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The *Passions of the soul* and Descartes's machine psychology

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Abstract

Descartes developed an elaborate theory of animal physiology that he used to explain functionally organized, situationally adapted behavior in both human and nonhuman animals. Although he restricted true mentality to the human soul, I argue that he developed a purely mechanistic (or material) 'psychology' of sensory, motor, and low-level cognitive functions. In effect, he sought to mechanize the offices of the Aristotelian sensitive soul. He described the basic mechanisms in the *Treatise on man*, which he summarized in the *Discourse*. However, the *Passions of the soul* contains his most ambitious claims for purely material brain processes. These claims arise in abstract discussions of the functions of the passions and in illustrations of those functions. Accordingly, after providing an intellectual context for Descartes's theory of the passions, especially by comparison with that of Thomas Aquinas, I examine its 'machine psychology', including the role of habituation and association. I contend that Descartes put forth what may reasonably be called a 'psychology' of the unensouled animal body and, correspondingly, of the human body when the soul does not intervene. He thus conceptually distinguished a mechanistically explicable sensory and motor psychology, common to nonhuman and human animals, from true mentality involving higher cognition and volition and requiring (in his view) an immaterial mind.
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1. Introduction

Descartes considered mind and body to be separate substances, each capable of existing independently of the other. This famous doctrine, substance dualism, rightly dominates discussions of his philosophy of mind. However, excessive focus on his dualism can be distorting. In popular and philosophical circles, Descartes has been painted as dividing the mental and the material so cleanly that bodily processes make no real contribution to guiding human behavior.[1] Descartes has been accused of 'disdain' for the body and of seeking 'liberation' from the body and emotions, so as to become a purified or disembodied mind.[2]

The substance dualism of Descartes does indeed entail that some thoughts can occur independently of the brain (7:358),[3] and that some actions of the body can be controlled by the thinking substance through a pure act of will, without regard to previous bodily states (11:359–360, a. 41). However, these aspects of Descartes's philosophy of mind, if taken by themselves, present a picture that is woefully incomplete. Fortunately, the focus of interpretation has widened in recent years to include mind–body union and interaction.[4]

By heeding several core features of Descartes's understanding of human psychology, we can see why an overemphasis on his dualism would be misleading. Descartes held that very few of the actual thoughts of any human being occur independently of the body (7:228–229). Most human thoughts result from a bodily cause (3:691–693): all sensations and imaginings, a large class of memories, and other sorts of feelings, including all 'passions' (a primary sub-

[1] Those who accept a clean divide place everything 'psychological' on the side of the mind. Flanagan (1991), Ch. 1, incorrectly limits Descartes's physiological explanations of behavior to innate reflex responses, such as knee-jerks (p. 4), and assigns any psychological concepts to the immaterial mind (pp. 21–22). King (2002a), p. 376, has Descartes strictly dividing neurophysiology from psychology and assumes that he was unconcerned with psychofunctional description. Kambouchner (1995, Vol. 1, pp. 331–345, Vol. 2, p. 327) considers it 'inconceivable' that Descartes would assign psychological processes to the body. By contrast, Fancher (1979, p. 26) recognizes that 'Descartes provided a mechanistic analysis for an extremely wide range of functions, including many that are "psychological" in the modern sense of the word'. Others recognize what Fancher would call 'psychological' operations as performed by the Cartesian body, without labeling them as such: Sutton (1998, Chs. 2–3) examines the Cartesian 'philosophy of the brain', focusing on memory; Talon-Hugon (2002, pp. 158–167) accords Descartes the concept of a 'physiological evaluation', which she contrasts with a psychological operation (restricting the latter to the soul).

[2] Bordo (1987), pp. 92–95; see also Damasio (1995), pp. 249–251.

[3] References to Descartes's works are to the pagination in his *Oeuvres* (1974–1976), originally edited by Charles Adam and Paul Tannery; because all my page citations to Descartes refer to this edition, I omit the usual abbreviated reference to 'AT' and give volume and page numbers only, as in (7:358). Quotations from the *Passions of the soul* are from the translation of Stephen Voss (Descartes 1989), cited by AT volume and page numbers and numbered articles, as in (11:359, a. 41). Quotations from the *Treatise on man* (also AT, vol. 11) follow Descartes (1998). The remaining works are quoted from Descartes (1984–1991), for which references to AT, Vols. 1–5, are to the *Correspondence* (first published in 1657–1667); Vol. 6, the *Discourse on the method* and *Dioptrics* (first published in 1637); Vol. 7, the *Meditations on first philosophy* (first published in 1641); and Vol. 8A, the *Principles of philosophy* (first published in 1644). Where I've altered the translation, the AT numbers are followed by an asterisk, as in (7:21*). Those few citations to AT for which no translation exists are marked by italics, as in *11:519*.

[4] For example, Rorty (1986), Hoffman (1990), James (1997), Ch. 5. The French literature attended to mind–body union and interaction in Descartes, on which, see Rodis-Lewis (1998). The older English-language literature examined those topics, for example, Gibson (1932), Ch. 7, and Kenny (1968), Ch. 10; they received passing attention in Wilson (1978), Ch. 6, slightly more in Williams (1978), Ch. 10, and virtually none in Curley (1978), Chs. 7–8.

class of emotions). Descartes further held that purely material physiological activities are deeply implicated in normal human behavior. Indeed, he held that many behaviors result from bodily processes alone, without any role at all for the mind (7:229–230).

This last fact should not be surprising if you believe, as I do, that Descartes considered nonhuman animals to be mere machines, devoid of mental substance and of all properly mental states.[5] If animals generate all of their behavior without a mind, surely human beings, whose bodies work on the same principles (3:121, 11:226), must have bodily mechanisms capable of producing much of human behavior. The questions of present interest then become: how much of human behavior is bodily caused, and what is the character of such behavior? Shall we think of bodily controlled movements as mere reflexes, as our blinking when something rapidly approaches our eyes (11:338–339, a. 13)? Or did Descartes envision that bodily processes alone might cause more sophisticated behaviors in both human and nonhuman animals?

I shall approach these questions through Descartes's psychology of the passions of the soul. Passions of the soul are defined as mental states that have bodily states as their causes. They are 'passions' because the mind is passive, relative to the body that acts on it (11:327–328, aa. 1–2). In this broad sense, all bodily caused mental states are 'passions', a group that includes external sense perceptions and internal sensations such as hunger. But Descartes also has a theory of 'passions' in a restricted sense of that term (11:348, a. 25), which I call 'passions proper'. Such passions are a subset of what we (and he) would broadly label as 'emotions', a category to which he also assigned intellectual feelings that do not have a bodily cause, such as intellectual joy or intellectual love (3:601; 11:397, a. 91; 11:440*, a. 147). Since the intellectual emotions are not caused by the body and hence are not 'passions of the soul', they fall outside our present interest.

Descartes's theory of the passions proper has been the subject of increased attention in recent years.[6] Although some philosophical commentators judge Descartes's theory to be 'incoherent',[7] other scholars see it as the fulfillment of his project to found a complete science of nature and a theory of morals based thereupon.[8] Some philosophers contend that the theory is ill-fitted to Descartes's general metaphysics of mind–body dualism.[9] A contemporary neurologist, Antonio Damasio (1995, pp. 249–250), has diagnosed what he considers to be 'Descartes's error':

[5] Interpreters of Descartes (including his principal followers) usually have regarded this 'animal machine' hypothesis as excluding sentience and genuinely cognitive states, such as mental representations, in nonhuman animals. Several recent authors (including Gaukroger 1995, and Cottingham, 1998) have argued that although Descartes denied an immaterial mind to nonhuman animals, he attributed sentience and perhaps intentional cognitive states to them, excluding only reflexive awareness. In this article I assume that Descartes's animal machines lack sentience and genuinely cognitive states. I do not here mount a detailed response to opponents (see Hatfield, Forthcoming a), but I give citations in support of my interpretation.

[6] French commentators have long studied the *Passions*: Geneviève Rodis-Lewis edited Descartes (1988 [1955]), and Ferdinand Alquié extensively annotated the *Passions* in Descartes (1973), 3:939–1103; for further references, see Rodis-Lewis (1989) and the recent works by Kambouchner (1995) and Talon-Hugon (2002). Some earlier English-language works also attended to the *Passions*, for example, Smith (1953), Ch. 6, and Levi (1964), Chs. 9–10. Recent work (for example, Rorty 1986; James, 1997, Ch. 5 and *passim*; Radner 2003; and Shapiro 2003b) has been spurred by several factors, including the growing tendency to approach Descartes's *oeuvre* as a totality; a general revival of interest in the emotions; and Voss's new translation of the *Passions*.

[7] Grene (1985), Ch. 2, 'Cartesian passions: The ultimate incoherence'.

[8] Levi (1964), Ch. 10. Talon-Hugon (2002), pp. 13–14.

[9] For example, Hoffman (1990).

> the abyssal separation between body and mind, between the sizable, dimensioned, mechanically operated, infinitely divisible body stuff, on the one hand, and the unsizable, undimensioned, un-pushpullable, nondivisible mind stuff; the suggestion that reasoning, and moral judgment, and the suffering that comes from physical pain or emotional upheaval might exist separately from the body. Specifically: the separation of the most refined operations of mind from the structure and operation of a biological organism.

Descartes is, of course, partly guilty as charged. He considered the pure intellect to operate independently of the body (7:73, 358), as when it attains metaphysical insight into the essences of mind and matter and the essence and existence of God. So, according to Descartes, some reasoning goes on without the body. But the correctness of Damasio's charge ends there. Descartes held that most human reasoning uses images, an activity that, in his scheme, requires the mind to interact with the brain (3:692–693, 7:73). Further, although moral judgment, as does all judgment, depends on an act of will, and so on a purely mental faculty of mind (7:56–58), Descartes reasoned that, in forming such judgments, the passions, which are inherently bodily caused, may aid us (11:464, a. 161). Finally, 'physical pain and emotional upheaval' are also bodily caused. For Descartes, there can be no physical pain without a neural cause: even in the case of a phantom limb, in which a pain is felt where a body part no longer exists (say, in the fingers of an amputated hand), a nerve process somewhere in the body is required as a cause (1:420, 8A:320). And although Descartes allowed that some emotions (such as intellectual joy) occur independently of the body, he required a bodily cause for all the passions that might cause 'upheaval' (11:362–363, 485–488, aa. 45, 211).

Ironically, it is on Damasio's home turf—the passions or 'feelings and emotions'—that Descartes developed his most extensive account of the body's essential role in producing some mental states. The final work that Descartes published in his lifetime, the *Passions of the soul* (1649), was devoted exclusively to these topics. The *Passions* treats human emotional life in detail, including the physiological processes that underlie the passions. Descartes's theory of the passions and his broader physiological theories, especially as found in the *Treatise on man*,[10] provide a very different picture of Descartes's conception of the role of the body in human behavior than that offered by Damasio.

Traditionally, Descartes is supposed to have limited bodily caused responses to mechanical reflexes (Flanagan, 1991, p. 4). However, close study of the *Passions* and

[10] Descartes exhibited interest in human and animal psychology, including the passions, from his earliest writings (10:215, 219). The *Rules* (10:412–417) discuss the senses and imagination, though more epistemologically than psychologically. The *Treatise* records Descartes's first extensive theory of human and animal mechanisms of behavior; the *Discourse* (6:55–59) lists the fruits of this theory without revealing its substance. Having suppressed his physics (which included the *Treatise*) in 1633 owing to Galileo's condemnation (1:270–271, 281–282, 285–286), he later spoke of publishing it (3:272, 433); in 1641 or 1642 he had a fresh copy of the *Treatise* made (4:566–567), and in 1648 he began a more comprehensive work (5:112), the *Description of the human body*, which was to incorporate his theory of animal reproduction (embryogenesis) together with his machine physiology and psychology (the *Treatise* and *Description* were published posthumously). While his theory of the passions underwent intensive development in the mid 1640s (Talon-Hugon, 2002, Ch. 2), stimulated through correspondence in the mid 1640s with Princess Elizabeth of Bohemia (on a variety of topics, including health, happiness, politics, morals, and a brief sketch of Descartes's account of the passions [4:310–313]), his machine psychology in general remained basically the same from 1630 onwards, so that the *Treatise* may be used to fill out the sketch found in the First Part of the *Passions* (as is evidenced by their mutual consistency).

the *Treatise* reveals that, even in the human case, Descartes did not restrict purely bodily caused behaviors to those that neurophysiologists would now label as reflexes.[11] Rather, he envisioned a gallery of complex and functionally adaptive behaviors that would tend toward the preservation of the body, and hence of the mind–body complex.[12] These behaviors and their purported physiological causes are of such sophistication that we would be justified in speaking of a 'psychology' of the body for Descartes. This term is appropriate for two reasons. First, in his doctrine of the animal machine (including the human bodily machine), Descartes intended to mechanize the functions that were previously assigned to the Aristotelian sensitive soul (with some exceptions, discussed in Section 3). These functions fell within Aristotelian 'psychology'; hence, in terms contemporary to Descartes—and allowing that the Aristotelian term 'psychology' included vital, sensory, and rational functions, only the latter two of which are 'psychological' in today's sense—he sought to provide mechanistic explanations for psychological phenomena.[13] Second, Descartes described the behavioral phenomena he sought to explain functionally, as behaviors that tend toward the preservation of the organism, but he sought, in his machine theory, to provide nonmentalistic explanations for them. This conception resonates with the nonmentalistic 'psychology' of American behaviorism (see Hatfield, 2003a), of which Descartes may well have been a distant ancestor (perhaps via Huxley 1884; see also Pavlov, 1927, p. 4; Fearing 1970 [1930], pp. 284–286).

