

Goethe's Natural Science Some Non-Cartesian Meditations

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As the historians of science who touch upon the matter are fond of remarking, Goethe's approach to natural science is not that of the present scientific community. Until recently, however, there has been little interest in alternative empirical methods, especially in methods connected with the tradition of German *Naturphilosophie*, which P. B. Medawar, for example, terms "a philosophical indoor pastime of German origin." Individual voices have been raised against this attitude, but these usually found a very small audience. I cannot help wondering, given the events of the last decade, whether this situation may be changing.

Reasons for this last remark will be immediately apparent to some readers, but a review is in order. Living in the midst of change, we are apt to mistake it for daily continuity. We have evolved, quite rapidly, from talking of "the relation of science to art" and "the creative process," to "the sociology of knowledge" and "the subjectivity of truth." Articles in scientific journals may begin by discussing the impossibility of induction and the inseparability of fact from theory. Science does not seem as all-inclusive as it once did; we are intrigued with pre-logical cultures simply because they were pre-logical. This is not a failure of nerve, but an intellectual advance.

Symptoms of Iconoclasm

Take, for example, the argument found in *The Structure of Scientific Revolutions* by Thomas Kuhn. The central notion of his thesis, which has become coinage within American universities, is what the author terms the *paradigm* — almost the *way of looking* — fundamental to any world view, and thus to the natural science belonging to that view. As the paradigm shifts, suggests Kuhn, so does the science. Aristotelian science is not Galilean science, nor Galilean, modern. The difference is not merely one of conclusions, but of method itself. These are different *sciences*.

If there have been, as claimed, differing sciences, our own is not the sole contender, nor is the history of science the record of a single, steady line of development. It may not be a development at all, but rather a series of substitutions. Cultural attitudes change, and with them, the way in which the world is viewed. A new way of looking, a new paradigm, implies the need of a new method of investigation, for the existence of such a paradigm is a precondition to *any* investigation.

Let us approach this through one of Kuhn's examples. The Galilean analysis of the pendulum may be said to be an advance from the Aristotelian analysis. But if by this we mean that Galileo made a better interpretation, we may be distorting the matter. When Galileo sat before a pendulum,

he did not seem to *see* the same thing as Aristotle did. He *perceived* the object differently, and therefore offered a very different analysis. We cannot say that the Renaissance scientist simply reasoned better than the Greek Philosopher, for he was reasoning about something else.

If this is true, however, the interpretation of history is only a secondary problem. Can men actually look at the same sort of objects and *see* different things? Kuhn suggests that this may well be the case. And then he makes his most radical statement: the supposition, he argues, that the disagreement between theories is merely a matter of reasoning, rather than one of perception, is itself “an essential part of a philosophic paradigm initiated by Descartes and developed at the same time by Newtonian dynamics.” With this quiet *coup*, the author limits the world-picture of modern science to a relative viewpoint, and indicts it, by implication, for a lack of self-knowledge. Under attack is the demand for what we usually term “objectivity,” and it is accused of mistaking *a* way of looking for the *only* way of looking.

For the purposes of this paper I shall call the paradigm in which this demand for objectivity appears after the philosopher who made the most competent formulation, early in its career, of the independence of mind and world upon which the paradigm is structured. Thus, I take *Cartesianism* to represent, not merely the formulation advanced by Descartes, but the lived attitude from which his formulation arises: the *felt* alienation of mind from extended bodies which is the very *raison d’etre* behind the demand that the scientific observer separate, to the limits of his ability, all mental elements from the observed world of material objects. By arguing that it is, in principle, impossible for scientists to do this Kuhn has suggested that there is a contradiction at the heart of the Cartesian paradigm itself.

How has such a thesis become popular? That it *has* done so seems very clear, for references to the relativity of the starting point, or paradigm, continually appear in academic discussions. One might speculate that the major causal factor was simply an increasing sophistication among academic and scientific ranks. Whatever explanation is offered, however, must include mention of the growing dissatisfaction with the Cartesian world view that has become so apparent in American universities since the early sixties. I am not familiar with the situation in Europe, but it is obvious that here there exists an attitude, held by a good number of both students and faculty, that has need of the apparatus of critique formulated by Kuhn’s text. An articulate criticism, not merely of science, but of the Cartesian paradigm as well, seems to be a demand of our times. I am aware that some find only a tendency towards irrationality in this demand, others but the last gasp of Romanticism. Yet works like *The Structure of Scientific Revolutions* have provided ideas which fall outside the Cartesian framework with an intellectual respectability, effectively countering the claim that Cartesianism and rationality are co-extensive, and although the dissatisfaction with the present world-picture does seem to have a Romantic aspect, it does not show any signs of early retirement. The “last gasp” theory is, I am afraid, only wishful thinking.

