Spirits and Clocks

Machine and Organism in Descartes

Dennis Des Chene

2001

Cornell University Press
Ithaca and London
Unity of the Body

For common sense and the schools, an animal is a unity, a paradigmatic individual substance. It would seem that the Cartesian is bound to disagree. The machine has no special status among the configurations of matter. It is an enormous collection of parts of matter, joined locally by relations of contiguity, common motion, or momentary contact. But the arrangements we call animals and plants are no more natural than other arrangements or none at all. Descartes insists time and again that nature’s laws are indifferent to the distinction between a living, intact animal and a mutilated, diseased, or dead animal.

Yet he, like everyone else, treats animals and plants and their organs as phenomenal unities. Does he stick to the letter of his doctrine, and treat those unities entirely on a par with clocks? Can he do so consistently while putting forward his version of the science of living things? The answers, we will see, are not straightforward. In what follows I first outline what might be called Descartes’ official view on reasoning from ends. I then develop four conceptions of unity applicable to collections of simple bodies (their individuation, troublesome though it is, I here take as given). Physical unity is the unity that parts of matter have when they share a common motion; dispositional the unity of something whose parts are said to be “disposed” or arranged in such a way that the whole has some designated effect; functional or intentional the unity of a thing which has the purpose of producing a designated operation (in Descartes’ way of thinking, ‘functional’ and ‘intentional’ coincide, as we will see); substantial the unity which a collection of parts of matter enjoys by virtue of being joined with a single substantial form. In Descartes’ world only the human body, when joined with the soul, has substantial unity. For that reason substantial unity lies largely outside the scope of this work, and my treatment will be brief.

6.1 Against Ends

In the vocabulary of Aristotelianism, funcio is allied with terms like officina and manus, which in their most direct usage denote roles or duties. On the face of it, Descartes has no use for such notions in his natural philosophy. The stark rejection of any appeal to ends is exemplified in a paragraph from the Principles:

we do not avail ourselves of any reasonings [rationes] concerning natural things [taken] from the end which God or nature in making them proposed to itself [added in French: and we reject entirely from our philosophy the search for final causes]. We are not so arrogant as to think ourselves party to his deliberations. Rather, considering God as the efficient cause of all things, we will see what, from certain of his attributes which he has wanted us to have some knowledge of, the natural light which he has imparted to us discloses that we ought to conclude concerning certain of his effects that appear to our senses.

Descartes’ constant refrain is that, while reasonings about particular divine ends may have a role in ethics or apologetics, they are “inert” in physics. We would, moreover, be overstepping our limits if we inquired after them, the implication being that to inquire into divine purposes puts one only a step away from questioning them.\(^1\)

---

1 'Office' occurs in a letter to Élisabeth: “l’office du foye & de la rate est de contenir tous- siours du sang de l’orcure” (“the office of the liver and spleen is always to contain blood in reserve”) (To Élisabeth, May 1646, AT 4:407).
2 PP 1528, AT 8:1:15–16; 9:2:37. I have consulted CSMK for help in translating the second sentence. The French transfers the phrase ‘from certain of his attributes,’ etc. to another sentence about the guarantee given to clear and distinct ideas which is absent from the Latin. A letter to Élisabeth makes the point very clearly: if we “attribute to them other imperfections they don’t have, in order to raise ourselves above them,” we engage “an impertinent presumption,” and “take charge of the world with [God],” which “causes an infinite of useless inquietudes and vexations” (To Élisabeth, 15 Sep 1643, 4:292).
3 To ..., Aug 1643, AT 3:421, and the letter to Élisabeth just cited. It is worth noting that Descartes always refuses to admit in science theological grounds for asserting human pre- eminence or dominance over nature (see, for example, his interpretation of the days of creation: To Chanut 6 Jun 1643, 5:53–55). Revelation aside, whatever mastery we assert, we assert for ourselves, without the sanction or command of God. In particular, no policy regarding the treatment of animals can be inferred from the fact that they are machines, though we will indeed have no duties toward them as we do toward humans, if those rest on having souls.
Machines, Mechanisms, Bodies, Organs

His practice, by and large, conforms to his precept. The physiological texts are striking from that standpoint. In other texts of the period, owing to the precedent not only of Aristotle but of Galen's masterwork De usu partium, ends and final causes are ubiquitous. Even Gassendi, no friend of Aristotle, argues at length in rhetoric reminiscent of Galen's that the parts of animals testify to the capacity and industry of the creator. In a paragraph whose targets might well include his illustrious contemporary, Gassendi writes:

To us it suffices that no one can, with open eyes and attentive mind, fail to acknowledge immediately that any person must be bereft of reason who believes that the parts of Animals were elaborated without reason, deliberation, foresight, and appointment to certain uses and ends. (Gassendi Syntagma 251 memalibec, Opera 2:231b)

Adding all the usual instances on behalf of the role of divine foresight in the constitution of plants and animals, he concludes that just as the Divine Performer of works [Divinus tamen Opifex] did not require pre-existing matter to operate, so too in directing things he required no external exemplar; for by his immense insight he understands no less those things which are not than those which are, and from the fecundity of his own intellect, both conceived the work that was to be, and foresaw its aim. (Gassendi Syntagma 251 memalibec, Opera 2:235b)

It is not surprising that the strictures in the fourth Meditation against appeals to ends in natural philosophy should have caught his eye. Descartes argues that since God is immense, incomprehensible, infinite, "that whole genus of cause, which customarily argues from ends, I judge to have no use in Physical matters," adding the usual warning about tenuity (Med. 4, AT 7:55).

Those strictures no doubt apply, Gassendi agrees, to ends "which God himself had to be hidden, or of which he has prohibited the investigation." But not to those "which he has set, as it were, in an open space and which without great labor become known" (4 Obj., AT 7:309; Gassendi Opera 3:359a). To which Descartes replies, with all the air of one who has arrogated the title of "philosopher" to himself (4 Resp., 348-349, 352), "One cannot pretend that some of God's ends, rather than others, are out in the open; all are hidden in the same manner in the inscrutable abyss of his wisdom" (375).

All of God's ends hidden in the abyss? Had Gassendi not studiously followed the order of topics in the Meditations, he might have mentioned the passage in the sixth Meditation in which Descartes affirms that the relations instituted by God between the motions in the brain and the sensations they give rise to are, "of all that could be inferred, those which are most, and most often, conducive to the conservation of human health" (Med. 6, AT 7:87). What is human health in this passage but a divine end? How indeed might one appeal to God's goodness if not by considering his ends?

It is difficult to see how Descartes could avoid appealing to ends in the vindication of the senses in the sixth Meditation.

First, with respect to the understanding. Divine veracity is inferred both from God's goodness and from his power. God is not malicious, and so he would not deliberately make us believe that the cause of our sensations is extended substance if it were not. God's intellect and will, moreover, are not so weak (imbecillia) that he would give us the power of being able to form judgments capable of truth and then neglect to ensure that the conditions under which the power may successfully be exercised actually obtain.

Second, with respect to the senses themselves. If they are to have any use in the search for truth, the sensations that result from them must be such that a true theory, not merely of the most general features of the natural world (namely, that it consists of res extensa), but of particulars (like the size of the sun) should be attainable by their use. It might well be consistent with their

[118]
role in the conservation of health that the senses should fail to represent bodies as they really are, it is not consistent with the possibility of knowing particulars that they should yield no information at all about the external world. Even where he is discussing the body alone, Descartes often gives the appearance of appealing to purposes. L'Homme is bracketed between two occurrences of the word function:

I suppose that the Body is nothing other than a statue or machine of earth, which God forms expressly to make it as similar to us as possible [. . .] and finally that it imitates all the functions that can be imagined to proceed from matter, and to depend only on the disposition of the organs. (L'Homme, AT 11:120)

I wish you to consider [. . .] that all the functions I have attributed to this Machine, like the digestion of food, the heat of the heart and the arteries, the nourishment and increase of its members, breathing, waking and sleeping, [a long list follows] [. . .] I wish that you should consider that these functions all follow naturally, in this Machine, solely from the disposition of its organs. (L'Homme, AT 11:202)

One might suppose that in these passages 'function' is a mere façon de parler, and that 'movement' would do as well. But Descartes on many occasions uses what grammarians would call 'clauses of purpose.'

sound, pain, and so forth, although they are very doubtful and uncertain, from this fact alone, that God is not deceptive, and so it cannot be that any faith should be found in my opinions, unless there is some faculty bestowed on me by God to correct it. I gather some hope of grasping the truth in them also" (AT 7:80). The argument rests on no other basis than that the "complexion" of my cognitive faculties has been intended by God to be capable of truth—or at least of avoiding error. But it seems clear that in the instances here mentioned the "correction" (correction) of error does not consist merely in the suspension of judgment. There is a very careful version of the argument in a late letter to Cleresier: A being in which there is no imperfection cannot tend toward non-being (et non esse), or "have non-being for its end and institution", but falsehood is non-being (et non esse), and so a being without imperfection cannot tend toward falsehood (To Cleresier 2 Apr 1649, AT 5:357). Any situation in which a creature of God is, by its own nature or the nature of things, bound to fail, is a situation in which God himself, in the act of creation, must have had non-truth for his end; but since God is perfect, that cannot be.

11 Cf. Discours, AT 6:456.12 A parallel passage in the Description does have 'movement' rather than 'function': "tous les mouvements que nous n'expérimontons point dépend e de notre pensée, ne doivent pas être attribuez à l'ame, mais à la seule disposition des organes" (AT 11:225).