For mindless nonhuman animals, bodily mechanisms alone must account for their entire psychology: that is, for the internal mechanisms that generate the behavior of such animals. The fact that mindless animals engage in complex, adapted behaviors in itself indicates that there can be a psychology of the mindless machine. Indeed, we may view Descartes as describing just such a psychology in the *Treatise*, where he examines the capacities of an imaginary human body *without* a mind. A mindless *human* body is 'imaginary' and counterfactual because Descartes held that functioning human bodies always

[11] Canguilhem (1955) argues that Descartes did not possess the concept of 'reflex', though he discussed reflex actions such as the eye blink (11:338–339, a. 13) and attributed them to involuntary, automatic bodily operations. He rightly notes (Canguilhem, 1955, pp. 41–46) that Descartes did not specially designate a class of simple, closed loop reactions (fitting the nineteenth-century definition of reflex), but assigned the eye blink to a class of whole organism, bodily caused responses that direct the organism toward benefits and away from harms. Fearing (1970 [1930]) finds various concepts of reflex action at work in psychology and physiology; he describes Descartes's specific contribution as the first 'systematic discussion of the phenomena of involuntary action' to be published (ibid., p. 26 n. 12), an important step in the formation of the concept of reflex action.

[12] Descartes spoke on occasion of the 'preservation' (*conservatio*) of the 'healthy man' (7:87), and more frequently of actions and circumstances that tend toward the 'benefit' (*commodum*, *profiter*) or 'harm' (*incommodum*, *nuire*) of the animal body. The idea that animals are functionally adapted toward their own preservation is a commonplace of biological thinking from antiquity. The notion of 'function' employed here is *biological function*, which since Aristotle was discussed under the concept of the 'uses' of the parts of an organism (which suggests that the parts contribute toward an end). Typically, physiologists made judgments about functions by considering the role that the parts play in a healthy organism; of course, most early modern thinkers held the background belief that God designed the parts to serve their functions, but that belief could play little role in deciding which parts had which uses or functions. More generally, in this context the modifier 'adaptive' means 'adapted to fit the circumstances': either standing circumstances, as in the case of instinctual responses (the eye blink when a hand is thrust toward the eye: 11:338–339, a. 13), or contingent circumstances, as when, with the stomach empty, the body starts roving about in a state prepared to detect and grasp food (11:194–195; also, *11:519*). On Descartes's conception of physiology, see Hatfield (1992). On pre-Darwinian notions of function and adaptedness, see Russell (1916), Chs. 1–13, and Rudwick (1985), Ch. 3.

[13] On the term 'psychology' in the seventeenth and eighteenth centuries, see Vidal (1992) and Hatfield (1995).

have minds interacting with them; the mind stops interacting with the body when the body dies (11:330–331, a. 6). But Descartes's psychology of the mindless machine extends to both mindless animals and normal human beings constituted of both body and mind. In the psychology of normal human beings, purely bodily mechanisms are not limited to causing mental states in a mental substance: purely bodily processes also function as psychological mechanisms that cause behaviors that do not depend on the mind.

Descartes's dualism notwithstanding, Cartesian natural philosophy entails that some psychological processes occur independently of the mind, and hence that 'the psychological' (where this adjective denotes mechanisms that guide complex adaptive behaviors) is not coextensive with 'the mental' (where this adjective denotes an activity of an immaterial *mind*). Of course, other human psychological states, such as conscious sense perception, intellectual cognition, intellectual emotions, and acts of will, require a mind and, in some cases, involve mind–body interaction. My focus will be on those 'psychological' processes of mindless machines that occur independently of what Descartes would term properly mental states, that is, states that involve mind.[14]

This article examines Descartes's psychology of machines (or 'machine psychology') through the *Passions*, the earlier *Treatise* (first composed in 1630–1633 and published posthumously), and Descartes's *Correspondence*. Section 2 provides background by surveying some common attitudes toward the passions and emotions in writings that were available in Descartes's time. Subsequent sections compare Descartes's treatment of the passions to Aquinas's influential account (3); sketch the material mechanisms underlying his machine psychology (4); examine his psychology of habituation or association (5); and consider some implications of Descartes's machine psychology for his contribution to the philosophy of mind (6).

2. The passions in the seventeenth century

Thomas Aquinas's extensive treatise on the passions in the *Summa theologiae* (Aquinas, 1964–1981),[15] which drew heavily on the Aristotelian tradition, provided the background for many discussions of the passions during the seventeenth century. Neoplatonic and

[14] In present-day discourse, the term 'mental' is often used more broadly, to include complex psychological processes of the kind envisioned in Descartes's machine psychology, especially if an author ascribes intentional or cognitive content to such processes. Some commentators retrospectively denominate Descartes's machine psychology as 'cognitive' in this sense, bringing it within the present-day conception of the mental (for example, Gaukroger, 1995, p. 287). As mentioned earlier (n. 5), such authors may ascribe genuinely cognitive states, embued with intentionality and sentience or feeling, to Descartes's neurophysiological processes (for example, Cottingham 1998). Baker & Morris (1996) take an intermediate stance: although they class 'mental' and 'psychological' together (ibid., p. 81), they recognize that Descartes used 'sensitive predicates' (such as 'sees light', ibid., pp. 77–78) in two ways: to describe purely bodily processes that both human and nonhuman animals exhibit, and to describe states of human beings that depend on the rational soul. They describe the animal processes as 'biological' or 'physiological' (not psychological) and suggest that Descartes employed behavioral criteria to discern such processes (ibid., p. 82) and that he ascribed 'sentience' to nonhuman animals only in that restricted sense.

[15] Thomas Aquinas (1964–1981), abbreviated 'ST' and cited by Part, Question, and Article: First Part, Question 80, Article 2 is ST I.80.2. The *Summa* treats the passions in two contexts: as natural phenomena pertaining to the powers of the human soul (ST I.80–82), which is a psychological and hence natural philosophical context; and in relation to the voluntary acts of human beings and so as regards their moral qualities and related moral requisites (in 'Of the passions', within subpart one of the Second Part of the *Summa*, Questions 22–48: cited as ST II-1.22–48).

Neostoic perspectives, stemming from Augustine, from the Florentine Platonism of the fifteenth century, and from the Stoic revival of the sixteenth century, were also present, as were medical accounts, largely stemming from Galen.[16]

Seventeenth-century authors approached the passions in various contexts: natural philosophical (also called 'physical'), medical, moral, and theological. In the natural philosophical context, authors such as Aquinas and his followers treated the passions in terms of Aristotelian faculty psychology, going back to Aristotle's *De anima*. In the scholastic tradition and throughout the seventeenth century, psychology was widely considered to be a branch of natural philosophy (that is, physics).[17] Natural philosophical accounts of the passions drew on the medical literature, which treated the passions in both normal and pathological contexts, seeking remedies for the disruptive effects of excessive passions. Aquinas extensively discussed the passions in relation to the voluntary acts of human beings, drawing on the natural philosophical account in considering the moral qualities of the passions. In a moral context, philosophers asked whether the passions are intrinsically antithetical to moral action, are morally neutral, or are necessary and beneficial, when properly controlled, for a moral life. The Stoics were commonly regarded as having banished the passions from the life of the 'wise man',[18] a position that complemented the theology of those who considered the disruptive passions to be unnatural corruptions of human nature that arose with the Fall of man and were propagated with original sin. Others, including Aquinas, adopted a theological perspective from which the passions are naturally good and are, in themselves, morally neutral (ST II-1.24.1–4).

The majority position throughout the seventeenth century was that the passions are not intrinsically harmful and that to achieve a moral life we should cultivate them. Even authors who adopted the most negative view of the passions, such as Jean-Francois Senault in *De l'usage des passions* (Senault 1987 [1641]), recognized their usefulness in promoting human morality. Senault, a priest of the Oratory, agreed with the Stoics that the passions of fallen humankind are mixed with vice and hence are 'criminal' (ibid., pp. 28, 78), but he did not view them as the Stoics did: as confused judgments. To Senault, the passions are sensitive appetites stemming from love (ibid., p. 56). Before the Fall, human beings experienced only 'pure', 'innocent', and *unconfused* passions (ibid., pp.

[16] On the immediate background to Descartes, see Levi (1964), Chs. 1–9, and Talon-Hugon (2002), Ch. 1. On the ancient and medieval background, see Knuuttila (2004).

[17] In relating the passions to the powers of the sensitive soul, Aquinas (ST I.80–81) connected his discussion with the subject matter of Aristotle's *De anima* (see also Vives, 1538, Bk. 3) and hence with the rubric of natural philosophy (as also, for example, Keckermann, 1614, 'Systema physicum', Bk. 3, Chs. 25–26, cols. 1555–1563; see Hatfield, 1998, p. 956). On Aristotelian psychology and its fate, see Vidal (1992) and Hatfield (1995). Aristotle's work is more easily recognized as pertaining to psychology under its Greek title, *Peri psyches*, by contrast with the Latin title, *De anima* (made standard by the curiously persistent tradition of citing Aristotle's works by their Latin titles). Aristotle's concept of the soul (*psyche*) comprised both life and mind, that is, it comprised vital as well as cognitive and motivational activities.

[18] On Stoic theories, see Knuuttila (2004), pp. 47–80, who reviews recent controversies concerning the Stoics' 'good emotions', which the primary Stoic theory contrasts with the false judgments constituting the (allegedly) bad emotions. Whatever the correct interpretation of ancient Stoicism, writers in the sixteenth and seventeenth centuries often understood the Stoics as having distinguished 'bad' passive emotions (which are to be extirpated) from 'good' active emotions (which are based on correct judgments of good and evil); see Levi (1964), pp. 12–13, 72, 157, 160, 302, 308. Levi (1964, pp. 74–95) shows that the sixteenth-century Neostoic author Guillaume du Vair adopted Stoic negativity toward the passions (which, in his view, must be extirpated) and that, in later works, he joined it with a Neoplatonic encomium to the active, rational emotions.

28, 67–8). Human beings in their fallen state, however, are beset by confused representations of good and bad that lead them to act 'against the laws of nature' (ibid., p. 52). Such confusion was not present before the Fall and so is 'unnatural', that is, not a feature of original human nature. Unlike the Stoics, Senault did not conclude that human beings therefore could or should avoid passions. According to him, in our fallen state, if we learn to control and properly direct the passions we can use them to promote our own morality (ibid., pp. 78, 117).

Most seventeenth-century philosophers disagreed that the passions are bad of their kind for today's human beings. Some argued that prior to the Fall, the passions had their current status of confused sensations, and that the effect of the Fall was to cloud the understanding and weaken its power in relation to the passions.[19] Most regarded the passions as naturally beneficial to both animals and human beings, directing both away from harmful things, which appear undesirable or aversive, and toward beneficial things, which appear desirable. From a moral standpoint, most authors regarded the passions generically as either neutral or beneficial but as beneficial if properly directed, while conceding that some specific types of passion may be harmful. There was widespread agreement with Aristotle and Aquinas that, at least in part, moral virtue consists in developing habits that keep the passions in check or that use the passions to strengthen moral responses.[20]

For my purposes, the most important theoretical disagreements among philosophers concerned the description of the passions from a psychological perspective. The areas of

[19] Reynolds (1971 [1640]), pp. 44, 61; Malebranche (1997 [1674–1675]), pp. 337–339.

