Biological Explanation

A lecture delivered at St. John's College in Santa Fe, April, 1968

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The College, April, 1970

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January 26, 2015

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Preface

Mr. Neidorf's article, reproduced below, appeared originally in the publication of St. John's College (Annapolis and Santa Fe) called simply *The College* [17]. The subtitle above ("A lecture delivered at St. John's College . . . ") is a footnote to the title in the original text. That text has one more footnote, labelled by an asterisk; this appears below on page 32.

Footnotes labelled by Arabic numerals are my own comments. Emphases in **boldface** are by me, as are <u>underlinings</u>. These additions to the original text are the traces of my attempts to come to terms with Mr. Neidorf's lecture. The possibility of leaving these traces is a reason to digitize the text as I have done.

The College is described in its colophon as

> a publication for friends of St. John's College and for those who might become friends of the College, if they came to know it. Our aim is to indicate, within the limitations of the magazine form, why, in our opinion, St. John's College comes closer than any other college in the nation to being what a college should be.

It is an arrogant opinion, but one that I share. As a student on the Santa Fe campus of St. John's College, 1984–7, I knew Mr. Neidorf as Dean on that campus. I assume the lecture reproduced here is one of the Friday-night lectures of the Collge, these being the only lectures in the curriculum. I remember such a lecture by Mr. Neidorf on the brain: the lecture had been inspired by the speaker's suffering a brain tumor.

I record how I produced the text below. The lecture was recommended for discussion on the Unofficial St. John's College Alumni Email List, where the link `http://www.sjc.edu/files/8113/9658/0526/sjc_review_vol22_no1_1970.pdf` was supplied. Using the `pdftk` program, I separated the eight pages of the printed lecture; then I fed them one by one through the OCR program at `www.onlineocr.net`, obtaining plain-text (`txt`) files. Unfortunately, each of these files still presented the text of the lecture in two-column format, just as in the original document. I concatenated the eight text files into one `tex` file, for complilation by LaTeX. I formatted each of the original pages as a two-column table. In a LaTeX table, columns are separated by ampersands (`&`). In the text files, on most lines, the two columns were separated by at least three spaces, so I could search for these and insert the ampersands automatically.

When the `tex` file was compiled and a `dvi` file produced, this could be diplayed by the `xdvi` program; and the columns of text could be selected one by one and pasted elsewhere. Unfortunately, in this process, spaces between words were lost. So I went back to the `tex` file and replaced the between-words spaces with asterisks. Then, when I had cut and pasted the sixteen columns of the original text into one continuous flow of text, I could replace the asterisks with spaces again.

There may have been a more efficient way to proceed. Using perhaps the program called `briss`, I could have separated the original `pdf` file into its sixteen columns before feeding these through the OCR program; or I might have found an OCR program that recognized columns as such and rendered them continuous.

In any case, I had to reproduce by hand the emphases in the original document; I hope I have detected them all. These are set in *slanted type* in the original, rather than properly *italic type*; so slanted is what they are here. Long quoted passages in the original document are also slanted, rather than intented; the practice is continued here. Emphases in my own footnotes are italic. As I said, I have given **bold emphasis** to some technical terms defined at the beginning of Mr. Neidorf's lecture; and I have <u>underlined</u> some passages that I might underline on paper.

Finally, the original text was accompanied by two illustrations, both unlabelled, though the second was referred to in the text. I cut these out of the `pdf` files saved them as `eps` files, and incorporated them in the present document as numbered figures.

The closing paragraph about Mr. Neidorf is from the original article, though the heading "The Author" is mine. The bibliography is also mine; it lists the works that I cite in my notes.

Unfortunately LaTeX may not handle long footnotes in the best way, but their use may lead to large amounts of white space. This problem could be dealt with my writing of notes had come to an end; but it might never come to an end.

Biological Explanation

This paper discusses an old but continuing controversy in the philosophy of biology. It is the controversy between those who claim that purpose and action for an end is present in the behavior of animals and in the development of their internal structures, and those who claim that it is inaccuracy of thought or plain superstition to speak that way. This second group I will call **mechanists.**[1] The first group used to be called **vitalists,** but for reasons that will emerge I do not wish to use that term, since it carries certain unfortunate associations.[2] The paper falls into two parts. The first is analytical and destructive; the second suggestive, vague, constructive, much weaker as argument, and to me much more interesting.[3]

[1]The word "mechanic" entered English in the 14th century; "machine," in the 16th; both derive ultimately from the Greek $\mu\eta\chi\alpha\nu\acute{\eta}$ and are thus cognate with the native English "may, might" [18, 11]. Since machines are built to serve a purpose, and also *might* is normally *human* power, which can be used for a purpose, it is unclear why the term *mechanist* should be used for somebody who denies the value or possibility of analyzing nature in terms of purposes. Or perhaps the very use of the term *mechanist* shows that this denial is ultimately futile or vacuous.

[2]Mr. Neidorf will however use the term again (or more precisely the abstract noun "vitalism," p. 6).

[3]To my mind, if this controversy under consideration is meaningful, it should be understood as follows. Obviously the notion of purpose is meaningful. We may often do things accidently, but sometimes we do them on purpose. I am creating the present footnote on purpose, and the end I have in mind is the clarification of my thoughts. I said that *we* sometimes do things on purpose: *I* do, and I presume that *you* the reader do too. The word "purpose" is after all a part of our common language. The question is: Should *we,* who do things on purpose, number amongst ourselves even those animals with which (or with whom) we do not ordinarily share a language? The way to answer this is to try to get to know those animals anyway, despite the initial lack of a common language, and see how far we can get. Mary Midgley cites an example of one approach in *Beast and Man* [14, ch. 11, p. 252]:

I. Living things, especially animals, have incredibly complex internal structures; their organs, tissues, and cells seem to be arranged[4] in patterns which subserve the growth, maintenance or reproduction of the organisms in which they occur. So thoroughgoing is the apparent functional relation between the structures and their containing organisms, that the whole presents the appearance of a miracle. We see nothing like it in the rocks, the weather or the stars. It is then

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In Niko Tinbergen’s book, *The Herring Gull’s World,* there are two especially instructive illustrations. One (p. 145) shows a gull reposing, eyes closed and wings folded, the picture of fatuous parental contentment, on an empty nest, while its eggs addle in the cold, a foot away. Helpful ethologists have removed the eggs to see which the creature would prefer, and it has settled for the nest. The other (p. 209), still more remarkable, shows an oyster catcher trying to perch on top of a monstrous egg, larger than itself, ignoring its own egg and a rather larger gull’s egg that is there for further choice. The large egg, a dummy, has been provided by the ethologists to test the bird’s powers of discrimination.

Thus we might *not* want to say that a gull sits on her eggs on purpose—at least not in the way we might sit on a seat on purpose, to make or keep it warm for a friend.

There is however a further question. Most of the books on the shelves in the room where I write this note have been given their arrangement on purpose: either they are ordered according to the birth year of the writer or subject, or, being large-format art-books, they on the shelves that are tall enough to accommodate them; or they have been set apart according to their subject, as mathematics or linguistics. But some books have not found a place in the general arrangement: they are not ordered in any particular way. If you studied my bookshelves without knowing me, you might detect a pattern on some shelves, and assume it was intentional; elsewhere, you might detect no pattern and assume that none was intended. In either case, you could be right or wrong. Our second question is, Should we approach nature this way, with the presumption that some aspects of it may be intentional, some not? But perhaps there is a prior question. Obviously we *can* approach nature this way, since we can approach something like a library in this way. But can we approach nature in any *other* way?