And the fire in the heart of the machine [. . .] does not serve for anything else but to dilate, heat, and sublimate the blood. (L'Homme, AT 11:123)

you can easily also understand how this machine may sneeze, yawn, cough, and make all the other movements necessary to reject various other excrements. (141)

But the little threads that compose the marrow of the nerves of the tongue, and which serve as the organ of taste in this machine, can be moved by actions lighter than those nerves that serve only for touch in general. (143)

The spleen is "destined to purge the blood" of certain particles, the kidney "destined" to purge it of others (169); if the hand is heated too much by fire, some of the animal spirits are conducted to the nerves "that serve to move the exterior members, in the fashion required to avoid the force" of the fire's action (193). The passions "serve to dispose the heart and liver" and so forth "in such a way that the spirits that are generated then turn out to be proper for causing the movements that ought to ensue" (i.e., movements to avoid harm or pursue benefit) (193). In the Description, Descartes writes of the "principal use [usage] of the lung" (AT 11:236). All the branches of the great artery are joined to branches of the vena cava "in such a way that after having distributed to all the parts of the body the blood they ought to receive, either for the nourishment, or for other uses," they bring the rest to the vena cava and the heart (238). The dilatation of the blood in the heart changes the nature of the blood "as much as one might imagine it ought to be changed, in order that the blood should be prepared, and rendered more proper to serve as nourishment for all the members, and to be employed in all the other uses it serves in the body" (244). This in a passage where he is arguing against people who attribute "facultés" to the heart in order to account for changes in the quality of the blood. Although such constructions occur far less frequently than in Aristotelian works (especially in the description of the formation of the fetus, where they are sparse indeed), and although some (like 'so disposed that') are ambiguous, there are sufficiently many that one cannot regard them as mere slips or as concessions to the vulgar way of speaking.

If we follow the official view, it would seem that only two principles of unity will be available: physical and dispositional. Functional and intentional principles have no role. They require a knowledge of divine intentions that in
natural philosophy we cannot attain to. But it remains to be seen whether the official view is a sufficient characterization of Descartes' stance.

6.2 Physical Unity

A principle, according to Aristotle, is "the first thing, from which something is, or comes to be, or is known" (Meta. 5c1, 1012b33–35). Suárez reduces the list to two, the first of which, the principium ejus quod fit, the principle of that which comes to be, includes "every principle of change or operation, as such, or even of any successive thing." More pertinent here is the principium ejus quod est, the principle of that which is (or exists), which includes, for example, the material and formal causes of a complete substance: these do not bring about change, each is in its own manner that by which a thing is (or is such-and-such, in the case of form). 'Principle' is broader than 'cause,' because entities of reason and privations have principles but not causes. A principle of unity, then, is the primary ground of a thing's being one. A living body, evidently, has parts—its organs, the blood—which, even if they are not distinct substances, can subsist in some way (though perhaps not as organs or blood) apart from the rest. The principle of its unity is the ground upon which the body is nevertheless rightly said to be one thing.

The most basic principle of unity in Cartesian natural philosophy is mutual rest (PP 3§5, AT 8/1:71). What unites the left half of a second-element sphere with the right half is simply that they are not moving with respect to one another. According to Descartes' rather peculiar definition of movement,

that means that at this moment they are not rupturing, or not ceasing to share a common boundary, like ice sheets slipping off the face of a glacier. That principle has its difficulties, but they do not impinge greatly on physiology. The other principle of unity inherited by the physiology from the physics applies primarily to collections of individual bodies of the fundamental sort. In the definition of 'one body' (unum corpus sive una pars material), Descartes specifies that a body is "everything that is transferred at once, even if this is constituted from many particles that in themselves have other motions" (PP 3§25, AT 8/1:54). A ticking clock carried to the prow of a ship, or the earth with its oceans and its proper vortex, can be said to be one body because the whole collection moves at once with respect to the ship or to the sun and the fixed stars (3§31, 8/1:57; 3§29, 8/1:92).

Again this less strict notion is not without its difficulties (Groszholz 1991: 68–69). Set aside the difficulties that pertain to animate and inanimate alike. Where plants and animals are concerned, the definition draws some odd boundaries. The air in my lungs, the water I have just taken into my mouth, will be part of my body. Two lovers locked in tight embrace will, it seems, really be one flesh. It does seem to be true, on the other hand, that the body of an animal will be included in a single body: the problem is that too much else will be also.

But the chief objection to physical unity applied to organisms is that it has nothing to do with their nature as organisms, as living. It would be strange if the nature of an organism, and the conditions of its unity, were so divorced. Descartes recognizes that point where the human body is concerned.

Although the entire mind seems to be united to the entire body, nevertheless when a foot or arm or whatever other part of the body you please is cut off, I recognize nothing to have been thereby removed from the mind. (Med. 6, AT 7:80)

12 Suárez, Dis. 1251a04, 12. 25, Opera 25:377, 393. There is a brief discussion of principles in a letter of Descartes to Clerelier, but the principles in question are principles of knowledge, not of being or becoming (To Clerelier, Jun or Jul 1646, AT 1:144).

13 'Individuum' as its etymology indicates, denotes something whose parts are either incapable of separate existence as something of that kind, or which has no parts. But the problem of individuation is typically presented, perhaps in a certain mode of Neoplatonic doctrines of emanation, in the idea of "dividing" a species into its members, if Peter and Paula had no mode or accident but those they have by virtue of being human, they would be one. A "principle of individuation" is whatever it is that, added to the specific nature which is exactly the same in both, makes them two. If we consider a human being as its existence as a complex of variously distinguishable parts, then its principle of unity is whatever justifies saying of each part that it belongs to this whole (and of alien parts that they do not). Since parts, to be identified, must be individuated, individuation is prior to unity. On the other hand, a principle of unity does permit one to distinguish individuals by distinguishing the parts of one from those of another. For Suárez, individuation is equivalent to the "individual and singular unity" possessed by each member of a species (Dis. 5§1107, Opera 25:141). Form is in most cases an adequate principle of individuation for complex substances, being joined with form yields a principle of unity for the proximate matter of a substance. (On all these matters, see Grucci 1994a.)


15 The definition is too narrow to accommodate Christ's scattered body in the attempt at explaining the real presence that Descartes sought (with some misgivings) to Medeick 1643 or 1646 (AT 4:345–348). Since the explanation depends on the notion of substantial union, I will discuss it under that heading.

16 Allowing, for the nonce, a family to be an individual of a sort, the point is that it is one family, not one collection of bodies, and that its unity as a family ought to be derived from its nature as a family, not its nature as a collection (or mereological sum) of bodies. The contemporary notion of supervenience would seem to allow for violations of the maxim. If the mind supervenes on the brain or the body, then questions about the individuation of minds devolve onto questions about the individuation of brains, since there can be no difference in mental properties except if there be a difference in physical properties. Mental properties per se are irrelevant to determining the individuals in this world.
It is not less a mind after than before; which is to say, its unity does not depend on the integrity of the body, and that is because its essence as a thinking thing has nothing to do with body. But a dog, too, though its tail be bobbed, remains no less a dog than it was. Or again, if we imagine that part of the human body—by the resection of nerves, say—no longer is united with the soul, no more so than a prosthesis, then the thing which is physically one and the thing which is joined with the mind are no longer the same. So too a tree one of whose limbs has died is physically one thing with the limb, but as a living thing it is only what still bears leaves, to which some wood happens to be joined.

Everything in the Cartesian world of nonliving things is a "part of matter," a region of extension delineated by the occurrence of rupture at its boundaries. But among the parts of matter there is a great variety of shapes and sizes, which correspond to commonsense kinds like water, oil, glass, iron. Descartes has no uniform term for what distinguishes those kinds. Malebranche, noticing the absence, uses 'configuration.' The configuration of blood, for example, consists in its having numerous twisted branches, which is "proper" to blood. All and only particles of blood have that configuration. In each instant its unity as a particle of blood and its physical unity amount to the same thing: it will be one blood-particle just in case it is one body. But if we consider its unity from one instant to another, it can cease to be one body without thereby ceasing to be one blood-particle. Descartes supposes that as they circulate through the body, blood-particles tend to be pruned of their branches. Yet the same particles pass through the heart many times.

The strict criterion of physical unity, then, does not coincide even with criteria of unity for inanimate kinds like oil or blood (considered in its own right, as a viscous sticky fluid); still less is it sufficient for the unity of machines. Neither is the lax criterion. In analyzing the capacity of a pump, Caus isolates mechanisms—the system of gears and cylinders, as opposed to the gear train that transmits the motion of the boxes to that system. The parts of a mechanism, as it operates, move in many directions. That its parts should, in what we would now call a certain inertial frame, all have the same uniform motion is relevant to its unity as a mechanism, but only in the following respect: if the parts did not satisfy that condition, then in time, some parts whose contiguity is necessary to the functioning of the machine would cease to be contiguous, and the machine would no longer have the same disposition or fulfill its function. In short, physical unity matters only because it is necessary to disposition or function. Dispositional or functional unity is in that sense prior to physical unity. The Aristotelian accepts that conclusion wholeheartedly. Dispositional unity is exactly that unity which is conferred on the combination of matter and form by its form, from which its powers flow. The question, then, is whether Descartes is compelled to admit dispositional unity into his natural philosophy, and whether that is consistent with his principles.

6.3 Dispositional Unity

The term disposito, as I have mentioned, means 'an arrangement to some purpose or end.' How much weight is put on arrangement, and how much on purpose, varies with context. Arrangement, in the cases of interest here, denotes spatial arrangement. Spatial arrangements are disrupted if their parts do not maintain, in some broad sense, more topological than geometric, their mutual relations in space. To that extent the lax criterion of physical unity would seem to suffice. But the more weight put on purpose, the less relevant that criterion becomes.

