THE CARTESIAN DEFORMATION OF THE STRUCTURE OF CHANGE AND ITS INFLUENCE ON MODERN THOUGHT

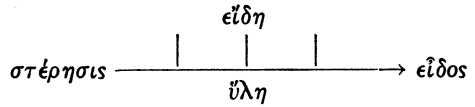
IT IS commonly held that time and change are in some sense problematic for us. This paper is an attempt to arrive at an understanding of why this is so. It falls into three divisions: (I), the classic description of the phenomena of change (Aristotle); (II), Descartes' view of change; (III), the influence of Descartes on the modern conception of change. Throughout the paper, change is taken to be a 'philosophic fact' perceived in every area of existence open to us. Limits of space demand conciseness of treatment. We must restrict ourselves, therefore, to the basic phenomenon, without attempting to work out subordinate detail. Many border problems must be left untouched. In spite of such limitations I believe that a critical review of the major outlines of the traditional theories of change, if adequately performed, has much to contribute to contemporary philosophical issues. The present paper is written in the hope of calling forth more intensive and elaborate studies of this basic problem so widely and inarticulately emphasized, but so seldom treated with any careful attention to what has been done in the past.

I. *Aristotle and the Classic Description of Change*

(1) *The General Structure of Change.* Change in the broad sense, or mutation, is a universal fact. The stone falls, the river flows, the brick is heated by the sun, the soil is moistened by the rain, the acorn grows into an oak, timber and stone are built into a house by the architect and his assistants, color is perceived by the eye of the animal, and the student is led by his teacher to know a theorem which he did not know before. These are instances of change or transformation (μεταβολή). What is the basic structure common to them all? In accordance with the principle that it is wise to proceed from what is better known to us (γνωριμώτερον ἡμῖν),[1] though perhaps less intelligible by nature (ἧττον γνώριμον φύσει), let us start with technical transformation, where all the factors are under control.

[1] *Phys.* 184a 16; cf. *Meta.* 1029b 4.

The rough lumber in the carpenter's shed, for example, is made *into* a chair. As lumber, it is actually neither box, stool, bed-frame, table, nor formed utensil, though it is the "stuff" (ὕλη) out of which any of these *might* be made. It is potentially all of these, actually none. In becoming a chair, one of these



potentialities is actualized, and others eliminated. The timber in its "rough" state (στέρησις) is prepared and smoothed, sawed into certain lengths, fitted and nailed together, painted and polished. After passing through these several discernible phases (εἴδη), which are left behind, the wood becomes a chair, that is, something (τόδε τι), here before me (τόδε) of *some* sort (τι)—namely, with back, and legs, and seat for one person. The wood, or matter, *endures* throughout the change. This is one aspect of the structure. In the change, however, a certain phase (the "rough" state) is eliminated or left behind, and displaced finally by the form (εἶδος). The whole (τὸ σύνθετον) neither remains the same, nor is it displaced, but rather changes or moves from the "rough" state into the formed or finished chair.

All change is of an underlying matter (ὕλη) which is transformed. Each *thing* we can identify is not only the matter out of which, but the order or structure to which it is transformed. Aristotle presents an account of this general structure of mutation (πᾶσα γένεσις) in the *Physics*, Bk. I, Ch. VII.[2] For example, mud is not only soil, capable of being moist or dry, frozen stiff or melted, but *moist* soil, existing in a certain form to which it has been brought by rain and dew. The river is not only the continental water-shed, capable of being moulded this way or that, but already brought *to* a certain stable structure of main valley and sub-valleys by atmospheric action. The oak tree is now in a phase to which it has been brought out of its seed. The eye, capable of perceiving the normal range of the spectrum, is now perceiving green. The understanding, capable of knowing this or that, is now learning this particular theorem. All change is

[2] Cf. also *Meta.* Z, Ch. 7.

from matter, which is relatively vague and potential, to form (*μορφή*), which is relatively definite and actual. Thus form also, in addition to matter, is an *intrinsic* cause of transformation (*αἴτιον ἐνυπάρχον*).[3]

But things do not change of themselves. The wood does not turn *itself* into a chair. It must be transformed *by* the carpenter. In addition to the intrinsic causes, the matter "out of which" (*ἔκ τινος*), and the form "into which" (*τι*), we must, therefore, add the extrinsic cause *by* which (*ὑπό τινος*).[4] In the case of the chair it is clear that this extrinsic cause has two aspects. There are, first, the motions made by the carpenter in planing, sawing, nailing the wood, and caring for its preservation once it is made. These motions precede the various phases of the wood-becoming-chair. They determine the process of becoming, and maintain the form once it has become. They make up the determining cause (*ὅθεν ἡ κίνησις*). But this cause must itself be determined. It must *tend* to the production of a *chair*, *not* a table or a bed. Otherwise it could not realize its end. This end exists in the understanding of the carpenter as the final cause (*τίνος ἕνεκα*).

Our knowledge of nature is so inadequate that we can do little more than discern a small part of the causal structure in this or that process. Nevertheless the general structure of natural process may be seen to be the same. The stone, for example, is heated by the sun. It *can* be heated or cooled, and holds itself

open to all these phases, though it can realize only one of them at a time. *Now* it is cool. Through the action of the sun it is brought into the phase of "hot" (*μορφή*). The privative phase (*στέρησις*) is eliminated or displaced; as in the case of the chair, it passes away. It is a ground of the *becoming*, not of the *being*

[3] *Meta.* 1070b 22, 1013a 19.
[4] *Meta.* 1032a 13.

of the hot stone. It is annihilated by its opposite (ἐναντίον). The hot stone *which* becomes is first, matter (ὕλη), second, form (μορφή), brought about by, third, the efficient action of the sun directed by, fourth, further causes involving the cosmic order as a whole (φύσις). The structure is the same, though far less well known to us.

