies 'capable

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[963] Ibid., p.142.
[964] See above, pp. 72-74.
[965] Lamy, *Explication méchanique*, p. 144: 'Cette perception se fait par l'attouchement de la semence, qui agite d'une maniere agréable esprits animaux contenus dans les nerfs distribués dans ces parties; et cette agitation se communique à l'âme, qui en trace le vestige dans le cerveau par la seule nécessité du mouvement qu'elle a receu.'
[966] Ibid., p. 145.
[967] Ibid., p. 148: 'Comme je ne veux expliquer que la manière de la perception, sans parler ny de la structure de l'organe ny exactement de l'objet qui la cause'; see also p. 151.
[968] Ibid., p. 148.

of thought, perception and movement'?[969] The very perfection of these mechanisms and of their adaptation to environmental constraints - usually praised as the creation of the divine architect[970] - could not be fully explained merely in terms of physiological, mechanical or chemical phenomena, insofar as doing so would lead to the need to praise the perfection of these second-order phenomena, and so on in an infinite regress of perfect mechanisms. In Lamy's mind the switch to a second-order level of explanation did not necessitate the usual appeal to the architect of these marvellous, admirable mechanisms: once again, a final cause was merely an alibi for the absence of a proper explanation. His approach was to justify the Gassendist notion of the soul by treating it as a body, endowed like all bodies with its own figure and movements. Perceptions or passions were the soul's movements, just as fire was a body whose movements were heat and light (which he thought was a substance and identical to colour).[971] The atomic constitution of each body, as of each sense, defined its properties. That, in effect, sufficed to define the nature of the sensitive soul.[972]

As we have seen, these 'various impressions caused in the soul by the actions of objects, which agitate the animal spirits in the nerves' and soul amounted to none other than the *sensus communis*. Imagination and memory - the internal senses - were easily explained by a soul which enabled traces of objects to remain even in the absence of any will to recall them. They did not require sense-data to function.[973] In beast as in man, the sensitive soul alone ensured the presence in mind, as it were, of images and ideas whose atomic constitution nevertheless corresponded with that of the original objects. The trace theory further explained why the sense of time was intrinsic to memory: you did not need to 'know the nature of time in general and abstractedly, nor to know all the metaphysical questions the School made out of it',[974] in order to know that you had done a particular thing at a particular time. Lamy suggested, as Robert Hooke would also do in a brief text he wrote on the nature of memory,[975] that memory consisted of overlapping traces - agent, action and situation

[969] Ibid.: 'Or, si la perception n'enfermoit autre chose que ce mouvement de matière et ce caractère qui en reste, tous les corps seroient capables de pensée et de perception comme de mouvement'.
[970] See Tocanne, *L'idée de nature*, pp. 70-78.
[971] Lamy, *Explication méchanique*, p. 150.
[972] Ibid., pp. 147-148.
[973] Ibid., p. 153.
[974] Ibid., p. 155: 'Il n'est pas nécessaire de connoistre la nature du temps en général et par abstraction, ny d'en sçavoir toutes les questions métaphysiques qu'on en fait dans l'Ecole'.
[975] See *The Posthumous Works of Robert Hooke, Containing his Cutlerian Lectures, and Other Discourses*, ed. Richard Waller (London, 1705): *Lectures of Light, Explicating its Nature, Properties,*

- impressed upon the soul, through the sense of sight, for example, at the time of the event. As for dreaming, it corresponded to the soul's state of rest and weakness, in which it absorbed the 'ideas' of a variety of objects, and where 'ideas of good and evil' impressed themselves all the more easily due to the absence of reflexion to mitigate them.[976]

The atomist doctrine allowed for flexibility in the account of the soul's functions. As a unifying concept, the 'soul' as envisioned by Lamy could not be located in one place, while the presence of cognitive, sensory and motor functions in beasts was at least symptomatic of the fact that this soul could not be immaterial. The explanatory system chosen by Lamy was thus perfectly suited to his inclination to understand the body in its own, material terms, and to describe it in such a way that it seemed to include functions usually ascribed to the rational soul - as he himself noted his opponents were prone to believe he wanted to do.[977] This preemptive accusation did not conceal his belief in the inalienably subjective character of, for instance, emotions: words might describe them, but anyone who had not experienced and 'felt' them would not really understand what those words signified.[978] It was possible to understand the phenomenon of emotions in terms of the idea-imbued soul's overflow into the heart, followed by the rarefaction of blood and subsequent exaltation of the blood's flow. But again, although an ultimately 'physicalist' account - part atomist, part Cartesian, part chemical - of these phenomena must necessarily be true, it was impossible, Lamy maintained, to know the whole story.[979]

Lamy's belief in the validity of an automaton theory of emotion and cognition in the Cartesian mould allowed him to say that there was a direct connection between the internal sense of imagination, reliant on traces in the brain, and the heart's movements: the impression made by the soul on the heart returned to the brain, and this explained why we knew 'that we love or that we hate' and remembered 'having loved or hated'. The heart was the instrument of emotional life, just as the external senses were the instruments of sense perception; and it impressed