[20] This portrayal renders seventeenth-century attitudes toward the passions more positively than do Levi (1964) and James (1997). The following passages and citations, in chronological order, support my description. Wright (1604): just as the four humors are conducive to or even constitutive of health, but may cause disease if out of balance, the passions are useful if moderated, bad if excessive (ibid., pp. 16–19); 'God and Nature gave men and beasts these natural instincts or inclinations, to provide for themselves all those things that are profitable, and to avoid all those things which are damnifiable' (ibid., p. 21). Camus (1614), p. 69: 'Concluons donc que les passions sont necessaires, & inseparables de l'estre de nostre ame, voire bonnes & utiles, pourveu qu'elles soient bien dressees, & conduittes'. Reynolds (1971 [1640]): passions, as 'naturall motion, ordained for the perfection or conservation of the Creature', are 'altogether Good' (ibid., pp. 46–47); they are morally neutral but useful 'for the heating and enlivening Vertue' (ibid., pp. 41, 45); the natural harmony of sensitive appetites with reason was disturbed in the Fall of man so that individual passions in excess have bad effects and must be curbed (ibid., pp. 44, 61). Digby (1645), Vol. 1, pp. 357–361, 368–369, presents the passions as naturally good, serving to guide human and nonhuman animals alike. Descartes: 'I cannot convince myself that nature has given men any Passion which is always unvirtuous and has no good and praiseworthy use' (11:462, a. 175); passions are for the good of the body, and in excess can be a hindrance to morals, but through cultivation of virtuous habits they can be regulated and put in the service of virtue (11:464, 483, 485–488, aa. 177, 206, 211–212). La Chambre (1658–1662), Vol. 1, p. [xxiii]: 'si elles [Passions] sont bien reglée, elles forment les vertus & conservent la santé; mais si elles vont dans l'excez, ce sont les sources d'ou les desordres de l'ame & du corps prennent leur origine'. Charleton (1674): although the passions cause 'perturbations' in the soul (ibid., p. 69), we ought not blame nature for them, for they serve our good, but we should train ourselves to make the best use of them (ibid., pp. 168–169); 'I am confirmed then, that because man is constituted propens to Passions, he is not therefore *less perfect*, but rather *the more capable of pleasure* from the right use of the good things of this life' (ibid., pp. 169–170). Malebranche (1997 [1674–1675]): 'The *passions* of the soul are impressions from the Author of nature that incline us toward loving our body and all that might be of use in its preservation' (ibid., p. 338); after the Fall, we are too attached to sensible things, so that the (naturally good) passions may lead us astray (ibid., p. 340). Of course, I am not asserting that, in the seventeenth century, only Senault viewed the confusion of the passions as unnatural, nor have I precluded that someone might consider the passions to be natural but not good (though I think it unlikely). The prevailing view was that the passions are natural, good of their kind (as working for the preservation of the body), and morally useful if properly constrained.

disagreement concerned whether the passions are exclusively cognitive; whether they are caused by bodily states or, conversely, are causes of bodily states; whether they are responses of a lower part or power of the soul, such as the sensitive power, or are partly or exclusively responses of the rational soul; and how they interact with appetite and will. The Stoics had held an exclusively cognitive theory, according to which passions are constituted by confused rational judgments regarding good and evil—judgments that might, in principle, be wholly avoided by suspending judgment or by replacing confused judgments with clear ones.[21] Aquinas, by contrast, viewed the passions as forms of sensitive appetite: we are naturally drawn to sensible goods as represented by the sensitive power. The passions are not judgments (which are acts of the intellect), nor do they directly affect the will; rather, they are responses of the sensitive appetite to sensitive representations, and thus belong to a 'lower' power of the soul (ST I.80.2, II-1.22.3). For the Stoics the passions are 'passive' because they are confused judgments instigated by sensory or imaginal processes; for Aquinas (ST II-1.22.1) they are 'passive' because the appetitive power is moved by something else (a sensory apprehension).

Various authors, including Aquinas and his followers, associated the passions with the body because the passions depend for their existence on corporeal organs and are directed toward the good of the body. Further, Aquinas and many others, including Galen, Suarez, and Vives, acknowledged that bodily conditions can affect the passions (for example, persons of 'cold and dry' temperament are more susceptible to fear).[22] However, it appears that no one prior to Descartes had maintained that the passions are passively and directly caused in the soul by bodily processes alone.

3. Descartes compared to Aquinas

The originality of Descartes's theory can be brought into relief by comparing his views with those of Aquinas and his followers. I focus on certain core features of Aquinas's position, which, although not ubiquitous among theorists in the early seventeenth century, were widely repeated.[23]

According to Aquinas, as states of the sensitive appetite passions are directed toward an end. Everything in nature is directed toward an end, and the sensitive appetite is directed toward the good of the body. This appetite responds to objects as they are presented in sensory perception and further assessed by the sensitive power of the soul (ST I.81–82, II-1.22.2). In the Aristotelian scheme, the sensitive power responds to sensible things as being good or evil for the animal, a function that Aquinas ascribed to the 'estimative power' of the sensitive soul in nonhuman animals and to the 'cogitative power' of the

[21] Knuuttila (2004), p. 54; he also describes a minority Stoic position in Zeno, that emotions are the bodily effects of judgments, rather than being the judgments themselves. See also Levi (1964), pp. 12–13.

[22] On the role of the body in conditioning the passions according to the authors named, see Levi (1964), p. 23; Casini (2002); King (2002b); and Knuuttila (2004), pp. 95–97.

[23] For accounts of Aquinas's theory itself and in comparison with some principal followers, see Knuuttila (2004), pp. 239–255, King (2002a), and James (1997), Pt. 1. Many authors agreed with Aquinas in holding that the passions are sensitive appetites that can be governed by reason, and also in enumerating eleven primary passions (often dividing them into his six concupiscible and five irascible passions, discussed below), including: Wright (1604), pp. 8, 22–26 (who accepted Aquinas's eleven as 'convenient', while claiming that he could reduce the irascible to the concupiscible); Camus (1614), pp. 70, 96–97; Reynolds (1971 [1640]), p. 38; and La Chambre (1658–1662), Vol. 1, p. [xiv–xvii].

sensitive soul in human beings (ST I.78.4). The sensitive appetite is drawn toward good and shuns evil as represented by the estimative or cogitative powers. This appetitive response is a 'movement' in a thing that is moved, and the passions are to that extent passive effects. However, they tend to move the nonhuman animal toward the good and away from the evil, and to move the human will in those same directions. In that sense, the passions are movers, too, as also when they cause bodily expressions such as tears or blushing. Aquinas held that good and evil are absolute properties of things. Our passions do not respond directly to these properties but to our perceptions of them through the cogitative power. Hence, if the cogitative power presents something as good even though it isn't, we will be drawn toward it.

In human beings Aquinas recognized intellectual appetites or intellectual emotions, such as intellectual love, that are distinct from the passions of the sensitive appetite. The will is the intellectual appetite (ST I.82) and it can overrule the sensitive appetite (ST I.81.3). We can refrain from sensible goods in order to serve a good that the intellect recognizes. In a modern example, we refrain from ice cream in order to restrict our consumption of fat and cholesterol. Aquinas held that the will can not only trump the inclination of the sensory appetite but, aided by intellectual apprehension of the truly good, can often control the appetite itself (ST I.81.3, II-1.24.1). Accordingly, we can not only decide not to eat the ice cream but we can also make the ice cream less desirable to ourselves. Furthermore, we can establish habits that control the passions for moral ends, so that we no longer act on our desires for sensible goods that are morally objectionable.

The passions themselves are all responses to perceived good and evil. Aquinas divided the passions into two groups, 'concupiscible' and 'irascible'. The first group contains three pairs of opposed responses to good and evil: love and hate, the initial responses to good and evil; desire and aversion, responses to not-yet-attained (or not-yet-avoided) good or evil; and joy and sorrow, responses to attained (or unavoided) goods and evils. The irascible group (from the Latin root *ira*, anger) is conceptually descended from (but not equivalent to) Plato's 'spirited' part of the soul. It pertains to sensual goods and evils, present or future, that are represented as arduous. The irascible passions presuppose a prior concupiscible passion, which is then intensified under the aspect of ardure in obtaining or avoiding the object of that prior passion. The two opposed pairs of hope and despair and of confidence and fear are irascible intensifiers of desire and aversion: hope is a tendency toward a good that is difficult to obtain, and despair is a turning from that good in the face of ardure; confidence is a tendency to attempt something arduous to address and remove a coming evil, fear is a tendency to withdraw from the evil in the face of difficulty (ST II-1.2–4). The fifth irascible passion is anger, which intensifies the hatred and sadness that arise in response to a present evil. Aquinas assigned no opposite to anger, on the ground that the opposite of a present evil is a present good, and that there is no ardure if the good is present (ST II-1.23.3).

Descartes's theory was similar to Aquinas's in ranking the passions with sense-based phenomena. Also like Aquinas, he distinguished sense-based passions from intellectual emotions. He agreed with Aquinas that the passions are basically good for human beings (11:462–463, aa. 175–176) and that habits can and should be used to control and direct the passions toward moral ends (11:436, 453, aa. 144, 161). Further, like Aquinas and many others, Descartes considered the passions from both natural philosophical and moral perspectives, although he differed from some previous authors in giving greater weight to the

natural philosophical approach.[24] Indeed, in his second prefatory Letter to the *Passions*, he famously wrote: 'my purpose has not been to explain the Passions as an Orator, or even as a moral Philosopher, but only as a Physicist' (11:326). This is an overstatement, since in the body of the work he devoted considerable attention to moral aspects of the passions (11:436–442, 443–499, aa. 144–148 and Pt. 3).

Descartes's theory departed from that of Aquinas and his followers in three important ways. First, Descartes modified the description of the function or end of the passions: they exist not only to guide us toward what is good and away from what is evil but also to direct us to what may be 'important' (11:372, a. 52). This entails that, for him, the perception of good and evil is not basic to *all* passions; consequently, he added 'wonder' (a response to novelty) as a basic passion, on the ground that what is novel may well be 'important to us' (11:372; also, 11:384, a. 75).

Second, for Descartes the passions are not appetites but a kind of perception (11:349–350, aa. 27–28). They are cognitive responses that represent circumstances as being good, bad, or important. They are not external sense perceptions, but in the primary instance are representations of the tenor of the body and its current or future circumstances; they may be attached to external objects or not. As perceptions they are, in Descartes's formal ontology, modes of the intellect (as are sense perceptions proper [7:78, 8A:17]); as modes of intellect that represent the good, the bad, or the important, they naturally move the will (11:359, a. 40), which means that they have an appetitive effect on the will (11:364, a. 47). This appetitive effect is the consequence of a passion, but it is not the passion itself.

Third, such appetitive effects are not the primary cause of our initial bodily movements when we have a passion. Rather, the body's physiology causes our initial behavioral response, as well as causing the passion that affects the will (11:358, a. 38). Indeed, we shall find that for human and nonhuman animals alike, Descartes held that purely mechanical processes mediate a behavioral response to what is good or bad for the body, in such a way that these processes perform a function that Aquinas had assigned to the estimative and cogitative powers.

According to Descartes, there are six primitive passions: wonder, love, hate, desire, joy, sadness (11:380, a. 69). Wonder is new. The others are the concupiscible passions of Aquinas, with aversion collapsed into a kind of desire: desire to avoid. Although Descartes rejected the formal distinction between concupiscible and irascible passions (11:379, a. 68), he built his accounts of hope, despair, confidence, and fear on desire plus a 'representation' of the likelihood of success in obtaining one's desire, in a manner broadly similar to that of Aquinas.[25]

[24] Popular treatises commonly observed that both natural and moral philosophers could discuss the passions, the former in the context of the sensitive soul and the commonalities between human beings and beasts (for example, Wright, 1604, pp. 2–3). It was a commonplace that the passions arise from human nature and are 'natural' to humankind (for example, Reynolds, 1971 [1640], p. 41). There was nothing unique in Descartes's adopting a natural philosophical approach to the passions; the distinctive aspect of his approach was his corpuscular and mechanistic natural philosophy.

[25] Descartes differs from Aquinas by distinguishing between passions such as hope and courage by asking whether the outcome of a situation depends on us: hope, apprehension, confidence, and despair depend on a representation of the likelihood of our fulfilling a desire (to obtain or avoid something), whether the outcome depends on us or not, whereas irresolution, courage, boldness, cowardice, and fear arise when the outcome 'is represented to us as depending on us' (11:375–376, aa. 58–59). The 'representing' in this case seems to arise wholly within brain events, on which see the next note.

Descartes's greatest originality lies in his conception of the bodily mechanisms that produce the passions. For Descartes, the passions are directly produced in the mind by complex mechanical processes. Whereas Aquinas and other Aristotelians conceived the bodily organs as being endowed with a sensitive power that rendered them capable of perception and basic cognition, Descartes construed the body as a purely mechanical organism, whose systems operate together like those of a clock or a hydraulic automaton. Consequently, the passions, as caused in the mind by bodily processes, are the bare effects of purely mechanical processes. In Descartes's physiological idiom (see Section 4 below), these mechanical processes involve tubes, filaments, and fluids ('animal spirits' in the form of subtle matter).

Descartes accommodated the passions to his mind–body dualism. Drawing on a standard account of the relation between actions and passions, he held that a passion (passive state) always entails an action (active state) that brings it about. With the passions, the body is the causally active factor, the mind the passive factor (11:327–328, aa. 1–2). In fact, Descartes held that all perceptions are passive, whether caused by the body or not: the only active faculty of mind is the will and perceptions belong to the intellect (8A:17; 11:342–343, aa. 17–18). Some perceptions are purely intellectual and have no bodily cause; *as perceptions*, they are passive, but Descartes advised that these particular perceptions not be called 'passions' (11:343, a. 19). The perceptions that the body causes in the mind are called 'passions of the soul' just because they are caused by the body. These 'passions' fall into three kinds: sense perceptions, which we 'refer' to the external bodies that normally cause them; internal sensations, such as hunger, thirst, or bodily warmth, which we 'refer' to our own bodies; and the passions proper, such as love, sadness, and desire, which we 'refer' to our mind or soul (11:345–348, aa. 22–25).