Descartes' use of disposito is sometimes tantamount to 'whatever arrangement can operate in the specified way.' The process of digestion consists in part in the filtering of food particles through sieves of various sorts. Of them Descartes writes: "As for the size and figure of the pores [in the filter], it is evident that it suffices to bring it about that particles of blood which have a certain size and figure will enter into certain locations in the body rather than others [. . .] Thus the blood, pushed by the heart into the arteries, no doubt finds various pores, through which some of its particles can pass and not others" (Descrip. 3. AT 11:251). It hardly matters what the size and figure of the pores actually are, but that some such arrangement should be capable of the task of separation, so that faculties of selection and attraction are superfluous. Similarly, in the formation of the organs of sense, or the conditions of the animal spirits that give rise to the passions, the details are, in a way, gratuitous, so long as it is plausible some arrangement or other can produce the required operations. In this case we can say a little bit more—namely, that different effects must have different causes—but not much. The rest is invention.

Dispositions and functions alike share a more or less marked indifference to matter, to the particulars of realization. But in early modern philosophy disposition maintains its long-standing ties with arrangement and order. In this century those ties have been loosened. Instead it has taken over some of the territory of the older, disused terms 'faculty' and 'power'; its now dominant
use outside philosophy is to denote temperaments or habits of mood. The notion of arrangement, if present at all, is off in the wings.  

Descartes' laws of motion are stated in the indicative: the rules of collision as counterfactual conditionals. Each of the rules describes what we might think of as a simple arrangement of parts of matter, and then what motions would (or always do) result from it. Describing the motions of a clock is only a more complicated, not a different, task. To say that the motions of the body, or its functions, "follow from" its dispositions is to sum up an indefinitely large collection of propositions of the form "if the body were acted upon thus, such--and--such motions would occur."

Function, on the other hand, focuses rather on the operations. Descartes tends to use it in more programmatic contexts. He uses it, moreover, of the operations of both body and soul. Disposition too can be used of capacities of the soul. But Descartes seems not to use it that way, no doubt because the soul is not supposed to have parts that could be arranged. That difference in use survives despite the shift in use of 'disposition.' Sugar has the disposition, not the function, of solubility; there are functionalists, but (to my knowledge) no dispositionalists, philosophers of mind.

18 It is not altogether absent; see Quine 1960: 322.
19 PP 2546, AT 8/1: 68. The French preserves the counterfactual construction (AT 9/2: 89).
20 Some English translations do not. I should note that Beeckman's early statement of some rules of collision, written in collaboration with Descartes, uses the indicative (Beeckman Journal 23 Nov-26 Dec 1618: 1: 265--266). So perhaps no great weight should be put on grammatical mood. What matters is the character of the laws that the subjunctive imperfect conveys, namely, that they are "universal" conditionals, which hold in conditions that need not obtain. Some philosophers have sought to reduce dispositions in the sense of 'active or passive power' to counterfactuals: 'x is soluble' is supposed to mean, or be equivalent to, 'x would dissolve if x were immersed in the appropriate solvent.' The counterfactuals are in turn supposed to be backed up by general laws. In effect, the proposal defers the problem of distinguishing genuine dispositions from merely accidental properties (planets have no "disposition" to revolve around the Sun even if all known planets do) to that of distinguishing genuine laws from accidental generalizations. Descartes' treatment of relatively simple, but nonfundamental properties like flexibility and weight tends in the same direction; his laws, for their part, are genuine because derived from the immutability of the divine will, which in matter manifests itself as the preservation of the total quantity of motion.
21 The verb fungio means to perform, execute, serve as; in most occurrences, what is performed is a duty. Pufo officia was a circumstance for 'die.'
22 As in the titles of three articles in the Passions: "Breve explication des parties du corps, & de quelques uns de ses functions," "Quel est le principe de toutes ces fonctions," "Quelles sont les fonctions de l'oeil." (AT 54, 8, 1: AT 11: 331).
23 The soul is known to us only by the fact that it thinks, "that is, that it understands, wills, imagines, remembers, and feels, because all these functions are species of thought (toutes ces fonctions sont des especes de penser)." (Duseney, AT 11: 224).
24 Dispositio can denote the arrangement of vims, for example, that together make up some other virtue. Prudence is deliberation, judgment, and command suitably ordered (Suarez Disp. 4:350[1010], 12, 25, Opera 26: 613).

120

Machines, Mechanisms, Bodies, Organs

The question now is whether dispositions provide a principle of unity, independently of their purposes. With mechanisms there are two possibilities.

1. Linkage
The basic unit in a machine is a linkage between its parts. Reuleaux, after a careful survey of previous attempts to delineate the class of machines, defines a machine as "a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work accompanied by certain determine motion." (Reuleaux 1874--5/1876: 33). One resistant body can determine the motion of another only through contact.

In the machine [... ] the moving bodies are prevented, by bodies in contact with them, from making any other than the required motions. This contact also, if the problem is to be entirely solved, must take place continually. (41)

Hence the machine "cannot so well be said to consist of elements as of pairs of elements." (43). Each element of a pair (except the first or last pair) must be rigidly connected with another. A linkage or "kinematic chain" is a sequence of such pairs, subject to the further condition that "every alteration in the position of a link relatively to the one next to it be accompanied by an alteration in the position of every other link relatively to the first." (46). Only then will every link have a determinate relative motion relative to the others. Reuleaux calls such a chain a "constrained closed" or "closed" chain. The simplest closed chain has four parts, each consisting of a pin and collar—in Figure 14, ab or cd, for example. A link in the chain joins two pairs—bc or de. The possible paths of all the elements in the chain are determined when one link is fixed—by fastening the rod between a and h to a support or stand, say.

The machine, then, requires continuous contact between pairs of parts, and its configuration is such that the movement of one part determines all the rest. That determination is geometrical, not mechanical: the laws of motion have no role in calculating the path of any part. In that sense, the operations of a machine, like the curves traced by Descartes' proportional compasses, follow precisely from its disposition.

We have already two kinds of unity in a linkage. The first is the connectedness of its parts. Between any two points in a linkage, no matter what its

127
present state is, a continuous curve may be drawn. When it is stationary, it is in fact physically unified, if we neglect the possibility that the two elements of a pair may be separated by first- or second-order element particles. Even when it is moving, the two elements of a pair cannot separate entirely; their reciprocal movement is a kind of sliding. The second kind of unity is the mutual determination of their motions. In Figure 14, once one link is fixed, the motion of any other link determines that of all the rest.

It might seem that the hydraulic mechanisms that predominate in Descartes' physiology cannot be subsumed under Reuleaux's definition. But Descartes tends to think of unidirectional flows as if their kinematic properties were essentially those of rigid rods. In the Discours, the traditional analogy between seeing something and touching it with a baton is applied to the more or less fluid medium of light. The hydrodynamics of the pineal system are best understood if one treats the animal spirits issuing from the gland on the analogy of the constant outpouring of particles from the Sun. A "ray" from the gland is then not unlike a rigid rod wedged between the gland and the walls of its chamber in the brain, so that when a pore in one of the walls opens, there is a release of pressure on a particular point of the surface of the gland.

The gland is "held up, as if it were in a balance, by the force of the blood that the heat of the heart scolds toward it" (AT 11:179). One of Casus' jeux d'esprit offers a compelling analogy. The second problem of the second book of his work gives the "design of a grotto where there is a Ball which is raised by the force of water."

---

As in the motions of the "stirred" or "channeled" particles that cause magnetic phenomena (PP 357, 361 & 146, AT 8:1:142, 279, 287). See also Des Chene 1996:265.

27 Disc. 1, AT 6:86, 7, AT 6:135; cf. Le Monde 14, AT 11:100 and L'Homme, AT 11:100 & Fig. 15.

28 L'Homme, AT 11:176. The Passions are much vaguer (PP 517, 31, AT 11:341, 352). Some contemporaries hold that Descartes changed his view, and that the animal spirits are no longer supposed to issue forth from the gland, or that Descartes returned to a sanguistic notion on the matter (Rambach 195:132-152); his thorough treatment includes a survey of literature on the question.

29 As far as I know, the analogy has not been noted in the literature. Baltrusaitis notes the close resemblance between the fountain-figures described in L'Homme and certain of Casus' designs (Baltrusaitis 1984:53-66; see also Krukkert 1995:63).

---

[128]
in order to make the water raise the ball well if the water proceeds out of a tank, it is necessary that the bottom of the tank should be at least twelve feet higher than the surface of the earth, and at most twenty-four feet, and the pipe from which the water issues will be as thick as the little finger, narrowing a little at the tip, and the end through which the water issues will be at the bottom of a vessel in the form of a funnel to receive the ball more easily when it falls, and to remove the water that falls into the vessel, there will be holes at the very bottom of it. The rocks [i.e., the walls of the grotto] will be decorated with animals made of natural shells fitted and glued together, which will emit water through little pipes that they have in their mouths, so that those jets may sometimes strike against the ball to make it fall; immediately it will rise again by means of the water that pushes it upward, and thus hopping back and forth it will be pleasant to watch. (Causes Forces mouvantes Liv. 2, Prob. 2)

One would have only to arrange somehow that water should issue from the ball, and enter the mouths of the animals on the walls of the grotto, to have the pinal system. In the plate illustrating Cau's machine, moreover, the jets ignore the force of gravity, and look for all the world like rigid rods. Only the splashing water at their ends betrays their fluidity.  

Hydraulic devices, in short, are much like devices whose parts are rigid, except that their "rods" are easily changed in size and direction, or added and removed (by opening and closing valves), and are able to transmit motion along curved channels. It is reasonable, though at some cost to the precision of Reuleaux's definitions, to transfer the terminology of linkages and mechanisms to them also. The continuity of the jet replaces that of the rod, and the basic pairs are replaced by jets and chambers, in which the pressure of a jet against the chamber causes it to move or change shape. It is, in fact, the changes of shape caused by the motions of the animal spirits that give the machine the capacity to acquire new dispositions, and thus new patterns of behavior—a capacity more difficult to realize in rigid mechanisms. There is, nevertheless, nothing aleatory or chaotic about hydraulic devices: their operations too follow from their dispositions.

