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Lindisfarne Letter

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All such disciplines, theories, and scientific investigations, as truly invigorate the eye of the soul, and purify the intellect from blindness introduced by studies of a different kind, so as to enable it to perceive the true principles and causes of the universe, were unfolded by Pythagoras to the Greeks.

IAMBLICHUS, Life of Pythagoras

What he said to his disciples, no man can tell for certain, for they preserved an exceptional silence. However, the following facts in particular became universally known: first, that he held the soul to be immortal, next that it migrates into other kinds of animals, further that events repeat themselves in a cyclical process and nothing is new in an absolute sense, and finally that one must regard all living things as kindred. These are the beliefs that Pythagoras is said to have been the first to introduce into Greece.

PORPHYRY, Life of Pythagoras

At this point we may ask the question: since we are distinguished from all other existing things, for what particular purpose have nature and God brought us into being? Pythagoras, when asked this question, replied, 'To view (or contemplate therein) the heavens.' And he added that he was a viewer of nature, and had come into life for this purpose.

ARISTOTLE, Protrepticus

Then comes the most difficult of all questions, whether unity or being, as the Pythagoreans and Plato said, is not a particular something at all, but is the very being of any being.

ARISTOTLE, Metaphysics

Wise men, Callicles, say that the heavens and the earth, gods and men, are bound together by fellowship and friendship, and order and temperance and justice, and for this reason they call the sum of things the 'ordered' universe, my friend, not the world of disorder or riot. But it seems to me that you pay no attention to those things in spite of your wisdom, but you are unaware that geometric equality is of great importance among men and gods alike, and you think that we should practice over-reaching others, for you neglect geometry.

PLATO, Gorgias

They very much honored the memory, abundantly exercised, and paid great attention to it. In learning, too, they did not dismiss what they were taught, till they had firmly comprehended the first rudiments of it; and they recalled to their memory what they had daily heard, after the following manner: A Pythagorean never rose from his bed till he had first recollected the transactions of the former day; and he accomplished this by endeavouring to remember what he first said, or heard, or ordered his domestics to do when he was rising, or what was the second and third thing which he said, heard, or commanded to be done. And the same method was adopted with respect to the remainder of the day. For again, he endeavoured to recollect who was the first person that he met, on leaving his house, or who was the second; and with whom in the first, or second, or third place discoursed. And after the same manner he proceeded in other things. For he endeavoured to resume in his memory all the events of the whole day, and in the very same order in which each of them happened to take place. But if they had sufficient leisure after rising from sleep, they tried after the same manner to recollect the events of the third preceding day. And thus they endeavoured to exercise the memory to a great extent. For there is not any thing which is of greater importance with respect to science, experience and wisdom than the ability of remembering.

IAMBLICHUS, Life of Pythagoras

The Two Lights

ARTHUR G. ZAJONC

IN THE DIALOGUES of Plato and the lectures of Aristotle we recognize ourselves in inspired infancy. The dialogues seem warmed and illumined still by an ancient, perennial source grown feeble with time but which flourished again in Plato's hand. By contrast the learned and probing mind of Aristotle appears bent on illuminating and enumerating the entire cosmos, its contents, structure and Creator by the methodical brilliance of the human mind alone. When we place Aristotle against the background of Pythagoras, Homer, Hesiod and the Mysteries—that is, against the backdrop of myth, epic, ritual and initiation—the contrast is the greater. A profound transformation of the human psyche is foreshadowed in ancient Greece. It will take long centuries of neglect at the beginning of our era, rediscovery in Arabic Spain and Sicily in the 12th century, and vigorous explication and elucidation at the hands of Arab and other scholastic commentators before the singular accomplishment of Greece grows and diffuses into the mode of reflection common to Western thought. Once this heritage has become a commonplace, it can be challenged, for example, in mechanics by Galileo or in methodology by Francis Bacon and René Descartes. With them and their contemporaries another cognitive stage is begun in the midst of which we ourselves stand.