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and Effects, &c., pp. 71-148: VII, pp. 138-148. A discussion of this text is in Douwe Draaisma, *Metaphors of Memory: A History of Ideas about the Mind* (Cambridge, 2000), pp. 52-65.
[976] Lamy, *Explication mechanique*, pp. 155-156.
[977] Ibid., pp. 156-157.
[978] Ibid., p. 159.
[979] Ibid., pp. 158-161.

its traces on the brain, ensuring full cognition of emotional life.[980] The soul's perpetual motion thus ensured what one might call an experiential continuum. Although reason, that is, the superior rational soul, could control passions, they in the end usually ruled, especially the passion of love, which Lamy described minutely over a number of pages.[981] He stated clearly that he focused on that aspect of the sensitive soul which was proper to man alone, rather than to man and beast, 'because it is easier to know what is happening in ourselves than in animals, and it is easy to establish what is going on in them by comparison'.[982] It was also the case that, for him, human psychology was clearly of far greater interest, and a more apposite object of study, than either animal minds or the rule of reason. Voluntary movement, however, could be explained in *both* man and beast in terms of the bodily machine having a disposition such that the sensitive soul was directed by a passion to flow into one muscle rather than another. This sort of determination was necessary, but also voluntary, thought Lamy, insofar as it obeyed the soul's very nature.[983] As Minerbi Belgrado has noted, Malebranche would use the same idea in his *Recherche de la vérité*;[984] but, again, for Malebranche these processes did not explain anything about the soul. Sensory knowledge and imagination depended on traces; the ideas of such knowledge had, 'so to speak, body', according to Malebranche.[985] But 'there are no traces in the brain that can of themselves awaken ideas other than those of sensory things', he wrote elsewhere, 'for the body is not made to instruct the spirit, and it speaks to the soul only for its own sake'.[986] Like Descartes and even Malebranche, Lamy thus promoted subjective introspection together with a mechanical and corpuscularian account of motor, physiological and psychological function, in order to paint a plausible portrait of human nature and 'animal' action. But the portrait was

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[980] Ibid., p. 161-163.
[981] Ibid., pp. 164-168.
[982] Ibid, p. 168: 'je me suis pourtant principalement attatché à celles de l'homme, parce que nous sçavons mieux ce qui se passe en nous-mesmes que dans les animaux, et qu'il est aisé de juger de ce qui se passe chez eux par comparaison.'
[983] Ibid., p. 175.
[984] 'Introduction', Minerbi Belgrado, in ibid., p. 28, n. 85; she refers to Malebranche, *Recherche* (II.1.vii) as a whole.
[985] Malebranche, *Conversations chrétiennes*: 'Entretien VII', p. 151: 'Mais les connaissances sensibles, etcelles où l'imagination a beaucoup de part, étant soutenues par les traces du cerveau, elles peuvent résister à des sentiments contraires. Les idées de ces connaissances, ont pour ainsi dire, du corps: elles ne se dissipent pas facilement.
[986] Malebranche, *Recherche*, I (II.1.vii, §6), p. 253: 'Car enfin il n'y a point de traces dans le cerveau, qui puissent par elles-mêmes réveiller d'autres idées que celles des choses sensibles: parce que le corps n'est pas fait pour instruire l'esprit, & qu'il ne parle à l'ame que pour lui-même.'

also unlike Descartes's, in that dualism was of no use as a key to interpreting it, however much Lamy claimed it was built into a structure similar to that within which Descartes himself wanted to work.

To an extent, then, Lamy got rid of the incorporeal *res cogitans*, while preserving the notion of self-representing emotions and of willed bodily action. He saw matter as a substance, structured in such a way that second-order awareness, or consciousness, could be included within an analysis of matter's functions.[987] Claude Perrault was also strongly aware of the self-representational role of the soul. In the *Méchanique des animaux*, he spoke in one breath of 'the particular place nature has chosen as the tribunal in which the soul judges everything that is brought to it by the senses', and of 'the centre which receives all the lines from the senses, as from a circumference'.[988] That place, for him, was far too difficult to *locate*,[989] and he preferred to concentrate on finding out 'how this propagation of emotion and movement caused by the sensation can take place all the way in the depths of the brain'.[990] Perrault had trouble understanding not only how one could find out where the seats of judgement and memory were, but also how spirits could produce sensation and perception. It seemed to him unintelligible to say, as was usually done, that spirits could generate both at once.[991] It was better, he thought, to allocate the functions of the sensitive soul entirely to the internal senses. In his view, however, the actions of the sensitive soul were not in themselves corporeal, as opposed to the external senses and the organs associated with them: 'the soul which is united to all the parts of the animated body' did not need to accede to the brain in order to have perceptions.[992] The brain's job with regard to the senses was simply to 'prepare the spirits necessary for the disposition of each organ of external sense to be in such a

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[987] Minerbi Belgrado makes a similar point in her 'Introduction', in Lamy, *Discours*, p.18.

[988] Claude Perrault, *Du bruit*, 'Troisième partie: Où il est expliqué comment l'agitation particuliere de l'air qui fait le bruit, est rendue sensible à l'organe de l'Ouïe', p. 263 : 'l'on n'est en peine que du lieu particulier que la nature a choisi pour estre comme le tribunal dans lequel l'ame juge de tout ce qui luy est rapporté par les sens; ou comme le centre qui reçoit toutes les lignes qui des sens y viennent aboutir, comme d'une circonference.'

[989] Perrault, *Du bruit*, pp. 173-174.