The values basic to this dissatisfaction can be made quite clear. Cartesianism is a view of reality premised upon a divorce between mind and body, spirit and matter. It proposes, therefore, that except for the wandering human and animal islands (and God, if one includes him), the universe is devoid of consciousness, empty of mind. When all the implications are understood, this is not a pleasant prospect. Such a universe is not one that we should like to term *home*. Consider, for a moment, the picture made of it by the biologist, Jacques Monod:

The scientific attitude implies what I would call the postulate of objectivity — that is to say,

the fundamental postulate that there is no plan, that there is no intention to the universe.

If he accepts this message — accepts all it contains — then man must wake out of his millenary dream; and in doing so, wake to his total solitude, his fundamental isolation. Now does he at last realize that, like a gypsy, he lives on the boundary of an alien world. A world that is deaf to his music, just as indifferent to his hopes as it is to his suffering and his crimes.

(Monod, 1971)

We find essentially the same attitude in a recent essay entitled *Reflections of a Working Scientist* by Steven Weinberg:

there is an essential element in science that is cold, objective, and nonhuman ... the laws of nature are as impersonal and free of human values as the rules of arithmetic ... Nowhere do we see human value or human meaning.

(Weinberg, 1974)

While reading such accounts one cannot help imagining some form of the rejected “millenary dream” just to see how else the matter could be viewed. Indeed, the very postulation of the above exclusions leads us to the attempt to understand what is being excluded. In this way we may come upon an outlook which, while somewhat familiar to us, may have escaped our serious consideration for being a bit too far from common sense. Yet as the “common sense” of a historical period is but a relative viewpoint, perhaps we are not really duty-bound to live in a “cold, objective, and non-human” world.

This is exactly the structure of argument by which Theodore Roszak, in *Where the Wasteland Ends* (1973), suggests the viability of an admittedly romantic outlook. Translating the paradigm notion into the Freudian terminology of “Reality-Principle,” the author asks us to imagine the world as seen through a non-Cartesian Reality-Principle:

Suppose this ability we have to find something of ourselves in people should be expanded, so that the same personal transaction occurred with animal and plant ... Suppose that ability began to reach out further still, discovering a reality of inventive pattern and communicative vitality even in what we once regarded as the dense, dead stuff of the world ...

Suppose the whole of creation began to speak to us in the silent language of a deeply submerged kinship ...

Suppose, in short, that mind were not excluded from matter! Roszak goes on to argue that the assumption of a mind-matter split is exactly that: an *assumption*, not the result of investigation. The result of this assumption, when not merely advanced hypothetically but deeply believed, when *imagined*, is the world as we have come to know it. Thus, should we unlearn our present paradigm, and begin to imagine reality through a new one (or an old one), we may find a world that is not only poetic and human, but quite workable.

Roszak is a popular spokesman, in English, for such interests, and has become a recognized critic of science. It was Roszak, in fact, whom Weinberg was answering in the article mentioned above. But an “answer” to the argument above will take some doing, for as Weinberg tacitly

admits, the Cartesian paradigm is a necessary precondition to any scientific investigation, and this grants the crucial point. The precondition to investigation could hardly be the result of same. To my knowledge, the writers who attempt to answer Roszak, or Kuhn, have not been able to justify their insistence upon Cartesian objectivity. Non-Cartesian views of reality have received, on the very eve of what looked to be their final eclipse, a sudden reprieve.

Phenomenology

In the first years of this century, Edmund Husserl founded the philosophic movement that he termed *Phenomenology*, and with his work a major stream of European thought took a profoundly anti-Cartesian turn. Although Husserl was himself trained in the natural science of his day, and in mathematics, he came to the conclusion, due in part to the influence of Franz Brentano, that the sciences were in a crisis of their own making. Cartesian “objectivism,” he argued, had led the western mind into conflict with its own cultural impulse, which was the drive toward fully realized *science* — not merely the truncated material science of his day, but a true *Geisteswissenschaft*, a way of knowledge that incorporated the spiritual side of existence. The argument has not had much effect upon the actual practice of science, but its import for our present concerns is enormous. The current excitement over alternative modes of knowing, the new sense of freedom from Cartesian limitations delivered by the paradigm argument, can go no further without an epistemological foundation, and that is just what phenomenology offers.

In order to see how the phenomenological position arises, let us review the web of difficulties into which the Cartesian search for objectivity seems to lead. We shall find that the problem always enters with the antagonism between two principles: one, the principle of experience, which demands that an empirical science limit itself to what is given by experience; two, objectivity, which postulates that the “external” world has no share in mind, or in any other content that is derived from the constitution of the observing subject.

Galileo’s separation of Primary and Secondary qualities was an attempt to meet these demands by distinguishing the content of experience that was derivable from subjective constitution — color, smell, taste, in fact, any immediate *sensation*, since these depend upon the activity of our sense organs; from that which was not separable from the extended body in space — number, position, figure, motion, etc. This distinction has been fundamental to physical science ever since, even though it no longer seems to work.

The senses, as Galileo noted, are hardly innocent. They translate what they meet in the world into their own language of sensation. Thus since they cannot help distorting the world in this manner, we must restrict ourselves to the discoverable *relations* between sensations, taking the stuff of sensation proper as the medium through which the message comes. But this strategy overlooks the fact that by the time we become aware of the report of the senses that report has also been translated into the language of *mind*. After all, the senses are activated, directed, and purposively used, by the mind. The information they provide is limited to what their auditor, the mind, selects. All in all, they seem to be very biased servants — they lack objectivity.