[4] By saying “seem to be arranged,” rather than “are arranged,” Mr. Neidorf seems to defer to those who say that there cannot be an arrangement without an arranger who intended the arrangement.

natural to suppose that plants and animals cannot be understood in the same way as earth, cloud and heavens.[5]

How then can the organic world be understood?[6] One might think of material organisms as governed by one or more Intelligences that are non-material, spiritual,[7] in some way separate from the material organisms they govern.[8] This hypothesis is usually called **vitalism,** and it is not susceptible to investigation by familiar methods; for this reason I lay it aside, but without prejudice.[9] The obvious alternative is to think of governing Intelligences that are natural parts or

[5] Rather, we *do not* understand plants and animals in the same way as earth, cloud, and heavens. We make a distinction between, say, the animate and the inanimate, according to our way of understanding. We are not presented with two boxes, labelled "animate" and "inanimate," such that, after looking inside, we decide to investigate them by different techniques. Rather, we are presented with one box, containing all of nature; and we find it useful or "natural" to distinguish between the animate and the inanimate contents of this box.

[6] Again, I think the more accurate question is, How *do* we understand the organic world? For *we* are the ones who have identified an organic world in the first place.

[7] I wonder if the meanings of these terms *non-material* and *spiritual* can be explained clearly. See note 10.

[8] Our word "govern" comes to us *via* French and Latin from the Greek $\kappa\upsilon\beta\epsilon\rho\nu\acute{\alpha}\omega$ "to be a helmsman, steer" (whence "cybernetics"). A person can steer a boat or govern a province. But we also steer or govern *ourselves.* Other things can steer or govern *themselves.* There is no requirement that the governor must be separate from the governed.

[9] It seems to me that a proper hypothesis must come with method for investigating it. Thus, if vitalism is not susceptible to investigation by familiar methods, and if it does not try to make some unfamiliar methods familiar, then I would lay aside the "vitalist" hypothesis *with* prejudice. In any case, "vitalism" seems to be more precisely defined here than at the beginning of the article.

aspects of animal material.[10] Again there may be one or many, and the notion of a plurality of such Intelligences is not inconsistent with their subsumption in some fashion under a single world-embracing Intelligence.[11] For simplicity, I concentrate in what follows on the hypothesis that there are many, each associated with a definite material organism. In this view the term Intelligence has to be understood metaphorically, since we do not find in plants or animals any evidence of deliberation or ability to grasp a universal.[12] The hypothesis therefore takes this form: in the plant and animal worlds, vital processes are governed or at least influenced by some inarticulate and usually unconscious striving toward the achievement of a

[10] Mr. Neidorf says there is an "obvious alternative"; but the real difference between the alternatives is not obvious to me. He is talking about arbitrary "material organisms"; but since we humans are material organisms, I think for the moment we can just look at ourselves. Each of us is intelligent; or as we may say, each of us is an intelligence. An intelligence is non-material and thus perhaps "spiritual": it is not described in terms of mass or volume or pressure or atomic number or any of the various ways that material things are described. However, intelligence is certainly an aspect of ourselves: the aspect viewed when we are attending not to such things as mass and volume, but to things like language. Intelligence, or just "spirit," cannot be separated from a person; it *is* the person. And yet evidently the possibility of separating it is suggested by some thinkers. Why is this? I am reminded of the proposal of Julian Jaynes in *The Original of Consciousness in the Breakdown of the Bicameral Mind* [12]: When Odysseus, say, got advice from Athena, it was "really" advice from one part of his mind to another, only he did *not* understand the "Athena" part of his mind as if it were himself.

[11] Though we may govern ourselves individually, we may be subject to some "higher" government, depending on which political unit or units we live in. Just so, apparently, one might hypothesize some higher government over the various material organisms of the world.

[12] This is a surprising remark from somebody who will go on to show sensitivity towards animals, or at least to the scream of a dog, as on page 29. I myself have watched a cat deliberate on whether to attempt a leap. She may then make the leap, or she may decide it is too far. However, I do not know that I would call my observations *evidence.* If I watch you deliberate on a question, does your facial expression constitute evidence of deliberation?

goal specific to the organism—that goal being the development and maintenance of just those structures and activities that are typical of the species, and the production of further instances of their own kind.[13] This purposive striving is simply a characteristic or quality of the kind of matter that we encounter in the organic world, namely organic matter.[14] This, as I understand it, is the core of the view held by Galen, and before him by Aristotle, a view now widely rejected as metaphysical,[15] anthropomorphic, superstitious,

[13] Here again it seems enough to look at ourselves as humans. We engage in *action*—deliberate motion—; but we also "engage in" (so to speak) bodily growth and sexual desire, neither of which is deliberate on *our* part, though we may hypothesize that it nonetheless serves the purpose of *some* intelligence.

[14] Instances of matter may have "extensive" properties like volume and mass, and "intensive" properties like pressure and temperature. (I seem to remember learning these terms in the Freshman Laboratory at St. John's College.) An additional property is chemical composition: an analysis into molecules or atoms of certain kinds, which are identifiable by certain characteristic properties). Is the "hypothesis" being considered that there is an additional possible property of matter called "purposive striving"? Some matter does indeed have this property: the matter known as ourselves. But if one distinguishes matter from form, one may prefer to say that striving is a feature of our form, not our matter. Nonetheless, it would seem to be a simple observation that matter on earth strives to fall down. Is there a further question of whether this striving is "purposeful"?

[15] It is a shame that "metaphysical" should be a pejorative term. In *An Autobiography* [5, pp. 65–6], R. G. Collingwood writes,

> It became clear to me that metaphysics (as its very name might show, though people still use the word as if it had been 'paraphysics') is no futile attempt at knowing what lies beyond the limits of experience, but is primarily at any given time an attempt to discover what the people of that time believe about the world's general nature; such beliefs being the presuppositions of all their 'physics', that is, their inquiries into its detail. Secondarily, it is the attempt to discover the corresponding presuppositions of other peoples and other times, and to follow the historical process by which one set of presuppositions has turned into another.

Thus "metaphysical" is misused as a synonym for today's "paranormal" (defined in the 1976 edition of the *Concise Oxford Dictionary of Current English* as "Lying outside the range of normal scientific investigations etc." [19], though the word does not exist in the original *Oxford English Dictionary* [16]). Our sentimental, dogmatical, and—worst of all—prescientific.[16] I call it **organicism.**[17]

Part of the contemporary attitude of disdain toward organicism is based on evolution, for it seems that evolution makes it possible to understand the organic world in precisely the same way as the inorganic; that is, as a series of events governed by a blind mechanical

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present inquiry is best understood as metaphysics proper: an investigation of how we and others do in fact approach, or have in fact approached, the study of nature. However, Collingwood's approach to metaphysics, while acknowledged, is dismissed by (at least) one more-recent textbook on the subject: Michael J. Loux, *Metaphysics: A contemporary introduction* [13].