The transformations have been many and profound, yet for all the monumental accomplishments in science, art and social life, many contemporaries have spoken of something precious as fallen away from our culture, especially since the rise of the scientific worldview in the 16th century and its rapid diffusion in the 18th, the "enlightenment" which it proposed to advance, seemed rather to obscure and overshadow certain of mankind's noblest visions and aspirations. Even during the steady expansion of science in the 18th and 19th centuries, we may hear dissenting voices which speak to us of the losses incurred through the assumption of a narrow, mechanistic science. We think immediately of Blake or Keats, the romantic poets of Britain and Germany. Even in the provinces of transcendentalist New England, echoes of the same sentiments arise. Lamenting the prevailing science as myopic and impoverished, Thoreau would make the following entry for Christmas 1851 in his journal.

I, standing twenty miles off, see a crimson cloud in the horizon. You tell me it is a mass of vapor which absorbs all other rays and reflects the red, but that is nothing to the purpose, for this red vision excites me, stirs my blood, makes my thoughts flow, and I have new and indescribable fancies, and you have not touched the secret of that influence. If there is not something mystical in your explanation, something unexplainable to the understanding, some elements of mystery, it is quite insufficient. If there is nothing in it which speaks to my imagination, what boots it? What sort of science is that which enriches the understanding, but robs the imagination? . . . If we knew all things thus mechanically merely, should we know anything really?[1]

Thoreau gives voice to one of the great tensions that animated not only the romantic poet but which also has stimulated controversy and provoked persecution in nearly each century since at least the time of Plato. We are reminded of Plato's suggested sentence for atheistic atomists, five years in solitary confinement and, if unreformed, execution. The tables have slowly turned so that now the sincerely held convictions that the cosmos is spiritually based and that our human species shares in the divine, these carry with them the sentence of intellectual isolation. Between our time and Plato's we encounter struggles similarly driven in the antagonism between the Cambridge Platonists and the rising materialism of Locke, Descartes and Hobbes, or again in the attempt to reconcile Christian or Islamic doctrine with Greek philosophy during the Middle Ages. Often it is the fight between the reactionary and avant-garde of society. Yet occasionally a period or individual while fully dedicated to advancing a new world view becomes poignantly aware of a spiritual, moral or intellectual loss. Then there arise great and noble attempts at reconciliation and synthesis rather than reformation or return to a "purer," ancient state closer to God, whether biblical or hermetic. It is, I think, something of this that has brought this conference together around the person of Pythagoras. We look back to his community in Croton and recognize elements which seem extremely modern: mathematics and acoustical studies for example. Yet the ritual and form of daily life appear rooted in a deep and ancient tradition. The tension between scientific investigation and a religious life which creates so much discord in our age seems to have produced harmony for the Pythagoreans.

In his opening address Christopher Bamford suggested that after Pythagoras something very precious did fall away from Western consciousness. In mythopeic terms it might be called the loss of Orphism. By this I understand a final loss of our one time native, unconscious participation in the phenomenal world called by Owen Barfield

"original participation." In this ancient mode of consciousness the subject/object split of Cartesian dualism is nonexistent. The soul-spiritual content of the world is experienced in unity with the phenomena it presents outwardly. It was a slow fall from grace, one which the mysteries and the community of Pythagoreans doubtless knew and attempted to forestall, yet it does seem, as Chris suggested, that with the fall of the community at Croton and the subsequent development of Western thought, we witness a profoundly symbolic change not only in world view but in the mode of knowing practiced by the intellectual West. I cannot accept that this transformation was an unnecessary aberration or tragic deviation in human evolution. It may just as well have been the "discovery of mind" which, while promoting an individualized mankind, may lead to a genuine human freedom. Yet it does seem abundantly clear that individuation can and must lead to anarchy unless a new harmony is established between the sacred and the profane. We must not imagine the reconciliation as the triumph of a divine knowledge over a worldly one but rather as Novalis saw it, as a reciprocal raising and lowering in which the divine takes on the countenance of the mundane and the world becomes the visage of God.