Ever since Kant, the relations found within the sensible report, including the Primary qualities, have come under scrutiny. If sensation is not innocent, why should the relations between sensations be above suspicion? The more one studies the act of perception, the more it appears to be mental as

well as physical. What about the corrections to visual perception that we introduce without making any changes in the aim and focus of the eye, for instance? The double-take is a subject of continual humor, and most of us remember what it was like to be taken rather badly on the first try. In the twilight it is easy for a shrub to seem a cat, a cow to seem a bush, or *vice-versa*. But we do not blame this on a defect of the eye. The situation becomes all the more pointed when gazing at an “ambiguous figure,” a drawing that can be seen in more than one way, presenting at least two possibilities. (Figure-ground shifts are the simplest of these designs.) In all these instances, it is not the eye that refocuses when we obtain a new image, but the mind.

Perception, argues a recent text on the subject (Gregory, 1970), may be considered a process of problem solving that builds and tests hypotheses. The hypothesis is here, however, a perceptual pattern rather than an idea abstracted from that pattern. Be that as it may, if this is a correct description of perception, then those *relations* which Galileo thought so secure are actually, while within the sensible report, patterns supplied by the formulaic activity of the mind. In these terms, the resultant *facts* are, at the same time, theories. This result leads the author to some rather upsetting questions about the validity of modern scientific methods. Well it may, for such a conclusion leaves nothing in experience that can be abstracted from the human subject — we cannot separate a purely objective element.

It would seem, given these results, that the principle of experience is not compatible with the demands of objectivity. We could, of course, try to interpolate, hoping to minimize the subjective contribution, but how shall we identify it? The incommensurability of the experiential and the objective makes any equation of them untenable.

It is for these and related reasons that Karl Popper and his one-time pupil Paul Feyerabend have argued that science produces no ontological knowledge — no actual comprehension of “what is really happening out there.” (For the basic argument see Popper, 1959, 1962.) We get, instead, a system of trial and error which tests predictions and rejects erroneous suppositions, leaving only those hypotheses whose predictions have not, as yet, been falsified. Under this restriction, science is a mode of investigation that increases our knowledge, not of the being of the world, but of its behavior.

That is one way of approaching the difficulty, but we could also turn in the opposite direction. We must compromise the principle of experience in order to advance the postulate of objectivity, for if we cannot *know* the nature of external reality, we can hardly be certain that this reality *is* objective, i.e., that it is divorced from mind. That being the case, we might just as well suspend the objectivity postulate as an open question and try to maximize the restriction to experience.

After all, my experiences are manifestly *there*, which is a good deal more than I can say for the unperceived world that may be the ultimate cause of these experiences. Of course, all that I am sure of in experience is the mere experience as given — the way the thing *seems*. As I mentioned above, a second glance may make it seem quite different. But with all its troubles, this is at least a definite beginning. I may never be sure how a thing really *is*, but I am not deceived about how it *seems* to me.

Consciousness, as Descartes himself demonstrated, cannot doubt its own existence without falling into self-contradiction. But consciousness is always consciousness, of *something*, always has an object, and it can no more doubt *of what* it is conscious than it can doubt *that* it is conscious. In this we have Husserl’s starting point. We can know whatever is directly given to our consciousness. Our interpretation of appearances may be merely hypothetical, but the appearances

themselves, *qua* appearances, cannot be doubted.

The reason, given above, for our inability to separate appearances from consciousness now becomes the basis for the intimacy of my knowledge. The mind is not a passive spectator before its experiences. Awareness is essentially active, an *act* of attending. But to *attend* to anything is to *take it* for something. The mind must have a *seeming* of some sort to focus upon, and therefore needs discriminations. This directional quality of attention, the fact that it must mean or intend some particular thing, Husserl terms *intentionality*, and the result of this analysis links Husserl's point about appearances directly to Descartes' proof of the indubitability of the activity of thinking. We can doubt the structure, or formulation, of appearances no more than we can doubt our own thoughts, for we must *mean* them both.

We do not notice, in ordinary mental life, the intentional act, but this is simply because we must enter into a special state of awareness in order to observe our own activity. When I look at a table, I am aware of the object, but not of my attending to it. I may think, "there is the table," but I do not usually add, "I am thinking the table." When I attend to some image, since I am not at the same time attending to my act of attention, I do not notice the formulaic activity of intentionality. In special circumstances, however, I may discover it. Looking at an ambiguous figure, for example, I can bring my control over the figure (perhaps a figure ground alternation, or even two seemingly unrelated images) to that point where I may change how I take it at will, seeing first one image, and then the other. At this point my willing is no longer tacit but self-conscious, and I am no longer unaware that I am responsible for the formulation of what I see. I can, in this state of awareness, examine the act of intentionality in detail, for it is *my* act, and once I make it conscious it lies completely open to me.