[16]The view attributed to Aristotle and Galen *is* prescientific, if science means today's natural science. But what is meant by "view"? I find it useful to look at the beginning of Collingwood's posthumous book *The Idea of Nature* [4]:

> In the history of European thought there have been three periods of constructive cosmological thinking; three periods, that is to say, when the idea of nature has come into the focus of thought, become the subject of intense and protracted reflection, and consequently acquired new characteristics which in their turn have given a new aspect to the detailed science of nature that has been based upon it.
>
> To say that the detailed science of nature is 'based' upon the idea of nature does not impıy that the idea of nature in general, the idea of nature as a whole, is worked out first, in abstraction from any detailed study of natural fact, and that when this abstract idea of nature is complete people go on to erect upon it a superstructure of detailed natural science. What it implies is not a temporal relation but a logical one. Here, as often, the temporal relation inverts the logical relation. In natural science, as in economics or morals or law, people begin with the details. They begin by tackling individual problems as they arise. Only when this detail has accumulated to a considerable amount do they reflect upon the work they have been doing and discover that they have been doing it in a methodical way, according to principles of which hitherto they have not been conscious.
>
> But the temporal priority of detailed work to reflection on the principles implied in it must not be exaggerated . . .

The three periods that Collingwood considers are Greek, Renaissance, and Modern. If one is going to say anything at all about the Greek period, one should ask whether the views expressed by Aristotle and Galen did actually fit the individual problems that they tackled.

[17]Do organicism and vitalism, as now defined, together constitute what was earlier called vitalism, as opposed to mechanism (or mechanicism)?

causality.[18] But here we come upon a surprise. At the very beginning of *The Origin of Species*, Darwin quotes Aristotle approvingly. He suggests that the principle of natural selection is "shadowed forth" in Aristotle, and he cites a passage from *Physics*, II, 8, which I give in the Oxford translation:

Why should not nature work, not for the sake of something, nor because it is better so, but just as the sky rains, not in order to make the corn grow, but of necessity? What is drawn up must cool, and what has been cooled must become water and descend, the result of this being that the corn grows. Similarly if a man's crop is spoiled on the threshing-floor, the rain did not fall for the sake of this—in order that the crop might be spoiled—but that result just followed. Why then should it not be the same with the parts in nature, e.g., that our teeth should come up of necessity—the front teeth sharp, fitted for tearing, the molars broad and useful for grinding down the food—since they did not arise for this end, but it was merely a coincident result; and so with all other parts in which we suppose that there is purpose? Wherever then all the parts came about just what they would have been if they had come to be for an end, such things survived, being organized spontaneously in a fitting way; whereas those which grow otherwise perished and continued to perish.

Evidently Aristotle is here expounding a view, attributed to Empedocles, which has something in common with Darwin's. But Aristotle does not believe it, as we see in the passage immediately following:

[18] The Latin *causa* has meanings like "reason, motive, lawsuit" [15]; it is not something blind and "mechanical." (As an example of how to do metaphysics, Collingwood works out the history and meaning of "cause" in *An Essay on Metaphysics* [6, IIIc, pp. 285–343].) Instead of "a blind mechanical causality," Mr. Neidorf might just refer to "blind mechanism." What is being contemplated is apparently that nature might operate like a *machine,* doing what it was made to do by its creator (see note 1, page 4), but doing nothing on its own initiative. What kind of machines would Aristotle have been able to use as examples?

It is impossible that this should be the true view. For teeth and all other natural things either invariably or normally come about in a given way; but of not one of the results of chance or spontaneity is this true. We do not abscribe to chance or mere coincidence the frequency of rain in winter, but frequent rain in summer we do; nor heat in the dogdays, but only if we have it in winter. If then it is agreed that things are either the result of coincidence or for an end, and these [*i.e.*, the teeth] *cannot be the result of coincidence or spontaneity, it follows that they must be for an end. . . . Therefore action for an end is present in things which come to be and are by nature.*

The argument may be restated thus: if a structure serves a purpose, the series of events causally antecedent to the structure are either relevant to the purpose or not.[19] If not, they do not often realize the purpose, as we see empirically. But the teeth almost always *do.* Hence the process of eruption of the teeth is relevant to the purpose,

[19]It seems to me that, etymologically speaking at least, to be "causally antecedent" means precisely to be relevant to the purpose. See the previous note.

is "for an end."[20]

We must ask how a modern biologist of the mechanistic stripe would reply to this. No doubt he will point out that Aristotle has

[20]I do not understand Mr. Neidorf's way of putting things here. If anything is empirical, it is that we do in fact make a distinction between chance events and normal events. Around the Aegean Sea at least, rain is normal in winter, but not in summer. Teeth normally grow in a certain pattern. Being normal *means* having an end—that end being simply *to be* in that way that we call normal. Hippocrates Apostle seems to agree with this interpretation in his notes on his translation of the *Physics* [2]. He renders Aristotle's sentence

> For teeth and all other natural things either invariably or normally come about in a given way; but of not one of the results of chance or spontaneity is this true (*ταῦτα μὲν γὰρ καὶ πάντα τὰ φύσει ἢ αἰεὶ οὕτω γίγνεται ἢ ὡς ἐπὶ τὸ πολύ, τῶν δ' ἀπὸ τύχης καὶ τοῦ αὐτομάτου οὐδέν* [1, $198^{\mathrm{b}}34$–6])

as "for the examples cited and all things by nature come to be always or for the most part, but none of those by luck or *chance* do so likewise," and his note on this reads,

> By definition, chance causes or effects by chance are infrequent; but rain in the winter (resulting in growth), non-rain in the summer (tending not to spoil the wheat) and also heat, sharp teeth in front, broad molars at the sides—all these come to be for the most part and not infrequently. So by definition these things do not come to be by chance.

Aristotle would seem to be doing metaphysics in Collingwood's sense (as in note 15; it is a sense that Collingwood claims to find in Aristotle's *Metaphysics* [6, p. 11]). Finding a pattern in nature *means, to us,* finding something that could have been done on purpose. When we do find a pattern, Aristotle seems to take issue with any suggestion that the pattern does not *really* happen on purpose. A pattern as such *must* happen on purpose. Any suggestion that a seeming pattern does *not* occur on purpose should be understood as meaning that there might not be a pattern after all.

"Purpose" should be understood broadly. In mathematics, seeming patterns must happen on purpose to be real patterns, where "on purpose" means "by a theorem." Thus in *Mathematics: A Very Short Introduction,* in the chapter called "Proofs" [10, pp. 35–48], Timothy Gowers observes that, if n points on the circumference of a circle are connected by straight lines, then the circle is divided into 2^{n-1} regions, at least if $1 \leqslant n \leqslant 5$. But there is no true pattern here, because there is no theorem that the number of regions is 2^{n-1} for all n. Indeed, the pattern fails when $n = 6$. Even the fact that the pattern fails when $n = 0$ is cause for suspicion that it will fail elsewhere.