In saying that the passions proper are referred to the mind or soul, Descartes means that we experience love or sadness as feelings 'in us'. Such feelings may have accompanying bodily sensations, such as warmth in the chest in the case of love (11:402, a. 97), but the passion itself is something that persons feel in themselves as a state of mind. Nonetheless, the passions proper are *perceptions*, albeit 'obscure and confused' ones (11:349–350, a. 28). They inform us that things are good, bad, or important, without necessarily revealing the details. In the least informative case, we might feel sad for no reason: we feel that things are bad without being able to say why (11:371–372, a. 51). We attach the badness to no cause in particular, but we feel it as pertaining to us: *we* are sad, things are bad *for us*. On most occasions, we perceive particular external objects as the causes of our passions, with the passion affecting how we perceive and behave toward those objects. If something that is bad for us is near (an approaching bear), it will cause us to feel apprehensive and to want to avoid it: the feeling of apprehension causes us to perceive the bear under the aspect 'bad for us'. This passion-mediated perception of the-bear-as-bad-for-us combines two factors: the brain-caused passion of fear and the brain-caused sense perception of the bear.

Descartes allowed that a variety of causal chains may lead to passions. The causal chain need not be initiated by the body, but may start with a judgment or with a decision to imagine a particular object (such as a frightful animal). However, because passions are effects of bodily states on the mind, an initiating mental cause can produce an initial passion only inasmuch as it affects the flow of spirits. Although mentally induced passions would figure more largely in a general account of Descartes's theory, here we focus on Descartes's own primary case: passions that are initiated by a direct physiological response

to an external object.[26] In the case of the approaching bear, the physiological response that causes the passion arises without a prior mental judgment of the bear's friendliness or harmfulness. Let us consider how.

When the passion arises from a specific object, such as a bear, the corporeal image (or corporeal 'idea') of the bear in the brain is partly responsible for the passion. In Descartes's own example of a 'frightful' animal, the feeling of apprehension arises because of our past experience with the animal.[27] Presumably, the brain image of the bear interacts with the brain mass to yield a further brain effect that causes the passion of apprehension.

Descartes further explains that it is not our feeling of apprehension that initially makes us run from the bear. Rather, the physiological process that produces fear in the mind also initiates the motions of running.[28] On Descartes's view, not only is the feeling of apprehension caused by a purely mechanical brain process, but so too is the action of the body in turning and running. These bodily processes are dependent on the wiring—or we might say the 'plumbing'—of the brain, which depends on basic anatomy, individual differences in temperament, and past experience. If one has a temperament that does not produce abundant spirits to counter the effects of apprehension (11:460–462, aa. 171–174), then the physiological process that causes the feeling of apprehension is likely to produce

[26] Throughout Parts II and III of the *Passions*, Descartes writes as if some of the passions arise from a prior judgment: for example, the passions proper 'may sometimes be caused by the action of the soul, which decides to conceive of this or that object' (11:371, a. 51); in imagining a frightful animal, its brain image initiates the passion of apprehension. Yet Descartes focused primarily on passions that are excited not by judgments or other actions of the soul, but by 'objects which move the senses' and the 'effects of these objects' (11:372, a. 51). Because the passions are formally defined as mental states caused by a flow of spirits (11:349, a.27), the 'effects' of external objects can cause passions only inasmuch as they cause the spirits to flow appropriately. In Descartes's primary theoretical descriptions, such effects are mediated *without* a contribution by the soul (11:358, 359, 372, aa. 38, 40, 52). When Descartes speaks as if particular passions arise from 'perceiving' objects as 'good or bad' (e.g., 11:374, a. 56), we must read carefully to determine whether he actually invokes mental perception and judgment. Sometimes, as in the case of remorse, the need for a genuine judgment is evident: 'Remorse of conscience is a species of Sadness which springs from our doubt that something we are doing or have done is good. And it necessarily presupposes doubt' (11:463, a. 177); the judgment (doubt) presumably interacts with the primary passion of sadness (and its spirit flow) to yield remorse, which is a species of sadness. Nonetheless, when Descartes says that bodies are 'represented' as being good or bad (11:374, a. 56), although this may seem to suggest a mental representation it is likely that he is talking about a brain image that affects us in the way that the wolf affects the sheep (that is, without mental mediation and judgment), as envisioned in Articles 36–38 (discussed in the next paragraph). This interpretation covers most cases in Parts I and II (or so I think), and it provides the primary model of the passions for Descartes. (In the complex passions of Part III, mental reactions that feed back on primitive passions are frequent.) In rendering passions with judgments in their etiology as secondary (though not uninteresting) cases, I differ from many commentators (but not from Brown, 1999, pp. 220–222, or Talon-Hugon, 2002, Ch. 3); for a balanced view of the psychology of Cartesian passions and emotions, including the complex passions, see James (1997).

[27] In Article 36, Descartes uses an example in which past encounters determine the brain response; elsewhere, he describes human instincts to avoid harms, as in the eye blink (11:338–339, a. 13) or the wide range of cases of 'natural instinct' in the *Treatise* (11:192–195), including the physiological counterparts to the passions (on the relation of the *Treatise* to the *Passions*, see note 10). I thus disagree with Brown's view (1999, p. 219) that Descartes makes all passions 'dependent upon our prior experience of the effects of objects'; and also with Kambouchner (1995), Vol. 1, p. 149, who has Descartes invoke memory in the genesis of all passions.

[28] In Part III, Descartes argues that 'fear' (*peur*) is not itself a 'particular passion', but arises from an excess of cowardice, wonder, and apprehension (11:463, a. 176). In Part I, he used fear as an example of a passion (11:356, 358, aa. 36, 38) that can arise from 'apprehension' (*crainte*). There is no contradiction if his final position is that fear is not a 'particular passion' but a *complex* passion arising from an excess of one or more particular passions.

feelings of fear and terror. Further, if one has responded to bears in the past by running,[29] then that response will be plumbed into the brain, and we will turn and run now. Descartes asserts that past cases of contact with a frightful animal may dispose the brain so that the brain image of a bear causes the physiological processes that move the legs to flight, 'merely by the disposition of the organs without the soul contributing' (11:358, a. 38; also, a. 36). That is, the brain state that causes the feeling of fear also causes flight, without any mental intervention.[30]

We can now appreciate the novelty of Descartes's physiological account of how passions proper are caused in the mind. Descartes did not merely ascribe the cause of the passions to the body alone (11:349, a. 27), which would already be a novel approach. More ambitiously, he proposed to explain the initial behavioral effects associated with the passions, which Aquinas and others ascribed to the estimative and cogitative powers of the sensory soul, by appeal to mechanistic operations alone. In effect, this account in the *Passions* tacitly embodies a claim that Descartes had made in the *Treatise* and reprised in the *Discourse* (6:55–59): that he can explain mechanistically, in clockwork fashion, a wide variety of human behaviors, including those that depend on the interaction between sensory stimulation and a purely corporeal memory, without invoking his conception of a human mind and without requiring vitalistic concepts such as an Aristotelian 'sensitive soul' (11:202). Descartes of course excluded sensory consciousness, which depends on mind–body interaction, from these purely mechanistic processes, and he also excluded the 'passion proper', that is, the feeling in the mind (along with its subsequent effect on the will). But he claimed to mechanize everything that Aquinas had included in his theory of the passions: sensory images, a linkage between current responses to such images and the history of one's previous sensory images, appropriately different responses to things that are good or bad for the body, and sensory appetite as a cause of bodily action (but not as a kind of feeling or internal sensation, which requires the mind). The 'images' in question are now purely material, since Descartes's reserved consciousness to 'mind', a rough equivalent to the Aristotelian 'rational soul', a term that Descartes also used (6:59, 11:143). In Descartes's account, any feelings involved in the passions arise from the effects of the body on the rational soul. But the initial bodily behaviors associated with the

[29] Descartes's account raises the question of why one runs the first time. We might imagine that Descartes believed that the machine of the body is programmed to copy the motions of others, so that if, when we first saw a bear, others near us ran, our body would follow. However, the *Treatise* teaches that in some cases mechanical instinct directs the bodily machine to avoid harmful things, suggesting that some brain images of external objects are naturally disposed to induce approach or avoidance by physiological mechanisms alone (11:192–196).

[30] Although Descartes has us running before we feel fear, he did not hold a Jamesian theory of the emotions (or James did not have a fully Cartesian theory). According to James (1890, Vol. 2, pp. 449–453) we feel fear because we perceive some internal physiological stirrings that are caused by the same brain events that cause us to run. James argues that emotional responses are tied to instinctive reactions to external objects, but that an emotional reaction 'usually terminates in the subject's own body' (ibid., p. 442) and does not represent external circumstances. The instinctive reaction may serve an end, but without representing either that end or an evaluation in relation to that end; instincts are reflexes (ibid., p. 383–384). In Descartes's theory the feeling of fear is not a perception of internal physiological stirrings (though sensations of bodily reactions may accompany it); rather, it is a perception that dangerous things are present, and it induces the will toward going along with running. Descartes assigns a cognitive function to emotions *per se*, contrary to James (further discussion in Hatfield, Forthcoming b). On Descartes's theory as cognitive, see also James (1997), pp. 94–108, and Brown (1999).

passions arise through functionally conceived, purely mechanistic processes in the body and brain.

This mechanization of the sensitive soul, together with Descartes's radical mind–body dualism, entail that nonhuman animals have no 'passions proper', no mental states that affect the will. Since, in Descartes's view, such animals do not possess a will, there would be no functional role for passions proper to play. But in both human and nonhuman animals, physiological processes, devoid of thought, do play the role that passions played for Aquinas: they spur individual organisms toward objects and toward behaviors that will, on the whole, be beneficial, and away from those that would be harmful. Descartes was committed to a teleology of the mechanical organism, which means that the organism tends toward what is good for it (without, of course, always reaching it: a machine might eat poison food because it affected its senses just as would good food [7:83–84]). In both nonhuman and human animals, the types of physiological process that cause the passions proper (in humans) are teleologically directed toward the good of the body. I call such physiological processes 'corporeal passions'.[31]

In human animals, Descartes also conceived the passions proper teleologically. Article 52 tells us that their use or function is to 'dispose the soul to will the things nature tells us are useful and to persist in this volition' (11:372). One might think that this means that the passions are to initiate useful behaviors, such as retreating from a bear. However, as presaged above, it is the bodily mechanism that initiates flight from the bear. Descartes reaffirms that point: 'the same agitation of spirits that usually causes them [the passions] disposes the body to the movements conducive to the execution of those [useful] things' (11:372, a. 52). The passions proper are not the initiators of useful responses, but they serve to bring the will to want to do the things that, in the typical case, the body is already doing. In this role, the inclination brought on by the passions is not ineluctable. The person may decide it would be better not to run from the bear, or perhaps not to move at all. Although the will cannot simply banish the fear, it can override the bodily action of running (11:364, a. 46). Presumably, it does so as a result of intellectual deliberation, a position similar to Aquinas's doctrine that the rational soul, a higher power, can override the appetitive response of the sensitive soul, a lower power.

[31] In the *Treatise* (11:194, 202), *Discourse* (6:55), and subsequent correspondence (4:574–576), Descartes spoke of processes in unensouled human bodies and in animals as 'passions'; in the *Passions*, he once refers (pronominally) to purely physiological processes as 'passions' (11:359, a. 40, second 'they'). Nonetheless, in the systematic theoretical framework of the *Passions*, passions proper are passively caused effects in the human mind (and so, strictly speaking, cannot exist in a mindless machine). However, in Article 1 Descartes affirms the principle that 'even though the agent and the patient are often quite different, the Action and the Passion are always a single thing, which has these two names in accordance with the two different subjects it may be referred to' (11:328). This suggests that in the human case, the proximate physiological cause of the passion is part of the 'single thing' (presumably a single *complex*, *relational* thing, *pace* Hoffman 1990) that includes the mental passion proper. Further on, Descartes explains that, although the perception of a volition is also a passively caused state of mind, it is not labeled a passion but an action, because 'the denomination is always made by the loftier' member of the pair (11:343, a. 18). If a passion proper is 'loftier' because mental, then, by parity of reasoning, what I term the 'corporeal passion' might be called a 'passion'. The term 'passion' would be extended to nonhuman animals through the analogy between animal and human bodies, with the human passion proper setting the label for its human physiological cause and for functionally similar physiological states in nonhuman animals (which have no minds). More generally, corporeal passions might be ascribed to animals through analogy of behavioral patterns, as when we ascribe 'love' to a pet animal on the basis of leg-rubbing behavior.