A mechanism has a unity more complex than physical unity. It may, perhaps, be physically united according to the lax criterion, but that, as Reuleaux's argument indicates, is a consequence of its being a mechanism (and thus a necessary condition). Instead the unity of the mechanism consists in the joint influence of its parts on one another, an influence analyzable into the transmission of force by contact from each link to the next.  

Were they to act at a distance (or if electromagnetic forces were brought into play), contact would no longer necessary. One could well imagine a version of Cau's dancing ball made with magnets—a more elaborate device, but working on the same principle, as Descartes' dancing statue.

2. Concert

The machine, in its simpler forms, is intended to produce a single motion. Its elements work in concert to produce that motion, whether it be lifting water, transferring a load, or producing a jet. "Every motion that differs from the one intended will be a disturbing motion, and we therefore give beforehand to the parts which bear the latent forces [. . . ] such arrangement, form, and rigidity that they permit each moving part to have one motion only, the required one" (Reuleaux 1874-5/1876:35). The reference to intention points toward intentional unity: it is the intention of the machine-builder that supplies the norm against which some motions are disturbances, and some not. But there is, one might say, a fact concerning the motion of the machine that has nothing to do with intentions: the clock's hands would turn, the animal-machine's heart beat, even if they had popped out of the void. It is, as Descartes insists, a matter of indifference to nature whether the clock is capable of turning its hands, or the heart of beating; but that does not gainsay the fact that when it is whole, it does what it's supposed to.

The fact that the parts of a machine act in concert to produce one motion cannot without further ado be enlisted to the service of dispositional unity. The one motion stands out only, it would seem, in relation to the intentions of its builder (or someone else's guesses about them). The turning of a clock's hands is itself the cause of further effects—movements of the air, a changing pattern of shadows on the clock face. The beating of the heart has effects.
throughout the body. From nature’s standpoint, the choice of a terminus for the concerted motions of the parts is arbitrary. Similarly the choice of the initial, activating motion. To isolate the machine from its environs we must, it seems, either look downward toward physical unity or upward toward functional and intentional unity.33

Descartes exhibits no interest whatever in such problems. He never asks himself why the sun whose light acts on the eye is not part of the visual system. To be sure, it shines on other things too. But the fire in my cat’s heart warms me just as the fire in my own heart warms me. Even so, some of Descartes’ pronouncements about the animal-machine make the most sense if what he has in mind as a principle of unity is dispositional unity. If his *diktat* against ends were strictly enforced, then the animal-machine can have no more than dispositional unity, because, as I will argue shortly, functional and intentional unity are virtually inseparable in his thought. Nevertheless, if what may be called the boundary problem could be solved without appealing to intentions, dispositional unity would supply Descartes with everything he wants—a way of picking out the animate individuals of the natural world while referring to nothing beyond it.

6.4 Functional and Intentional Unity

The occurrences of ‘function’ in Descartes’ physiology might well be done without. Descartes himself, as I have mentioned, in a passage in the *Description* paralleling the introduction of the animal-machine in *L’Homme*, substitutes ‘mouvement’ for ‘fonction.’ Yet there are numerous passages in which a mechanism is said to “serve” a power, especially a power of the soul, like vision, or to be “for” some operation. Those passages, as I have said, are not easily dismissed or translated into counterfactuals. In Aristotelianism, such talk is taken to designate ends and, under certain conditions, final causes.34 Any natural change has a terminus toward which it tends, and which it will attain unless prevented. The eye, when acted upon by light, will produce the intentional species of color unless it is clouded or otherwise incapacitated. Aristotelian physiology classifies the operations of the soul according to their ends, and sets up a hierarchy of ends from the specific to the general: digestion, the natural *terminus* of the stomach’s activity, serves nutrition, which in turn serves the overall aim of all vital operations, the material conservation of the organization and the perpetuation of the species. Like Gassendi, Suárez and the other Aristotelians whose works I have studied believed that natural purposes were laid open to view. The role of the eye in seeing, the role of the sexual organs in generation, are not matters to be discovered only by deep theoretical penetration into nature’s secrets; they are among the phenomena which the philosopher is called upon to explain.

Nevertheless, in contrast with Aristotle himself, the Christian inheritors of Aristotelianism tended to assimilate natural ends to intentions—those of the Creator.35 The natural world reveals itself to have purposes because in it we can read the designs of God, and thus his intelligence and foresight. In so doing, the Aristotelians could answer a number of nagging questions about the final cause. How, for example, can it be a cause if it does not yet exist? How can plants and the inferior species of animal, devoid of cognition, be made to follow ends they are incapable of recognizing? The answer is that, to use Thomas’s often-cited analogy, they are directed to them as an arrow is directed to its target by the archer. The wisdom they exhibit is not theirs but God’s. For higher animals the allocation of foresight is less clear. Brute has the *sensus communis*, and thus are capable of a certain degree of abstraction; they have memory, imagination, and even a kind of judgment that allows them, in Suárez’s words, to apprehend the good, but only “materially,” not “formally.” Sheep fleecing a wolf do *not* recognize the wolf under the concept “harmful thing”: they see the wolf, and “by a natural instinct judge it to be worth wanting, seeking, or fleecing [*naturali instinctu judicant sibi esse appetendum, prosequendum, vel fugiendum*].”36 Not would if we ran away without thinking.

33 The difficulty of picking out naturalistically the appropriate point in a causal chain is a well-known difficulty for causal theories of content. See, for example, Dresnke 1981:156–157.

34 A *final cause* is not merely an end. It is an end which can be brought under the general notion of cause as that which “causes being,” where “being” means either existence simpliciter, as in creation or generation (in generation, the matter exists beforehand, but not as a complete substance), or existence in some manner, as in alteration where a cold thing, say, is made warm. The final cause is used under this heading in *Meditations* as the form achieved when a natural change reaches in *terminus* is intended by an agent—in the actions of nonrational agents, God—under the “formal reason” of the good. My thought, considered as a mode of thinking substance, or “materially” in the terminology of the *Meditations*, is the efficient cause of my taking medicine to cure an illness; the content of my thought of the medicine, recognized as a good, or

35 See Des Chene 1996, c. 6 and references therein for discussion of this point; see also Oder 1996, 2000, forthcoming; and Menn forthcoming.

36 Suárez *Dop.* 235:100014, *Opera* 25:889. In the terms of n. 34, the perception in the sheep’s soul that impels it to flee the wolf is only the efficient cause, not the final cause, of the sheep’s flight. We may even agree that the sheep has a perceptual conceit of a “wolf,” but that concept is associated with harm only by way of God’s intentions in instituting certain relations among the perceptions, feelings, and actions (or, to put it anachronistically, the “motor programs”) of
MACHINES, MECHANISMS, BODIES, ORGANS

Ascriptions of ends to non-rational or "natural" agents and their actions rest on our conceiving them as designed by God. In that respect Descartes differs very little from the Aristotelians. The difference lies, rather, in the interpretation of teleological explanations, and their admissibility in natural philosophy. Descartes treats any ascription of tendencies to natural agents in terms of deliberate intentional action: "That it appears that I took my idea of heaviness partly from the idea I had of the mind rests principally on the fact that I believed heaviness carried bodies toward the center of the earth, as if it contained some recognition [of the center] within itself" (6 Rep., no. 10, AT 7:442). To have a tendency—toward the center of the earth, toward nourishing oneself, toward pursuing edibles—a thing must "recognize" it, and wish to approach the thing it tends to. But recognition is a mode of thought, and every mode of thought inheres in a thinking substance, a mind. Hence only thinking substances have tendencies. Functions, because they imply a distinction between the way a thing actually does operate, and the way it should, and also that the 'should' is intrinsic to the thing, entail tendencies. To say that the function of the heart is to heat the blood, if by that one meant that the heart has, of itself, a tendency to do so would be like treating heaviness as a genuine quality of things. It would be to treat the heart as if it had the power to recognize the act of heating and the will to perform it.

In a world of tendencies, there is a genuine distinction to be made between "natural" and "violent" changes. Natural changes are those in accordance with a thing's tendencies; violent changes are those that frustrate them. To lift a stone upward is to perform a violent act. So too the birth of monsters, in which the natural tendencies of the seed have somehow been perverted, is violent. Tendencies supply a norm. They enable us to distinguish what actually happens from what ought to happen, the normal from the monstrous, health from disease.

There is no basis in Cartesian physics for ascribing tendencies. That is one moral to be drawn from the analogy between living things and clocks:

the sheep. God designed the sheep to take care of itself, but the sheep does not intend to take care of itself any more than the heart intends to heat the blood.

Having a mind, moreover, is an all-or-nothing property. In Aristotelian terms, there is no remission of substantial form: Socrates is all man or no man at all.

Descartes does, of course, use the term 'tendency to move.' Light is said to consist in the tendency to move of second-element particles. But tendency in this sense is dispositional, not functional: it is a brief way of saying that a body would persist in its present state if not acted upon by others, and in particular that it would maintain the instantaneous direction of its motion. That it would do so follows from the first and second law of motion, and thus ultimately from the immutability of the divine will—not, it should be noted, from any particular volition. The laws are part of God's design only in the attenuated sense that, having willed that there should be a world of extended substances, and a certainty quantity of motion in that world, it is a consequence of that volition that the actual motions in the world should be in accordance with the laws. (It may be also that the form of the laws, to the extent that they require geometry for their statement and application, will depend on God's will if geometry is included among the eternal truths created by God. Even the first law would be instantiated differently in a world with different congruence relations.)

To "denominate" a thing is to designate it under an identifying description, to refer to it other than by an indexical or proper name. To denominate it intrinsically is to do so by a description that refers to a real entity inhering in the thing, or among those of which it is composed (real: here, name: belonging to it independently of our manner of conceiving it). To denominate it extrinsically is to do so by a description that refers to an entity to which the thing is related. 'Radium' is intrinsic (radium does have the power to produce rays), 'curium' is extrinsic.