The last of Euclid's theorems about numbers is that if $1+2+2^2+\cdots+2^n$ is a prime number p, then $2^n \cdot p$ is *perfect,* that is, equal to the sum of its proper quite missed the point of the evolution theory. Evolution, he might say, does not invoke coincidence to explain the eruption of these particular teeth in this particular animal, but to explain the general fact that animals of such and such a kind have teeth of such and such a kind. The *first* teeth arose coincidentally, as the outcome of mechanical causes unrelated to nutrition;[21] but since they *did* serve the nutritive function, the animal possessing them enjoyed a competitive advantage, and so on with a familiar story.[22] Ultimately, *teeth*—not

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divisors [8, IX.36]. (Note that $2^{n+1} = p + 1$.) For this result to represent a real pattern (or a significant pattern, or something like that), probably the converse should be true. In fact an *even* number is perfect if *and only if* is it $2^n \cdot p$ for some prime p such that $p + 1 = 2^{n+1}$. (Descartes reportedly said he could prove the "only if" part in 1638 [7, p. VII]; a proof appeared in a paper by Euler published posthumously in 1849; Dickson gave a simpler proof in 1911, sketched as follows. Let $\sigma(a)$ denote the sum of the divisors of a. If p is odd and $2^n \cdot p$ is perfect, then $2^{n+1} \cdot p = \sigma(2^n \cdot p) = \sigma(2^n) \cdot \sigma(p) = (2^{n+1} - 1) \cdot \sigma(p)$, so $\sigma(p) = p + p/(2^{n+1} - 1)$, and thus $p/(2^{n+1} - 1)$ must be the only divisor of p, other than p itself. Then $p = 2^{n+1} - 1$, and this is prime.

To return to Aristotle and the natural world: If an unexpected summer rain spoils your harvest, then, unlike certain religious people today (and perhaps in his time too), Aristotle does *not* tell you it must have happened for a reason.

[21] Again it is strange to refer to "mechanical causes." The mechanical is *repetitive* and thus *predictable*. As I understand the theory, the first teeth arose through random genetic mutation, effected perhaps by cosmic radiation. A particular instance of such an event is unpredictable, even in principle.

[22] The story of evolution may *not* be familiar in sufficient detail. In any case, the difficulty with which it was established should not be discounted. Mr. Neidorf does go on to sketch the story briefly. In order to evolve, the first teeth must be present "from birth," that is, genetically. If an animal creates its own teeth, perhaps by wearing away its gums to expose bumps on the jawbone, this action by itself will not cause the evolution of teeth in its descendents. The belief that it *will* is Lamarckianism or, in its worst form, Lysenkoism, a terrible instance of politicians' trying to tell scientists their business. A source on these matters is Martin Gardner, *Fads and Fallacies in the Name of Science*—which also ridicules St. John's in the chapter "The Forteans" [9, pp. 42–52], on the followers or fellow travellers of Charles Hoy Fort. Thanks to an inheritance,

> For the remaining twenty-six years of his life, he [Fort] pored over old magazines and newspapers, taking notes on every mysterious occurrence which did not jibe with established scientific notions . . .
>
> In recent years, on top educational levels, there has been a minor, but

just these teeth but teeth in general—appear on the scene coincidentally; particular teeth, other than the first, arise by the operation of mechanical necessity flowing from a mechanism of inheritance. When we take this view, further shifts of emphasis occur, for then Aristotle's insistence that "action for an end is present in things that come to be . . . by nature" now appears superfluous; the mechanical causes explain everything.

So Aristotle's view is refuted or outflanked by shifting the subject to a wider context. But we have not heard the end of him, for his argument can also be shifted to that wider context and repeated. Thus: throughout the animal and plant worlds we see structures serving the accomplishment of what look like natural purposes. The occurrence of structure functionally adapted to ends is the general

observable, Fortean trend. It is due, in part probably, to a revival of religious orthodoxy, and in part perhaps, to resentment against the atom bomb. Its subtlest manifestation is in certain sections of the Hutchins-Adler Great Books Movement . . .

The science "classics" reprinted in the Hutchins-Adler fifty-four volume set of *Great Books of the Western World,* 1952, are so dated and often so technical that they have almost no value for any reader except a specialist in the history of science . . .

At St. John's College, Annapolis, where Robert Hutchins' educational views have been most successfully practiced, they make, it is true, a great hubbub about science. The school's catalog boasts that more mathematics and laboratory work are required than at any other college, and there is even a pretentious listing of all pieces of apparatus used by the student, down to such items as compass, calipers, and ruler. But so heavy is the emphasis on highlights in the past history of science, that little time is left for acquiring a solid grasp of current scientific opinion.

For another example of College boasting, see the quotation above (p. 2). The boast about the mathematics and laboratory at St. John's reminds me of what I saw in promotional literature in a chiropractor's office about how students of chiropractic learn more anatomy than regular medical students. What matters is what you *do* with what you learn. (Here *thinking* should be understood as a kind of *doing.*) If Mr. Neidorf can take for granted a correct understanding of the current theory of evolution, that is good. Gardner notes later (his p. 135) that "Dr. Mortimer J. Adler of the University of Chicago and Great Books fame, and one of the nation's leading neo-Thomists, has for some time been carrying on a one-man crusade against evolution . . . "

rule, not the exception. Hence that general fact cannot be the result of coincidence; therefore action for an end exists in things that come to be by nature.[23] It does not matter at this point whether we hold, with Aristotle, that species are fixed and have always existed much as they are now, or whether we think with the evolutionist that species begin in time and evolve one from another. The *general* fact is the existence of functionally adapted structure, and that general fact has to be explained by acknowledging the existence of action for an end. To put the same point differently, the mechanist cannot prevail by referring the development of adapted teeth to an ingenious genetic mechanism, for we still have to explain the functional appropriateness of that mechanism.[24] Thus Aristotle's argument has some residual forces[25] despite evolution, and we see that the argument between biological mechanists and their opponents is really independent of the fact of evolution, which could have been inferred from the fact that the controversy antedates Darwin by two millennia.

Thus generalized, the Aristotelian argument on behalf of action for an end in nature is I think conclusive, provided we admit that there are such things as ends. So our question is now disentangled from the confusing context of evolution, and takes a simple form: is there such a thing as end or purpose in animals?

For Aristotle it was past doubt that the normal series of events

[23]Again I think the wording is imprecise. The natural world—the world perceived as natural—is a world in which things happen for a reason. This is true "by definition," or "analytically": it arises from analysing the concept of nature, analysing what we *mean* by nature. By the way though, we *cannot* conclude that there must be a Creator who fits the description in the mythology of this or that religion.

[24]Rather, the reference to mechanism, especially *ingenious* mechanism, already makes Aristotle's point. As machines serve a purpose, so the evolution of teeth serves a purpose. This is what it *means* to evolve; that is, we should not call it evolution, if we could not see a purpose in it.

[25]I wonder if "residual forces" was meant to be "residual force," in the singular.

in the life of a normal living creature represented an approach to a "completion," then a recession from that completion in senility and death. The completion itself is defined by the disposition to perform, and the ability to execute, a variety of complicated and highly integrated processes, including self-maintenance and reproduction. Except when he is in a theological mood—which is for him a strained one—it is no use asking him what the completed mature animal is for. It is for itself, for its specific normal processes. As the Zen Buddhists have it, the purpose of a flower is simply to open, a truth—if it is one—that cuts clean across the flower's reproductive function. For the mechanist, the attribution of the term "completion" to the adult animal is a conventional or subjective mode of speech; for him there is just a physico-chemical system passing through varying stages of activity and stability, and it makes no objective sense to single out any one stage as a privileged one, worthy to be called the completion or the desired end.[26]

How can the controversy between mechanism and organicism be decided? I will review five different attempts to decide the issue.[27] The first three are attempts to come to a decision on empirical grounds, the fourth on pragmatic grounds, and the last on analytical grounds.

First empirical attempt: someone asks me whether animals have completions or ends and I try to find out by cutting up the animal, looking for the end or the directive agent for all the world as if I were looking for the vermiform appendix. This is clearly wrong. It is as if someone tried to find the form in matter with the help of a

[26] But to analyze life into stages at all would seem to privilege these stages.