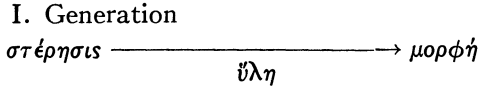
Something in nature, open to a whole range of phases (γένος), but existing in only one, is brought to another phase, which it *was* not before. This first, privative phase is displaced by the form; the matter or substratum (ὑποκείμενον) remains. The whole thing (τὸ σύνθετον) becomes—the hot rock changes. Furthermore, the natural change is brought about by an extrinsic cause which acts or tends in a determinate manner, towards something (τέλος) to produce a final result (ἔργον). The soil is moistened by the rain, the valley worn down by the decomposing action of the atmosphere, the acorn developed by the intrinsic, organizing power of the plant in connection with environing agencies of soil, atmosphere and sun. The eye is brought to perceive green *by* the actual green color on the leaf, and so on. The brick is heated *by* the sun, cooled again *by* the evening breezes.

In things made by art it is possible to identify the matter out of which, the form to which, the efficient action *by* which, and the end determining this tendency. In natural processes our knowledge is far less adequate. We perceive regular effects and gain a dim sense of the operating agency here or there. The brick is cooled by the ocean breeze, which is due to the cooler, heavier air flowing in from the sea, which is governed by the motions of the earth and the heavenly bodies in concatenation. For the most part, our knowledge of natural processes goes little further than this. Where we can artificially reproduce certain conditions, we gain a quantitatively more exact knowledge of certain measurable aspects of nature. Here and there, little areas of causal action are illumined. But we cannot penetrate very far into the sources of actual motions without simply referring to astronomical or physical constellations as they are—the φύσις of the ancients. That they act in regular ways upon myriads of secondary agents, acting in their turn upon myriads of further subordinate agents, is witnessed by our use of such terms as acci-

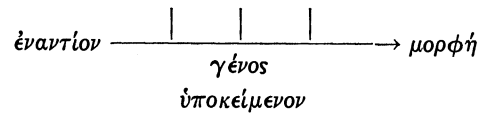
dent and chance to refer privatively to unexplained, or perhaps inexplicable deviations from the general, causal order which prevails for the most part (*ἐπὶ τὸ ποπύ*). Beyond the fact that every change in a certain matter is transformation *by* action tending toward something determinate, we cannot go.

(*2*) *The Kinds of Change.* So far we have concerned ourselves with the structure of change in general (*κίνησις*). We have said nothing of the different *kinds* of change. One such distinction is of peculiar importance. It has become deeply engrained in our common understanding of the world, and in the structure of our ordinary speech. One type of change involves the emergence of a "thing" or "substance" not there before. Thus the chair is made "out of" wood, and the animal is generated by the parent forms. This emergence of a "new" substance was termed *γένεσις*, or generation, by Aristotle. In our own language we refer to it by such phrases as "the wood was *turned into* a chair," or "made *out of* wood"[5]. We distinguish such change from that apparently *less*

I. Generation



II. Alteration



radical type in which a substance, already existing, is merely altered or modified. Thus we do not say the cool stone was turned *into*, or *out of* a hot stone, but simply "the stone became hot", recognizing the persistence of a single substance *underlying* the change. Of course even generation is out of a matter which persists or underlies. But we neither say that "the wood became a chair", nor that "the man became *from* or *out of* the youth". In the former case, we indicate that a *new* substantial form has been imposed *on* the matter out of which. In the latter case, we indicate, on the contrary, that a single substance (not merely matter) has persisted *under* an alteration. Thus what we call thing or substance is a specific route of change, remaining

[5] Cf. Aristotle, *Phys.* Bk. I, Ch. 7.

what it is in spite of contrary oscillations.[6] The disturbance of such an underlying route, with the dissolution of substance into matter, or the origination of new substance is *becoming* proper: the passing away (*φθορά*) of the one; the generation (*γένεσις*) of the other.

Change in general (*μεταβολή*) is either the emergence of something (*τόδε τι*), out of matter, or mere alteration of what is already there. Two general classes of things are to be distinguished: (a), those generated by nature (*τὰ φυσικά*), and (b), those generated by art (*τὰ κατὰ τέχνην*). Of these, the former, through their greater stability and independence, are regarded as substances in a stricter sense.[7] This is because substance is what can preserve its specific nature throughout change. Hence natural things or substances are classified according to the types of change peculiar to them.[8] The more changes a "thing" can endure without changing the higher it is in rank. Among natural substances the following are distinguished: (1), physical things proper, which sustain only locomotion (*φορά*); (2), physico-chemical things such as the elements and their compounds, which sustain locomotion and alteration (*ἀλλοίωσις*); (3) plants or growing things which endure locomotion, alteration, and growth (*αὔξησις*); (4), animals which endure locomotion, alteration, growth and activation (*ἐνέργεια*) in the form of perception; and finally man, who endures not only all the above types of change but insight (*νοῦς*) as well. Only the simpler natural substances (1 and 2) can be generated or destroyed by human art. For the most part we can only observe and measure certain changes to which they are subject, and correlate them with certain measurable aspects of their causes. The further subdivision of these changes lies beyond the scope of this paper. We must be content with the major types described by Aristotle: (1), locomotion or change of place (*κατὰ τὸ ποῦ*),[9] sometimes called *κίνησις*; (2), qualitative change —hot-cold, white-dark, etc. (*κατὰ τὸ ποιόν*); (3), growth and decline (*αὔξησις-φθίσις*); (4) activation (*ἐνέργεια*). Of these, only the last requires special comment.

[6] *Categ.* 5, 4a 11; cf. 3b 24.
[7] *Meta.* 1043b 21.
[8] *κινήσεως καὶ μεταβολῆς ἐστὶν εἴδη τοσαῦτα ὅσα τοῦ ὄντος*, *Phys.*, 201a 8. *τοσαῦτα ὅσα τοῦ ὄντος*, *Phys.* 201a 8.
[9] *Phys.* 192b 14.

In physical change (κίνησις), as we have noted, one phase (εἶδος) displaces another (ἀντικείμενον) which is eliminated or left behind. The body, now at *b*, is no longer at *a*; the leaf, now brown, is no longer green. Certain types of change (ἐνέργεια), however, do not thus proceed from one phase to another. The form does not displace its *opposite*, but rather fills a place already thoroughly prepared and waiting. Thus the earlier phases of the growth of a plant are not simply annihilated as the form is realized. The preceding phase endures through the next as its substrate (ὑποκείμενον). Thus the growing organism is no mere composite (σύνθετον) of substance and accidents. The plant is not something in which growth takes place. But the plant itself grows. It *is* its growth, each stage being substance for the next. The flower does not displace the bud. It *is* the bud, realized and perfected. Such realization, without the elimination of antecedent phases which occurs in physical change, Aristotle termed activation (ἐνέργεια). It constitutes the basic distinction between the inorganic and organic realms, its major types subdividing animals from plants, and man from the other animals.