[990] Ibid.: 'J'en suis encore à comprendre comment cette propagation d'émotion & d'ébranlement causé par la sensation se peut faire jusqu'au fond du cerveau'.

[991] Ibid., pp. 263-264.

[992] Ibid., p. 266: 'l'ame qui est unie à toutes les parties du corps animé, n'a que faire d'aller contempler ces images dans le cerveau'. This view was a variation on that held by Gassendi, as reported by François Bernier in his *Abrégé de la philosophie de Gassendi*, IV, 6, 'De l'âme', p. 456, that the soul was 'la fleur de la matiere, dont les parties sont dans une certaine disposition ou habitude,

way that it is easily affected by objects'.[993] Sensations imprinted themselves on sense organs, and these impressions were easily accessible to the corporeal soul via the internal senses. Failures or anomalies of perception were not due to cerebral lesions, but to a lack of spirits coming from the brain, within the organs of external sense.[994]

The notion of self-representation here remained at the centre of what was conceived as the range of functions of the sensitive soul.[995] But with Perrault, it was unnecessary, even confusing, to suggest that sensation, memory and so on were in a one-to-one correspondence with corporeal events. Sensations did not travel in the body; rather, internal senses in the brain ensured that parts of the body were capable of sensation by giving them 'the disposition to be sentient'.[996] The information that the body - in the case, for instance, of phantom limbs[997] - and the memory retained was not itself material. There was no particular storage place for memories: since sense-perceptions could *not* have figure and movement, they could not possibly leave traces in the brain either.[998] Traces and images were such only metaphorically, or analogically, not as paintings or seals, but 'rather in the way that speech is said to be the image of thought, and writing the image of speech'.[999] Memory seemed akin to images because it was *representational*; but that merely showed that something in animals was capable of perceiving, preserving and representing emotion.[1000] Perrault knew that this theory did not explain why there seemed to be a correlation between disturbance of corporeal function and loss of memory, or how the phantom limb phenomenon could take place in the absence of stored images;[1001] and he was aware that, without mechanism and without traces, it might seem difficult to account for

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& symmetrie speciale avec les parties les plus grossières du corps; car en tant qu'elle est substance, elle peut estre le principe d'agir a cause de sa mobilité'.

[993] Perrault, *Du bruit*, p. 266: 'l'office du cerveau selon mon hypothèse n'étant à l'égard des sens, que de préparer les esprits nécessaires à la disposition que chaque organe des sens exterieurs doit avoir pour estre facilement émeu par les objets'.

[994] Ibid., pp. 266-267.

[995] Picon, in *Claude Perrault*, p. 83, identifies this as an Augustinian strand in Perrault's conception of the relation of soul to body; see also pp. 75-88 for his excellent account of Perrault's ideas about physiology and soul, discussing also the text I refer to here.

[996] Perrault, *Du bruit*, p. 268: 'la disposition à estre sensible, qui est donnée par le cerveau à la partie'.

[997] Ibid., p. 273, where Perrault writes of 'les accidens qui arrivent à ceux à qui les bras ou les jambes ont esté couppées, qui sentent quelquefois des douleurs au pied ou à la main qu'ils n'ont plus'.

[998] Ibid., p. 269.

[999] Ibid., p. 270: 'comme quand on dit que la parole est l'image de la pensée, que l'écriture est l'image de la parole'.

[1000] Ibid.

[1001] Ibid., p. 272.

memory at all.[1002] Still, he held on to his belief that each part of the brain *produced* spirits which then travelled in the nerves, instead of serving as a *container* of acquired images. This helped explain how a dog, for example, could find his way back home: mere traces could not provide the inference necessary in making sense of an inverse order of succession on the road. An understanding of causes and a 'power capable of turning the premises into the cause of the conclusion, and the conclusion into the effect of the premises'[1003] - a power not unlike rationality, as it turned out - were necessary for the memory of the road to have anything to do with the dog's capacity to find his way back home. This capacity seemed to require some sort of judgement.[1004] The order of causes at work in memory and in the capacity for organs to have a disposition for appropriate action, Perrault made clear over and over, was not identical to the straight, mechanical causality at work in the physical world. In other words, if traces were what constituted memory - the records of perceived events registered in 'real time' succession - and 'memory' was identified as the faculty which made it possible to act in a way appropriate to the environment, the temporal dynamic at the heart of memory was lost. One had static repetition instead of dynamic action free from immediate stimuli.

Here again, observing what a faculty could do - what sort of function it had - did not necessarily produce a definition of what sort of thing it was, or what sort of structure it had. Rather than present a ready-made thesis about the souls of beasts and so engage in the dispute about the beast-machine thesis that Bayle had described in his *Rorarius* article, Perrault, like Willis, concentrated on a physiological account of cognitive functions which in turn led to his conclusion about the presence of a soul in animals. The focus on function rather than on form resulted in helping us understand the physiology of human cognition while emphasizing its similarity to animal cognition. Apparent form was here divorced from function; instead Perrault assumed that hidden forms determined function and defined the unity of nature. This leads us to a possible, although necessarily partial, conclusion to our enquiry.