[27] To me the issue is not clear. A way to "decide the issue" is just what is needed to explain the issue in the first place.

microscope.[28]

Second empirical attempt: are there phenomena inconsistent with one theory or the other?[29] And first, are there things that animals do that chemical systems cannot? If there are, it would overthrow the mechanist view. No one has yet built a tiger in a laboratory, but there seems to be no limit to the extent to which machines can imitate macroscopic biological behavior, and no limit to the ingenuity of biochemists in synthesizing almost-biological microsystems. It would be bad tactics to hang the organistic philosophy on the prediction that machines cannot do X, Y or Z; name it, and someone builds a machine that can do it. And it would be bad logic to hang it on the prediction that no one will ever build a machine that can do *everything* animals can, for this might be true as an accidental matter, even though animals were just machines.

Next, are there hard facts, real or imaginary, that could overthrow organicism? I can only think of one that has been proposed, and that is the imaginary fact of the laboratory production of a genuine animal, fertile and true-breeding. But I think it is wrong to imagine

[28] And yet today Edward O. Wilson can write approvingly, of neuroscientists, that "their sights are set on discovering the physical basis of consciousness" [20]. There is no question that consciousness "exists"; therefore it must be possible to find consciousness by cutting up (so to speak) a conscious animal:

> the increase in brain size leading up from the habiline prehumans to *Homo sapiens* suggests that consciousness evolved in steps, similar to the way other complex biological systems developed—the eukaryotic cell, for example, or the animal eye, or colonial life in insects.
>
> It should then be possible to track the steps leading to human consciousness through studies of animal species that have come partway to the human level.

It sounds as if the aim is to pinpoint features of the brain and say, "These constitute our consciousness."

[29] The phenomenon that biology is a distinct science from chemistry would seem to be inconsistent with the "mechanist" view. Biologists are *not* just doing chemistry (or physics), but are doing something else. This might however be the "pragmatic" approach to the controversy, which Mr. Neidorf himself will take up later (p. 21).

that this would refute the organic view. It would only show that animals can be produced in a peculiar manner. Roughly half of the higher animals—the female half—possess the capacity to synthesize animals from relatively simple chemicals; only the process is so usual that we fail to dwell on its truly remarkable and very puzzling characteristics, and in the human case we often take pains to prevent it.

Third empirical attempt: is one of the two views more adequate than the other? I.e., are there phenomena that can be accounted for under the one theory that the other theory must ignore as unexplainable? Again, probably not. The organicist says that stems grow up in order to put the leaves into the light and air. The mechanist discovers growth-controlling fluids generated in the tip which flow differentially down the stalk depending on its orientation, thus insuring that the stem grows upward. The mechanist now claims to have explained the directionality of stem growth, which his opponent could not do. His opponent replies that any purpose has to be effected by a mechanism, and he thanks the mechanist for having found the relevant one in this case.

Next, are there phenomena that can be explained teleologically but not mechanically? Again I think not. I think anything *can* be explained mechanically, but to explain why requires a digression, for here I must explain what I understand by mechanical explanation. What follows is a simplified version of an account found in Ernest Nagel's book, *The Structure of Science.*

I propose that mechanical explanation of a system involves four conditions. (1) The system or phenomenon enjoys momentary states or conditions defined by a finite collection of simultaneous momentary qualities; for example, in Newtonian mechanics the state of a material particle is defined by its location and its instantaneous momentum.[30] (2) There is a formulated procedure for observing and

[30]Momentum may be a "momentary quality," in the sense that the momentum

measuring these qualities. (3) There are mathematical functions which connect the states of the system at one time with its states at other times in such a way that, given the state at some chosen initial time, one may in principle predict the state at any future time. (4)

of a particle is understood as a function of time; and yet momentum cannot be *observed* (or measured) in a moment, but needs a period of time. It requires "temporal thickness"—which Mr. Neidorf will introduce later (p. 31).

The system behaves in accordance with these predictions.[31] Some philosophers hold that this is the general pattern of all explanation,

[31]By establishing a fourth condition, Mr. Neidorf suggests that a prediction as such need not be a *correct* prediction. It is also interesting that the functions mentioned in the third condition are specified as being mathematical. This specification would seem to be redundant. Mr. Neidorf's account seems to boil down to the following, that a mechanical explanation of a system exists if the system in any arbitrarily short period of time determines the system at any future moment in time, in a way predictable by us. There is however a difficulty in understanding what "determines" means, which Mr. Neidorf will broach soon (p. 22). Meanwhile, Collingwood [6, ch. XXXII, pp. 321–2] spells it out, having defined "determination" in the present sense as "causation in sense III":

> Most people think that when we use the word 'causation' in sense III we mean to express by it something different from logical implication, and something more than uniformity of conjunction, whether observed only, or observed in the past and also expected in the future; and that this 'something different' and 'something more' is in the nature of compulsion. On the historical issue of what has actually been meant when words have actually been used, this is correct . . . The idea of compulsion, as applied to events in nature, is derived from our experience of occasions on which we have compelled others to act in certain ways by placing them in situations (or calling their attention to the fact that they are in situations) of such a kind that only by so acting can they realize the intentions we know or rightly assume them to entertain: and conversely, occasions in which we have ourselves been thus compelled. Compulsion is an idea derived from our social experience, and applied in what is called a 'metaphorical' way not only to our relations with things in nature (sense II of the word 'cause') but also to the relations which these things have among themselves (sense III). Causal propositions in sense III are descriptions of relations between natural events in anthropomorphic terms.

By referring to a future state of a system as a *mathematical* function of a past state, I think we try to avoid anthropomorphism. Perhaps we fail. In the most general sense, a *real-valued function* on a nonempty interval I of real numbers is a set F of ordered pairs (x, y) of real numbers, where x is always in I, such that (i) for every x in I, for some y, (x, y) is in F, and (ii) for all x and x' in I and all y, if both (x, y) and (x', y) are in F, then $x' = x$. The cardinality of the set of such F is greater than the cardinality of the set of real numbers themselves, and this cardinality is itself uncountable. But the functions governing a mechanical system should be functions that already belong to, or can be brought into, mathematicians' repertoire of known, *defined* functions: polynomial functions, trigonometric functions, and so forth. This repertoire is *countable.* However, the repertoire can always grow: if we specify a class of definable functions, we can always find more functions outside the with some variation in the definition of state to allow for statistical and probability considerations that are prominent in some kinds of systems. As might be expected, such philosophers tend to be hostile to teleological explanation. Mechanical explanation understood in this way is historically linked to an atomistic and chemical understanding of nature, which thus leans heavily on the ideal of prediction.

The 19th century biologist Hans Driesch believed that certain biological phenomena associated with embryological development and regeneration of lost members could not in principle be understood mechanically. But the history of biology passed him by and later workers, mostly enthusiastic mechanists, discovered mechanisms of heredity and growth control of a subtlety and complexity apparently undreamed of by Driesch. I believe this is typical of a general pattern; phenomena at one time inexplicable and unpredictable except from the teleological point of view later yield to mechanical explanation. One might even suggest that the mechanistic program is doomed to succeed; for given any regular phenomenon, it may just be a matter of ingenuity to invent a mechanical system with suitable state-definitions and time-dependent mathematical functions that "explains" the phenomenon.