To pursue these subdivisions in further detail is beyond our present purpose. We must merely note that in perception, which is peculiar to animals, there is the same maintenance of a balanced structure throughout the process, characteristic of all activation. It is true that we see now this, now that, but the function is "all there", being exercised as a whole or not at all. Hence, as Aristotle says, to see and to have seen are all one.[10] To see is thus not to move on (κίνησις) toward a further end. The action constitutes its own end.[11] It does not achieve a product external to itself, as the house built by the builder, but it is its own work (ἔργον). The work achieved by seeing (ὅρασις) is simply to see. Hence such a function does not realize anything other than the thing itself, as the action of the potter is *in* the vase. The actual seeing, on the other hand, is *in* that which sees, the understanding *in* that which understands.

There are, therefore, *two types* of activation *in general* (ἐνέργεια

[10] ὁρᾷ ἅμα καὶ ἑώρακε *Meta.* 1048b 23.
[11] *Meta.* 1048b 22.

ἐπὶ πλέον); one, *pure* activation (ἐνέργεια) bears its end and substrate within itself; the other, *mobile* activation (ἐνέργεια κατὰ κίνησιν), is moved towards an external end by some external cause. Wherever there is *pure* activation, there is a certain degree of autonomy or self-dependence. Thus no external power can *make* the plant mature and ripen save the plant itself. No external agency can make a man perceive or see. As we say, he must see for himself. Nevertheless, both these forms of activation are *conditioned* by processes beyond the direct control of the organism. The plant cannot grow *without* the co-operation of various agencies at work in the soil and atmosphere. The eye cannot see *without* the stimulation of the retina by light proceeding from the colored object. Such activation is thus partially conditioned and realized *out of* motion.

There is one type of activation, however, understanding (νοῦς), which is wholly non-kinetic or non-physical in character. This faculty has to be prepared in the *process* of learning by all sorts of motions and alterations,[12] but when it is so prepared and actually exercised, it is independent of all extraneous influence, realizing itself in itself and through itself alone, being its own substance, its own efficient cause, nature and end. Far from requiring any external condition for its exercise, as perception, any such alien influence acts on the understanding as prejudice, and deforms or corrupts it. Understanding cannot be brought about *in* anything other than the understanding itself (being its own ὑποκείμενον). Its nature and end are simply to realize and perfect itself.[13] They do not lie beyond. In spite of the fact that we never find it fully perfected, understanding constitutes the purest form of activation (ἐνέργεια) which is directly known to us.

(3) *The Major Principles of Change:*

(a) *Each thing is moved by another thing in one single motion.*

Several important conclusions follow from this description of the basic phenomena of change. First of all, motion (κίνησις) is always between *two* separate substances. Nothing *moves* itself, though it may be self-*activating*. This is perhaps the most important respect in which Aristotle improved upon Plato's many

[12] *De An.* 417a 30.
[13] *De An.* 417b 7: εἰς αὐτὸ γὰρ ἡ ἐπίδοσις καὶ εἰς ἐντελέχειαν.

suggestive descriptions of motion and generation.[14] Motion is always the action of an agent (κινοῦν) upon a patient (κινούμενον). The agent by itself is able to act (κινητικόν); the patient by itself is able to suffer (κινητόν). Thus the ball in motion is *able* to move the ball at rest, and the ball at rest is *able* to be moved. As potencies, agent and patient are two separate entities. But the actualization of these potencies is *one single motion—viz.*, the motion of the ball previously at rest by the *other* ball already in motion. The sun, which is able to heat, is one thing, the brick, which is able to be heated, another. But the actual heating of the brick by the sun is one single change, *not two*, as we are so apt to suppose in speaking of cause and effect. Cause and effect are two in *potency*, one in act: this is the first important principle of change. It is *one* motion which can be read in two ways, as the line a——b is one, though it can be read in two ways, either ab or ba.[15]

(b) *The single motion so caused is in the patient.*

Furthermore, this change is *in* the patient, *not* the agent (ἐστὶν ἡ κίνησις ἐν τῷ κινητῷ).[16] The motion of the one ball by the other is *in* the ball which is moved. The heating of the brick *by* the sun is *in* the brick, not the sun. Indeed, we can see that this must be the case, since otherwise, if the agent itself moved *as* agent, it would be moving not another thing but itself, which is strictly impossible. Of course the agent may happen to move in another connection, but this is accidental or irrelevant to its own active agency. *As* active, it moves not itself but *another*. As cause, it reaches out beyond itself, effecting itself in another which is affected by it. Both cause and effect are one single motion or change *in* what is effected. The action of the builders is in the house being built. The action of the teacher on the student is *in* the student (*i.e.*, his learning). The teacher remains fundamentally unchanged throughout the process. The power to move and the moving power are the same, but the ability to be moved, when actualized, is *change*, or motion *in* what is moved. This is the second important principle of change.

[14] Cf. *Theaet.* 153–158, 181c–183; *Rep.* V, 478e–480; *Phaedrus* 245c–246; *Laws* 893–900.
[15] *Phys.* 202b 10 ff.
[16] *Phys.* 202a 13.

(c) *This single motion embodies a two-fold order, causal and genetic.*

There is one motion in the patient, but it may be read in two different ways, as we have seen. This one motion is (1), the "being acted on" of the patient, and (2), the "acting upon" by the agent. As Aristotle puts it "the being" is distinct.[17] The single motion, one in number, *is both* the passion or effect in the patient, and the action or cause by the agent. There are, therefore, two orders of motion,[18] the genetic order (ἀριθμῷ),[19] in which each substance may be traced *back* to the individual matter out of which it emerged, and the causal order (τῷ εἴδει),[20] in which it may be traced *ahead* to its active sources. This is the third essential principle of change. For instance, my acts may have the following genetic history: I put on my hat, go out the door, move three blocks to the right, enter a house, confer with a doctor, subject myself to a certain treatment, regain my health. Causally, however, it must be read in the reverse order: the good which I desire requires health, health requires a certain treatment in my case, this treatment requires a doctor at once, the doctor lives in a certain house, this house is three blocks to the right, this requires going out, and going out requires a hat. These are not two acts, but one act carrying two orders within it, the genetic motions, and their causal structure. Each motion, though one in number is, therefore, dual in structure. Genetically the egg is first, and *then* the hen. Causally, the hen is first, and then the egg. But the life and growth of the chicken is one. Which is *really* before the other? Which order is prior? Which is first, matter or form?