> The world must be romanticized. In this way one rediscovers the original meaning. Romanticizing is nothing other than a qualitative potentization. In this operation the lower self becomes identified with a better self—just as we ourselves are a series of such qualitative potentizations. This operation is still entirely unknown. By giving the common-place a high meaning, the familiar a secret aspect, the finite the appearance of the infinite; thus do I romanticize it.—The operation is just the opposite for the high, the unknown, the mystical, the infinite—it becomes "logarithmitized" through this process.—It receives a familiar countenance, romantic philosophy. *Lingua romana.* Reciprocal exaltation and descent.[2]

In one sense, we must regain what we have lost, we must descend like Orpheus in search of the shade of Eurydice and bring her to the light of a new day. Yet to merely run time backwards, to create a new Croton, to re-enact a sacred tradition, is to deny what twenty centuries of honest toil have given to mankind. That is to say, it avoids a critical responsibility, namely, to evolve a tradition in keeping with our time. Pythagoras traveled to many centers of ancient culture and sacred knowledge, yet he created a ritual and practice uniquely his own, suited for his people and age. Is it not incumbent upon us to do likewise? Certainly, we also may travel to temples and study the traditions of sacred knowledge, but must we not also likewise master the knowledge and methods of our own age? Through the confluence of these we may truly unearth, not an eclectic muddle of imported doctrines, but the sacred knowledge of our epoch. Such is only possible when all has passed through the alembic of the seeker and reappears in the dress both of our time and eternity.

In what follows I shall not guess what will become the content of a new sacred tradition. Rather I would like to address the nature and healing of the rift between the traditional sacred and profane modes of knowing. For I feel that only when these two join in a common endeavor in each individual knower, can a new tradition be founded. The world-historic struggles between sacred tradition and a rising scientism move likewise in the psyches of each of us. We each know the ebb and flow which brings us one moment to the tranquil heights of spiritual reverie or again to the brilliant clarity of well-reasoned discourse. Are these truly complementary modalities? Or is the split not rather a reflection of our present cognitive stage which by conscious effort may be changed? If there was an "original participation" in which no rift existed, is there not a "final participation" towards which we may labor? In this work we shall each find mentors who articulate our hopes and provide insights into the means and content of what I have been calling a new sacred tradition. For those who know the contributions of Rudolf Steiner to this task, my debt to him in what follows will be obvious.[3]

Of Craftsmen and Priests

As a framework allow me to adopt a terminology which has arisen in this conference. In characterizing the split or epistemological gap, as Chris Bamford called it, which occurred after Pythagoras, Joscelyn Godwin introduced the terms positive and negative gnosis. I understand by these two polar relationships or attitudes which an investigator or seeker may have to the external world. Positive gnosis admonishes us to engage the world if we would find true knowledge or "gnosis." By contrast, negative gnosis considers the earth as a dark illusion, a prison from which we must seek release. In this view, gnosis is only to be found by inner illumination. To gain a clearer understanding of these terms, we could remain within the esoteric tradition and contrast the two disciplines of alchemy (as positive gnosis) and mysticism (as negative gnosis). However, I will choose another approach. In many exoteric disciplines we may see a reflection of these same attitudes. The history of medicine is a wonderful instance of the varying attitudes its practitioners have had towards the world, emphasizing in turn positive or negative gnosis.

In the writings that come down to us as the Hippocratic corpus from about the time of Pythagoras, we find descriptions of a rich and varied relationship between medical theory and medical practice. On the one hand one finds there descriptions of philosophers who propose sundry theoretical schema for the understanding of illness and disease. These may take the form of humoral pathology, the explanation of illness in terms of an imbalance of the four elements, or atomism, but in all cases the philosopher remains remarkably distant from "clinical" experience. At the opposite pole we learn of the barber-surgeon or nurse who without benefit of theoretical knowledge attempts cures by the most varied and often radical means. Between these two resides the true physician as a Hippocratic ideal. He is admonished to go to the bedside of his patients and carefully observe their surroundings, the weather, and especially to inquire after the history of the illness. Prescription of a careful regime and diet along with certain purgatives or laxatives are then given and frequent, even daily monitoring of the patient's symptoms is practiced. In addition, each physician struggles to integrate his own experience through theory. As a consequence each will usually adopt a theoretical framework according to his individual disposition so that there exists a certain happy contention among practitioners. Perhaps because of this, theory rarely rises to the status of dogma. In our imagined Hippocratic physician we find the two poles of theoretical and practical knowledge seeking reconciliation. The physician may be deeply reflective but he is also engaged with human disease and misery.