[1002] Ibid., pp. 272-276.
[1003] Ibid., p. 279: 'à quel principe peut-on attribuer ce changement d'ordre, qu'à une puissance capable de faire que les premices soient la cause de la conclusion, & que la conclusion soit l'effet des premices, par une suitte dont la nature est tout à fait differente de celle qui fait que le feu est suivy de la fumée, & que la fumée est suivie des larmes qu'elle fait venir aux yeux.'
[1004] Ibid., p. 278.

We have returned to the difficulties inherent in postulating a belief in the reality of unseen, but imaginable, explanatory models such as animal spirits, cerebral structure and so on. Endowed with the three-dimensional features of figure, movement and extension, these were recognizable, even familiar models. Perrault seems to have understood that they also played the role of establishing the boundaries within which assertions about mental function were meaningful. For a natural philosopher intent on interpretive caution and convinced of the need to rely on observation, this is not really surprising.[1005] But the point for us is that, beyond these boundaries within which language existed and sense could be made of observation, the concept of 'soul' lost all meaning. The effort to atttribute semantic content to non-verbal, non-symbolic thought, with which this dissertation began,[1006] found expression in the creation of explicit rules (such as those promulgated by the Royal Society and its French admirers to establish criteria of credibility and plausibility) for the pursuit of empirical, sense-based enquiry into natural objects no longer knowable, nor recognizable, through the abstract speculation favoured by the Schools. Arguably, this effort could have entailed a belief, not in a purely rational soul, but in an embodied one, the sort which Lamy dared to imagine. Yet, the difficulty of abandoning the notion that function must correspond to material structure meant that the very ability to observe, with the embodied senses, continued to seem separate from the capacity to think, that is, to think verbally. Anatomical observation and physiological theory were thus conceived as unfolding in a realm apart from the existence and operations of rationality which were assumed to exist in the non-physical, infinite, celestial realm that reason itself was so good at describing and guaranteeing. It was our capacity to represent ourselves to ourselves - in other words, verbalizable self-representation, or consciousness - that made it impossible to let go

[1005] This was discussed in Part II, Chapter 1. See also, e.g., Fontenelle's statement about the Académie des Sciences in the *Préface sur l'utilité*, in *Histoire*, that 'l'Académie n'approuve les raisonnemens qu'avec toutes les restrictions d'un sage Pyrrhonien', cited by Roger, *Sciences de la vie*, p. 199; see also ibid., p. 201. In the *Memoires pour servir à l'histoire naturelle des animaux et des plantes* (Amsterdam, 1736), Perrault wrote, 'Preface', p. ix: 'comme il est impossible de philosopher sans avancer des propositions générales, qui doivent estre fondées sur la connoissance de toutes les choses particuliéres, dont les notions universelles sont composées; & que nous avons encore long-temps à travailler, avant que d'estre instruits de toutes les particularitez qui sont nécessaires pour cela: nous croions qu'on ne s'arrestera pas beaucoup aux raisonnemens que nous avons mêlez parmi nos expériences, & qu'on jugera aisément que nous ne prétendons répondre que des faits que nous avançons, & que ces faits sont les seules forces dont nous voulons nous prévaloir contre l'autorité des grands Personnages qui ont écrit avant nous'.

[1006] See Part I, Chapter 1.

of the idea that the source of our representations could not be physical. The dualist assumption was a powerful one for this reason. One may ask (although the question presumes that thought and matter are not identical) whether this was due to a wrong notion of thought or to a wrong theory of matter.

Opinions about the existence of a soul in animals constituted responses to this question of what was wrong with accounts of matter or notions of thought. Perrault had a particularly interesting answer: in his view, animals were endowed with a capacity for thought. Matter and thought, in other words, were not so neatly divided as Cartesian orthodoxy would have had it. No definition of reason as a substance was needed for proof of its existence. It was not that functions necessarily must be believed to exist in the absence of visible structures, but that thought and reason were the best available explanations for a number of animal actions. More to the point, Perrault insisted that

> it is not necessary to know what thought is and what reasoning is, in order to think and to reason. The most stupid man nonetheless thinks incessantly, and reasons in his most minute actions without knowing it and without his ever thinking about it, long-established habit having the power to render thought's actions imperceptible, although thought always accompanies all other actions of animals.[1007]

Such an account of reason as a set of environmentally adapted functions, some of which could be deemed to be instinctive, would enable one to say that animals were endowed with a capacity for thought even without the capacity for verbal language. This might consitute an answer to some of the questions left open in Part I about whether animal action was explainable by instinct or by reason (and a nod to Cureau de la Chambre, as will be apparent).[1008] It was not a self-conscious thought, but a 'confused' one, a constant, subterranean process which differed from the 'precise and distinct' thinking we associated with the Cartesian category of human reason. Both sorts of thought - the conscious and the non-conscious one - were inseparable from

[1007] Perrault, *Du bruit*, pp. 282-283: 'qu'il n'est point necessaire de savoir ce que c'est que pensée, que raisonnement pour penser & pour raisonner: Et que l'homme le plus stupide ne laisse pas de penser incessament, & de raisonner dans ses moindres actions sans qu'il sache & sans qu'il croye y penser; la longue habitude ayant le pouvoir de rendre insensibles les actions de la pensée, quoy qu'elle accompagne toujours toutes les autres actions de l'animal'.
[1008] Ibid., pp. 306-309. See also Picon, *Claude Perrault*, p. 84.