(d) *The causal order is prior to the genetic order.*

Aristotle answers this question in Book θ, Ch. 8, of the *Metaphysics* in a well-known passage. Activation (ἐνέργεια) is prior to potency (δύναμις) in understanding (λόγῳ),in time (χρόνῳ), and

[17] τὸ εἶναι: *Phys.* 202b 9.

[18] *De Part. An.* 646a 35: τῷ μὲν οὖν χρόνῳ προτέραν τὴν ὕλην ἀναγκαῖον εἶναι καὶ τὴν γένεσιν, τῷ λόγῳ δὲ τὴν οὐσίαν καὶ τὴν ἑκάστου μορφήν.

Here "time" means the genetic order as it is perceptually apprehended, not time as it actually is. Thus when speaking of time in *this latter sense* Aristotle sometimes says that the actual is prior to the potential even in time. Cf. 1049b 11, and 431a 2.

[19] *Meta.* 1049b 19.

[20] *Meta.* 1049b 18.

in substance (*οὐσίᾳ*). This is the fourth principle of change. It is prior in understanding, since the capacity is a capacity *to actualize*. Thus the ability *to* build can be understood only from a prior understanding of building *in act*. We recognize a capacity only in the light of that actualizing for which it is only the potency. With respect to time it is true that if we regard *only the individual motion*, the seed comes before the mature plant, and the ability before the actual exercise of a function. But the motion did not actualize itself. There were other individuals, already *in act* and similar in form (not in number), which pre-existed in time. Thus the seed was brought forth by a mature plant already grown. An "ability" is developed by actual exercise either of the same function or others by whose action it is initiated, as tennis may "bring out" a quickness of sight. Man is generated from man, and the cultivated from the cultivated.

Form of any sort can be actualized only by some pre-existing form. The real substance is not the "first" potential phases but the fulfillment, which is what the thing really *is*. We do not think for the sake of the capacity to think, but we have the capacity in order to think. Substance lies in the act itself, or the work that is done, *rather than* in a preliminary phase. In general, act is more substantial and hence prior to potency. The less potency a thing has in its nature, the more substantial it will be. In this causal order, "one activation precedes another until the first mover is reached".[21] In the genetic order, on the other hand, the "final" act is numerically later. The very same process can be read *from behind*, as an evolution from what was materially previous, or, depending on our knowledge, *from ahead*, as the efficacy of a devolving act, formally previous. This latter reading, though harder to *know*, is truer to the nature of things, for, in the order of *being*, actuality is prior to potency.

(*4*) *The Basic Structure of Motion*. We are now at last in a position to understand the nature of change (*μεταβολή*). It is *in* the patient as something suffered passively. Is it then a mere "effect"? We speak of the stone as "being heated", it is true. But we also speak naturally of the stone as "becoming warm", or "growing warm", as though this were a "doing" or "realizing"

[21] *Meta.* 1050b 4.

on the part of the stone. The "confusion" of the passive with the active in ordinary speech is a noteworthy phenomenon. Thus "to suffer" is itself an active verbal form. Is this really a confusion? It all depends on how we interpret.

The stone becomes warm. It is in a certain phase. The phase-content comes from the sun, but this phase also belongs to the range of phases to which the stone is by its nature *open*. Something of a different nature, say a man, would not be open to such a phase. As we say, he becomes warm in a *different way*. The warming of the stone is thus a fulfilment, or realizing in the wide sense (ἐνέργεια ἐπὶ πλέον), of something inherent in the stone. But the fulfillment is never complete. Motion is imperfect actualization (ἐνέργεια ἀτελής).[22] The stone is always open to further phases. When warm it *can* become cool; when cool it *can* become warm again. Even though "held" in the phase of warmth, it is being eaten into by potency, and still "on its way to" what lies beyond. Motion (κίνησις) is thus realization (ἐνέργεια), but of a certain special type (κατὰ κίνησιν).[23] What is realized is not the pure form as such, but the material potency *of* the form. Hence the famous Aristotelian definition: Motion is the realization of potency *as such* (ἡ τοῦ δυνάμει ὄντος ἐντελέχεια ᾗ τοιοῦτον κίνησίς ἐστιν).[24] The realization of what is *not* potential, but really actual, is pure activation (ἐνέργεια).

II. *Descartes' View of Change*

(1) *The Structural Deformation of Change.* As Aristotle had pointed out, the mathematician regards things apart from motion.[25] Hence it is not surprising that the application of mathematical method to nature should really deprive it of motion. Descartes found Aristotle's definition of motion as "the actualization of the potential as such", hopelessly unintelligible[26] and even contradictory.[27] A thing must be either the distinct actual

[22] *Phys.* 201b 31 f.; cf. *Meta.* 1048 b 29.
[23] *Meta.* θ, 1046a 2. [24] *Phys.* 201a 10. [25] *Phys.* 193b 34.
[26] Descartes, *Oeuvres*, Adam and Tannery, IV, 426, 16–20. . . . at vero nonne videntur illi verba magica, proferre, quae vim habeant occultam & supra captum humani ingenii, qui dicunt *motum*, rem unicuique notissimam, *esse actum entis in potentia, prout est in potentia?* Quis enim intelligit haec verba? Quis ignorat quid sit motus? & quis non fateatur illos nodum in scirpo quaesivisse? Cf. II, 597, 26; XI, 39, 4–13.
[27] IV, 697, 26. Quantum ad definitionem motus, liquet eam rem, quae dicitur esse in potentia, intelligi non esse in actu; adeo ut, cum quis dicit *motum esse*

thing that it is, or nothing. The method of clear and distinct ideas at once rules out all potency and vagueness from the world, and, as a consequence, the lot accorded to motion is no less drastic, though partly concealed by the continued employment of the term.