UNITY OF THE BODY

It might be said here that [people whose senses are disrupted by disease] err because their nature is corrupted; but this does not remove the difficulty, because a sick man is no less a creature of God than a healthy man; and it seems no less repugnant [to God's benevolence] that he should have from God a nature prone to error than that the other should. Just as a watch constructed from wheels and weights no less precisely observes the law of nature when it is badly made and does not correctly indicate the hours than when it satisfies every desire of its maker; so too if I consider the body of man as a certain machine [. . .] I easily recognize it to be equally natural for the body if, for example, being hydropic, it suffers dryness in the throat, which ordinarily implies thirst to the mind, and if its nerves and other parts are so disposed that it drinks something that aggravates the disease, as it is for the body, when there is no fault in it, to be moved by a similar dryness in the throat to drink something useful. (Med. 6, AT 7:84–85; cf. L’Homme, AT 11:202)

Just as the conception of the use of a clock provides the standard by which to judge that it is not working well, so too the health or sickness of the body are judged by a standard derived from a conception of the use of the body. That use is to conserve the union:

I observe finally, that since each of the motions that occur in the part of the brain which immediately affects the mind causes [inhibit] just one sensation [sensation], nothing better could be thought up than if the motion should cause just that sensation which, of all that can be caused, most and most frequently leads to the conservation of man's health. (93)

Sickness and health, then, are, as Descartes puts it, "extrinsic denominations," in just the way that signifying the time is extrinsic to the bits of matter that make up a clock. Nature itself—not, it should be noted, in the sense of
Machines, Mechanisms, Bodies, Organs

"God himself, or the coordination of created things instituted by God" (80), but in the sense of the whole assemblage of material things governed by the laws of motion—contains no clocks, but only things that may or may not serve to tell the time, and no eyes, if by that one means things suitable to see with, but only things that may or may not serve the sense of vision.

In the Traité de l’Homme, and even more so the Description, that theological setting, which alone justifies the language of function and service, is kept in the background. The Traité substitutes for the language of optimally instituted relations between movements and sensations the language of imitation, even where the language of institution would in order.

As for the disposition of the small fibers that compose the substance of the brain, it is either acquired or natural [. . .] In order that I should tell you what the natural [disposition] consists in, know that God in forming the small fibers has so disposed them that the passages he has left between them may conduct the spirits moved by a particular action toward all the nerves they ought to go to so as to cause the same movements in this machine, as those to which a like action would incite us when we follow the instincts of our nature. (L’Homme, AT 11:192)

The norm is set not by the end of conservation but by that of imitating the acts we are accustomed to perform by our nature. Only at one remove does the conservation of the machine enter into its description.

Descartes needn’t have changed his mind between writing L’Homme and writing the Méditations. L’Homme was originally supposed to include parts on the soul and the union. Without having presented his theory of the union, he was not in a position to make the instituted relation between bodily movements and sensations a standard by which to judge the dispositions of the body. The failure of imitation supplies an intention that can be specified independently of the union.

That intention shares, moreover, with the intention that the body be fitted as well as possible to conserve the union, the feature of having as its object the whole body. It can therefore take the place of the other in providing a principle of unity for the machine. Let us say that a thing has intentional unity just in case it is the object of a single intention by which it is directed to one end, whether that end is imitation or conservation. Intentional unity is in one respect narrower than functional unity, and in another broader. It is narrower to the extent that things may have ends independently of their being intended to serve those ends. We have seen that Descartes denies that natural things do have ends except by way of intentions; but there is no need for us to prejudge the issue.

[136]

Unity of the Body

Intentional unity is broader than functional because certain intentions, those by which one thing is made to signify another, require nothing of the representation except that it exist. At the outset of Le Monde, Descartes advises the reader that “there can be a difference between the sensation that we have [of light], that is, between the idea that is formed in our imagination by the intermediary of our eyes, and what it is in the objects that produces this sensation in us.” (Le Monde 1, AT 1:3). The quality of the objects that produces the sensation of light, like words “which signify only through human institution,” could well be a sign “established” by Nature to do so (4), and thus need bear no resemblance to the sensation it gives rise to. The institution or establishment of signs may be a more complicated affair than an intention—for the nonce, perhaps, and not habitual—that one thing should signify another. But in either case no resemblance, indeed no natural relation at all, is necessary to its success. That something has the function of signifying, then, does not of itself entail that the thing has any particular disposition or qualities at all.

The intention to make something in imitation of something else, on the other hand, will require that the imitating thing resemble the thing imitated in some respect. In L’Homme the man-machine is made by God so as to resemble us in outward aspect (oddly enough, Descartes includes not only figure but color, which one would think was quite irrelevant to the purpose of the exercise) and in operation. Descartes includes only those “functions” that “can be imagined to proceed from matter, and to depend only on the disposition of the organs”, but that, as we have seen, is, at least for machines of finite duration, no restriction at all on the actions of the machine, so long as they resemble ours. Any finite sequence of actions is consistent with the absence of understanding and will. But clearly not just any machine will do. Clocks, for example, will not. As Fontenelle observed later, clocks do not reproduce themselves. Very few actual machines in Descartes’ day were capable even of sustained self-movement (Causs’s automata require an influx of water, which they do not provide for themselves, and watches need to have their springs wound or their weights reset).

The conditions under which the machine will resemble us are just that it should have our outward shape and that in any circumstance we are likely to
encounter it be so disposed as to act as we would act in that circumstance. It should be geometrically similar to us, and simulate our actions. The intention to build a machine to resemble us is bound by those conditions. Its intentional unity—the unity it has as the one thing which is intended to simulate me or you—requires that the mechanisms comprised in it which produce its actions should also have dispositional unity.

Nevertheless the intentional unity of a simulating machine cannot be reduced to dispositional unity. There is, first of all, no guarantee that a machine will manage to simulate us even if it is intended to. That remains to be proved. Second, it is not clear that the dispositions of the mechanisms comprised in the machine can be conjoined into a single disposition attributable to the whole. The only description of the action of the whole that comes to mind is that of self-preservation. But self-preservation would seem to re-introduce the norms that a reduction to dispositions was supposed to eliminate. Without them it is not clear that we would know under which conditions the machine could be described as intact. A rusted-out hulk of a clock observes nature’s laws no less than a clock still ticking. Like seeds recovered from ancient tombs and germinated thousands of years later, a machine can remain dormant for an indefinite time and yet still be intact, ready to spring to life when acted upon in the right way. Although it might seem quite certain that a machine ground to dust is no longer capable of working, one should remember that in a world where matter is infinitely divisible, no portion of matter is too small to contain all that is needed for the operations characteristic of the human machine.

Functions, one might say, live in the space between intentions and dispositions, a kind of hybrid of the two. The intention to imitate the human body, or to produce a machine which will act to preserve the union of body and soul, is not pure like the intention to signify one thing by another. It contains an admixture of the material. This is evident for the functions formerly attributed to the vegetative soul, since Cartesian mind has no part in them. Growth, for example, is change of quantity. In the Cartesian world, there is no way to change the quantity of a body but by accreting other bodies to it (the food of the machines of L’Homme, I should note, since it comes from the world of Le Monde, is itself a simulation; in the Description, on the other hand, the food of this world is configured extended stuff). So the animal-machine, if it is to grow as animals do, will need some means of bringing into itself matter to accrete. Since, moreover, animals, unlike houses, grow in every part, the matter to be accreted to the parts of the machine will have to be divided into bits and distributed. Although you don’t need a circulatory system to ac-

Unity of the Body

complish that feat, experience tells us that in humans and higher animals there is such a system, and it is reasonable to suppose that it can be made to serve the end of growth.

The senses are more complicated. First of all, the intention to imitate and that of producing the machine best suited to preserve the union diverge. The second must take into account the occasional interposition of thought between the action of sensibles on the sense organs and the responses of the machine. But if, like Descartes, we consider in the body only those sequences in which the soul does not intervene, then the second coincides with the first, except that the assumption of normality, which in the project of imitation is screened off, becomes explicit.

Consider vision. It is a means by which the machine can maneuver well among the things around it, and distinguish edibles from inedibles; it is, moreover, a channel through which those things act on it by way of light rays. Though Descartes does not put it this way, part of the analysis of vision in L’Homme and the Dioptrique consists in describing the information that can be extracted from the luminous presences on the body, and in particular on the retina. Light travels in straight lines; light rays do not interfere with one another’s passage; bodies reflect light; the texture of their surfaces produces changes in light which the soul apprehends as colors. The eye contains, moreover, a device we can show to have the disposition necessary to focus rays entering through the pupil, and which forms an image on the retina. Experience shows, finally, that humans and some animals act as if they had information about the shapes and sizes of objects around them that we may suppose is conveyed to them by light (the absence of contact rules out touch; that sound may serve the same purpose did not occur to Descartes, even though it was believed that echoes are caused by reflected sound).

The operations of vision, then, must be realized by a mechanism consistent with the phenomena I have just sketched, and which can be shown to help conserve the machine. That mechanism has both the intentional unity conferred on it by its purpose (which, as before, exists only in the divine understanding) and the dispositional unity of a mechanism in the sense of René: it is constrained to act in a determinate way when a particular force is applied to its initial segment (namely, the retina). The pressure of light on this small
Machines, Mechanisms, Bodies, Organs

part of the retina always results in the opening of this valve in the brain and no other, the two being linked by a nerve fiber which, in Descartes’ scheme, is treated as if it were a rigid rod.

In Descartes’ physiology, the operations of the body, though undoubtedly physical, cannot be completely understood except by referring them to ends. Ends cannot be entirely supplanted by dispositions, even in animals. Reference to them can be deferred by fables of imitation. But if the physiology is to escape the confines of fiction, the role of norms in defining the functions of the body must be acknowledged, and with it that of the rational agent, God, whose intentions in creating animals establishes those norms. The ban on the consideration of ends in natural philosophy must be lifted, even if inferences from dispositions to ends are, as Descartes argues in replying to Gassendi, less certain than inferences from effects to causes.