It is in this state, by the way, that I discover that intentional formulation cannot be voluntaristic, although it can be made voluntary (a matter of conscious choice). Ambiguous figures, for example, must first be constructed in such a manner as to allow me to see more than one image. I cannot do this without the cooperation of the sensible report, nor can I make a stone look like a plant, or a plant an animal. The intentional formulation must proceed within the limits of possibility provided by the raw materials of sensation. It is, as Gregory suggested, a problem solving activity, an attempt to find the most intelligible manner of formulating the given, and is always restricted by the problem at hand.

Because I can enter into the unusual state of consciousness above, I can examine the structure of given appearances in depth. I can trace their very constitution, for this constitution, although demanded by the evidence, is yet *my* formulation. This "phenomenological standpoint" could be, then, the basis of an entirely rigorous science — rigorous in the sense that it could restrict itself entirely to the appearances *as given in experience*. A descriptive morphology of the given appearances would result, and the possibility of such a morphology has immediate implications for the existent sciences.

The founding intuitions of Galilean mechanics were phenomenological in nature, that is, they were intentional structures which were constitutional of the given appearances. Inert bodies *look* inert to us because they do not seem self-moved, which is to say, they seem to be moved only from the outside. This formulation of appearances has already included, as an intentional structure *within* appearances, what becomes, when abstracted from appearances and expressed in words, the "law of inertia." To abstract that principle is only to reflect, in a statement, how the appearances are constituted. But not every science is so founded.

The great success of classical physics led researchers in other sciences to wonder whether their own problems could not be solved upon the intentional structure of mechanics. This gave rise to a tendency toward reductionism in the sciences, and a departure from immediate experience. Appearances were supposed explainable by an interpretation that reduced them to effects of unseen mechanical causes. Then, since the concepts of mechanics were crystal clear, the investigator could make speculative hypotheses as to the mechanical interaction behind the appearances that gave occasion to them. In this manner the sciences abandoned any strict application of the principle of experience and evolved into a more speculative, less perceptually oriented viewpoint, even though the start made by mechanics was not of this nature.

This criticism of reductionism becomes, in Husserl's hands, a criticism of "objectivism" as well. The inability of present sciences (with certain exceptions, particularly mechanics) to derive their interpretive principles from the given appearances is accepted only on the basis of the Cartesian duality between external, objective nature and internal, subjective mind. The investigator *must first discredit the given* before he can reinterpret it through a reductionist logic. This is done in just the way I have done it in this paper, by pointing to the impossibility of separating the content of experience from the activity of consciousness. But in order to carry out such a program, the investigator must conveniently forget that the mechanical intuitions that he would substitute were themselves originally given in experience, and cannot, therefore, be abstracted from the intentional activity of the mind. This contradiction, however, has a far more general form.

It is only "common sense" that the world of appearances, the things about us, are "out there," over against the observing subject. This "outness," as Coleridge called it, of phenomena is an experienced quality and no mere hypothesis. We can hardly deny what we can see so plainly. But just because this is so we can conclude that what we are seeing is not a basis for Cartesian externality. The qualities of experience, as we said, cannot be divorced, from the formulaic activity of the mind, and the "outness" of experience is itself such a quality. The speculative nature of the Cartesian paradigm is thereby revealed. Apologists like Monod and Weinberg may indeed *think* that the evidence of experience supports their paradigm, but so opposed is the basic postulate of that paradigm to the principle of experience that it is unlikely to find any support there whatsoever. After all, Cartesian objectivity precludes the study of appearances *qua* appearances and thus denies itself the phenomenological standpoint. How could such an approach build *anything* upon immediate experience?

Goethe and Descriptive Morphology

In 1932 (the year of the centennial of Goethe's death), during a speech to the Saxon Academy of Science, Werner Heisenberg remarked that as science progresses, "the claim of the scientist to an *understanding* of the world in a certain sense diminishes." He meant, evidently, that the familiar world of experience is less and less the one studied by the scientist. The Cartesian paradigm has been, to be sure, the basis of extraordinary accomplishments, but these were increasingly bought at the cost of "renouncing the aim of bringing the phenomena of nature to our thinking in an immediate and living way." Heisenberg then spoke of the work of Goethe in this regard, claiming that "The renouncing of life and immediacy, which was the premise for the progress of all natural science since Newton, formed the real basis for the bitter struggle which Goethe waged against the

physical optics of Newton.”

Even a cursory reader of Newton’s *Optics* and Goethe’s *Farbenlehre* will quickly discover the difference between the two works. Newton had, by his premises, to reduce color to the relations of Primary qualities in order to explain it. His text is not about the experience of color but of the angles of refraction of paths of light. In Goethe’s pages, however, we find considerations of color *as given*: felt polarities of tone, of brightness and darkness, of saturation. While Newton attempts to understand color in a reductionist manner, Goethe is performing that examination of immediate appearances that Husserl would term a “descriptive morphology.” Some hundred years before Husserl formulated the epistemological principles of such a science, Goethe had already begun to practice it.