Motion for Descartes is not the emergence from potency to act, but a *state*. It does not have the structure of from-to, but is a fixed mode or quality, like figure[28] which is either present or not present.[29] Motion, of course, can be thus regarded as a "mode" or quality[30] of a body *after* it has happened. But then it is no longer moving, or going on, and hence not motion at all. To conceive of motion in this way as a "state" is really to misconceive it, and all the unfortunate features of Descartes' theory may be traced back to his youthful inability to understand the Aristotelian descriptions of potency, as mediated by the late scholastics with whom he was familiar.[31] Whatever *is*, is already what it is, and "potential being" is, "properly speaking, nothing".[32]

Descartes continued to use the traditional language of the four causes. He speaks of the material cause,[33] the formal cause,[34] the efficient cause,[35] and does not even *openly* deny the final cause, though he claims that physical motion is explicable without recourse to what lies beyond our ken, and hence rejects

actum entis in potentia, intelligatur motum esse actum entis, quod non est in actu, quatenus non est in actu; quod aut apparentem contradictionem, aut saltem multum obscuritatis includit.

[28] Itemque diversos modos extensionis sive ad extensionem pertinentes, ut figuras omnes, & situs partium, & ipsarum motus, optime percipemus, si tantum ut modos rerum quibus insunt spectemus. VIII, 32.

[29] Et hoc corpus alio modo se habere, cum transfertur, & alio cum non transfertur sive cum quiescit: adeo ut motus & quies nihil aliud in eo sint, quam duo diversi modi.

[30] *Principiorum Philosophiae*, Pars Prima LVI, VIII, 26, Et quidem hic per modos plane idem intelligimus, quod alibi per attributa, vel *qualitates*.

[31] Cf. Gilson, *Index Scholastico-Cartesien*, especially pp. 187–97.

[32] Cf. VII, 47, 20–21.

[33] Cf. VII, 366, 1–9, where, as a result of his rejection of "potency", he denies that there is *any* perfection of form in the material cause. "Nunquam enim perfectio formae in causa materiali, sed in sola efficiente, praeexistere potest intelligi." This is, of course, equivalent to a denial of matter in the Aristotelian sense, though the *word* is still employed.

[34] VII, 242, 15–22.

[35] For Descartes, the efficient cause becomes the total cause of the thing, really combining into one the Aristotelian material and efficient cause. Thus he says, III, 274, "Il est certain qu'il n'y a rien dans l'effet *quod non contineatur, formaliter vel eminenter, in causa efficiente* & TOTALI . . . " For Descartes, the

any appeal to final causes within this sphere.[36] This clinging to the traditional vocabulary often conceals the fundamental deformations introduced by this "static" view of motion. The Cartesian "moved body" bears some resemblance to the material cause, but this "body" is already essentially what it is before being impelled. Motion is only accidental to "it". Hence geometrical *form* is the ultimate "out of which", and really replaces the material cause. The "impelling body" seems analogous to the efficient cause, but, since it lacks a final cause actually determining it, Descartes views it as "coming from behind".

While temporal priority is not *necessary* to the cause, as he says in his reply to the fourth set of objections, nevertheless the ordinary effects observed by us are not cotemporal with their causes (as is really true of God alone), but follow *after* them in time.[37] This fatal suggestion is closely connected with the elimination of the final cause which *now* determines the efficient cause *to* its effect, for, if the efficient cause is not *now* so determined, it must be assumed that it *was* determined in the past by another efficient cause working from behind. But how can a thing exert causal efficacy when it is no longer there? Descartes was aware of this difficulty[38] but he never extricated himself from it. Thus he often leans toward occasionalism which eliminates all secondary causal efficacy.[39] The radically non-Aristotelian doctrine of an efficient cause working *from* behind was later crystallized by Descartes' followers into one of the major dogmas of "empiricism". Thus Locke assumes that "effects" are "things thus made to exist, which were not there before",[40] and according to Berkeley, "the physicist looks upon the series or successions of sensible things regarding what precedes as cause, what follows as effect".[41] This blunder, originating with the denial of final causes, could have no other conclusion than the scepticism of Hume,

only intrinsic cause is the form; the only extrinsic cause, the efficient. Material cause and final cause are thus ignored.

[36] *Principiorum Philosophiae*, Pars Tertia, arts I–III: VIII, 80–81.

[37] VII, 240, 6–8. Cf. p. 108, 10.

[38] Nam contra non proprie habet rationem causae, nisi quandiu producit effectum, nec proinde illo est prior. VII, 108, 14–18.

[39] As in III, 428, 5–22, where he says: nec video cur non eadem jure dici possit, nullas *iam* actiones esse in mundo, sed omnia quae fiunt esse passiones actionum, quae in prima mundi origine fuerunt.

[40] *Essay* II, Ch. xxvi, fr. p. 435. [41] *De Motu*, Sec. 71.

whose destructive polemic it so clearly underlies.[42] How, indeed, can what is no longer existent "influence" that which is? The "four causes" make up one single structure. To deny final causation, as we see so clearly in Hume, is really to deny all causation. While this consequence is largely concealed in Descartes himself, by his deceptive tendency to use traditional terminology, it becomes evident if we consider his famous treatment of motion in the *Principles*, Part II.

(2) *The Reduction of the Kinds of Change to Locomotion.* With matter or potency ruled out of the physical world, material substance, instead of being regarded as a compound (σύνολον) of matter and form, is identified with extension, really an attribute. Hence it is no longer possible to distinguish the generation of one thing "out of" another, from the various kinds of motion.[43] Furthermore, with the final cause eliminated, it is no longer possible to distinguish between the various types of efficient causation (φορά, ἀλλοίωσις, αὔξησις, ἐνέργεια). All of these reduce simply to impulsion "from behind". One body may move against another, which is *then* moved against another, and so on. There is no change other than locomotion (φορά).[44] Qualitative change (ἀλλοίωσις) is banished from nature, and removed to "mind", thus preparing the way for the subjectivizing of nature itself by those like Berkeley who saw at least that *where* the qualitative change took place, there also the locomotion must occur.[45] Growth is viewed as mere accretion, in spite of Aristotle's observation that the latter has no limit, whereas growing things pass through the phases of growth (αὔξησιν),[46] acme (ἀκμήν) when the limit is reached, and decline (φθίσιν).