The Hippocratic corpus reflects, however, only a passing phase in medical history. With the great compilation of medical knowledge executed by Galen (circa 200 A.D.) the ephemeral union of positive and negative gnosis ruptures. In place of the bedside physician acting as both nurse and philosopher, we find the physician off in his study or at the podium, with his barber-nurse following directives. Diagnoses usually were made by visual inspection of a urine sample alone which had been collected by the nurse and brought to the physician's study. All treatments, including necessary surgery, were performed by the nurse. Before the time of Vesalius, dissections, when allowed, also were performed by the barber-nurse. The attending physician would read the appropriate sections from Galen while students looked on. In the adjoining illustrations we see a graphic presentation of the separation of positive and negative gnosis, of craft and theoretical knowledge, which was prevalent during the Middle Ages. The physician above stands reading from a book whose contents became dogma for centuries, while below a technician practices his craft. Through intimacy with the phenomenal world the craftsman-artisan widened and deepened his positive knowledge of the world. By contrast, the scholar turned away from the sense world, revering Galen and Aristotle with nearly

The medieval physician lectured or read from Galen while his attendant performed the actual dissection. (From the *Fasciculo de Medicina*, 1493.)

Here we see Vesalius on the floor, himself performing the operations required. Craft becomes again a part of knowing. (Title page of *De fabrica*, Basel, 1543.)

as much ardor as holy scripture. It became the work of the scholar to explore and unravel the truths within these texts unfettered by challenges from natural knowledge.

Not until the time of Paracelsus do we find individuals who again struggle with both positive and negative gnosis. Paracelsus recognized two "lights," the light of revelation and the light of nature. Although clearly the lesser of the two lights, the "light of nature" seemed to him, at least at times, to be the only mode open for human inquiry. One could study the documents of revealed knowledge, indeed he studies them deeply, but the days of revelation were past. Thus we find Paracelsus in the mines studying the formation and powers of minerals, we see him seeking out the folk remedies in village and country in search of the lost craft of medicine, and we find him in the town square of Basel burning the near-sacred books of Galen. Paracelsus was a heretic in his own time, yet we may see him as someone deeply committed to the study of nature in the light of a sacred tradition, Christian and alchemical.

In the history of medicine then, one witnesses a reflection of the fragmentation of knowledge. A great schism seems to separate the scholar and the practitioner during the Middle Ages. We should remark, however, that together with this fragmentation there arises the possibility for an extraordinary cultivation of thinking on the one hand and artistry on the other. Perhaps it would have been impossible for the West to develop the formidable intellectual powers it did during the scholastic period, had the schism never occurred. We must recall that when the world view and theology of this period projects itself through the positive genius of architect and craftsman into stone and glass, the Gothic cathedrals result. As the spirit of the scholastic rises through dialectic and the seven liberal arts to embrace a divine order, so also does the craftsman master masonry and stained glass as never before—or since. Through his art an earthly edifice may embody that same spirit. The pristine unity of knowledge was broken, yet the loss can also become the means for transformation and reunion. Can we not learn something from this? Let us be wary of a premature union before we have fully experienced the joys and struggles of both pure thinking and an intimate worldliness. Then perhaps we may find the goal of a unitary knowing nearer at hand. We will learn to know fully once we have known partly.

Allow me to re-emphasize the dangers associated with the premature synthesis of theoretical and empirical knowledge by an example drawn from contemporary physics.

In his Nobel acceptance speech, the physicist Edward Purcell recalls his emotions upon seeing the world in the light of his discovery of nuclear precession.