Goethe’s scientific works have been generally dismissed, along with the rest of *Naturphilosophie*, as overly and irresponsibly speculative. I do not mean to deny that there were many speculative excesses within this movement, but I find this judgment entirely erroneous when applied to Goethe. The truth is just the opposite: Goethean empiricism is a procedure much more restricted to experience than is Cartesian science, and by comparison, it is the latter that must be found speculative. This is a problem of reading, but until the reader is aware of an alternative to Cartesianism there seems little chance that he could read Goethe at all.

Subject Matter

Goethe remarked, on occasion, that morphology took its start from generally recognized entities. The familiar world of rock, tree, and bird is a world of common experience, its inhabitants recognizable by common standards. These “standards,” however, are mostly intuitive and frustrate our efforts to articulate them. Even so, they are shared over large cultural ranges (the natives of New Guinea distinguish many of the same groups as does the western biologist). A descriptive morphology may take its start from such common recognition because in this way the standard it seeks to find has already fallen within its reach, namely, the intentional structure by which we *mean* the object, and by which, therefore, we recognize it.

I have chosen, for the following discussion, the problem of the “archetype of plants” posed by Goethe’s botanical writings, since it is this language that calls up the most heated attacks upon Goethe or *Naturphilosophie* as a whole. The problem of the lionhood of lions or animality of animals, is, along with the planthood of plants, central to biological concerns. But the notion of archetypal essences has long been considered unworkable. What is impossible for Cartesian science, however, is not necessarily denied to alternative approaches.

Although the eighteenth century naturalists tended to make taxonomic distinctions upon merely convenient grounds, the pre-Darwinian nineteenth century morphologists, including Goethe, had abandoned the “artificial” systems of species definition (such as that of Linnaeus) in favor of discrimination based upon fundamental similarity of structure, or *common plan*. There were a number of methods used to establish these plans, the most direct of them being the graded series, a sequence of forms in which each individual was but a slight modification of the form before it. Looking at such a series, the viewer has the impression that he is actually watching the form at one end of the series transform, by these intermediate stages, to the form at the other end. The relation between forms established in this manner was termed, by Richard Owen, *homology*,

meaning that such forms shared an underlying identity. Owen was so impressed with such evidence that he began to refer to “the Platonic *eidos*” when discussing the principle of unity so demonstrated.

To others, however, the matter was not so mysterious. In 1830 Cuvier had rejected Geoffroy St. Hilaire’s notions of an archetypal animal, *the animal per se*, hovering above the animal kingdom. In 1858, the argument came to a head again with Huxley’s rejection of Owen’s archetypes (lecture on the theory of the vertebrate skull). Huxley noted, at that time, that the “Intelligent student” cannot help but be struck by the impression of transformation and ideal unity which the graded series produced. But he then argued that, when we reduced such evidence to statement form, we found it meant only that propositions of great generality could be made about every member of the series. Chapter XIII of Darwin’s *Origin of Species*, published a year after the Huxley lecture, made much of the appearance of transformation derived from the graded series, but by that time Huxley’s attack had cleared the air of speculation about Platonic forms.

Darwin explained the matter as follows. All lions resemble each other, as do, for that matter, all cats, but this easily recognizable resemblance (which suggests that a graded series can be made either of all lions or of all cats) does not imply the existence of an archetype of lions or of cats. Such resemblance is caused by the sharing of certain characteristics (in these cases quite fundamental ones). The only real question, therefore, is how this sharing of identical characteristics came about, and this is answered by the postulation of shared inheritance. All cats are descended from a common progenitor.

The thesis of *The Origin of Species* depends, of course, upon the prior answer given to the question of resemblance and the meaning of the graded series. Owen did not accept that thesis, but Owen had a different answer for the question of resemblance. So did Goethe.

The graded series may be most simply investigated through geometric forms. The triangle, for example, may be drawn with successive modifications, so that the resulting sequence seems to portray a continuous transformation. That is, every picture looks to be a metamorphosis of a single underlying form. But all we are really seeing, says Huxley, is the sharing of identical characters by all the figures of the series. If this were so, however, we should expect the unity of the whole row to depend completely upon the presence, in each figure, of the same characters. But this is *not* the case. The continuity of the whole depends, not merely upon the sameness of each figure, but very much upon the *difference* between them as well, for it is through this difference that we see the *movement* of the series, and thereby gain the impression that we are watching one thing transform, rather than the continuous substitution of different things. If the shared characters of each static figure were all that was necessary, then the order in which the series was arranged would not matter, but this order is, in fact, crucial to our sense of transformation. It is crucial also to the examples given in Chapter XIII of the *Origin*.

Transformation is obviously not substitution — the latter concept indicates a complete change of identity, the former, a change of appearance only. When I walk past a table, for example, and watch the shape of the table change with my changing point of view, I do not suppose that someone is changing tables. It seems clear that I am watching a transformation; it is always the same table, but its appearance alters. The triangles of the series above are also projective transformations. I can, for example, rotate a wire triangle in silhouette and see the same sort of continuous transformation. If I am careful to look from all angles my silhouette figure will pass through every possible triangular configuration. I am again watching a continuous transformation, but of what?