The failure to distinguish action (ἐνέργεια) from the other kinds of motion (κίνησις) led to serious difficulties recognized by Descartes himself. An understanding of these may lead us to see why such care was taken by Aristotle to establish this crucial

[42] In the *Treatise*, Bk. I, Sec. ii, Selby-Bigge, p. 76, Hume mentions two relations as "essential to causes and effects". One is "continguity", the other "that of *priority* of time in the cause before the effect". His whole polemic thus simply passes by the classic doctrine of cause.

[43] XI, 39, 23 ff.

[44] Motus autem scilicet localis, neque enim ullus alius sub cogitationem meam cadit; nec ideo ullum alium in rerum natura fingendum puto. VIII, 53, 7–9. Cf. VIII, 32, 7; 33, 28–30.

[45] *Princ.* Sec. 10.

[46] *De An* 434a 24; cf. 432b 25.

distinction.[47] The active power of one thing to act on another, must be distinguished from the passive power to be acted on. Failing to recognize the existence of potency in general, Descartes, of course, fails to focus this distinction, though it hovers over much of his discussion, involved as it is in his primary distinction between the body which is impelled and that which impels.[48] Descartes, nevertheless, has to confess that he is unable to see "how action and passion are distinguished one from the other".[49] Having really eliminated causation from reality, the distinction between cause and effect becomes purely an arbitrary one. What is before us is a single motion, which can be referred to either as active or passive.[50] How can *one* motion be *both* action and passion? Nevertheless, such is the case, and Descartes now views it one way, now the other, but usually chooses to regard the motion as a mere passive "effect". In one range of phenomena this decision led him to radically "novel" results. Vital forms are distinguished from non-living forms in possessing an efficient cause of motion within themselves.[51] But for Descartes there is no such thing as animal motion (ἐνέργεια), distinct from motion externally caused (κίνησις). Animal motion is thus reduced to locomotion (φορά),[52] and recognized as the passive effect of an external agent. Hence animals are reduced to machines.

But it is equally possible, on this basis, to reduce machines to animals, as many of Descartes' modern followers have chosen to do.[53] The distinction between active and passive is purely arbitrary. Hence we may say with equal plausibility either that animals are machines moved by mechanical impulsions, *or* that machines are really animals *moving* themselves. From one point of view any motion moves itself. Hence Descartes sees no diffi-

[47] *Meta.*, θ, Ch. 6; cf. *De An.* 431a 6–7.
[48] VIII, 54, 3–9.
[49] . . . quomodo actio et passio ab invicem distinguantur. III, 428.
[50] Semper enim existimavi unam et eandem rem esse, quae cum refertur ad terminum *a quo*, vocatur actio, quae, cum refertur ad terminum ad quem sive *in quo* recipitur, vocatur passio: adeo ut plane repugnet, vel per minimum temporis momentum, passionem esse sine actione. III, 428.
[51] *De An.* 415b 22 ff.
[52] Qui motum cordis aiunt esse animalem, non plus dicunt quam si faterentur se nescire causam motus cordis quia nescient quid sit motus animalis. III, 455.
[53] Cf. the revival of panpsychism in Whitehead, Hartshorne, etc.

culty in regarding certain machines as spontaneously moving.[54] Physical things *move* just as well as animals. Hence as long as we ignore the causal structure of the motion, it is possible to regard atoms, machines, etc., as self-moving animals. The whole basis for distinguishing life from the inorganic is lost. So we may become either mechanists or panpsychists as we please.

Of course, this idea of a thing *moving* itself runs counter to the Aristotelian principle that "nothing moves itself",[55] later known as the principle of sufficient reason. The animal does not *move* itself. But it may *act* of itself on certain mobile parts, and thus originate motion within itself. But ignoring the difference between motion and action, Descartes is forced to question the dictum that no body moves itself. All bodies may be regarded as passive, *or* as moving themselves, for *once* moving (and a body is either moving or not moving—there being no potential condition *between*), it is moving itself. Thus "there is reason to say that one has fallen into great error in admitting as a principle that no body moves itself. For it is certain from this alone, that a body *has commenced*,[56] it has in itself the force to continue to move itself . . . ".[57] Thus it is necessary to say that "in a certain sense" (quodammodo)" even God causes himself, though Descartes admits that strictly speaking this is a contradiction, which of course it is, as much in the case of a body as in the case of God, for how can something be before itself, or be other than it is? Nothing reveals more clearly the confusion into which Descartes was led by his tendency to regard motion as a finished *state* or quality already there, rather than as the emergence *from* potency to *act*. This tendency led him not only to deny the principle of sufficient reason, but the other basic principles of motion laid down by Aristotle.

(3) *The Deformation of the Major Principles*. We have seen that according to Aristotle there are four supreme laws or principles of motion: (a) *each thing is moved by another thing in one single motion;* (b) *the motion produced by an extraneous cause is one single motion in the patient;* (c) *this motion displays*

[54] Sed ut sponte moveri est genus respectu machinarum omnium quae sponte moventur ad exclusionem aliarium quae sponte non moventur. III, 566.
[55] *Phys.* 258a 2 ff. [56] Note tense—my italics. [57] III, 213, 1.

a double order, (1) *the genetic order from passive potency to act*, (2) *the causal order from active power to act;* (d) *motion itself is the emergence of a patient from potency to act by an agent already in existence, or prior in act.* Each of these is denied by the Cartesian theory.

(a) *Denial of causal efficacy* (*sufficient reason*). There are many passages in which Descartes denies causal efficacy, or the action of one thing upon another. We must be content to take only one such passage from the *Principles of Philosophy*,[58] where motion is *defined* as "the translation" (translatio) of a body from one vicinity to another. In commenting on this famous definition, Descartes says: "translation is not the force or action which transfers"; that is, it is not the action of an external cause already in existence and moving. But "the translation is always in the mobile (or moved) thing, not in the moving thing". In other words, Descartes destroys the distinction between agent and patient in the Aristotelian sense. What is there is one moved thing (mobile), which, so far as it is now moving, is *both* moved and mover. There is no external mover *now* in existence, moving it. No wonder that Descartes elsewhere denies, in so many words, the principle "that no body moves itself".[59] Each body, as moving, both is moved, and moves itself. In so far as this motion is not self-originating, it can come not from another body already in act, but from some body *in the past.*

(b) *The motion is one, and in the patient.* Since the whole Aristotelian distinction of agent and patient is eliminated, it is no longer true to say that the motion is *in* the patient. Indeed motion does not *essentially* belong *in* anything, but is regarded as only a "*mode*", as "figure is a mode of the figured thing or rest of the resting thing". The thing remains essentially what it is, whether in motion or not. Thus *the same* motion can be passed on from one body to another without ever *belonging* to anything.