In sum, the Cartesian passions proper are bodily caused states of mind that influence the will. They are not themselves volitions, hence are not themselves appetitive responses. They are perceptions (11:349–50, a. 28) and hence are mental representations that belong to the intellectual faculty of the mind (7:78, 8A:17). Although obscure and confused, they nonetheless represent a state of affairs as being harmful or beneficial to the body. That would explain their effects on the will, which has an intrinsic appetite toward the good and away from the bad (and toward the important), as represented to it (in this case, confusedly) by the intellectual faculty (6:28, 7:57). The passions thus are possessed of cognitive content. Such content mirrors that found in Aquinas's sensory representations, but it does not play the same causal role. In Aquinas's theory, sensory representations engage the sensory appetite to produce an inclination to movement. In Descartes's scheme, purely mechanical processes initiate such movements and also cause the passions. Cartesian passions proper engage the human will, but they do not engage the 'sensitive appetite'. Strictly speaking, Descartes has banished the sensitive appetite, as depending on a sensitive soul, from his world, and he has reassigned the function of that appetite to a purely mechanistic corporeal process (3:371–372, 11:202).

In classifying the passions proper as cognitive or perceptual, Descartes was in limited agreement with Stoic theories. But his position differed from the primary Stoic view that the passions are confused judgments. In Descartes's view, the passions themselves cannot be judgments, for judgments require an act of will and the passions proper are not acts of will. The passions are feelings that may incline the will toward certain acts, including acts of judgment. Descartes also differed from the Stoics in that he held that the passions are basically good for us, directing us toward the beneficial and away from the harmful (11:372, a. 52). He agreed with Aquinas in thinking that, when properly directed through 'habits' of moral virtue, the passions aid morality (11:464, a. 161). He denied the Stoic theory that the passions could (or should) be extinguished. In his view, 'all the good and evil of this life depend on [the passions] alone' (11:488, a. 212; but cf. 11:440–441, a. 147). Far from eliminating the passions, we should cultivate and direct them.

4. The machine psychology of the passions

Descartes ascribed a considerable role to purely physiological processes in the instigation and control of human behavior in the *Passions*. That was not new for him. In previous works, he had made large claims for the psychology of mindless machines. At the end of the *Treatise*, he claimed that the human body, conceived mechanistically and imagined without a mind or soul, could perform a variety of functions that we and Descartes's contemporaries would describe as 'psychological':[32] the reception of sensory impressions, the storage of these impressions as material 'ideas' in the memory, the 'appetites and passions', and 'finally the external movements of all the bodily parts that so aptly follow both the actions of objects presented to the senses, and the passions and impressions that are encountered in memory' (11:202). These bodily movements 'imitate as perfectly as is possible the movements of real men' (11:202), that is, of normal human beings with minds conjoined to their bodies. In Part V of the *Discourse*, he claims that in his (as yet) unpub-

[32] Vidal (1992); on psychology among Descartes's followers, see Hatfield (1995), pp. 193–194, and Hatfield (2000), pp. 646–648.

lished *Treatise* he had shown how corporeal 'ideas'[33] in the 'fantasy' can 'by distributing the animal spirits to the muscles, make the parts of this body move in as many different ways as the parts of our bodies move without being guided by the will, and in a manner that is just as appropriate to the objects of the senses and the internal passions' (6:55*). The 'sensory objects' in this case have their effect merely by producing brain states, and the 'internal passions' are what I have termed corporeal passions. Although neither Descartes nor his contemporaries would describe these purely material mechanisms as 'psychological mechanisms', seventeenth-century authors could recognize the *phenomena* that these mechanisms purported to explain as psychological, thereby opening a conceptual space for a mechanistic psychology.[34]

In the *Passions*, Descartes provided a summary statement of the mechanics of these processes (11:329–342, 354–356; aa. 4–16, 34–35), which he had described more fully in the *Treatise*. Basically, Descartes envisioned a mechanical sensory–motor feedback loop. The machine is powered by blood that is impelled to the brain from the boiler-like heart (fired by spontaneous natural heat). The most active particles of the blood push their way into the arteries of the brain, where the subtlest particles are filtered out to form the animal spirits, a fluid that is distributed from the centrally located pineal gland to the motor nerves, which are tubes that form the mass of the brain and (in some cases) lead to the muscles. At the muscles, the arriving spirits are shunted by various tubes and valves so as to cause the muscles to inflate and contract, or to deflate and grow flaccid. The flow of spirits from the gland is controlled by four factors: patterns of openings created in the brain by sensory stimulation; the innate plumbing of the brain; alterations in brain plumbing due to previous patterns of stimulation; and the character of the spirits themselves, as sent up from the heart (11:166, 192–193). The pattern of sensory stimulation affects the spirits through the sensory nerve filaments that are ensleeved by the hollow nerves. When stimulated at the sense organs—eyes, ears, nose, tongue, and skin (for external senses); stomach or other internal organs (for internal senses)—these filaments cause their ensleeving tubule to open and to admit animal spirits, which flow to the tube from the pineal gland.[35] When a current pattern of stimulation causes the machine to move, new patterns of stimulation again affect the flow of spirits to the muscles, creating

[33] In the *Treatise* and the *Discourse*, Descartes speaks of 'ideas' as images or other structures in corporeal organs of the 'common sense', the imagination, or the memory (6:55, 11:176–177, 202)—faculties that, in the counterfactual *Treatise*, operate independently of a mind or soul. This suggests that some ideas can be corporeal. But in the *Meditations*, Second Replies, he defines 'idea' as 'the form of any given thought, immediate perception of which makes me aware of that thought' (7:160), indicating that only those brain images that cause mental states may be termed 'ideas' (7:160–161). And yet in the *Passions* he uses the term 'idea' for brain states that have only physiological effects and that, at the least, are not *currently* causing a mental state (11:429, a. 136; see Voss's n. 36 at 11:497, in Descartes 1989). This passage can be rendered consistent with the Second Replies by assuming that a brain pattern can be called an 'idea' if it *could* cause a corresponding mental state, even if it isn't doing so at a given time. On corporeal ideas in the seventeenth century, see Michaels & Michaels (1989).

[34] Smith (2005) argues against the conceptual and referential continuity of terms such as 'memory', 'imagination', and, indeed, 'psychology' and 'psychological' across the early modern period and into the nineteenth and twentieth centuries, which would tell against my argument here. Without claiming that the various terms retained exactly the same meanings, I urge a developmental continuity of concepts, with later meanings arising out of earlier meanings and core meanings remaining relatively constant over extended periods. Hatfield (1990), Ch. 7; Hatfield (1992), pp. 338–340; Hatfield (1995).

[35] For more on pineal mechanics, see Hatfield (1992) and Beyssade (2002), which differ from Kambouchner (1995), Vol. 1, pp. 134–135.

a feedback loop. More generally, owing to the innate or acquired dispositions of the nerve tubules, a given pattern of stimulation may cause the machine to flee from a bear, to move its arm toward a point on which its eyes are focused, or to draw back and grimace when its hand nears a fire.

The *Treatise* describes several initial sensory–motor loops and provides figures to illustrate them, two of which are reproduced here.[36] Figure 1 shows a mindless machine (shaped like a human being) that shifts its eye-fixation from C to B and moves its arm. Light from point B stimulates nerve fibers 3–4 in each eye, opening tubules 4 and causing spirits to flow from point *b* on gland H (the pineal) into openings 4 and 8, thereby causing the eyes to focus on point B and the arm to move toward point B, whereas previously the eyes had focused on C and the finger had pointed to C, because spirits had flowed from point *c* into tubules 4 and 8 (11:181–183). Figure 2 shows a mindless machine with its hand in a fire. If the fire is strong enough to burn the hand, the spirits flow with so much force into tube 7 that they push past N to passage R, which 'conducts them into all the nerves that serve to move external bodily parts in the way needed to avoid the force of this action, such as those that withdraw the hand or the arm or the entire body, and those that turn the eyes toward the fire so as to see more particularly what it must do to protect itself' (11:192–193)—where 'seeing' is a purely material process such as that illustrated in Figure 1. Other spirits push past N to passage S and so cause corporeal passions suitable to a painful situation, together with concomitant external signs, such as making the machine's eyes form tears and its face grimace. And if the hand were cold and the fire moderate, the spirits would flow so as to cause different behavior, like that which occurs when we warm ourselves (11:193).

We know from the *Discourse* and other writings that Descartes did not believe that such an automaton or mindless machine could produce *all* types of behavior found in human beings: it could not exhibit intelligent speech or general intelligence (6:56–59). Mindless animals also would have no thoughts and feelings (3:85, 4:573–576, 5:275–278, 7:426, 559–560). But in various passages Descartes claims that they could exhibit behaviors appropriate to their external and internal circumstances, and indeed that many human behaviors are so produced (7:229–230). Thus, a machine that has no food in its stomach will behave differently from one that has, and will search out and consume food without mental guidance (11:194–195); a machine with agitated spirits will respond in an angry manner, compared with a machine with sluggish spirits (11:194); a machine that has had previous sensory contact with objects that resulted in bad consequences for the body will avoid objects that produce the same (or similar?) corporeal ideas in the senses. These wondrous effects occur partly through innate plumbing, in the form of instincts (11:192); partly through the character of the spirits that constitutes the corporeal passions, as deter-

[36] The manuscript of the *Treatise* called for illustrations throughout. Claude Clerselier, editor of the original French edition (Descartes 1664), found in his manuscript. only one drawing for the *Treatise* by Descartes himself (on antagonistic muscles in the eye), which he published. To supply the full complement, he commissioned independent sets from Gerard van Gutschoven, professor at Louvain, and Louis de La Forge, doctor of medicine at La Flèche. He chose Gutschoven's illustrations in most cases, including those reproduced here in Figs. 1 and 2 (from Descartes 1677). The Latin translation of the *Treatise* (Descartes 1662), edited by Florentius Schuyl from an imperfect ms. copy, had its own illustrations (not available to Gutschoven or La Forge as they worked), which are high quality engravings but are not as informative as those by Gutschoven; Schuyl's edition also presented an illustration of muscle function purportedly deriving from one of Descartes's own drawings. (See AT 11: vi–vii, 134 n.)

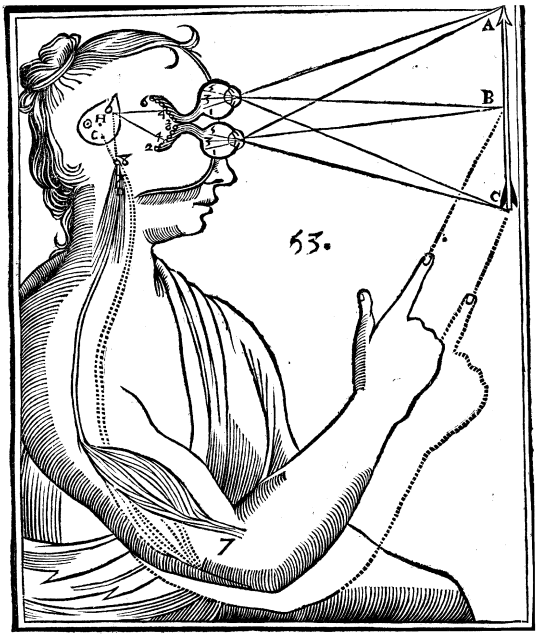

Fig. 1. Brain processes in a mindless machine, shaped like a human being. The machine's eyes shift their fixation point from C to B, causing the right arm to move from being aligned with C to being aligned with B. The change is mediated by brain events involving optic nerves 3–4, pineal gland H, pineal points *b* and *c*, and opening 8 of a nerve tubule leading to the musculature of the arm. From Descartes, 1677, p. 74.

mined by temperament and affected by recently ingested food or drink (11:166–168); and partly through the effects of a purely corporeal 'memory' that adjusts subsequent behavior to past events (11:185).

Descartes himself used the psychological vocabulary of 'senses', 'common sense', 'imagination', 'fantasy', and 'memory' in describing various anatomical structures and physiological processes in the mindless machine (6:55*; 11:163, 174). He also used such terms for processes that involve mind–body interaction in ensouled human beings and which are uncontroversially psychological (11:143, 159, 176; 11:360–361, aa. 42–43). The important thing to note here is that Descartes used these (Aristotelian) psychological terms to describe purely material functions in an unensouled machine. Further, he asserted that the structures and processes that realize these functions are so constituted that they tend toward the preservation of the animal body by directing the organism 'in the pursuit of desirable things or in the avoidance of injurious ones' (11:193). These objects are 'desirable' in the sense of being good for the body, and would produce the passion of desire in an ensouled human being: but Descartes here claims that an unensouled human body would pursue 'desirable things'—things that are (usually) good for the body—without mental intervention.