Having failed to decide the controversy by empirical means, I now turn to a pragmatic attempt. That is, we might give the palm to whichever view seems most useful in generating interesting research problems and useful medical devices. At first glance the mechanist has the advantage here; certainly those university biologists who espouse some form of mechanism are also those who have the biggest buildings, the most expensive equipment, and the greatest number of Ph.D. students. They also have a rhetorical point to make, for they tend to claim that if you are satisfied with teleological explana-

class, functions that are definable in a broader sense. At any stage in history, the definable functions are those that *we* have found it desirable to define.

tions you will be uninterested in finding mechanisms, thus choking off inquiry. But neither Aristotle nor Galen deny the presence of the importance of mechanisms, they only deny the adequacy of mechanistic explanations in isolation. Yes, says the mechanist, but we have

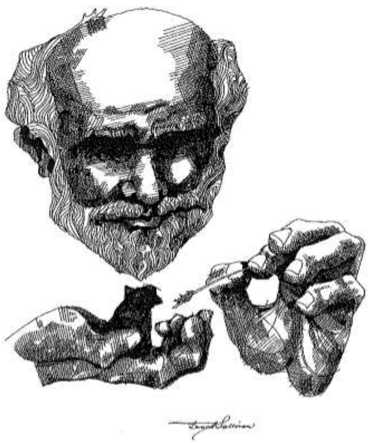

Figure 1

made great strides in biology precisely by ignoring the teleological approach; we never use the concept of purpose or end. Then, asks the organicist, why is your literature choked with the words *purpose, function, in order to,* and so on? Oh well, comes the casual reply, that is just a short-hand for a more elaborate series of statements; we *all* understand that.

But do we? The attempt to decide the issue pragmatically ends in confusion, as is perhaps appropriate for all pragmatic attempts. We now find the mechanist using teleological notions, but claiming that in a fundamental sense he is not *really* using them. We must therefore examine the attempt to rewrite all teleological propositions in the form of non-teleological propositions; for it is essential to the mechanist position that such rewriting must always in principle be possible.

Space forbids a detailed presentation of any of the many recent attempts to carry out this program. Perhaps the most characteristic effort was published in 1950 by A. Sommerhof in a book entitled *Analytical Biology.* Sommerhof takes it as axiomatic that living systems are characterized by behavior and structure-growth which is *adaptive;* that is, conducive to some *goal* defined as a frequent, typical, or otherwise important state of the system. His problem is to define the apparently teleological term *adapted* in non-teleological terms.[32] The analysis is complex, and colored by a full sense of the difficulties of the problem. He decides that a given response in a living system is adapted if and only if the following conditions hold. (1) The response will, in conjunction with a given environmental context, lead to the goal. (2) The response and its corresponding environmental context are each members of ensembles of real or imaginary responses and contexts, correlated with each other one-to-one, and such that any correlated pair will lead to the same goal. (3) The response enjoys a measure of causal independence from its corresponding context; rather, the response and its corresponding context are both outcomes of one set of prior causal conditions. (4) It is possible to say that, had the prior conditions been such as to produce a different environmental context, they would also necessarily have produced a different (but corresponding) response.

This schema provides a definite meaning for the assertion that a response is adapted, yet there is no reference to use, purpose, or striving. When we say a response is adapted we are referring in a short-hand way to its complex relations with other states real and

[32] Is it believed that "goal" has been defined non-teleologically? Mr. Neidorf seems to address this question presently, when he observes that death is not a goal.

ideal. What explains the response is the ordinary causal mechanism that produces it; and this latter is of course understood mechanically, in terms of disconnected momentary states related only by time-dependent mathematical functions.

But here I must express a misgiving. Let us assume—although it is arguable—that Sommerhof's analysis permits us to pass from any statement about goals to a complex of other statements expressed in strict mechanical terminology. Is this a translation? If it is, the process should work in reverse, and any biological situation that falls under the Sommerhof schema should be equally describable in terms of goals and purposes. I think that animal death is a case that falls under the schema, for in any environment that we know the higher animals all exhibit long-term processes leading to death. But no one will say that death is a goal, and that aging processes are responses adapted thereto. Sommerhof concedes this, and rejects death as a suitable goal-state on further grounds. It is then a matter for further discussion as to whether the rejection-criteria are—or can be—stated in purely mechanistic terms. My misgiving rests on the suspicion (perhaps unwarranted) that biologists characteristically select goal-states for causal analysis through a sense of their subject-matter that lies quite outside Sommerhof's schema, and quite outside any possible cluster of purely mechanical meanings. If so, Sommerhof's schema, however supplemented, is a way of deducing many useful mechanical statements from a few teleological statements, but it is not a *translation*.

This leads to what I think is the fundamental discomfort that will be felt by many persons, myself included, in the face of an approach like Sommerhof's. Even conceding that it is possible to replace all of our customary uses of teleological terms with strictly equivalent mechanical terms, we might still feel that the result could only provide the bare bones of an adequate description. Mechanical terms do not describe the states of an organism at various times as truly related to each other, but as discrete moments tied together by empirical mathematical functions. Differently put, a mechanical description like Sommerhof's is not dynamic, but kinematic; it has no room for the forces, tensions, and pressures that we think operate in the organic world; it only tells us about static states that appear and disappear under a purely adventitious order. Like the cinema, it suggests that what appears to be dynamic and flowing is actually a series of static tableaux. Of course certain kinds of changes in these successive tableaux could be labeled as forces, but this would not satisfy the objector, because he is convinced that something goes on in the animal world analogous to what he feels when he senses internal muscular stress, the restlessness of a frustrated bodily drive, or the quiescence of satisfaction. No doubt this objection is anthropomorphic; it remains to be seen if it is on that account vicious.

What I am finally questioning is the whole tradition of describing nature and animal life in terms of disconnected momentary states,[33] a tradition which derives on its epistemological side from Hume and on its ontological side from 17th century science. It is a tradition which insists that the fundamental entities of the world, or of our perceptive experience, are distinct items not related to each other except in space and time, and internally homogeneous. Thus, for Hume, any experience of feeling which differs from moment to moment is not one experience, but two. He says, "Whatever is distinguishable is separable." And for a devotee of Newtonian particle physics (which Newton was not), any change in the condition of an object has to be understood as a translocation of constituent particles, where each particle remains unaffected by its motion and is

[33] See note 30. In a diagram or 3-d model, features of a momentary state like position and color can be indicated more or less as they "really" appear; gravitational mass might be indicated by "lines of force"; but I do not know how velocity (or momentum) can be indicated, except by something like a little arrow. Strictly speaking, the arrow (or what it represents) does not lie in the space being depicted, but points into another "dimension."

really just a series of instantaneous acts of occupation of points in space. The atoms do not and cannot acknowledge each other by any internal alteration, nor can one moment in an atom's life acknowledge the existence of past or future moments.

II. Having failed to decide the original controversy by any of the approaches made so far, the suspicion arises that we are dealing with a pseudo-problem generated by inattention to the meaning of the term *purpose.* Some would say that we should read the meaning of purpose from the animal world, where we see structures serving ends. Since it is just the suitability of this posture which is under examination, we cannot locate the meaning there without begging the question. Another source for the meaning of purpose rests in deliberative human experience; but it seems clear that animals do not enjoy such experiences.[34] It is often maintained these these are the only two meanings for purpose; in which case the term is either applied to the animal world by convention and vacuously, or we have to impute thought to animals.