The physical object, the wire figure, is no longer visible due to the lack of reflected light; I have before me but a dark line, bent in a triangular fashion, but moving. I can see clearly that I am watching a transformation, that there is an underlying unity to the change of appearance, but what is appearing? Since this unity, the sense of a maintained identity within change, is dependent upon the sense of *movement*, the difference between each position that the silhouette passes through is every bit as crucial as the sameness, and we cannot reduce the unity to shared characteristics.

We have departed, by this time, from the sort of investigation that might be expected of a physical scientist. This is a study of the constitution of *appearances*, and we are now obliged to introduce the concept of intentionality. It is the perceiver who, for example, takes the forms of a graduated series to be arrested stages of a continuous transformation rather than totally independent objects. *He* must intend the context of movement, for there is certainly no physical movement present. Even when movement is directly presented to the eye, as it is by the change of the silhouette or the alteration of the table, the viewer must add something. The “eye of the mind” must always “see,” or intend, more than the physical eye, for the mind must always insist that the seen object is incompletely visible in any particular view. This notion, that one is seeing a *partial* disclosure, puts each disclosure, each viewpoint, in the context of an unseen whole. But although we cannot form a visual image of the whole (the totality of all the viewpoints), we can yet, by our intentional stance, make each image *represent* that whole. It is by this ability to make the image represent more than itself that we come by the permanence underlying the changing views.

But if this establishes our intentional contribution, it does not yet tell us the structure of that contribution. We must now drop the example of the table, for the table is more than a geometric form, and concentrate upon the triangle. What sort of entity is the represented “whole” in this case? What is being viewed through the changing silhouette? Attempts to think the ideal triangle usually come to grief at just this point, for each attempt to hold a specific notion before the mind ends by fixing *one* of the changing views, and thus falling into partiality.

It is just here that Goethe made his contribution. His first work on the problem was the *Metamorphosis of Plants*, an investigation which began from the question: how is it that all plants look like plants? In the attempt to discover the underlying plan for all vegetal form, Goethe became very interested in the comparisons made through a graded series. He found, for example, that he could arrange the stem-leaves of various plant species in a series so that they seemed to form a continuous movement. He also found (this was mentioned by Linnaeus) that some plants provide, in what was known as the metamorphosis of organs, a graded series of forms that runs from cotyledons to stem-leaves, stem-leaves to sepals, sepals to petals, and so on throughout the entire range of plant organs in such small steps that it is impossible to say where one organ begins and another leaves off. Following this suggestion, he found that plants that do seem to show a great distinction between organs can be considered to present the arrested stages of a continuous transformation of which most of the pictures are missing (even as very different static triangles may be considered stages of the continuous transformation above, but arrested and removed from that context). It seemed, at this point, that all above-ground vegetal forms were only metamorphs of a single underlying form. Everything was a transformation of the leaf. But what *is* the “leaf,” now that the stem-leaf is but a metamorphic form of the “leaf”? What is the triangle, now that all triangles are but partial views?

Goethe refused to retreat into a generalized statement. A list of characters, no matter how extensive, could refer only to a static shape, but the overwhelming impression of organic life is one

of motion, growth, and change. Even inert objects, as we have seen, do not offer us fixed appearances, but transform with our every movement. “The German,” he wrote,

has the word *Gestalt* for the complex of existence of an actual being. He abstracts with this expression, from the moving, and assumes a congruous whole to be determined, completed, and fixed in its character.

But if we consider *Gestalts* generally, especially organic ones, we find that independence, rest, termination nowhere appear, but everything fluctuates rather in continuous motion. Our speech is accustomed to use, therefore, the word *Bildung* appertaining to both what has been brought forth and the process of bringing-forth.

If we would introduce a morphology, we ought not to speak of the *Gestalt* at all, or if we do use the word, should think thereby only of an abstraction — a notion of something held fast in experience but for an instant. (“*Bildung und Umbildung Organischer Naturen*”)

The important thing was to place before the contemplating mind the actual experience of transformation, not the abstract *Gestalt*. This Goethe did, continually practicing, before his inner eye, the metamorphic sequences he encountered in nature, first forwards, and then back again. (He succeeded so well that at one point in his research he consulted a doctor about the images he saw whenever he closed his eyes. It seems that when he tried to dismiss the moving picture he had conjured up in his meditations, it sometimes refused to go away.) He discovered, in this way, an unsuspected aspect of the problem. The contemplation of the *movement* of the forms reveals what the static forms, as static, conceal.

Consider the experience of music. When a single note, say, middle C, is played alone, the experience we have of this note is quite different from that obtained when we strike middle C and then, as soon as it stops sounding, the G above it. The single tone in the second instance enters into movement — seems to be *going* somewhere. It has been placed in the context of the interval; it expresses a gesture.