(c) *Genetic versus causal order.* Since the motion *now* occurring is not being moved by something else *now* existing, it is no longer possible to say, with Aristotle, that "the action is not the same as the passion, but that to which they belong, the motion,

[58] *Pars Sec.*, XXV, 54, 3–5. [59] *Phys.* III, 213, 1.

is the same".[60] It is no longer possible to read the single motion in *two* ways, either causally, or genetically. The causal order, in so far as it is recognized, must be identified with the genetic order. Thus in spite of his admission[61] that nothing "properly has the nature of cause except while it produces the effect" (non proprie habet rationem causae, nisi quamdiu producit effectum), he is forced to admit that all *ordinary* causes precede their effects.[62] Priority is here conceived not as priority of act to potency, but as temporal or genetic priority. The efficient cause of motion now is the body *formerly* moving, "which gives to it of its motion".[63] Hence Descartes often speaks of "the infinite succession of efficient causes"[64] going *back* to God, the initiator of motion[65] who is, in a certain sense (quodammodo), causa sui, or self moving, the first efficient cause. Thus, as in the prevailing conception of evolution, the causal order is identified with the genetic order. The efficient cause is regarded as a force, or élan, or nisus, working *from behind.*

(d) *Inversion of structure.* This conception of motion represents a complete inversion of the classic structure. For Aristotle there is *one* motion which is the actualization of *two* potencies, the active power of the agent, and the passive potency of the patient. For Descartes, the motion is always the continuation of another motion in the past, while the two separate potencies are collapsed into one. The moving body, as it moves, both acts and is acted upon by itself. The one motion is thus multiplied into two, and the two powers reduced to one. As Hume later showed, this is equivalent to removing all causation whatsoever. Descartes himself seems to recognize this, for his definition of motion omits all reference to causation and potency. It is simply "the translation of one body from the vicinity of those bodies with which it is in immediate contact, and which are regarded as at rest, to the vicinity of others".[66] Motion is thus an un-

[60] *Phys.* 202b 20. [61] VII, 108. [62] VII, 108, 10.
[63] VIII, 65, 8.
[64] VII, 106, 16.
[65] VIII, 62, 1. Deus diversimode moverit partes materiae, cum primum illas creavit, jamque totam istam materiam conservet eodem plane modo eademque ratione qua prius creavit, eum etiam tantundem motus in ipsa semper conservare.
[66] VIII, 53, 26.

caused phenomenon—an arbitrary appearance depending on our point of view. One could hardly ask for a clearer anticipation of Hume's sceptical conclusion.

III. *The Influence of Descartes on the Modern Conception of Change*

The extent to which Cartesianism has influenced the whole course of modern philosophy is perhaps not yet fully appreciated. Even more important are the many respects in which it has affected that basic apprehension of the world upon which technical philosophy always rests to a degree, and to which we may refer as common sense. Our constant employment of such concepts as "the mind" and "the body", without any mediating term, such as "life" (anima), is a case in point. Even more significant is the capitulation of modern thought, in the broadest sense, to the Cartesian view of motion as a fixed or simple quality. To realize this we need only turn to the *Essay* of John Locke, on the whole the best compendium for English readers, of common sense philosophical usage.

Locke reiterates Descartes' disdain for the Aristotelian definition of motion as the emergence from potency to act. "What more exquisite jargon could the wit of man invent than this definition? . . . Which would puzzle any rational man, to whom it was not already known by its famous absurdity, to guess what word it could ever be supposed to be the explanation of".[67] Motion involves no *diversity* whatsoever. It is, like figure, a simple, primary quality, which is either there or not there. "These I call original or primary qualities of body, which I think we may observe to produce simple ideas in us, *viz.*, solidity, extension, figure, motion or rest, and number".[68] These "simple ideas" in us exactly correspond to the "primary qualities" without:— "The ideas of primary qualities of bodies are resemblances of them, and their patterns do really exist in the bodies themselves.[69] Hence motion itself is undiverse or motionless, since a simple idea, "being each in itself uncompounded, contains in it

[67] Bk. III, Ch. IV; Fraser II, 34–35.
[68] Fraser, I, 170.
[69] I, 173.

nothing but *one uniform appearance or conception in the mind*, and is not distinguishable into different ideas".[70]

In thus regarding motion as a fixed *quality*, Locke was followed by Berkeley and the whole "empirical" tradition.[71] Since potency is thus read out of the world, and experience atomized into separate and fully actualized qualities, motion is really eliminated, and replaced by its subjective, sensory correlate —succession. Just as Descartes had viewed the world as a "succession", held together only by the ineffable "action" of God, so Locke regards experience as a "stream of consciousness", or "succession of ideas in the mind".[72] According to him, "it is to me very clear, that men derive their ideas of duration from their reflections on the train of ideas they observe to succeed one another in their own understandings".[73] The full account of how "succession", the effect of motion on sense, came to be confused with motion itself, would require many pages. We must be content merely to note the presence of this confusion in Locke, Berkeley,[74] and the whole empiricist tradition.

As a result, there is no real becoming, but fixed, motionless qualities (the after-effects of motion) do succeed one another "in" consciousness. Change thus has to be interpreted as a compound of changeless units with no substance or substratum actually changing. Among the many pseudo-problems introduced by this substitution of succession for change, we must note the aporetic underlying Kant's famous second analogy. Any quality may succeed any other in experience. How then can we distinguish between "the objective connection" (das objective Verhältnis), *i.e.*, real motion, as we certainly do, and mere succession of appearances (Sukzession der Erscheinungen)?[75] Kant answers simply that we *do* make this distinction. Once having abandoned the basic phenomenon of motion, however, the only

[70] I, 145.