But I think there is a third source. Let me go back to David Hume, who is the outstanding exponent of the view that our experience is made up of disconnected bits and pieces carrying no intrinsic order. If under suitable circumstances I were to shout *Brutus,* most listeners could be relied upon to shout back *Caesar.* This is a kind of order among our perceptions that Hume must account for. He would point out that when we first meet Brutus we have no inclination to think of Caesar; that comes only after we have read Plutarch and Shakespeare. For Hume this shows that the psychological relation between imagined-Brutus and imagined-Caesar is not part of the perception we call imagined-Brutus; for if it were, it would have been there from the beginning. He accounts for the association by invoking a force of the mind which is trained, like Pavlov's dogs, to

[34] As I said in note 12, page 7, I think animals *can* deliberate.

repeat in imagination those conjunctions of perceptions which have been forced upon it by past experience. This associative force of the mind is inexplicable in Hume's system; it reveals itself as a felt tension under certain circumstances and must be accepted as brute fact.

I would draw from these psychic phenomena a different lesson. Instead of saying that imagined-Brutus is associated with imagined-Caesar by a mind-force, we may say that the content of the present perception "imagined-Brutus" is truly connected to, stressed by, influenced by our past reading, so that it is now essentially and intrinsically related to the present perception "imagined-Caesar." After reading Plutarch, the experience "imagined-Brutus—imagined-Caesar" is not two experiences, but one, with distinguishable but inseparable aspects. It is only a dogma to assume that the presence within the experience of distinguishable aspects must be explained by breaking the experience into a conjunction of separate experiences, as Hume would have it. We are now spared the embarrassment of a mysterious mind exerting curious forces on its own perceptions, a mind which Hume in other contexts insists is nothing more than the collection of its perceptions.

The same point may be urged with the aid of a sketch [Figure 2] that has appeared frequently in the works of Gestalt psychologists and recent philosophers. If you focus to the right of the central circle and say "antelope," you see one thing. If you focus to the left of the central circle and say "bird," you see something else. We have to distinguish carefully between the perceptions and what is supposedly really there on the sheet that bears the diagram. What is on the sheet is a pictorially neutral and unchanging pattern of ink-grains. But the existence of that unchanging thing is inferred from our perceptions, and it is a mistake to think *a priori* that our perceptions must have the self-contained neutrality that is in the inferred physical reality. It is therefore a mistake to suppose that there must be one unchanging perception upon which the mind puts

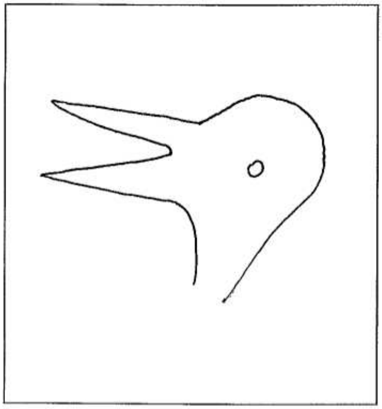

Figure 2

different interpretations at different times; there are many perceptions (loosely said to be perceptions of the same thing), spread out in time although bearing a family resemblance, and substantially influenced by other perceptions lodged in the same biography.

If it will be allowed that we have perceptions of sensation and imagination that cannot be analyzed atomistically, let me assume that the same holds for some of our emotions. I will then use the word *feeling* to refer alike to the contents of sensation, imagination or emotion. The next step is the claim that we have feelings which are organized organically, in the sense that there are indissoluble wholes within which one may sometimes discriminate tension and resolution, within which one may sometimes truly say that *this* strives for *that* and finds its completion therein. In a recent book, *Mind: An Essay on Human Feeling,* Susan Langer argues that this is so, and that the clearest articulation of such relations of feelings is to be found in the arts. She claims, for example, that the relations of tension and resolution found in music are really there as the music is felt, that they are not mere conventional terms of harmonic theory. In her view, all art is in part an articulation of this sort of genuine organic relatedness found at the level of feeling. I think it evident that such organically related feelings are found in our responses to felt bodily drives, to love, to novels and plays, and even to books on mathematics. Langer even maintains that our sense of deductive logical form is derivative from and dependent upon a universally shared feeling of rightness in connection with certain verbal relations. It is not essential to my argument to follow her that far, but only to concede that such a thing as irreducible qualitative "completion" exists in the life of feeling.

If this be allowed, we advance to another thesis:—that animals have such feelings. This should be laughable because so obviously true, but it is wrong to underestimate the power of scientific dogmas. One would think that anyone who has heard a dog scream would know that animals have feelings, yet there have been biologists who argued that vivisection without anesthesia is justified because animals are just machines, whose screaming is strictly analogous to squeaking gears. In any case, if animals have feelings I assume that some of their feelings are organic in the sense just stipulated; that is, that they sometimes constitute wholes within which there is tension and resolution, striving and completion. Surely animals do not attain to the levels of organic synthesis of feelings of which humans are capable, for we have the help of paint and canvas, drum and fife, and fairy stories;[35] but attain it they do.

[35] As a student in the freshman laboratory at St John's College, in a context I do not recall, I suggested that the world experienced by humans was richer than the world experienced by animals. For example, what we can see in the pages of books is lost on animals. The tutor (David Guaspari, as I recall) did not agree with me, and I think now he was right. At any rate, there is much that animals perceive that we do not: smells, for example, or sounds in the ocean. Mr. Neidorf speaks of *synthesizing* feelings, as by painting; but

The next step is critical. If the psychological life of an animal is susceptible of regions of organic organization, <u>why not admit that the same thing holds for the animal when viewed physically</u>? The animal viewed physically is just a collection of material substances, and we are here face to face with the dogma that matter cannot feel. But that view is linked historically to the science and philosophy of a certain time, and it seems to me silly to cling to it if the argument leads elsewhere. The chief obstacle to the organic view of matter comes from the fact that we think we know what matter is, pretty much. Matter is what comes in billiard balls, steel beams, piles of mud, pools of water, wind on the face. Whatever it is, it neither feels nor possesses desires; to think otherwise is to throw us back into the world of river-gods and wind-spirits that we have figured our way out of—thank God. But I think it has to be observed that those who cling to a radically inorganic view of matter have a difficulty:—they have to account for the rise of organic feelings in animals, and of feeling and thought in humans, and it is peculiarly hard for them to do so. If we endorse the premise that matter consists only of atoms going bump-bump in the dark, it is hard to see how billions of atoms can do anything else than go bumpity-bumpity-bump in the dark, and there is still no place for feeling, much less thought. This difficulty is independent of the particular type of atomic theory one holds; it arises so long as one assumes that the fundamental constituents of matter are unalterable and internally homogeneous entities, either classical atoms or momentary system-states. Materialists of this mechanistic persuasion usually account for feeling and thought by assigning them to a miracle, or to a non-material substance, or by denying that science is competent to cope

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perhaps a dog's urine, sprayed on a tree or a fire hydrant, can be likened to paint on a canvas. There are bird songs, whale songs, bee dances: I am not prepared to say that these have the complexity of human expression, but on the other hand I have no clear reason to think that animals' experience of the world is not as rich as ours.

with such airy things, or by denying altogether that they have any causally significant existence. I regard these one and all as counsels of despair.