the soul, which was 'not in our body as one is in a house, but united to it'.[1009] Thought was thus 'united to all our actions',[1010] even when it was not apparent, as in dreams.[1011] Not all thought was self-conscious, since it included corporeal functions and actions that had nothing to do with reflexive ratiocination. Only when the body's health was perfect could the soul pay attention - and Perrault insisted on the importance of the notion of the soul's *attention*[1012] - to external things rather than to 'natural functions'.[1013] Fever-induced loss of memory or disturbances of the reason could very well be explained without recourse to the notion of an alteration in the organs; they were simply due to the soul's busying itself with natural functions and not having the leisure, so to speak, to take care of the functions on which reasoning relied. On such occasions, non-conscious thought came to the fore. Changes in functions of the internal senses during sleep could be explained by reference to the same shift in the soul's activities, which included repairing spirits and rectifying humours disturbed during the day.[1014] If the body was disposed to act, that only affected the soul insofar as corporeal dispositions freed it to 'exert the functions of the internal senses'.[1015] There was no *direct* causal effect of body on soul when any one of the internal senses was active: the activity of one sort of sense enabled the soul to take care of the other. This was a dynamic economy, rather than a linear system.[1016]

Within this dynamic corporeal economy, the soul's capacity to think was measured by its freedom to do so, that is, by its freedom from the need to assist animal spirits in their functions. Reified as a busy, overworked agent, Perrault's soul was at once the efficient cause of all the subject's acts and an explanatory model for

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[1009] According to Picon, *Claude Perrault*, p. 82, this notion of the soul's presence in all living creatures - except in plants: see Perrault, *Du bruit*, pp. 301-304 - can be called animist.

[1010] Perrault, *Du bruit*, p. 283: 'Car s'il est vray que nostre ame ne soit point dans nostre corps comme on est dans une maison, mais qu'elle y soit unie; elle doit estre considerée comme agissante dans toutes nos actions; Or puisque comme il est certain, la pensée est inseparable de toutes les actions de l'ame, il s'ensuit que la pensée doit estre jointe à toutes nos actions'.

[1011] Locke, a few years later, would suppose and try to prove the very opposite idea: see *Essay*, II, 1, §11-17, pp. 109-114.

[1012] Perrault, *Du bruit*, p. 299: Perrault writes of 'cette hypothese de l'attention de l'ame pour la conduite de toutes les fonctions de l'animal'.

[1013] Ibid., p. 285.

[1014] Ibid., p. 286.

[1015] Ibid., p. 287: 'que les dispositions du corps ne servent qu'aux fonctions corporelles, & qu'elles ne fournissent point à l'ame des moyens directs d'exercer les fonctions des sens interieurs'.

[1016] Picon describes this dynamism as a 'circulation' and 'universal mobility', in *Claude Perrault*, p. 102: 'C'est cette mobilité universelle, synonyme de développement incessant, que la science a précisément pour objet d'étudier'.

the variety of mental and psychological life and its dependence on the body's state. If children could laugh in their sleep from their first days of life, but took longer to start laughing in wakefulness, that was because their soul was free, in sleep, from the care of external senses, and was then capable of 'the thoughts it has in a more advanced age', since the soul of sleeping children was the same as that of perfect adults.[1017] Perrault identified 'reason' and 'reasonableness' with the soul's capacity to run the body's functions. Involuntary action was caused by habitual thought: the soul got used to necessary or life-preserving actions in the body - which Perrault considered to be 'free' - such as heart beat, or eye movements, or a self-defensive reaction to aggression.[1018] The rules of grammar, musical skill and all the things learned at the beginning of life but whose origins were forgotten[1019] - including the fact that we viewed the world the right side up, although it reached the eye upside down[1020] - were also a matter of habit and amounted to manifestations of non-verbal, 'confused', non-conscious thought. Conscious thought, on the other hand, was fully free-willed: 'expresse' is the word he uses, and, later in the text, 'prophorique', that is, 'a reasoning that one can make known through speech, and that we ourselves also know, because of our reflection on our own thoughts'.[1021] This scheme meant that thought in humans could not be equivalent to reason's activity if pure and distinct Cartesian ideas were the sole criteria defining it. That was demanding too much of reason. Similarly, since animals had a body and soul, and the soul's function was to think,[1022] it followed that mechanistic theories of animal action did not explain enough about what we would now refer to as ontogenetic or phylogenetic development. That was demanding too much of mechanistic explanation.

Perrault never abandoned the notion that the 'machine' of the body was an admirable creation[1023] - a notion which Lamy was hard-headed enough not to have

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[1017] Perrault, *Du bruit*, p. 291: 'pendant le sommeil l'ame des enfans qui n'est point autre que celle des hommes parfaits, est capable des pensées qu'elle a dans un âge plus avancé'.
[1018] The notion of habitual thought was used by Locke, who noticed how easy it was to acquire habits of thought which could give rise to wrong associations; this helped explain how it was that one could bear in mind wrong ideas. See Locke, *Essay*, II, ix, §10, p. 147; II, xxxiii, §6, p. 396.
[1019] Perrault, *Du bruit*, pp. 292-296.
[1020] Ibid., pp. 297-299.
[1021] Ibid., p. 306: 'Les anciens appelloient ce raisonnement Prophorique, c'est à dire un raisonnement que nous pouvons faire connoistre par la parole, & que nous connoissons aussi nous-mêmes, à cause de la reflexion que nous faisons sur nos propres pensées'.
[1022] Ibid., p. 300. As Roger reminds us in *Sciences de la vie*, p. 340, Perrault did after all write a treatise called *Méchanique des Animaux*.
[1023] See above, e.g., p. 186.