> Professor Bloch has told you how one can detect the precession of the magnetic nuclei in a drop of water. Commonplace as such experiments have become in our laboratories, I have not yet lost a feeling of wonder, and of delight, that this delicate motion should reside in all the ordinary things around us, revealing itself only to him who looks for it. I remember, in the winter of our first experiments, just seven years ago, looking on snow with new eyes. There the snow lay around my doorstep—great heaps of protons quietly precessing in the earth's magnetic field. To see the world for a moment as something rich and strange is the private reward of many a discovery.[4]

One must not discount the power of such a vision. It is often just this which has filled countless scientists with enthusiasm for their work. Yet we should also be fully conscious of just what such a vision, taken literally, purports.

Through painstaking, detailed study of experimentally produced phenomena, Purcell and his colleagues saw confirmation of a certain theoretical model of reality. A spinning top which is tilted slightly will precess around a vertical axis. We all know this motion from playing with tops. The model elaborated by Purcell and others saw the proton as executing an exactly analogous motion. In this case the magnetic moment of the proton would precess around the axis of a laboratory magnetic field with the precessional motion inducing a small voltage in a detection coil. By measuring the detected voltage as a function of magnetic field strength, for example, one could compare measurements with predictions of the theoretical model. The work of Purcell is a classic example of the methods and explanations offered by physics. Let us focus a little more carefully on several features it possesses as these will be important to our discussions much later.

First of all we find that laboratory phenomena, like meter positions, are interpreted through a chain of more or less conscious inferences as providing confirmation or falsification of a particular theoretical model. Of course, one never *sees* a precessing proton. Rather, certain meter positions are understood as indicating the motion of electrons in the detection circuit under an induced electromotive force acting in accord with the laws of electromagnetism. Any measurement, therefore, entails a complex of theories not just a single one. As Pierre Duhem pointed out at the beginning of this century, each experimental observation is "theory-laden."[5] That is, when we say, "The meter reads three volts," all of electromagnetic theory is implied. The scientist, for the most part, assumes the validity of established theories unconsciously in even the most elementary observations. We can, therefore, say that contemporary experimental science is not concerned with essentially pure phenomena, but with very elaborate theory-laden observations. In the last part of this paper I will discuss Goethe's scientific studies which, by constantly remaining with the seen phenomena, differ markedly from the above characterization of contemporary experiments.

Let us turn to the theoretical component of Purcell's discovery. Physical theories are developed, of course, at various levels of abstraction, but perhaps the most common form is exemplified by the model which Purcell discusses. With it one is to understand the dynamics of nuclear magnetism as very much like the dynamics of spinning tops. Experience we have gained in the mechanical realm of tops is to be transferred to the atomic level. Clearly implied in this is the assumption that the world is inherently mechanical at all levels, microscopic as well as macroscopic. Very often this same assumption is extended to become the unifying element of all scientific explanation. Then biology, human behavior and much else besides are all conceived as inherently mechanical. All science is reduced to physics. Such a view is both extraordinarily arrogant and naive. Limiting ourselves to Purcell's model, however, we can say that he draws the features of his theory from the sensory realm of spinning tops. These abstracted tops are then projected back into the phenomenal world. The result is that a snowfield becomes a field of gyrating magnetic tops. Physicists insist that this is meant only as an analogy, an aid to understanding the relationships which obtain between magnetic fields and atomic moments. Yet all too frequently our models become our reality. As with all models, they are never congruent with reality but become a Procrustean bed which severs from nature those qualities and features so precious to the poet. Certainly the poet is no stranger to metaphor and simile, but the impressive applications of science and the simplistic popularizations of physical theories have conspired to elevate what was originally meant as analogue, to the level of established truth. It would be as if the declaration "Bill is a tower of strength," changed from a statement about Bill's moral character to a literal truth. Bill may be many things, but he is not a tower. No matter how fruitful or powerful the model, reality is ultimately reduced to less than it truly is. The mingling of thought and experience as metaphor may be, on one level, uplifting or successful, but, if taken literally, it becomes deeply disquieting on another. Thoreau would, I think, hardly be happier with Purcell's vision of a snowfield than he was with the explanation of a sunset given by 19th century optics. Here among ourselves during this conference, certain poets have expressed a similar dismay in seeing nature as essentially geometric

solids. Purcell's emotions were as genuine as our geometers'. I would suggest firstly a great tolerance for the myriad metaphors which may justly be applied to any single experience or object. Perhaps the happy contention among us will, as with the Hippocratics, prevent any one of them from rising to dogma. But moreover, I would suggest that we may postpone the union and rather practice *pure* positive and *pure* negative gnosis. We then may await the union as an act of grace and not one of human fabrication.