6.5 Substantial Unity

The introduction of a soul into the machine produces something new, the union. The Aristotelian would have it that body and soul are incomplete substances, and the union a complete substance. The incomplete substances are really distinct, but that is no bar to their joining to make a thing that is one in the strong sense, unus per se. Even though the soul, alone among corporeal forms, has powers that need no matter to operate, the metaphysics of the human being is in essentials that of any corporeal substance. The union presents no peculiar difficulties of conception. The difficulty for the Aristotelian lies rather in understanding how the soul subsists when it is not joined with the body, and whether its separate existence requires an extraordinary act on the part of God.

In Descartes, that difficulty is alleviated by rescinding from material things all powers of thought. For the Aristotelian, only the rational part of the soul can be argued to require no matter for its operations; the sensitive and vegetative souls are inextricably material. For Descartes no mode of thought is a mode of extension, or requires extended substance to exist; even sensation, considered as a mode of thought, must be conceivable apart from matter. The demonstration in L’Homme that a machine can simulate not only the vegetative functions but also what in animals we call sensing, feeling, imagining, and remembering allows Descartes to deny that the human soul has either a vegetative or a sensitive part. But a soul with only a rational part would, on the basis of arguments then used to prove the immateriality of the human soul, not depend on matter at all, a position tantamount to denying that it is the form of the body, and therefore contrary to doctrines made matters of Catholic faith at the Lateran Council of 1514. Yet that, it seems, is just what the Cartesian soul, stripped of vegetative and sensitive powers, must be.

Yet a Cartesian soul not only reasons and wills but senses and feels. Descartes does not dwell on the condition of separated souls. It is not entirely clear whether a separated Cartesian soul can have sensations and feelings in actu. But it runs contrary to his characterization of the difference between thinking and extended substance to suppose that the soul could be deprived of the power to sense and feel by its departure from the body. His demonstrations of the union seem to depend on its being in the nature of the soul to take on certain kinds of mode on the occasion of various events in the body. But if that were true only when the soul was joined with the body, the soul’s nature would be altered by union—a result not easy to square with the passivity of matter, or with the claim, put forward in the Note in programma, that even sensory ideas are innate.

[140]

Unity of the Body

It is not my aim to examine these issues in detail. The topic here is the unity of the body. Is the body, when joined with the soul, genuinely one substance? Descartes’ last attempt to explain transubstantiation in a letter to Mesland suggests that the answer is yes. But I am not sure that he had a settled view on the matter. We have seen that Descartes’ official view rules out appeal to ends altogether from natural philosophy: to intrinsic ends, because there are none; to extrinsic ends, because the will of the Creator is opaque to human understanding. The question here is whether the ban is lifted for the human body when it is joined with the soul, and thus whether in the union it can be said to have intentional unity, not just sub rosa, but according to Descartes himself. Does the brief mention in the Passions of the mutual dependence of the parts of the body apply to all animal-machines or only to the human body in the union?

41 See Des Chene 1997 for a comparison of arguments in Suárez and Descartes. On the “propositions to be held by faith” among Catholic authors, see Des Chene 2006, n. 2.

[141]
1. The Character of the Union
First a few points regarding the union. Regius, at a time when he was still willing to accept the tutelage of Descartes, proposed the thesis that the human being is an ens per accidens. In the terminology of Aristotelianism, that implied that the union of soul and body was no stronger than that between substance and accident. The implication would be either that the soul is an accident of the body, and not its substantial form, or else that the soul is in the body as a pilot in his ship, or (more pertinently) as an angel would be were it to exert power over a body. Descartes advised him to say instead that the human being is an ens per se, just as the Aristotelians do. Not merely for prudence’ sake, but on the grounds that the soul is, uniquely, a substantial form, and with the body produces something like an Aristotelian complete substance (To Regius, Jan 1643, AT 3:503, 508). The existence of the union “each person experiences in himself without philosophizing,” but the manner of the union we can conceive only with difficulty, or perhaps even not at all, because to conceive of it we must conceive of the mind and body as one, when everything in our ideas of them entails that they are two (To Elisabeth, 28 Jun 1643, AT 3:693–694; cf. Med. 6, AT 7:81).

Like Hoffman, then, I understand Descartes to be in agreement with the Aristotelians on the character of the union, with one necessary correction. Hoffman writes of form “inhering” in matter. The term “inherence” was by Aristotelians reserved for the relation between accidents and substances; substantial form is said to compose or be a component of a complete substance. This is a basic distinction, found in the first lines of Aristotle’s Categories, between what is said to be in a thing (accidents) and what is said to be of it (genus and species). The corresponding distinction in re is between inherence and composition or union (of matter and form). Because the logic now ordinarily used has no place for such a distinction, philosophers tend to ignore it, or misread it as a distinction between essential and nonessential properties.

44 On Regius’s theses and the controversy that arose around them, see the introduction to Verbeek 1993, and for further details Rodis-Lewis 1959, Verbeek 1988, Verbeek 1992. The correspondence between Descartes and Regius, and extracts from related documents, are in AT 3. Prudence was indeed in order, since Regius’s denial of substantial forms came under heavy fire from Giobertus Voetius, rector of the Reformed Church in Utrecht, who associated Regius’s views with those of bad characters like Basso, Sennett, and Gorius (see, for example, AT 3:513, 604).


46 I don’t think we need to saddle Descartes, as Hoffman does, with the view that “a substance can be a quality.” It is true that “needs nothing to exist but God”—the definition of created substance (PP 531, AT 8:7:24)—does not entail “cannot inherit in another.” Descartes’ word “need” (necesse in Latin, nous besoin in French) is vague (some critics noted, for example, but Descartes cannot quite maintain the Aristotelian position without qualification. Cartesian soul and body, unlike substantial form and prime matter, are not incomplete substances. Descartes identifies substance with self-subsistent entity, self-subsistent, that is, but for requiring the concurrence of God. Incomplete substance, if incomplete means “not capable of subsisting by itself”, is a contradiction, like a mode that not inhering in any substance. Neither can exist in the absolute sense of God (4 Resp., AT 7:222, 434–435). He has only himself to blame if we now find it difficult to understand his view. He was among those who did the most to destroy its logical basis.

Nevertheless, the view is the only one worked out in any detail by Descartes, and the only one that does not court the danger of making the soul an accident of the body, or else a forma assistens. Descartes’ insistence that thought is sufficient to constitute a substance, and the complete mutual exclusion of modes of thought and modes of extension, would indeed show that the soul is not an accident, but nothing rescues him from the accusation that the human that the body needs food to survive. But I am inclined to think that Descartes, rather than do yet more violence to the logic of substance than he had already done by throwing out incomplete substances, was here trying to make the substantial union of complete substances, neither of them mindlike. As a quality, a coherent conception. For Descartes to admit “substantial qualities” would also void his own criticisms of “real accidents,” i.e., accidents capable of subsisting with no subject of inherence, like the qualities of the host after transubstantiation.

Hoffman quotes a version of the argument (AT 7:434) but he takes Descartes to conclude from it that thoughtness, though a quality, can be a substance (even if in fact it isn’t). I think the intended conclusion is that the Aristotelian conception is incoherent, not just empirically false. Descartes is not seriously entertaining the thought that possibly thought is a quality, he is engaging in a refutation of the Thomist doctrine that in transubstantiation the accidents of the Host miraculously subsist without a subject, consistently with his response to Anassathal (AT 7:435–436). Descartes grants that the expression ‘una substantia altera substantiae accident’ has a coherent sense, but in the very same breath he denies that if a substance A ‘accides’ another substance B, then A is an accident of B.

His example (435) is taken from the rather embarrassing Aristotelian category of habere (being clothed) and the like, not to be confused with the habere which is a species of quantity). Citing Thomas, Toletus classifies habes among the categories that are “predicated of first substances extrinsically, because they do not belong in them.” Like Descartes he takes the predicate in question to be esse verum, and the uesti to be a substance (Toletus In Log., Cat. 243, Opera 1906). So if one said ‘this bread is hot’ and also said ‘this hotness can subsist without the bread by the absolute power of God,’ one would, like it or not, be treating ‘hot’ not as a genuine accident like color, but as a pseudo-accident like uesti.

47 De Chene 1996:794–5. The Aristotelian categories created difficulties of their own, not least in understanding what sort of being to attribute to the union. It is not a relation, since relation is an accident; it is not the complete substance itself, since, for example, it is not a subject of predication, nor is it a member of any species or genus. Generally it was classified as a mode, along with other puzzling entities like existences and inchoates (see Suarez Dep. 75:10016–22, Opera 22:2145–2148). The relation between Descartes’ use of the term modus and Aristotelian uses merits further study, as do the various sections of modus devoted to the real, formal, modal, and rational distinctions.

[142]
man soul is a \textit{forma assistens}, operating its body as an angel would. Causal relations certainly do not. On the contrary, the definition of soul as \textit{res cogitans}, together with Descartes' emphasis on the action of the soul on the body through the pineal gland, could not help but elicit, when combined with the claim that it is a complete substance, the accusation.\(^{49}\) In what follows, therefore, I take the union to be substantial union, and the human being to be analogous to an Aristotelian composite of matter and form.

2. \textbf{Substantial Unity of the Body}

The question now is: does the body itself—or rather, not to prejudge the question, does a certain collection of solids and fluids—become one thing in the union?\(^{50}\) You might think the answer was obviously yes. The soul is one thing; how can it be "substantially united" with several? Wouldn't the result be a Hydra, only much worse, since the human machine has so many parts (perhaps even infinitely many)?\(^{50}\) A logical monster indeed. Add to this Descartes' position that the soul is "truly joined with the whole body," which implies, of course, that there is a whole for it to be joined with.\(^{51}\) In fact he immediately adds:

and it cannot properly be said that it is in one of its parts to the exclusion of others, because it is one, and in a certain fashion indivisible, on account of the disposition of its organs, which are so related to one another that when one is removed, it renders the whole body defective; and because [the soul] is of a nature that has no relation with extension, nor to dimensions or other properties of the matter of which the body is composed, but only to the whole assemblage of its organs.\(^{52}\)

\(^{49}\) See Arnauld, \textit{Obi}, AT 7: 203. The charge was echoed in this century by Maritain, who accused Descartes of "angélisme" (Rodis-Lewis 1971: 541–544). See also Vos 1914.