any use for - or the belief that the constituent particles of both body and soul had been created by God, and indeed that nature itself was mechanical.[1024] He even compared animal bodies to organs, and their souls to organists.[1025] (Willis had a similar idea,[1026] while granting both cold- and hot-blooded animals what he called the 'dignity' of having a soul,[1027] fiery,[1028] and, of course, corporeal in the Gassendist sense.) The idea that mechanisms of various kinds were necessary for corporeal and mental activities to function did not *necessitate* adherence to the conception of the body as a machine or artifact. But, as we have seen throughout this dissertation, the language of most natural philosophers of the time betrayed the attraction of this analogy, however mitigated it might be by a pull towards naturalism.[1029] Perrault, who is mostly known as an architect, was no exception, although he was also convinced, in the text we have been looking at, that the machine analogy of Cartesianism was at the root of the misleading theory of brain traces.[1030] But unless the whole of nature was imbued with divinity, as vitalist alternatives to mechanism construed, the living body, that perfect machine, must be driven by the ghost within it. While, for Daniel Duncan, the spirit-filled cerebellum was a 'free city', whose inhabitants were 'the subjects of no one', the soul was the 'sovereign authority' to which all subjects were beholden, and for this reason the brain was comparable to a monarchy.[1031] What mattered was that, whether monarch or ghost, the soul ruled over human action. How it ruled was not an answerable question.

[1024] Roger, *Sciences de la vie*, pp. 206-216, 221-224, 340, 342, 443-444. See also Daston and Park, *Wonders*, pp. 292-301.
[1025] Perrault, *Méchanique*, 'Avertissement': pp. 1-2.
[1026] Willis, *Soul of Brutes*, pp. 33-34. At p. 34, he agreed with the 'vulgar saying in the Schools' that brutes '*do not so much act, as are acted*' (his italics), but with the proviso that one could also attribute to animal souls 'a certain faculty of Varying their Types' and a capacity for 'more intricate Actions'. Such actions were of course 'below the power of the Rational Soul' and had to be accounted for without recourse to an immaterial soul.
[1027] Ibid., p. 18.
[1028] Ibid., e.g., pp. 5, 29-31.
[1029] For a discussion of the metaphorical structure of scientific explanation see Peter Dear, *Discipline and Experience*, ch. 6, pp. 151-179: 'Art, Nature, Metaphor: the Growth of Physico-Mathematics', on the analogy of nature with a machine in the Scientific Revolution.
[1030] Perrault, *Du bruit*, pp. 309-310.
[1031] Duncan, *Explication*, p. 152: 'Le cerveau est comparable à une Monarchie, dont tous les sujets sont soûmis à une seule authorité souveraine, sçavoir à celle de l'Ame; & le cervelet à une ville libre, dont les habitans ne sont sujets à personne'.

Conclusion

Et puis qu'il est de la verité comme de ces terres inconnuës qui se découvrent de temps en temps, et souvent plus par hazard que par adresse.[1032]

To deal freely with you, I find the Notion of Immaterial Substance, to be somwhat too sublime for the comprehension of so humble and shortsighted a reason as mine is.[1033]

A number of themes emerge out of the various accounts I have presented of the status and function of the corporeal and rational souls and of the nature of the relation between them. I would like to recapitulate these themes as they have appeared in the course of this dissertation, and specifically in the light of the interconnected concepts which sustained them and which, I believe, continue to inform in some way present-day questions about the mind.

What was at stake in these accounts was not the definition *per se* of consciousness, but rather a concern to establish criteria for an adequate account of human cognition, *given* the undoubted existence of such phenomena as memory, dreaming, recognition, along with the self-representing higher reason associated with free will. Since it was accepted in the seventeenth century that this higher reason did not 'know itself', what we understand today as the problem of consciousness cannot be said to have existed then. The themes I have presented, however, can be said to constitute this problem as a philosophical one and to help us understand what it took to hold certain beliefs about the mind, the body and nature. The question of how to judge the rightness or fallaciousness of beliefs about the nature of matter, on the one hand, and of thought, on the other, which I addressed at the end of the final chapter of this dissertation, seems to have been a driving force - if an implicit one - in the process of reconstructing the cognizing and conscious human subject in the context of the new physics and the new orders of explanation which arose at this time. Cartesianism presented thought as excluded from enquiries into the make-up of bodily matter; and Descartes's automaton could co-exist with a bloodless but powerful soul. Much history of science in recent decades has been devoted to showing that the eagerness to define the proper realm of physics and the concern

[1032] Marin Cureau De La Chambre, *Traité de la connaissance des animaux, où tout ce qui a esté dit Pour, & Contre Le raisonnement des bestes, est examiné* (Paris, 1662 ; ed. Paris, 1989), p. 15: 'And truth is like those unknown lands that are discovered from time to time, often more by chance than ability.'