The ability of a mindless machine to change its behavior as a result of past sensory stimulation depends on the corporeal memory and its capacity to form associative connections. Descartes observed that even nonhuman animals can form such connections. Thus, 'if you whipped a dog five or six times to the sound of a violin, it would begin to howl and run

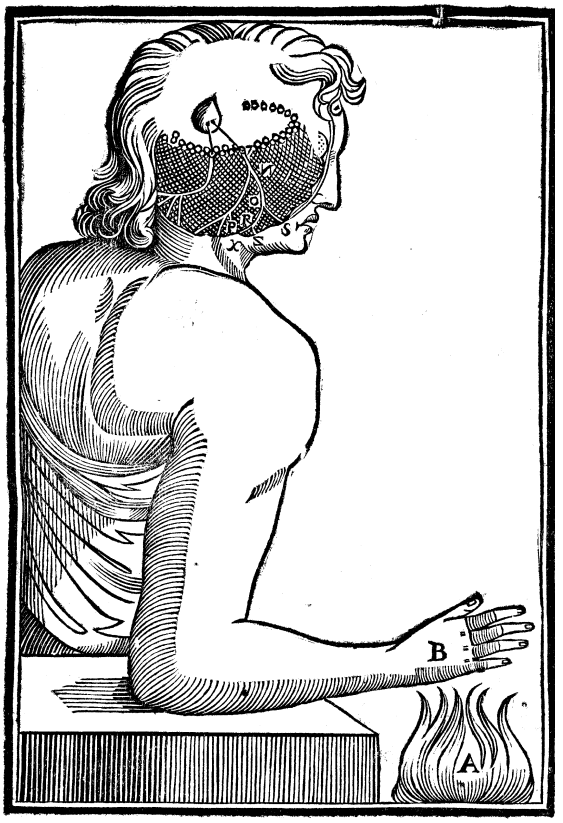

Fig. 2. Brain processes in a mindless machine with its hand in a fire. The action of the fire, which is strong enough to burn the hand, affects sensory nerve fibrils (not shown) that in turn cause nerve tubule 7 to open widely, allowing abundant spirits to flow into it from the pineal gland. A portion of these spirits pushes past N to passage R and on to various muscles that cause the arm to withdraw, the body to pull back, and the eyes to turn toward the fire. Another portion of these spirits pushes past N to passage S, causing corporeal passions typical of a painful situation, and simultaneously causing grimaces and tears. From Descartes, 1677, p. 87.

away as soon as it heard that music again' (1:134), or if you gave a magpie a 'tidbit' whenever it said 'good-day' on the approach of its mistress (4:574–575), it would repeat the word so as to get the food (but without thought). In the *Treatise*, Descartes developed a mechanical account of association. Corporeal memory might form such associations through the way in which the pores of the brain become mechanically related. He described the brain as being so constituted that if some whole pattern of pores has repeatedly been opened together, comprising elements A, B, C, and D (forehead, two eyes, nose, and mouth), then, if the image of B and C (two eyes and nose) occurs in the brain, the rest of the image will be filled out: that is, the pores portraying the forehead and mouth will open (11:178–179). Thus, in general, if local patterns A and B have co-occurred many times in a pattern of brain activity, then, if A occurs by itself on a subsequent occasion, the brain will respond by activating local pattern B. In this sense we can speak of mechanical operations of the brain that allow for associative 'recall' of past relations among previous sensory patterns.

This corporeal principle of association is surely one of the features of (corporeal) memory that Descartes had in mind when he ascribed great power to the memory for explaining the bodily movements of mindless machines:

> But the effect of the memory which seems to me to be the most worthy of consideration here is that, without there being any soul in this machine, it can be disposed naturally to imitate all the movements that real human beings, or even other similar machines, will make when the soul is present. (11:185)

The statement that the machine will imitate 'all the movements' of real human beings presumably is hyperbole, for only a few years later Descartes denied that mindless machines could achieve intelligent speech and generally intelligent behavior—which this statement, taken literally, would attribute to them (6:56–59). All the same, he clearly held that corporeal memory, with its ability to associate, was a primary player in his machine psychology.

The elaborate functional psychology of the mindless machine that Descartes articulated in the *Treatise* underlies his machine psychology of the passions. The human organism, as he described it in the *Passions*, is able to direct its legs toward flight at the sight of a bear because of structures in the brain that connect the corporeal idea or image of the bear with the physiological processes needed to move the legs appropriately for flight. The *Treatise* provides a fuller picture of the mechanisms by which purely bodily processes might produce such behavior, without mental intervention. The passions proper, as mental states with (confused) cognitive content, then function to incline the mind to favor the behavior that is already in progress. Descartes has (nearly) completely mechanized the Aristotelian psychology of the sensitive soul, so that sensory encounters with objects, the attendant corporeal passions, and corporeal memories (or brain-mediated dispositions to behavior) can all occur without cognitive or mental guidance. Sentient feelings and genuinely mental responses to sensory stimulation, including acts of will, remain unmechanized and require an immaterial mind.

5. The psychology of habituation and association

As had previous theorists, Descartes recognized an important role for habit-formation and association in retraining the passions proper for moral ends. Scholars have long appreciated that a principle of 'habituation' or 'association' plays a central role in Descartes's account of the passions, especially in mitigating the passions and in realigning the links between passions and objects.[37] With the above account of Descartes's machine psychology in hand, we are well positioned to examine closely the mechanisms by which associations (mental and mechanical) occur in ensouled human beings, and the role that they play in mediating the passions proper.

Cartesian passions need not be associated with or caused by external objects and may have a variety of initiating causes, including a prior judgment in the soul, individual temperament, and impressions arising fortuitously in the brain (11:371–372, a. 51). However, as his primary case, Descartes chose to analyze how an external object that stimulates

[37] Voss, in Descartes (1989), Translator's introduction, p. viii, posits a 'Principle of Habituation' as axiomatic in the *Passions*; see also Rodis-Lewis (1989), pp. xx–xxi. Shapiro (2003b, p. 42) posits a broader fundamental principle, to include the institution of nature: the 'Principle of nature and habituation'.

the senses can cause a passion. The physiological processes set in motion by sensory stimulation cause a sense perception and, through additional physiological effects, they can also cause a passion. Descartes did not hold that the same objects cause the same passions in every human being. In order to understand his account of such individual differences, we must examine the mechanisms that establish habitual linkages between object and passion.

In Article 39, Descartes observes that not everyone is afraid of the same things: 'the same impression that the presence of a frightful object forms on the gland which causes fear in some men may excite courage and boldness in others' (11:358). The reason is that brains differ (11:358–359):

> all brains are not disposed in the same manner, and the same movement of the gland that in some excites fear, in others makes the spirits enter the brain's pores that guide part of them into the nerves that move the hands for self-defense, and part of them into those that agitate the blood and drive it toward the heart in the manner needed to produce spirits suitable to continue this defense and sustain the volition for it.

While clearly stating that differences in brains yield different behaviors and different passions in different individuals, this passage does not say exactly how differences in brains cause different passions. One hypothesis might be that two individuals have (type-) identical central brain states that directly cause flight in one person and defense in another because the plumbing in their brain masses differs. Since the central cause of the bodily movements must also cause the attendant passion, this hypothesis would further require that type-identical central brain states cause the feeling of fear in one person and the feeling of courage or boldness in another. Thus, one type of central brain state would, in different individuals, directly cause different bodily responses and different mental states. This hypothesis requires that brain–mind linkages differ across individuals.[38]

This reading does not precisely match Descartes's contention that differences in *brains* (as opposed to brain–mind interactions) account for the differing passions of fear or courage. I therefore prefer another reading, one that is somewhat complicated but that captures much of what Descartes says in the *Passions*. Attending closely to Descartes's wording in Articles 36, 38, and 39, we see that the differences between individuals pertain to the linkage between brain images or 'impressions' of a frightful object, such as a bear, and two subsequent brain states, one of which differs between individuals and accounts for the differences in both behavior and passion. Let us assume that the image of the bear (B) is the same in both individuals and that this image causes a second brain state (A), which produces an initial passion of apprehension, also in both individuals. This corporeal passion of apprehension then causes either (1) further brain states (F) that direct the flight response and cause the passion of apprehension to be intensified into feelings of fear and terror, or (2) further brain states (C) that direct the defensive response and cause the mental feeling of courage, which displaces the initial response of apprehension. In the first case, we have B → A → F, in the second, B → A → C (see Fig. 3). The individual

[38] This reading of 'habituation' is offered by Alquié (in Descartes 1973, 3:944), Rodis-Lewis (1989), pp. xx–xxi; Voss (in Descartes, 1989, n. 42); Sutton (2000), p. 712; and Shapiro (2003a), pp. 226–232; (2003b), pp. 42, 52.

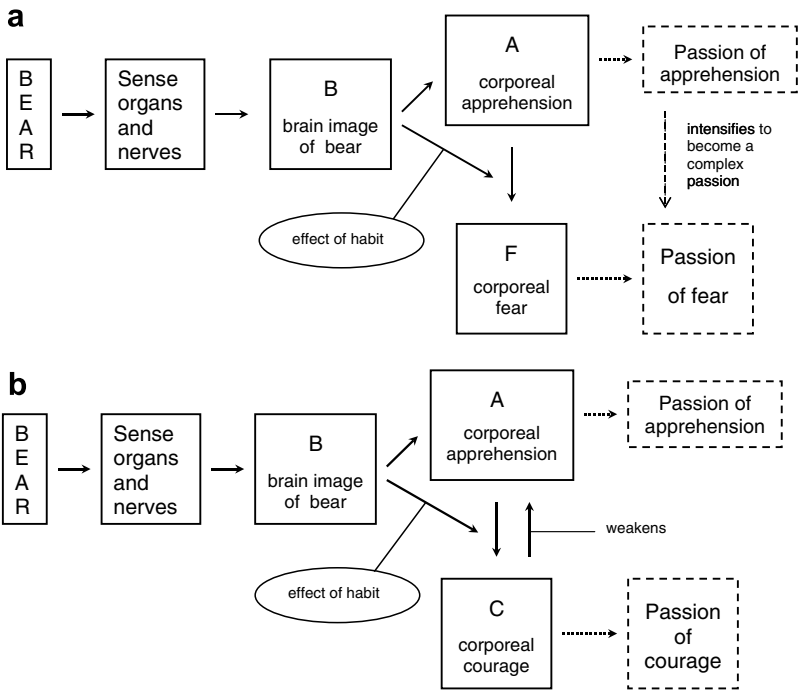

Fig. 3. Causal analyses of how the passion of fear or of courage arises in response to a bear. The solid arrows indicate causal relations between bodies or bodily states, the dotted arrows indicate body–mind interaction, and the dashed boxes are mental states. The analyses assume that sight of a bear nearby initially evokes apprehension. Part (a) shows how the brain image of the bear (B) causes the corporeal passion of apprehension (A), and how B and A are disposed, as a result of past experience, to produce brain state F, which causes bodily flight and the passion of fear (a complex passion). Part (b) shows how B and A are disposed, as a result of different past experience, to produce brain state C, which causes a defensive posture and the passion of courage. Brain state C feeds back upon and weakens A, abating the feeling of apprehension.

differences in behavior and passion are accounted for by the production of (F) which causes flight and fear in one individual, and (C) which causes defense and courage in the other.

This reading accords well with Article 36, where Descartes says that the image of a frightful animal initially causes the passion of apprehension. If an individual's previous response to such objects has been to flee, then (11:356) that prior event

> so disposes the brain that the spirits reflected from the image thus formed on the gland turn to flow in part into the nerves to turn the back and move the legs for running away, and in part to those which enlarge or contract the heart's orifices, or those which so agitate the other parts from which blood is sent to the heart, that this blood, being rarefied there in an unusual manner, sends spirits to the brain suitable to maintain and strengthen the passion of fear.

As a result of past events, the flow of spirits from a bear-image enters pores that are part of a brain disposition for causing flight and fear. The brain has been so modified that it alters the outflow from the bear-image in such a way that 'simply in virtue of entering these pores, these spirits excite a particular movement of this gland which is instituted by nature

to make the soul feel this passion', namely, fear (11:357, a. 36).[39] But, he explains in Article 39, if a second individual has previously defended herself on such occasions, then the same impression (of a bear) will cause brain events that lead her body to adopt a defensive posture and her soul to feel courage (11:358–359).

We can fill out this discussion in Articles 36–39 by turning to the later account of hope and courage in Articles 165–166 and 171–176. There, it becomes clear that courage arises in response to difficulty, which also (initially) causes apprehension (11:461, a. 173). Thus, we should hold that in the second individual the image of the bear first causes a brain state that causes the passion of apprehension, and this combined brain state of bear-image and corporeal passion of apprehension then initiates brain states that yield a defensive posture and that cause feelings of hope and courage (while also mitigating or eliminating the brain state for apprehension, and hence the feeling of apprehension). In the passage just quoted, Descartes distinguishes the specific brain state that causes defense or flight from the one that causes courage or fear. Such a distinction is also implied by Descartes's position that we can override our running by an act of will, but we cannot simply will away our fear (11:364, a. 46). Hence, we should augment our schematic diagram as in Fig. 4. In one case $B \rightarrow A \rightarrow (F_1 \& F_2)$—that is, the bear-image (B) causes the corporeal passion of apprehension (A), and B and A together interact with a brain disposition specific to that individual, so as to cause brain states F_1 and F_2, which respectively initiate the bodily motions of flight and cause the passion of fear. In the second individual, B and A interact with her differing brain disposition to cause brain states D and C, which initiate a defensive posture and cause the passion of courage, and these same processes negate A (lessening apprehension).