The movement of melody may be described as a sequence of musical gestures, or a long gesture of qualitatively differentiated stages. But the movement is never in the notes themselves. Alone, they go nowhere. We say we *hear* a melody, but by that we mean a mental process: we place the sounds in the context of the intervals and their sequence. Yet our speech is correct; we hear, and recognize, melody. By what sort of a concept is such a cognition formed?

The music moves, but its gesture is not made by the notes. Nor does the musician make the gesture — he only *follows* it. The melody itself acts as the directive power behind the whole process, leading the musician and placing the notes: a felt power, in response to which we make metaphors of the “drive” and “force” of a passage. As experienced, melody is never something done, a mere effect, but something doing, a causal activity.

This fact gives melody a cognitive status. Notice, for example, that if the melody itself did not direct the placement of the notes, then the musician would, and for reasons unknown to us. Without the melody, we could have no understanding of why one thing follows another, no law governing before and after. It acts, therefore, as if it were a conceptual standard explaining the why and wherefore of the sounds. Yet it gains this cognitive power only to the degree that it is directly perceived — *felt* — as the directive energy. It is both experience and idea, percept and concept, or better, an *intuitive* concept.

We do not usually notice this result, for we are so taken with the energy of the melody (which

we must intentionally participate) that we pay more attention to our experience of being moved than we do to our participation in the moving activity, and thus miss the cognitive aspect, i.e., our own thinking (intending) of the melody. It is typical, of course, of the mental stance of Cartesianism, that the thinker refer his thinking to something beyond it and therefore remain unaware of his own activity. But while this may cause no noticeable difficulties with regard to static subjects, the habit does lead to paradoxes when the referent is an activity. In this case it is impossible to place the referent beyond the thinking that refers to it, for the activity we cognize *is* the intentional activity by which we cognize it. Activity simply refuses to stand over and against the thinker; it is not something we sensibly perceive but something intuited through the change in the sensible report. We must intend it, and only through this intentional act does it enter into our awareness at all, and then as our own activity. We cannot bring it into the position of an “objective” fact.

It is for this reason that the concept of *force* in mechanics has caused so much difficulty. Since the days of Hume and Berkeley, empirical philosophy has speculated upon the possibility of a language reform which would do away with this “relic of animism.” But since such a reform would deny the intuitive participation in events that provides the foundation for mechanics itself, or at the very least, would commit that intuitive content to silence, it seems unlikely that the reform is really desirable. The problem of *force* will be solved when our treatment of it passes beyond Cartesian limitations.

My observations on music have some chance of being recognized due to our familiarity with music as movement or gesture, but it does not occur to the ordinary standpoint that other types of lawful change might be brought into the condition of music. We do not put the triangle, or the forms of the familiar world, in motion. Why should we? After all, until the experiment is made we have little reason to suppose anything missing. We habitually limit forms to space, making them fixed and partial. Only in special circumstances, like those of music, do we grasp form in the element of time. In the case of music our culture has trained our faculty. In most other cases, however, we must create this faculty by our own effort.

Here we see why Goethe had such difficulty in attempting to communicate his results. The comprehension of such work demands the development of a new faculty, but Goethe’s critics were all too willing to rely upon their established mental habits. What he claimed to have seen, they judged he merely theorized; what he called experience, they termed a speculative idea. When Goethe wrote that in his investigations “my observation is itself a thinking, and my thinking a way of observation,” the implicit suggestion that an idea could be an experience as well was reason enough to suppose him wrong. That thinking could become an organ of perception seemed a contradiction in terms. The “new faculty” above cannot be developed without entering into the unusual state of awareness through which we become conscious of our own intentional activity. It is necessary to turn the attention from our *thoughts* to an awareness of ourselves *thinking*. Only then do we discover that while a *thought* may indeed be devoid of perceptual content, things are quite otherwise with the activity of *thinking* (or intending), which activity provides an inner realm of experience. Each thought, each perceptual recognition, has a cognate experience in this realm, which remains tacit for normal mental life, but which can be awakened, by our own effort, into focal consciousness. Once this awareness is present, a new dimension is added to the perceptual and cognitive content of the world.

When Goethe attempted to make the forms move, he entered into this unusual standpoint. By

dissolving the fixed element in continuous motion, he turned from the produced to the producing, from the fixed thought to the activity of thinking. In this manner he came to experience his own will as it lived in the act of cognition, and became, through this, object to himself — thus his ultimate rejection of the postulate of objectivity. The final result of the phenomenological standpoint must be a participant attitude which directly contradicts the Cartesian stance, for with the contemplation of intentionality we come to a point in experience where we are most intimately ourselves — the activity of our own will — and *are yet most definitely the other* at the same time, since the activity in which we participate is the constitutional structure of the object contemplated. We are reminded of Aristotle's remark, in *De Anima*, that at the moment of *theoria* the mind becomes what it thinks and thereby thinks itself. In the Goethean paradigm, all knowledge of another is, of necessity, self-knowledge as well.