[1033] Walter Charleton, *The Immortality of the Human Soul* (London, 1657), p. 84 [Lucretius].

with hierarchies of soul function matched concern with political hierarchies at a time of social and political unrest. Insofar as this is true, the very business of providing guides to the corporeal soul was itself an expression of the rational soul in a confused, passion-ridden state rather than in a pure one. The rational soul's capacity, in turn, to define and promote *pure* reason was in this case a form of escape from social and political tension, as well as from physical discomfort and medical anxiety - the expression of a need for passion-free, bloodless, healthy rest.

The tension surrounding the definition of the rational soul in the context of accounts of the corporeal soul - a tension which runs through the texts I have discussed - need not be explained, however, solely in political terms in order to be intelligible to us. The status of the rational soul was conceptually problematic then in the same way that providing an account of consciousness poses problems to us now. As reasoning, perceiving and passion-ridden creatures, we have not lost the sense that an account of the nature of consciousness must be dissimilar - at least in its starting point - to an account of how perception and emotions function. This is precisely what the explanatory gap is about. At the same time, arguments about the embodiment of mind and claims that we can only understand what we are by understanding ourselves in our corporeality have gained in cogency and depth in the past years, and they continue to do so. Monist accounts seem to be slowly eroding the dualist bedrock which determined what sorts of questions were posed within modern philosophy, and what relation these questions bore to modern science.

Variations in states of mind, for example, can now be understood as variations in perceptual and body states, and vice-versa; a person whose body-image has been transformed through brain damage can most probably be said to have shifted in self-consciousness. The embodiment of mind - and thus of our capacity for representational language - means that we cannot examine the nature of consciousness without simultaneously examining the nature of perceptual cognition and instinctive behaviour. This has been my working assumption from the very outset. But it is in view of this very assumption the problems posed to us and to the thinkers I have studied here by the notion of an embodied mind emerge properly, helping us understand why consciousness apparently has to remain a 'hard problem', and why the explanatory gap continues today to look like a philosophical puzzle. It might be useful to see the 'hard problem', which in effect surrounds the explanatory

gap, as a springboard for further questions about mental function and about our generated, embodied selves, rather than as a subject-matter in its own right. That the explanatory gap has instead become such a subject-matter has some historical causes and conceptual roots in the period of the establishment of modern science and modern philosophy. As I have tried to show, this gap was once a metaphysically necessary state of affairs.

This dissertation began with an analysis of the relationship between reason and language, because, as was explained in the Introduction, it is the very capacity to think and to speak that remains, just as in the seventeenth century, at once a precondition for philosophical enquiry and the blind spot of our phenomenal selves. Reason and representational language are also the very features which, as I have tried to show in Part I, post-Cartesians insisted were what set humans apart from the animal realm. Part I, Chapter 1, 'Deafness, ideas and the language of thought', focused on the capacity for language and for understanding other minds, analysed in terms of the Lockeian doctrine of ideas and in the context of research, by prominent members of the Royal Society, including Dalgarno, Holder and Wallis, into the possibility for the deaf to acquire language. This capacity was believed to be related to our ability to investigate the world in Baconian terms. It was also regarded by Fénelon and De La Forge as an expression of Cartesian reason and a solution to the 'other minds' problem that arose with Cartesian doubt. While the linguistic function was most self-evidently exclusive to humans, the deliberative faculty it accompanied - or, according to Cordemoy, enabled - might still be identifiable, by non-orthodox or anti-Cartesians, in beasts, bearers *par excellence* of 'other minds'.

Another issue raised in Part I, Chapter 1 concerned Descartes's recourse to the notion of substance for the explanation of rational function and its failure to convince a large number of his own contemporaries and admirers. No reification of this invisible function could help explain how it operated, especially since it led Descartes to deny a soul to beasts. The philosophical background to the beast-machine thesis and to its connection with the identification of reason with language was laid out in Part I, Chapter 2, 'From other minds to animal bodies'. Here I explored the conditions and consequences, for natural philosophers from Harvey on, of the breakdown of Aristotelian physics, psychology and teleology, which was

instrumental in the creation of Cartesian dualism and the concomitant beast-machine thesis. This prepared the ground for Chapter 3, 'The beast-machine controversy: reason, instinct and the causality of motion', concerning debates about animal minds among thinkers such as Cureau de la Chambre and Chanet, Pardies and Dilly, and also Bayle. A central aspect of the debate was the question of whether one needed to naturalize reason and free will or to glorify instinct in order to establish what sort of soul animals could be deemed to have. Responses to this question had to accommodate theological concerns over the twin dangers of accepting unreservedly Descartes's beast-machine thesis, on the one hand, and of naturalizing the human rational soul, on the other.

It was on the line separating humans from animals that the boundaries of knowledge were most strikingly drawn. The subject of Part II, Chapter 1, 'Other worlds: the science of knowledge' was thus scepticism, the acknowledgment that there are boundaries to the power of the senses and of reason to know, and in its extreme, Pyrrhonic form, that one cannot know anything at all with certainty. As I attempted to demonstrate, scepticism was in itself an expression of the rational function tied to consciousness. At the same time, as became clear from the work of Glanvill, Fontenelle and Bayle, its function was not only to determine the boundaries of our consciousness but also to praise God for enabling us to know these boundaries. It was therefore instrumental in the construction of criteria for the practice of experimental science and for the defence of the corpuscularian philosophy; as such, it played an important role in the establishment of modern science. This chapter moved from England and the Royal Society to France, where experimental scientists were more enthusiastic about 'systems' than were their British counterparts. Furthermore, I suggested that questions about the perceptual capacities of humans were related to questions about our place in the universe, and that the 'other minds' problem (studied in Part I) was conceptually akin to the issue of imagining 'other worlds'. I showed how Fontenelle took on board Cartesian physics in order to ask questions about the capacity of humans to know about and perceive such other worlds, given the physical order of the universe and given our place in it.