[71] Cf. *Princ.*, Sec. IX, " . . . it is evident from what we have already shown that extension, figure and motion, are only ideas . . . ". Cf. *Three Dialogues*, (Everyman), 222 *et passim*.

[72] Bk. II, Ch. XIV, Fraser I, 244: " . . . the constant and regular succession of ideas in a waking man is as it were the measure and standard of all other successions."

[73] I, 163.

[74] Cf. Ecquid enim in se habet successiva corporis existentia in diversis locis, quod actionem referat, aut aliud sit quam nudus et iners effectus? *De Motu*, Sec. 49, p. 518.

[75] Second Anal. *Beweis*.

way of justifying it is to forge a "pure concept of the understanding" to take its place. This is "the concept of the connection between cause and effect, the first of which determines that which is later in time".[76] In this way "causation from behind" became one of the great "synthetic principles" of idealism.

As Hume had pointed out, however, if we do not directly know the motions as such, these too dissolve into mere after-effects, and we cannot without arbitrariness distinguish real change from accident. We can understand succession on the basis of motion. We cannot understand motion on the basis of mere succession. This confusion lies at the root of that doctrine peculiar to idealism, which thinks of motion as a "relation" of before and after. This applies to what *has* moved, after it has moved. *Then*, there is a sequence of before and after. But motion, *as* it moves, is *to* something not yet there in the genetic order, and hence unable to qualify as *the term* of a relation.

The Cartesian view has had its chief success in converting common sense to its own doctrine of "causation from behind". The cause, so far as it can be referred to at all (*cf.* Hume), *precedes* the effect, and forces it into existence from the past. This peculiar and novel way of understanding cause has been very rarely questioned, and underlies the causal theories of most of the modern schools. In particular, it has brought forth the over-simplified conception of "cause and effect", "stimulus-response" "production-product", "force-result" which rules everyday discourse, and the notion of "nisus" or evolution from behind. We must be content to adduce as typical examples of these two notions, the Lockian conception of cause-effect, and the "nisus" concept of S. Alexander.

For Locke, the cause is thought of as a force or power working from behind which brings something into being *not* there before. "Thus a man is generated, a picture made: and either of them altered, when any new sensible quality or simple idea is produced in either of them, which was not there before: and the things thus made to exist, which were not there before, are effects; . . ."[77] Two aspects of this conception are especially noteworthy. In the first place, the effect is viewed not as a motion

[76] Second Anal. *Beweis.* [77] I, 435, Ch. XXVI.

but as an inert "quality". In the second place, the cause, which is pure motion or production, works from behind, preceding its effect. This conception dominates our ordinary view of cause and effect, or blind productivity. *First* there is blind efficiency, then suddenly the passive effect. Nowhere is there anything *that* changes. Hence, as the passage from Locke so clearly indicates, no distinction can be made between generation and alteration. In the one case, as in the other, there is first of all an hypothetical, hidden activity, then a "*new*" sensible quality "not there before". Such a view is no longer a description of the real motions we observe to occur, the generation of an animal by the parents, the heating of the brick by the sun. Instead, we are presented with a succession—first, the quality (cold), then an hypothetical cause not observed, *then* a "new" quality (hot) "not there before". The way is already prepared for Hume.

In the modern conception of evolution, or "spontaneous variation", we find the same conception of blind efficiency from behind. Sometimes it is possible to discern traces of predetermination, or tendency (non-*genetic* determination), in descriptions of the evolutionary force or *élan vital*. But in those who have most thoroughly exploited the concept of self-evoking power, all such traces are carefully eliminated, and we see that what is really meant by evolution is simply the Cartesian view of motion. Thus, Professor Alexander, who has presented what is perhaps the most exhaustive analysis of this concept and its various implications, like Descartes, finds it unnecessary to deal with potency in connection with motion. Together with Locke and the whole "empirical" tradition, he finds that "there is a motion-quality as there is redness or sweetness".[78] Motion is divisible into a set of present *points*, one succeeding the other. "What we ordinarily call motion of a body is the occupation by that body of points which successively become present, so that at each stage the points traversed have different time-values when the line of motion is taken as a whole".[79] As we have already noted, under these assumptions the only interpretation which can be given to causality is the familiar notion of blind efficiency from behind. "All causality", says Professor Alexander, "is *a tergo*".[80]

[78] *Space, Time and Deity*, I, 321. [79] I, 6. [80] I, 287.

On this view the "cause" of the present is motion already past, and the present motion is *now* causing a "new" future not yet existent. "This relation of continuity between *two* different motions is causality, the motion which precedes that into which it is continued in the order of time, being the cause, and the other the effect".[81] Hence we find again the familiar Cartesian conception of a self-moving motion, transferring itself into successive, separable presents. When read backward from effect to cause, it yields mechanism. When read forward from cause to effect, it yields doctrines of "evolution". The confusion underlying both is the same.

Conclusion

The following conclusions are suggested by this study:

(1) When a modern, or contemporary author uses the words "motion" or "cause" he is thinking in Cartesian terms, unless it is carefully specified otherwise. The Cartesian theory underlies both the modern view of "mechanism" in its general sense, and "evolution" in its general sense.

(2) The Cartesian account of motion and cause differs in the most radical form from the Aristotelian account. They are, in fact, irreconcilable.

(3) Hume's critique of "causation" is a critique of Descartes, moving wholly in the field of Cartesian concepts, and has nothing to do with the Aristotelian doctrine. Thus he speaks of motion as a "quality",[82] and makes it clear that "the object we call cause *precedes* the other we call effect".[83]

(4) Aside from Hume's *reductio ad absurdum* of the Cartesian theory, this theory cannot be sustained by a phenomenological examination of the facts.

(5) At the present time, and in the present state of philosophy, Aristotle's account of the structure of change and becoming have for us an importance exceeding that of merely academic or antiquarian study.

JOHN WILD

HARVARD UNIVERSITY

[81] I, 2–9.

[82] *Treatise*, Bk. I, Pt. IV, p. 228: "To begin with the examination of motion—'tis evident this is a quality . . . "

[83] *Treatise*, Bk. I, Sec. XIV, p. 155.