\(^{50}\) A succinct statement of the issue, and a response to them on Descartes' behalf, is given by Rodis-Lewis (Rodis-Lewis 1990: 28–30). See also Rodis-Lewis 1950: 67, 239–240.

\(^{51}\) The circulatory system would seem to provide actual instances of the situation envisaged in the \textit{Principles} (PP 254–55). At 8: 159–160, where a circular stream of particles is contained between eccentric solid rings. In this situation it is necessary that "all its imaginary particles, which are truly innumerable, are moved by one another bit by bit."

\(^{52}\) "L'âme est vitralement jointe à tout le corps" (PH 530, AT 11: 351). Of course one can turn this into a tautology, \textit{tut le corps} simply means "whenever parts of matter the soul is joined with. But Descartes, even if he is echoing a traditional claim, does not seem to be treating it as true by definition."

\(^{53}\) "On ne peut pas proprement dire qu'elle soit en quelque de ses parties, à l'exclusion des autres, à cause qu'il est un, & en quelque façon indivisible, à raison de la disposition de ses organes, qui se rapportent telle leur tout l'un à l'autre, cela rend tout le corps défendu; & à cause qu'elle est une nature qui n'a aucun rapport à l'estendue, ny aux dimensions, ny autres proprietés de la matiere dont le corps est compose, mais seulement à tout l'ensemble des organes" (PH 530, AT 11: 351).

\textbf{Unity of the Body}

In a letter, soon to become notorious, that Descartes sent to the Jesuit Denis Mesland in 1645, he begins a new explanation of transsubstantiation with some observations on the body:

First of all, I consider what the body of a man is, and I find this word 'body' very equivocal; for when we speak of a body in general, we mean a determinate part of matter, and overall of the quantity of which the universe is composed, such that one cannot remove the smallest amount from this quantity without our judging that it is less, and no longer whole [entier]; nor can one change any particle of this matter, without our thinking that the body is no longer entirely the same, or \textit{idem numero}. But when we speak of the body of a man, we mean not a determinate part of matter, nor one that has a determinate size, but only all the matter that is together united with the soul of this man; so that, although this matter changes, and its quantity grows or diminishes, we always believe that it is the same body, \textit{idem numero}, while it remains joined and substantially united to the same soul; and we believe that the body is whole [tout entier] while it has in itself all the dispositions required to conserve the union. (To Mesland 9 Feb 1645, AT 4: 160)

Needless to say, this doesn't answer all the questions. Time now to begin asking them:

(i) The body is "indivisible," but only "en quelque façon." There is a causal dependence among its parts. To say that the removal of one renders the whole ("tout le corps") defective presupposes that one already knows what the whole is, unless "tout le corps" is taken distributively, as in "president of all the people." We begin with the Hydra, and meld all its heads together using the criterion of mutual dependence. But we must have known already which parts of matter the soul is united to. What else would make them "parts of the body" except union? But then the indivisibility—after-a-fashion of the body yields no argument for the conclusion that the soul is not united to some part rather than another, because everything that counts as a part does so by virtue of being united. As the letter to Mesland says, \textit{this} human body is just "all the matter that is united with" this soul.

(ii) The soul has "no relation" (\textit{aucun rapport}) with any extended substance or with its dimensions. Yet it does have a relation to the "whole assemblage." We know what 'no relation' means: aside from the modes common to all created substances, existence and duration and the like, no mode of extended substance is a mode of thinking substance and con-
versely. Certainly the size of the body, or the relative sizes of its parts, could have no relation—here roughly in the sense of "common measure"—with the soul; the letter to Mesland goes on to note that the body changes its dimensions a great deal as we grow up. How then could putting a bunch of bodies together make a support possible, where there could not have been one before? The soul, Descartes says at the end of the article of the Passions I have cited, "separates entirely from the body when the assemblage of its organs is dissolved." (The alternative, I suppose, is that it might withdraw from some but not all of the body, as color from a terrified person's face.) True enough, one might say, but that supposes a relation, a mutual fitness that Descartes elsewhere seems to deny: it can be objected that it is not accidental [accidentarium] to the human body, that it should be joined with the soul, but rather this is its very nature [spississim eis naturam]; because when the body has all the dispositions required to receive the soul, and without which it is not properly a human body, it cannot happen except by a miracle that the soul should not unite with it; so also it is not accidental to the soul, that it should be united with the body, but only accidental to it after death, that it is separated from the body. All these things should not be denied altogether, lest the theologians be again offended; nevertheless one should respond, these things can be said to be accidental for the reason that, considering the body alone, we perceive nothing in it on account of which [proper quod] it should desire to be united with the soul; and nothing in the soul, on account of which it ought to be united with the body, and so I said a little later, it is in a certain way accidental, but not absolutely accidental. (Descartes to Regius, mid-December 1641, AT 3:360-460)30

Though it is possible to doubt that Descartes is expressing his own view with entire candor, since he is advising Regius in his dealings with the professors, still it is also true that the tone of the correspondence (of which we have little from Regius) is one in which Descartes is casting Regius as his spokesman, to pronounce publicly what Descartes believes privately, even if in guarded terms. In any case the message is clear: nothing in the nature of the soul provides grounds (propter quod) that it should be united with the body, and so too for the body.

(iii) From the very fact that, as Descartes reminds Mesland, the parts of the body are constantly changing in every part of it is fluid, but some more than others, see §§2, 3), it follows that some bits of it can be removed without affecting others. But the parts in question are "organs": which parts are they? Perhaps just those whose removal does render all the rest defective. But the spleen, a kidney, a hand, an eye can be lost without making other organs defective. Either the list of organs is shorter than common sense and the anatomist would have it, or else "organ" can be defined independently of mutual dependence. How it is to be defined without appealing to ends is not clear, for reasons given already. The shape of a part does not make it an organ, or the events that go on in it: what would lead us to choose some shapes and not others?

(iv) The dissolution of the body is the end of the union. We have seen that from the standpoint of physical processes alone, the conservation of the body (and so its destructive states too) are not easily defined. "A horse whose hoof is cracked is broken" (Rodis-Lewis 1990:30). But what is broken about it? Part of it is no longer whole in the strict physical sense. But not every solution of continuity is breakage, nor of course is every defect a rupture of bodily parts. The horse no longer runs well, perhaps. But then we are applying a notion of normality—and merely statistical normality will not do.

The pieces of the puzzle begin to fit together if one keeps a steady eye on death. Death typically requires bodily change, even if it is by definition the destruction of the union and nothing else. Yet how should it be that any bodily change should bring it about that the soul ceases to be united with that body (or any body)? Some do: let's call them "dissolutions of the body." They differ from mere fractures and bruises because after they occur, we find that the body ceases to exhibit any of the behavior from which the presence of a soul can be inferred. No more in humans than in animals do we perceive even
the bodily processes that are called imagining and sensing (To Gibeuf, 19 Jan 1642, AT 3:479), and still less thinking and willing.

There is nothing in the nature of a human body that would ground the assertion that it should be joined with a soul.⁵⁴ Adding to the bare nature of res extensa a blueprint of the human machine does not alter the indifference of matter to mind in the least. Similarly the nature of human soul, considered only as res cogitans, contains nothing that would ground the assertion that it should be joined with a body. If there were, the argument for the real distinction between mind and body would begin to falter, because it requires that (in the words of the Fourth Replies) mind should have none of the “forms or attributes, from which we recognize that body is a substance” (AT 2:232). In particular, it seems to me that the mind cannot, considered only as mind, have what Suarez calls a “transcendental habititude” toward body.⁵⁵

And yet there is such a thing as death. There are conditions under which the union can no longer naturally exist. (Whether there are conditions under which it must exist, or under which “it cannot happen except by a miracle that the soul should not join” with the body, is another matter.) Those conditions, I should note, pertain entirely to the body. There is, so far as I can tell, no condition of the soul that would cause the union to cease. Merely wanting to die is obviously insufficient. We must suppose that the conditions of dissolution are grounded not in the nature of body, nor in that of soul, nor in the laws of nature, but in something else.

The Meditations tell us that the “corruption” of the nature of the person who wants to drink water even when it is harmful is “only an extrinsic denomination” with respect to the body. But “with respect to the composite, or the mind joined to such a body, it is not a pure denomination, but a true error of nature” (AT 2:86).⁵⁶ It is an error with respect to the composite because God has instituted between the motions in the brain and the modes of thought they give rise to that relation which, when a certain motion occurs

⁵⁴ Descartes says that it should desire [as desired] a soul, perhaps recalling the slogan ‘materiam formamque appetit’ which is often made the topic of a question in Physica communities (see, for example, Tolstoi’s Phys. I 745, Opera 4:576–586). But the point is not the relatively trivial one that matter has no desires: it is that in the nature even of a fully formed human machine, there are no grounds from which one may infer that it will, or ought, to be joined with a soul.

⁵⁵ Suarez De Deo. 1630:20: Opera 1:400. See Deo Chineau 2000, Chapter 5.