From scepticism, it was just a short step to the problem of functionalism and finalism. Part II, Chapter 2, 'Understanding function: the organs of cognition in

animal and man' analysed the relationship between form and function in anatomy, in the light of the tendency exhibited by a majority of natural philosophers to perceive finality in anatomical form, while nevertheless espousing the anti-dogmatic principles of the experimental method in science. Through key works especially by the physicians Steno, Willis and Perrault, I examined various responses to the difficulty of reading function into anatomical structure. This examination of the ongoing need, yet near-impossibility, of studying the world scientifically in finalist terms, led to the last chapter of Part II, 'From sense to soul: God, reason and human will', which focused on the functions of the corporeal soul, common to animal and man, and necessary for the human rational soul to be operative. Here the case of Guillaume Lamy showed how the total rejection of finalism went hand in hand with materialism about the soul. Debates were ongoing at the time about whether or not the rational soul as reified by Descartes could be called a substance, though this was generally accepted by the end of the century, especially among Gassendists; and, as the presentation of Perrault's alternative to both dualism and materialism made clear, so too was the view that the rational soul was a tool for the processing of stimuli, encompassing understanding and will. The chapter - and dissertation - closed with further comments and arguments about the apparent impossibility of eliminating the 'explanatory gap' from any discussion about higher consciousness.

I have aimed in this dissertation to provide a historiography of key concepts central to today's debates about the problem of consciousness. It is not intended to be an actual contribution to these debates as they stand. I do believe, however, that such a historiography can help us understand our position with regard to the seemingly ageless issue of the mind-body relation, and to what this issue implies about the status of human reason. This is why I have wanted to show that the concern over a naturalized consciousness or soul, which was an important aspect of the discussions of the mind-body relation in the seventeenth century, revolved around the methodological and theological impossibility of removing the explanatory gap. The question of whether animals could be said to have a soul was a manifestation of this concern, as were the difficulties of defining what in animal and human action partook of (innate) instinct, and what of (acquired) rational behaviour. Perrault identified basic elements of cognition, such as our capacity to invert the upside-down

images on the retina, or even the ability to speak, as mere 'habits of thought' - that is, acquired traits; and so the very ability of a horse to find its way back home might have been acquired as well, in which case its action entailed deliberation. The Cartesian identification of cognitive adaptation with automatic response did little to feed the debate on innate ideas; indeed, it stood on its outer frontier. Involuntary action remained compatible with free will for Descartes, because they each belonged to separate realms. But that said little either about involuntary action or about free will. The capacity for the machine of the body to respond appropriately to environmental stimuli, as was the case in involuntary action, could also be described as a natural faculty. The physician, physiologist and anatomist Marcello Malpighi acknowledged this when he wrote in his essay *Sugli studi dei medici moderni* that the 'smallest components', or '*minime*', were 'nature's method of composing everything which we have before our eyes'. Nature used 'liquids' - themselves made out of various, tiny bodies - 'for local motion, for concoctions, for fermentations, for sensations and for the other, similar operations'.[1034]

The natural body of man, equal in status to the natural body of animals, was rendered increasingly intelligible at a time when the concern for accuracy in observation was great, and when criteria for establishing what constituted accuracy and plausibility were carefully thought through. Few distinctions, apart from variations in shapes and sizes of body and brain, remained between man and beast when the former was placed on the dissecting table; for the immortal soul, which in life had enabled man to look for what he would never know, had by then flown away from his dead body. The permanent departure of such a soul in later modernity has made it easy for us to forget that self-knowledge and scientific knowledge overlap only intermittently, and never straightforwardly. But its disappearance has also uncovered the gap it once plugged and left us with the odd difficulty of having to define for ourselves the nature of our nature.

[1034] Marcello Malpighi, *Sulli studi dei medici moderni* (published posthumously), in Malpighi, *Opere scelte*, ed. Belloni, p. 504: 'Il metodo poi della natura nel comporre tutte le cose che noi abbiamo sotto gli occhi, è di servirsi di parti picciole, cioè di sali, di filamenti, e somiglianti: e con queste minime compone tutte le cose ... Nei viventi, poi, si serve di fluidi - che sono composti di picciolissimi corpi, ma varii - per il moto locale, per le cozioni, per le fermentazioni, per le sensazioni e per l'altre simili operazioni'. Malpighi wrote this essay as an angry response to a letter attacking the modern medical profession by Giovanni Girolamo Sbaraglia, published anonymously in 1689 - its subtitle is 'Risposta del Dottor Marcello Malpighi alla lettera intitolata "De recentiorum medicorum studio dissertatio epistolaris ad amicum"'. As Belloni describes it in his preface to the essay, pp. 494-495, the polemic would go on beyond Malpighi's death in 1694.

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