Beyond conforming to the statement that differences in *brains* explain the individual differences in passions, this reading has a further advantage: it permits us to explain how identical brain images can (ultimately) cause different behaviors and different mental feelings in different individuals without violating the *principle of psychophysiological regularity* between brain states and mental passions. Psychophysiological regularity was a central feature of Descartes's doctrine of mind–body union and interaction. In the *Dioptrics* (first published in 1637), he announced a principle of mind–body interaction according to which brain states cause sensations through an 'institution of nature' (6:130*), that is, as a result of a natural connection established between brain states and sensations even before birth (see also *Treatise*, 11:143). In the *Meditations*, he explained that nature has 'laid it down' that each type of brain state 'produces just one corresponding sensation' (7:87). Since passions are a type of sensation (11:350, a. 28), each brain state should produce just one passion. The passage from the *Meditations* explicitly asserts that mind–body relations are unique: one sensation per (type of) brain state. In the above analysis, we may assume that brain states B, A, F_2, and C each has a fixed psychophysiological effect (respectively

[39] The block quotation says that the passion of fear is 'maintained and strengthened' by spirits produced from the blood rising from the heart. Among the six primitive passions, five (excluding wonder) involve the heart and blood (11:401, a. 96). The continuation of the passage (as quoted above) makes clear that the passion arises immediately from pineal outflow to nerve openings that lead to the heart where the blood is affected, which implies that the passion is not originally caused by but is simply *maintained and strengthened by* the effects on the heart and blood. Descartes does not describe the precise mechanism by which the image of the bear becomes associated with apprehension and then fear (or courage); in non-instinctual cases it presumably is a mechanism of material association, which implies that the image of the bear is formed first and then, through association of brain-pore openings, the pineal outflow causing apprehension and fear is initiated. In an instinctual case, the association might simply be hard-wired (hard-plumbed).

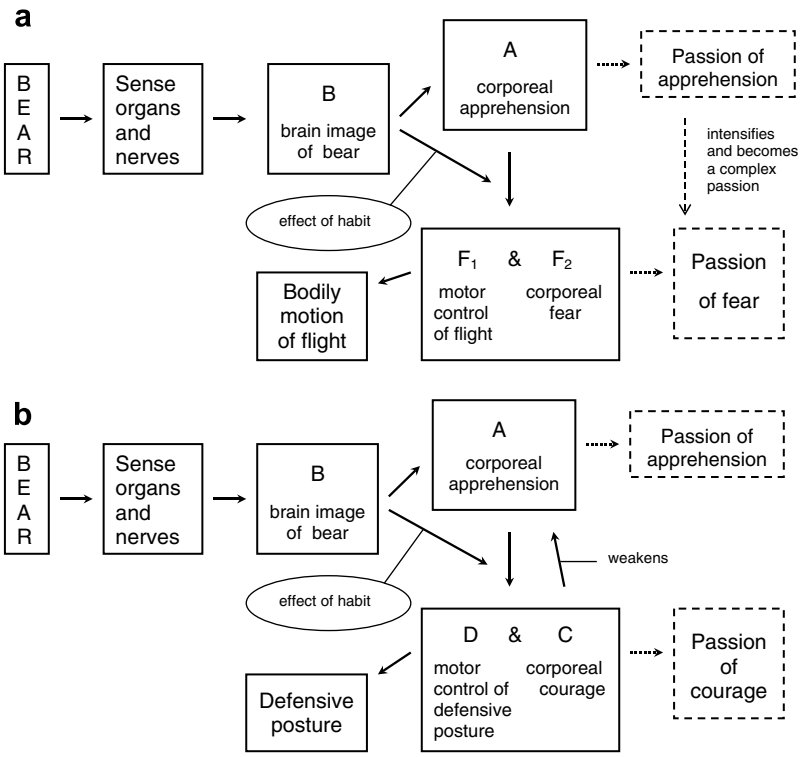

Fig. 4. Elaboration of the causal analyses found in Fig. 3. Part (a) shows how brain states B and A, as a result of past experience, yield brain states F_1 (causes bodily flight) and F_2 (causes the passion of fear). Part (b) shows how brain states B and A, as a result of different past experience, cause brain states D (causes a defensive posture) and C (causes the passion of courage). Brain state C feeds back upon and weakens A, abating the feeling of apprehension.

producing a bear-perception and the passions of apprehension, fear, and courage); the same external object can cause different passions in different individuals because of differences in the physiological associations between B and A (taken together) and each of F_2 and C.

Some further passages from the *Passions*, however, have seemed to suggest that Descartes intended to violate the principle of fixed psychophysiological regularity, at least for brain states and passions. At several places, Descartes observes that both the linkage between passions and objects and the control of passions depend on the fact that the same brain state can, over time, come to be associated with different mental states. In Article 50, he expounds the general principle that 'although each movement of the gland seems to have been joined by nature to each of our thoughts from the beginning of life, one can nevertheless join them to others by habituation' (11:368).[40] He here reaffirms the principle

[40] The antecedent for the pronoun 'them' in this quotation is not entirely clear. Voss (in Descartes 1989, 11:361 n. 43, and 11:368 n. 52) and Shapiro (2003b, p. 41) apparently read it as referring to the singular 'each movement', perhaps understood collectively as 'each of various movements'. But it better refers to the plural 'thoughts'. In either case, the question remains of how new connections are instituted between movements of the gland and thoughts: directly, or mediately. Although it is not inconsistent to hold that some connections are forged in each way, I reject any variation in direct connections because it would violate the principle of psychophysiological regularity.

of mind–body union and interaction according to which an 'institution of nature' joins brain states with mental states. But he also indicates that connections can be forged between brain states and new thoughts (see also 11:361, a. 44). By way of example, he describes how spoken words are naturally instituted to make us hear sounds, but in time they come to make us understand meanings. Thus, a physical entity and its brain effects (a spoken word, considered as affecting the sense organs and brain) at first naturally causes merely an experience of a sound (in an infant or someone learning a new language), but later causes one to grasp a meaning without attending to or noticing the sound.

A central question of interpretation concerns how this happens. In all cases of 'habituation' between brain states and mental sates, we may distinguish three possibilities: (1) that brain state A at first is linked to mental state B and then becomes *directly* linked to mental state C instead, so that the relevant relation of mind–body interaction is altered; or (2) that the new linkage arises *indirectly*, through either (a) the bodily mechanism described above for fear, involving altered connections only among brain states (with each state retaining a fixed psychophysiological effect), or (b) mental 'habituation', in which the mental experience of the sound of the words becomes associated with their meaning, so that we no longer notice the sound but are led immediately by habit from the sound to the meaning. In both cases under option (2), the institution of nature is not altered and a new mind–brain relation is not directly created; rather, the new connection is indirectly mediated by a new association between either (a) two brain states or (b) two mental states.

Although one might hold that options (1) and (2) both obtain (in different cases), I resist option (1), and any such hybrid solution, because it violates the principle of psychophysiological regularity. Fortunately, a close analysis of Descartes's examples of habituation shows that all of them either directly imply, or are consistent with, option (2). In Article 50, Descartes says that words 'excite movements in the gland which according to an institution of nature represent only their sound to the soul when they are uttered vocally, or the shape of the letters when they are written, but which nevertheless, by the disposition acquired in thinking of what they mean upon having heard their sound or seen their letters, usually make one apprehend this meaning rather than the shape of their letters or the sound of their syllables' (11:369). Now, if 'hearing' their sound or 'seeing' their shape involves a mental act, then this passage indicates that these sounds and sights are first produced by the institution of nature, and then these sensations are associated with the mental apprehension of the word's meaning, as under option (2b).[41]

Article 50 describes habituation of the passions through brain mechanisms. Descartes explains that 'although the movements—both of the gland and of the spirits and brain—which represent certain objects to the soul are naturally joined with those movements which excite certain passions in it, they can nevertheless by habituation be separated

[41] The antecendent of 'which' in 'but which nevertheless' is 'words' and not 'movements of the gland' (11:369); hence, the quoted passage provides no direct support for the positions of Rodis-Lewis (1989), Voss (in Descartes 1989), and Shapiro (2003a, 2003b). Similarly, when Descartes describes associating physical words with meanings in his letter to Chanut (1 February 1647, 4:604), it remains open that the link between a physical word and its sight or sound remains fixed, with a mental association between sight or sound and meaning mediating the new connection between physical word and meaning.

from them and joined with quite different ones' (11:369).[42] Here it is a matter of changing the associations between certain 'movements' and other 'movements' in the brain. Descartes gives the example of someone eating a certain food 'with relish' and then coming upon something foul in it; this encounter 'can so change the disposition of the brain that he will no longer be able to see any such food afterwards without abhorrence, whereas previously he used to eat it with pleasure' (11:369). The change is mediated by the brain alone; it occurs by altering the relation between the brain image of the food and the brain states that cause the passions of desire or abhorrence. Descartes's continuing discussion of the same kind of reassociation in nonhuman animals confirms this claim. He recounts how dogs, before being trained, run toward live partridges and away from gun fire, but that, after training changes 'the movements of the brain' (11:370), they will halt at the image of a partridge and run to retrieve the bird after the gun sounds. As he explains, this is the 'same thing' that happens in humans; it occurs in beasts not by arousing passions proper (for they have none) but by altering the nerve and muscle movements that would accompany the passions in us. A similar analysis is suggested by the wording in Article 136, which explains how someone may acquire an aversion to objects such as roses or cats through a 'shock' early in life: 'the idea of the Aversion he had then for the roses or the cat may remain imprinted in his brain to the end of this life' (11:429). This is again a brain–brain connection, between the brain image of an object and a material 'idea' of aversion (which in the presence of roses or cats is activated and causes the mental feeling of aversion). The mechanism he describes will work perfectly well even if certain brain states are fixed to cause desire or abhorrence, for the brain images of roses or cats can change their associative connections with the fixed passion-causing brain states so as at first to be associated with corporeal desire and then with corporeal aversion.

In Article 211, Descartes recommends a second way of controlling the passions, this time by establishing associative connections directly between one mental state and another (independent of brain associations). He suggests that, if we haven't been able to retrain ourselves by reassociating brain states, we should form a mental habit so that, when we feel a passion, we withhold judgment for the time being, or we use a mental action to counter the passion-induced inclination of the will, such as thinking about the consequences that may arise if we act from anger (11:486–488). Here, mental habits may lead us to automatically discount the effects that the passions have on our will, or to automatically restrain our violent inclination when angered. These mental habits affect the relations between objects and passions, but they do so by means of habits that connect passions (mental states) with voluntary suspension of judgment or restraint of bodily action (other mental states).

These reassociations of brain states with passions and these avoidances of actions initiated by corporeal passions occur by forging new connections among brain states or new

[42] In this passage, 'they', 'them', and 'ones' unambiguously refer to the 'movements' of the gland, spirits, and brain. Nonetheless, Shapiro (2003b, p. 45) contends that Descartes is here 'better read as suggesting that we can also come to feel different passions in being confronted with things by in some way changing the way in which we are directly affected by things' so that the things 'make us feel different passions immediately and not through any cognitive technique'. We should separate the question of immediacy from that of cognitive technique. On my reading, when we form habits, whether bodily or mental, we *mediately* change the way that things affect us. The process of forming a habit may or may not be cognitively guided, but once the habit is formed the result *seems* immediate. On effects of cognitive habit that seem immediate, see *Meditations*, Six Replies (7:438) and the discussion in Hatfield & Epstein (1979), pp. 376–377.

mental associations, and not by directly forging new mind–brain relations.[43] In the majority of Descartes's examples, new associations are forged among brain states. The elaborate machine psychology of the *Treatise*, as reconstructed in Section 4, permits us to understand how Descartes could assign such a large role to brain processes alone in forging new habits. I conclude that there is no reason to construe Descartes's discussion of habituation as requiring a *direct* realignment of brain states with mental states. We can retain the principle of psychophysiological regularity for the passions while allowing for an *indirect* realignment of brain states with mental states. Such realignments can occur either by realigning the connections between brain states or by our creating habitual connections between mental states. In either case, the importance of *habit* in Descartes's psychology (machine or mental) remains unabated.