⁵⁶ Paraphrased without the technical term denominari, Descartes’ claim is that with respect to the body ‘corruption,’ as a name for the body’s state, refers not to any property of that state, but to the diminished usefulness of the body, in that state, from the standpoint of the soul; on the other hand, the breakdown of the relations instituted by God between body and soul in the union, or their failure to fulfill their end, is a genuine “error of nature.” See Gueroult 1968, 1752, §4–5. The “nature” referred to by Descartes in the passage quoted is what Gueroult calls.

as a result of a particular condition of the body, will give rise to sensations and passions that incline the will to actions most conducive to the continued existence of the body in a condition that will normally sustain the union (Med. 6, AT 7:87). In a person whose sensations lead to actions endangering the union, the error is not that the instituted relations have been altered, but that the antecedent causes of some motions in the brain are not what they normally are — not, so to speak, what God anticipated in instituting the relations.

The extreme case is when the body is so badly damaged that its motions can no longer serve the end of guiding the soul in preserving it. When the soul is joined with the body, it feels joy, “because it cannot be believed that the soul was put into the body unless the body was well disposed, and when it is thus well disposed, this naturally gives us joy” (To Chanut 1 Feb 1647, AT 4:604). Joy, we learn from the Passions, is excited by “the consideration of a present good” (AT 11:376). The body is, precisely, present to the soul in the union, and its being well-disposed is, one must suppose, represented to the soul as good with regard to the soul itself (cf. 11:374). But how is it good with regard to the soul, if “there is nothing in the soul on account of which it ought to be united” with the body? The nature of the soul, considered as res cogitans, includes no teleos, no end that might be achieved with the aid of a body.

It is only with respect to itself considered as already united with the body that the body is a good for the soul; the union itself is a brute fact, upon which all other judgments of benefit and harm are predicated. Similarly it is only with respect to the union that the dissolution of the body — to the point where its sensations (or the corporeal ideas of L’Homme) no longer serve the soul in acting so as to maintain it — is a “corruption,” both in the sense of something bad and in the Aristotelian sense of the destruction of a complete substance. But it is a bad thing that ceases to be bad as soon as it happens, because the termination of the union is the termination of that upon which the judgment of badness was predicated.

An analogy will help illuminate the point. A partnership is a relation among individuals instituted to serve certain ends. We may suppose that a certain amity, or cooperation, among the partners is necessary to the continuation of the partnership. With respect to the partnership, a decrease in cooperation, or a cause of dimension, is bad because it endangers the partnership. But if the decrease is so severe that the partnership is terminated, then cooperation no longer is either good or bad, since judgments of its goodness or badness were predicated upon the existence of the partnership.

"my nature in the broad sense” (ibid. 2:160). Gueroult’s exhaustive analysis of the sixth Meditation is essential to understanding the teleological constitution of the body.
Machines, Mechanisms, Bodies, Organs

Now the partnership of body and soul is not, as I said, instituted to serve any ends (or at least there is nothing in the nature of soul alone to ground the supposition that it does; God may have his purposes in joining human souls with body, but that is none of our business except as he chooses to inform us). So the goodness or badness of the condition of the body is simply with respect to the union, whereas the goodness or badness of cooperation in a partnership might be regarded as an indirect means to the ends for which the partnership was instituted.

The very notion of dissolution rests on that of the union. As Gueroult writes, "It is the union with a soul that converts the relation, in itself purely mechanical, of the parts assembled into this whole into a teleological relation with respect to the whole body, and it is by the union that the corporeal organism succeeds in acquiring a genuine functional indivisibility" (Gueroult 1968, 2:185). If the body is a whole only in the union, then its ceasing to be a whole is only with respect to the union. The body considered apart from the union cannot die, no more than the soul, but for a different reason. The soul is immortal because it is not extended, and thus indivisible; the body, considered simply as res extensa, is indestructible because no configuration is more natural to its matter than any other.

We have seen that it is not easy to spell out the "mechanical relation" that obtains among the parts of a machine considered simply as a disposition of res extensa. Descartes' suggestion, included almost as an afterthought, that there is, in human and in animal machines, mutual dependence among the organs requires us to have a "mechanical" notion of defectiveness and of organ. But at most we can say that we sometimes notice that the ablation of a part (and especially the kind of part known to anatomists as an "organ") causes the rest to operate differently than before. That is very far from any notion of unity—or rather it will take centuries to make the underlying causal relations precise enough to yield a scientific notion that improves much on common sense.

Call the observed covariation of the operations of its parts the "empirical unity" of the machine. It is neither necessary nor sufficient for the union. That it is not sufficient is clear enough: no degree of complexity, no degree of fineness and differentiation in operation, could entail that a machine should be joined with a soul, since, as I have said, no mode of extension, complicated or not, can do so. That it is not necessary, at least with respect to the absolute

power of God, is clear from Descartes' explanation of transubstantiation in letters to Mersland from 1645 and 1646. The body, he writes,

[ ... ] Whatever matter it may be, and whatever quantity or figure it may have, provided that it is united with the same rational soul, we always take it for the body of the same man, and for the entire body, if it has no need of being accompanied by other matter to remain joined with this soul. (To Mersland 5 Feb 1645, AT 4:167)

Even the tiniest particle of the Host can be the whole body of Christ: "all the matter, however large or small it may be, that is together informed with the same human soul, is taken for an entire human body" (168). Descartes goes on to say that some may find his explanation shocking, but the reason is that such people think that "all the members of Christ's body are there with their same quantity and figure, and numerically the same matter of which they were composed when he ascended into heaven" (169). It was this point that would prove decisive in the hostile reception given to Descartes' explanation when it was finally made public. But for present purposes, Descartes' reasons for hesitation in offering the explanation to Clerescher are irrelevant, since they do not touch the basis of the explanation.

Whichever bits of res extensa are united to a soul are "bodies" of that soul in the miraculous circumstances of transubstantiation: whole bodies, not bits of bodies. Hence the only necessary condition for the unity of the body in the union is, precisely, union. One might well ask: how is it that when my soul is joined with what is, after all, not physically nor perhaps even dispositionally one body, I have just one body, not millions? Words like 'miraculous' and 'supernatural' won't make the question disappear. Instead they lead to a further question: what is natural about the union of the soul with what we usually call the body, and what would be unnatural about its being joined distributively to each of the bits of matter in the collection designated by that name?

Clearly the sense of 'natural' here is not that in which it is just as natural for a body to be dead as alive. Perhaps what is natural is only that God has chosen to unite human souls with bodies that have "empirical" unity (and thus perhaps dispositional unity, to the degree that the one is evidence of the other). Just as the relation between a particular configuration of the pineal gland and the mode of thought we call "perceiving red" is, it would seem, entirely arbitrary, so too the relation of union itself is arbitrarily instituted by God to hold between only some kinds of body and human souls, and not others. The correlation between the empirical unity of living human bodies and

37 "But if this end is not really imminent in the machine, there is no defect, whatever may happen to it. I simply observe that the absence of one of its elements gives a different convergence of movements that the one I habitually observe" (Gueroult 1968, 2:185, 4:184).
their ensoulment would be an inexplicable _factum_, and since there is no argument—as there is with the laws of motion—that the immutability of God's will should require him to join each soul with the same sort of body, physiology and medicine can rely only on the fortunate conciliation of God's choices.

But there may be a more promising alternative. Consider once again the passage from the sixth Meditation that I have mentioned several times already:

I notice, finally, that since, among each of the motions that occur in the part of the brain that immediately affects the mind, just that sensation follows from it, nothing better can be devised in this matter than if that sensation should follow, or, if that could follow, conduces best and most often to the conservation of the health of man. (Med. 6, AT 7:87)

For 'conservation of health,' read 'continuation of conditions under which union is naturally possible.' How will a sensation (taken in the broad sense to include passions) conduct to the conservation of health? By leading to some sort of action: eating what is nutritious, refusing what is harmful, sitting in green glens, and the like.18

Thus it is not modes of thought taken one by one whose relation to the body is instituted by God to be the best suited to conserving health. It is the whole complex consisting of brain movements (undertood in relation to their typical causes), sensations and passions, and the inclinations of the will resulting from those passions. In that sense only something very much like the whole body, empirically and dispositionally one, can rightly be said to be the object of God's intention.

It follows that in the human body, there is a kind of hierarchy among the various kinds of unity I have described. Physical unity, especially of the lax sort, is necessary in certain instances for dispositional unity, which in turn is necessary if the functions of the union—the operations by which it conserves itself—are to occur reliably; and those functions themselves are defined only in relation to the divine institution of the union. Nevertheless, the only real, the only metaphysical reason to call the body _one thing_ is that God has willed that this collection of parts of matter should be our instrument.

---

18 "La verveur d'un bois". To Élisabeth, May or Jun 1645, AT 4:120. According to _L'Homme_, green is the most moderate of colors.

Conclusion

Throughout his natural philosophy Descartes was too ambitious by half. Consider what was needed finally to understand the inheritance of characters. You would have to include organic chemistry, the cell theory, the discovery of mitosis, the identification of genes, the analysis of DNA and of the mechanism of replication—each of them a major achievement.1 A single lifetime, a single mind, even Descartes', were certainly not sufficient to complete the science of life. Not only did Descartes not manage to complete the science of life: in respect to particulars, he failed even to begin it. Within fifty years of his death, most if not all the mechanisms proposed by him were rejected outright, as were the feu sans lumière in the heart, the role of the pineal gland in sensation and memory, and most of his embryology, or substantially modified.

1. The Question of Emergence

Nevertheless Cartesian physiology carried the day on one point. The vegetative soul was dismissed. That may seem now like a minor affair, much less noteworthy than the elimination of the sensitive soul. But when the human soul ceased to have, in common with every living thing, a vegetative part, when it ceased to play any role in generation, a link between the intellect and the life of the organism was broken. It is true that Descartes adduces the

---

1 These are only some of the milestones in biology itself. From other fields one would have to add, for example, crystallography and the analysis of crystalline structures by X-rays to the list, since the techniques of that analysis were essential to the discovery of the double helix. Descartes foresaw (his contemporary Mersenne was more forward-looking, at least in practice) neither the conceptual nor the social revolutions that had to occur to make an understanding of inheritance possible.