Verification

As Karl Popper has demonstrated, there can be no verification procedure within a Cartesian science. Experimental test can indeed falsify, since a prediction made necessary by the hypothesis in question may be shown incorrect, but no amount of confirmed predictions can confirm the theory (and prove, therefore, that future cases must also conform to prediction). In the first case, that of falsification, the element of necessity comes from the logical structure of the hypothesis (if this is present, that will occur), and a single empirical instance to the contrary puts the theory, through its own demands, in contradiction with reality (a single white crow overthrows my theory that all crows are black). In the second case, that of verification, the element of necessity must be gained from the empirical event, but mere facts make no such demands (a black crow does not prove that crows *must* be black, nor will any number of black crow be able to demonstrate this). A confirmation of a prediction is only a fact — it shows us what *did* happen, but cannot reveal what *must* happen.

This inability to find necessity within empiric observations is a necessary result of our axiom, within the Cartesian paradigm, that empiric experience and idea are incommensurable. But it is our own point of departure, and not the evidence of experience, that creates this limitation. Since the phenomenological standpoint does not find any such incommensurability between idea and experience, the corresponding difficulty does not arise.

The model for descriptive science is mathematics, and any work in descriptive morphology must be brought to the level of mathematical culture. I mean by this that one cannot accept, in mathematics or descriptive morphology, anything that was not first placed there by his own activity. In mathematics we guarantee the truth of our operations by reference to axioms assumed from the beginning. In morphological research, we receive this guarantee from the structure of the given appearances which, as is argued above, is cognitive because we have ourselves intended it. Questions about the structure of appearances are, after all, questions about our own activity, and what we do ourselves is open to our inspection.

The mathematician solves his problem by working out what his statements must *mean*, in the light of his intended axiomatic structure. The morphologist proceeds by becoming reflectively conscious of what he himself tacitly *meant* by the formulation of appearances, by the way of looking or activity through which he recognized them. There is nothing in either field that

necessitates indeterminate thinking. Everything is transparently clear, for we accept nothing unconsciously, without the application of our will.

These matters and their application to Goethe's work have been fully and lucidly explained by the Austrian philosopher, Rudolf Steiner, whose works on the matter are now available in English (Steiner, 1950, 1968). His commentaries and epistemological analysis are exemplary in their penetration and empathy with the Goethean outlook, but for that very reason they have been much neglected.

Applications

It is obvious that with the rejection of the Cartesian paradigm Goethe's method gains ontological implications. These will be disagreeable to the "common sense" of many thinkers, but I cannot find any logical fault in them. The world they suggest is far closer to that imagined by Roszak (in the quote above) than it is to the world as understood by modern science, for the discovery of intentionality reveals a "submerged kinship" between self and other that brings mind into perception and perception into mind. By this one step, the "premise for the progress of all natural science since Newton," as Heisenberg called it, is discarded.

The progress of natural science is a rather impressive accomplishment, and it was not my intention to take it lightly. But is it not obvious that, at the present moment, this progress has itself given rise to demands that cannot be met from a Cartesian stance? I mean, in particular, those problems that are said to call for a *holistic* approach. Ecology is a primary example, and, as an offshoot, ecological approaches to medical problems (disease as an imbalance of the organism). Indeed, the living organism itself, or the concept of the whole as applied to taxonomic problems; the unity of a social order or economic system; the concept of the self in psychology and that of a people in anthropology, and so on. Situations which present a unity of process in which nothing is a discrete element but all parts are so interrelated as to depend, for their very identity as individual parts, upon such relations. Principles of unity are being sought in so many fields that the candid observer might well wonder whether a methodological problem was coming to the surface.

I think it obvious that this is indeed the case. Interdependent unity is contextual. The unity of the projective views of a geometric form or of melody, is of this sort. It is not provided by the static parts (which are then *not* parts), but by the context which cancels their separateness by taking their difference for process. Such a context cannot itself be a static element, a thing to be thought, but an activity of relating which thinks each part by including it within its gesture. One cannot find such a context "out there," entirely beyond the observing subject. It can be made focal only by an awareness of intentional activity, something that is neither merely "out there" nor "in here," but which is the unity and perhaps therefore the origin of these poles.

With the new awareness of the problem posed by the *whole*, science may itself be outgrowing the mechanistic discreteness that structures the Cartesian view. It may be that we are ready, at last, to consider the interrelation, perhaps even the *polarity*, of subject and object, mind and world. It may be time for man and nature to reconsider each other.

I do not, of course, mean to say that the Goethean approach can point to a list of accomplishments (this *could* be done, if one knows where to look, but the list is necessarily rather short). It is still a new science and must be practiced before it comes into its own. Any attempt to

compare it to Cartesian science on the basis of past accomplishments is patently absurd. It is not to the past but to the future that theoretical development looks, for it does not itself produce new *results*, its promise rests upon the far more important basis of new *questions*. If this approach had, to the moment, produced nothing at all, seen no applications, that theoretical promise would still be present. When he lectured on his experiments with electricity before the British Royal Society, Faraday was asked of what *use* was his discovery. "Madam," he replied, "of what *use* is a newborn baby?"

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