6. Psychology and the mind–body divide

Descartes articulated an elaborate machine psychology that he believed could account for much of the behavior of ensouled human beings and all of the behavior of nonhuman animals. A Cartesian 'machine psychology'—a functionally conceived psychology that material mechanisms make real—requires scholars to revise standard accounts of the place

[43] In Article 107, Descartes says 'that there is such a connection between our soul and our body that when we have once joined some bodily action with some thought, one of the two is never present to us afterwards without the other also being present—as we see in those who, with great aversion, have taken some potion while sick... For it seems to me that the soul's first passions, when it was originally joined to our body, must have been due to the blood, or other juice entering the heart, sometimes being a more suitable nourishment than the usual for maintaining the heat in it which is the principle of life' (11:407); later, when we feel love, we have similar reactions in the heart, liver, and lungs to those caused by the nourishment that makes us feel love in the first instance. Shapiro (2003a, pp. 234–235) reads Article 107 in an intriguing manner that enlarges upon the position I am opposing (that habitude reforges the brain–mind relation). She suggests that the original 'institution of nature', at least for passions, arises through a cognitive act by which the mind decides that a certain brain condition has arisen from a good bodily condition: an initial feeling of love arises from the mind's judgement that the spirits reaching it arose from nutritive blood. As interesting as this reading is, I read Article 107 so that the nutritive blood causes *motions in the spirits* that cause the passion of love by the institution of nature, with the brain state that causes this passion becoming associated with other brain states affecting the heart (11:407–408). I draw on Articles 36, 38, 39, 50, 136, and 211 in reading this passage as describing associations between a brain state that causes love and brain states that affect the other organs. Similarly, in Article 44, I read the habituation between the motion of the tongue and the meanings of words as mediated by a mental 'habit' (11:362*). The issues concern how to understand mind–body interaction and union in Descartes more generally, including whether the mind (1) 'perceives' and 'interprets' bodily states, or (2) the body causes sensations, passions, ideas in the mind as bare effects. I support (Hatfield 2000, 2005) option (2). Moreover, option (1) would not require that the interpretive relation be malleable; the institution of nature might fix certain brain states as unvarying 'signs' for certain mental states. Shapiro (2003a, p. 231) cites La Forge (1997 [1664], pp. 127, 129) a Cartesian follower who sees Descartes as allowing realignment of brain–mind relations. However, other Cartesians see fixed psychophysiological relations. Antoine Le Grand affirms psychophyiological constancy (Le Grand 2003 [1694], Vol. 1, p. 326): brain motions produce in the soul 'a certain *Sensation*, which will always accompany this motion, and the *Soul* not be able to separate it', and similarly for passions; his reading (ibid., Vol. 1, pp. 342–343) of Articles 44 and 107 ends by explaining learned connections though changes in the brain, not mind–brain realignment (ibid., Vol. 1, p. 343). Pierre Regis made soul–body relations depend on God's decision to establish 'laws' of their union (Regis 1970 [1691], Vol. 1, p. 124, Vol. 3, pp. 92, 339–340), and he explained 'acquired' passions through associations among brain states (ibid., Vol. 3, pp. 376–378). The issue is complicated if one interprets Descartes as holding an 'individual occasionalism' about mind–body interaction (Hatfield 2005); but that position is consistent with fixed psychophysiological relations as envisioned in option (2).

of psychology in the Cartesian mind–body divide. Philosophers and other scholars have typically assumed that *psychological* functions such as sense, imagination, memory, and the adaptive guidance of behavior are exclusively *mental* operations for a Cartesian such as Descartes.[44] But Descartes and many of his followers[45] maintained that animal bodies, operating independently of the mind, can carry out such functions so as to yield both human and nonhuman animal behavior. Conscious sensation, volition, reasoning, and other thoughts and thought processes are of course reserved for an immaterial mind. Nonetheless, in a Cartesian context, an implied concept of 'the psychological' is *not* coextensive with that mind's 'properly mental' states. Some psychological processes of memory, imagination, and sense perception require a mind, both as the seat of consciousness and as a vehicle for mental habit-formation, judgment, and other mental operations. But the psychological operations of material memory, physiological responses to sensory images, and the control of behavior do not require a mind.

This result raises new questions about the role of Descartes's theory of mind in the history and philosophy of psychology. In the history of psychology, the influence of Descartes's dualism on subsequent psychological thinking now receives the greatest attention. Further work is needed that examines the influence of his machine psychology on physiologically oriented psychology. An older body of scholarship followed this influence up to La Mettrie[46] and Diderot in the eighteenth century (Rosenfield 1940; Vartanian 1953), and took some notice of T. H. Huxley's (1884) appreciation of Descartes's 'animal automata' in the nineteenth. The extent to which Descartes's machine psychology inspired nineteenth-century mechanistic psychological thought, as in William Carpenter's 'unconscious cerebration', Henry Maudsley's conscious and unconscious material processes of the mind, or Herbert Spencer's 'objective psychology', remains uncertain.[47] I. P. Pavlov (1927, p., 4), whose work on conditioning influenced early twentieth-century behaviorism, stressed the historical importance of Descartes's animal-machine hypothesis, as did Fearing (1970 [1930]), in his study of the concept of reflex action.

[44] This quotation from Damasio exhibits a standard sort of misconception: 'The control of animal inclination by thought, reason, and the will was what made us human, according to Descartes's *Passions of the soul*. I agree with his formulation, except that where he specified a control achieved by a nonphysical agent I envision a biological operation structured within the human organism and not one bit less complex, admirable, or sublime' (Damasio, 1995, p. 124). In the *Passions* and other works, Descartes aimed precisely to show that there are physiological operations 'structured within the organism' (considered as a wholly material machine) that are *nearly* as 'complex, admirable, or sublime' as the achievements of the immaterial mind and that serve to structure our inclinations (and, through habits, can control them).

[45] Rosenfield (1940), Ch. 2, and Appendixes B and C, shows that the denial of sentience to beasts and the mechanistic account of their behavior was widely accepted among Descartes's followers. Malebranche (1997, [1674-1675], p., 324) and Le Grand (2003, [1694], 2:228–232) are examples.

[46] La Mettrie—without using the term 'psychology' to describe material processes—paved the way for such a conception by speaking of a *materialistic* theory of the human 'soul' (La Mettrie 1912 [1748], p. 85); unlike Descartes, he attributed sentience to the human machine (while denying an immaterial soul). Hobbes (1991 [1651]) offered purely material accounts of functions such as sense, motion, imagination, and memory.

[47] Carpenter (1874), Ch. 13, wanted to reduce some psychological processes to brain processes, while retaining a role for an immaterial mind. Maudsley wanted to reduce all mental processes to brain processes and to unify psychology with physiology (Maudsley, 1876, p. 63); he acknowledged the interest of Descartes's animal automatism (ibid., p. 48). On Spencer's objective psychology, see Spencer (1870–1872), Pt. 1, Ch. 7. On the place of Carpenter, Maudsley, and Spencer in nineteenth-century psychology, see Hatfield (2003b).

Within Cartesian studies, the conceptual resources of Descartes's machine psychology should be examined in their wider context. Descartes analyzed and described the corporeal passions and the passions proper using functional notions.[48] He contended that both corporeal passions and the passions proper should be investigated by starting from 'the different ways in which [external objects] can harm or profit us or, generally, be important to us' (11:372, a. 52). Indeed, the use or function of the passions and the attendant physiological processes is this: the passions proper 'dispose the soul to will the things that nature tells us are useful and to persist in this volition, just as the same agitation of the spirits that causes them disposes the body to the movements conducive to the execution of those things' (11:372, a. 52). Descartes's thinking is clearly teleological. As is well known, he excluded consideration of God's overall purposes from the investigation of nature (7:55, 8A:15–16, 80–81), which has sometimes been construed as a general ban on considering any functional ends in natural philosophy. But in fact Descartes explicitly invokes the ends of nature, or of God, in analyzing both animal bodies and the mind–body relation in human beings (7:82–89, 374–375; 11:121, 224–225). The structure of such teleological thinking, and its place in Cartesian metaphysics, warrants further investigation.[49]

I have described Descartes's machine psychology as functional, but I have not made use of notions such as 'representation' or 'signification' in describing his view of the relation between brain images and external objects. In the *Treatise*, Descartes speaks of the 'correspondence' between brain states and properties of external objects, such as their distance from the observer (11:183). Perhaps, then, we might choose to elaborate his machine psychology in the language of a biofunctional behaviorism, excluding mentalistic notions of 'representation'. But Descartes speaks in the *Passions* of brain images as 'representing' external objects (11:356, a. 35). Presumably he did not believe, as did the scholastic Aristotelians, that intentional representational relations exist in nature independently of the mind.[50] But did he think that brain images (considered as material patterns) naturally represent objects and their properties through some non-intentional relation, such as resemblance?[51] Perhaps he thought that some causally correlated events are natural instances of

[48] Radner (2003) examines the passions proper in a functional context, and Sutton (1998) examines the functions of the Cartesian brain. 'Functional' here has the connotation of 'biofunctional' or 'psychofunctional'; it is more closely allied to the 'functionalism' of American psychology (ca. 1900) and of functional analysis in philosophy of biology than to input–output functionalism in the philosophy of mind. See Shapiro (1994) on this distinction. On American functionalism, see Hatfield (2003a, 2003b).

[49] On the tension between Descartes's physiological teleology and Cartesian metaphysics, see Laporte (1950), pp. 343–361; Guèroult (1984–1985), Ch. 17; Rodis-Lewis (1978); and Hatfield (1992). One proposed resolution restricts such teleology to the mind–body relation (for example, Rodis-Lewis, 1978). Although Descartes of course allowed that minds have ends, I read the teleology of the passions as directed toward the preservation of the body, which, in ensouled beings, has the secondary effect of preserving the mind–body composite. For an attempted resolution regarding physiological teleology, see Hatfield (Forthcoming a). For a suggestion of how to avoid such teleology, see Rorty (1986), pp. 532–533 n. 11.

[50] On scholastic theories of intentional species, see Hatfield (1998), pp. 956–958.

[51] It is well-known that Descartes denied that sensations of secondary qualities such as color 'resemble' their causes in objects (7:82–83). He also denied that images or pictures must *fully* resemble their objects to represent them: in order to represent an object, an image need not 'resemble the object it represents in all respects'; rather, 'it is enough that the image resembles its object in a few respects' (6:113). This resemblance pertains to spatial properties, especially shape; it may be 'imperfect', as when, 'in accordance with the rules of perspective [engravings] often represent circles by ovals better than by other circles' (6:113), but it is resemblance nonetheless. Perhaps, in Descartes's view, bear-images naturally represent bears by possessing bear-shapes.

'reference'? Or shall we understand these mentions of representational relations as depending ultimately on the way in which the mind responds to brain images, so that intentionality and representation always derive from mind? And what of Descartes's use of the term 'ideas' to describe brain images or other brain states (6:55, 11:176–177, 202)? Does this mean that he attributes mind-independent representational capacity to such states, or does he honor such brain states with the term 'ideas' only for the reason he gives in the Second Replies, where the images 'in the corporeal imagination' fall under the term '"ideas" only insofar as they give form to the mind itself, when it is directed towards that part of the brain' (7:160–161)? On this latter reading, we would still have to explain why Descartes extends the term 'idea' in the *Passions* to brain states that, at the least, are not currently being contemplated by the mind (11:429, a. 136). Arguments can be made on both sides: for maintaining that in Descartes representational relations always derive from the mind and bodily states are at best in causal correspondence with external objects; or for maintaining that Descartes needed and used a notion of natural material representation.

A final set of questions concerns the success, or lack thereof, of recent attempts to eliminate the unreduced mentalism that forms a part of Descartes's intellectual heritage. Descartes included learning, memory, and adaptive behavior within his machine psychology. Suppose for the moment that this machine psychology is best articulated in a nonmentalistic behavioristic idiom. Descartes also believed that general intelligence, intelligent speech, and conscious experience require an immaterial mind. In recent decades, contemporary philosophers of mind have sought to extend a materialistic ontology as far as possible into these areas of Cartesian mentalism. Some consensus exists that intelligence and the production of language are on the way to reduction, whereas sensory consciousness (Feigl's 'central puzzle') has resisted.[52] Perhaps some perspective might be brought to this discussion by asking whether Descartes could legitimately import a notion of intentional representation into his ontology of bare matter. I think the answer is negative.

Modern attempts to bring the notion of representation into the natural world follow one of two strategies, sometimes using both. One strategy regards representation as a biological function (Papineau, 1987, Ch. 4; Hatfield 1988, 2004; Sterelny, 1990, Ch. 6). Representation here is a biological and psychological concept that might well remain unreduced. The other strategy supposes that naturally pre-existing physical information undergirds the intentionality found in biologically evolved representations (Dretske, 1995, Chs. 1–2). This strategy ascribes natural intentionality to regularities in nature in such a way that, when the sun warms a stone, the stone's temperature bears mind-independent information *about* the presence of the sun. The strategy promises to reduce the intentional to the physical by importing (or smuggling?) intentionality into the notion of physicalistically conceived matter through the (allegedly) physical concept of information. For Descartes, the corresponding strategy would be to acknowledge the natural intentionality that scholastic Aristotelians ascribed to sensible species, which was anathema to him (6:85).

Because these matters are not settled, the general mind–body problem as Descartes bequeathed it to us remains open, apart from his proposed solution of substance dualism. We should recognize that he has also bequeathed other resources for thinking about the

[52] Feigl (1958), p. 416. See also Sherrington's (1951, p. 109) 'greatest problem'. On the consensus, see Rey (1997), pp. 255, 288.

problem in the form of his machine psychology. At the very least, this psychology raises the question of how much psychological explanation we might obtain from a biofunctional perspective, without requiring the mentalistic capacities that Descartes reserved to an immaterial mind. At the most, Descartes incites us to try to extend physiological, functional psychology to account for all psychological processes, including those that remain under mentalistic description. Thus does the Cartesian heritage invite us to consider how far we might extend our descriptions of brain functioning to account for psychological and mental functions, without reducing those functions away and without assuming any version of Cartesian dualism. The answer is not clear. A major part of Descartes's achievement is that his work trenchantly raises these various aspects of the problem itself.

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