The view I am advancing claims that matter should not be understood as something composed of self-contained particles or momentary states; matter should be understood as organic through and through, made up of events or acts each enjoying temporal thickness,[36] capable of internal differentiation into aspects that from another point of view may also be events or acts, related to each other essentially rather than accidentally in space and time; matter is more like a changing forcefield, perhaps, than like a particle.[37] It is further maintained on this view that matter is sometimes capable of sustaining relations which deserve to be called tension-resolution, or striving-completion, and that these relations cannot be decomposed into ensembles of isolated states as in Sommerhof's schema, but are what they are in virtue of a unique qualitative attribute that we recognize because it enters our own experience frequently. In this view it is possible for matter to achieve conscious feeling and thought.[38] Compare this passage from Susan Langer's book, where she is discussing the complexity of physical and chemical systems:

The complexity of such processes is beyond the imagination of anyone who does not know some samples of them rather intimately; they grow up into self-sustaining rhythms and dialectical exchanges of energy, forms and qualities evolving and resolving, submicroscopic elements—already highly structured—merging and great dynamisms emerging. The common-sense tenet that such products of nature cannot attain feeling, awareness and thought loses its cogency when one is confronted by the actual intricacies of chemical and elec-

[36]"Temporal thickness": nothing occurs in a moment, but every event takes time.

[37]Is Mr. Neidorf talking about what matter is "really" like, as opposed to how we perceive it? Is he trying to tell scientists their business, or is he trying to make sense of what they actually do?

[38]Obviously matter can achieve consciousness: we are conscious material beings!

trochemical organization. The bridge to organism arises of itself, and the conviction that "extended substance" [*i.e.,* matter] *cannot think and "thinking substance" cannot have material properties appears as a medieval doctrine handed down to modern philosophy in Descartes' famous dictum, and with no firmer foundation than his word.*

The traditional view has now been turned up side down. Instead of regarding organisms as very complicated mechanisms, we regard mechanisms as tragically simple organisms. We see that for the mechanist action for an end was never possible in nature because in his view action in the dynamic sense is never possible at all. The controversy between mechanism and organicism may be decided in favor of the latter by imposing a metaphysical vision in which striving is present in animals because it is potentially present everywhere. It thus turns out that we are not discussing two contesting interpretations of experimental evidence; we are in fact discussing two contrary metaphysical visions about the basic character of the material world. It is obvious which view I incline to, and I would like to conclude by confronting the view with three brief criticisms.

First criticism: The view is silly because it imputes feeling to matter; the only kind of feeling we know is conscious feeling, and while animals may share this, surely plants and inanimate matter do not. This objection is based on the principle that there is no such thing as unconscious feeling. My only reply is to raise a further question. Suppose that during a heated conversation a man sits down beside me, so close that he crowds me on the bench. Without interrupting the flow of words, and without becoming aware of discomfort, I move over.* I would like to say that my motion was a response to an unconscious feeling. I suppose a mechanist would say that if I was not aware of any discomfort there was no such feeling, and my motion was a kind of reflex action. That is a possible way of

*This example was suggested by Mr. Dean Haggard.

describing the situation, but it seems to me an awkward way, and in any case I do not see why it is obvious that the situation must be described that way. Another example: Anyone who reads a lecture at St. John's and who survives the discussion afterwards finds out that he holds some important beliefs of which he was previously unaware.[39] In general, we have no qualms about using the notion of an unconscious belief. But the ability to believe something is a most sophisticated human capacity; the ability to experience feelings seems far more primordial. If the former can occur unconsciously, why not the latter? It is an open question.

Second criticism: The view is anthropomorphic because it seeks to understand nature in terms drawn from human experience. Reply: If you insist upon trying to understand nature in terms entirely alien from human experience, you will never be able to explain human experience in those alien terms, and you will then be driven to invoke supplementary or supernatural principles.[40] We see this in Descartes' theory that mind and matter exist side-by-side but independently. And we see it in Locke's theory that feeling and thought arise as a result of the action of matter on our brains, but how that happens is in his view forever incomprehensible to us.

Third and final criticism: Let us grant that organicism provides a unified scheme of explanation, even though that scheme may be more evident in the promise than in the execution; and let us grant that organicism is the only or the most accessible unified scheme. Still, why should we insist on a unified scheme at all? Perhaps the world does consist of a brute combination of mind and matter, which we describe and correlate but never render intelligible. Perhaps the material world does consist of a heap of disconnected atoms whose

[39] This is the real point of metaphysics: to find out what we believe. If we need to find it out, then our belief must have been unconscious; but it was our basis for understanding the world.

[40] How are you even going to *succeed* in understanding something "in terms entirely alien from human experience"?

spatial relations to each other can be summarized and predicted but never reduced to some underlying intelligibility. Reply: In the opening passages of *Process and Reality,* Whitehead gives an interesting definition of an *incoherent* metaphysics. He says that a metaphysical scheme is incoherent if it contains principles that can be understood in isolation from each other, such as mind and matter, or atoms and paths of motion. In this way he expresses his preference for a scheme of understanding in which nothing is left as ultimate mystery, describable but unaccountable; for an incoherent system as he defines it is one in which the connection or togetherness of first principles is unaccounted for.[41] Hence, organicism, which does not seek a simple deductive understanding of the world with everything flowing out of a single principle, but an understanding in which every principle, every experience, and every entity is incomplete in itself and must find its completion by reference to others. There is no mundane logic by which one can prove the superiority of such a scheme or vision.[42]

[41] Does Whitehead "prefer" to leave nothing unaccounted for? Or is it rather not ultimately *possible* to do so?

[42] Rather, the unified scheme might be understood as an *axiom* of logic. In the words of Collingwood from his first book, *Religion and Philosophy* [3, pp. 87, 196–7]:

> It is hardly possible to avoid the conclusion that materialism only succeeds as far as it does by implicitly abandoning its own principles. If it were rigidly held down to the axiom that everything must be accounted for by reference to something else, it could never make headway. As it is, it tacitly assumes that self-creation, self-determination, is real and omnipresent; and this assumption underlies all its progress.
>
> "Cheap and easy" are almost permanent epithets for the type of theory called monism, which explains reality as issuing from a single principle. And doubtless many monistic theories deserve such names; for to construct a view of the universe by leaving out all the facts except one is both easy and cheap. But monism properly understood is only another word for the fundamental axiom of all thinking, namely that whatever exists stands in some definite relation to the other things that exist. And the essence of dualism or pluralism is that it catalogues the things that exist without sufficiently determining these inter-relations.

These words were written a little more than a decade before *Process and Reality*—a book that I know of mainly because, for a reason I do not now

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Robert A. Neidorf received his B.A. and M.A. degrees from the University of Chicago and his Ph.D. degree from Yale University. From 1962 to 1964 he was a Tutor at St. John's College in Annapolis. He was Associate Professor of Philosophy at the State University of New York at Binghamton, 1964-1967. He is the author of *DEDUCTIVE FORMS: An Elementary Logic* (Harper and Row, 1967), a book intended to serve either as an introduction to general logic or for a first course in symbolic logic. Some of Mr. Neidorf's special interests have been the history and philosophy of science, Aristotle's *Ethics, et al.* He joined the faculty in Santa Fe in 1967.

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recall, I once met with Mr. Neidorf and an older student who was reading this book. I do not know whether Mr. Neidorf or others at St. John's College have read Collingwood; but I think the projects of Collingwood and the College are very close.

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