We have seen in physics that normal experimentation is thoroughly laden with implicit theoretical assumptions, and that conversely, theory is normally couched in the language and concepts of the perceptual world. Is it possible to separate these two pursuits and to cultivate them separately, at least as a discipline for the soul? I think so.

Plato admonished his students to study geometry as a *propedeutikon* for the mind, as a means of purification and exercise in pure thought. Goethe admonishes science and us to remain with the phenomena, not replacing them with mechanical models, but rather to exalt the phenomenal world itself until it approaches the ideal. I would suggest that we may gain greatly by following the injunctions of both. In what follows I will present a brief introduction to projective or synthetic geometry, not as sacred mathematics but purely as an inner exercise which stresses the perception of invariant relationships under geometric transformations. A second part will consist of an introduction to a science of phenomena as put forth by Goethe. Of particular importance will be Goethe's emphasis on the process of discovery which allows perception of unity in a multiplicity of phenomena. Indeed, invariance will be a common theme through both sections, otherwise dissimilar.

Transformation and Invariance

> Under that despotism of the eye (the emancipation from which Pythagoras by his *numeral*, and Plato by his *musical* symbols, and both by geometric discipline, aimed at, as the first *propaideutikon* of the mind)—under this strong sensuous influence, we are restless because invisible things are not the objects of vision; and metaphysical systems, for the most part, become popular, not for their truth, but in proportion as they attribute to causes a susceptibility of being *seen*, if only our visual organs were sufficiently powerful.[6]

Proclus tells us of the special character and value of mathematics in his Preface to *Euclid's Elements*.[7] In the neo-Platonic view, study and practice of mathematics lifts the soul from the mundane world to a realm intermediate between our extended, corporeal world and the purely non-spatial, unextended world of duration often termed the archetypal realm. This intermediate or ectypal realm shares the extended character of our world but lacks its substantial nature. The forms of geometry are incorporeal but remain spatially extended and so belong to the ectypal realm. According to neo-Platonism there can be no certain knowledge, only opinion, in the mundane world. Knowledge of the ectypal proceeds by a different faculty, *dianoia* or the discursive intellectual capacity. Indeed, the theorems of geometry may stand as a paradigm for that mode of inquiry which can move with complete security from one proposition to the next. An alternative mode of knowing, *episteme*, was demanded if knowledge of the archetypal realm was to be gained. Here it is not a question of sequential steps in a line of reasoning but rather an instant of recognition, of pure intuition which carries with it its own weight of conviction. There is no proof in the geometric sense wherein a faulty step in logic may insert itself. Nor as in the mundane world of opinion must one marshal evidence in support of one's hypothesis. Mathematics then played the tutor to the young philosopher or statesman who would aspire to rise to a higher, more certain vision.

The special character of mathematics, which made it so esteemed in Pythagorean and Platonic thought, also excited the young Novalis, who studied 18th century science and mathematics as deeply as he did poetry and philosophy. Among his fragments we find,

> Current mathematics is only the first and simplest revelation of the true science of spirit.
> It is little more than a special empirical organon or instrument.
> True mathematics is the proper element of the Magi.
> The life of the gods is mathematics.
> Pure mathematics is religion.
> In the orient true mathematics is at home. In Europe it has degenerated into mere technique.[8]

Novalis also knew the power of mathematics to lift us above the cares of everyday life. He wrote to his ill brother Erasmus:

> Your resolve to study algebra is certainly very healthy. The sciences have wonderful healing forces—at least like opium—they silence the pains and raise us into spheres permeated by an external sunlight. They are the most beautiful asylum to which we are granted access.[9]

Let us then explore this pole of our consciousness, one which turns aside from the facts and data of the natural world and concerns itself with pure forms, relationships and movement. The ap-

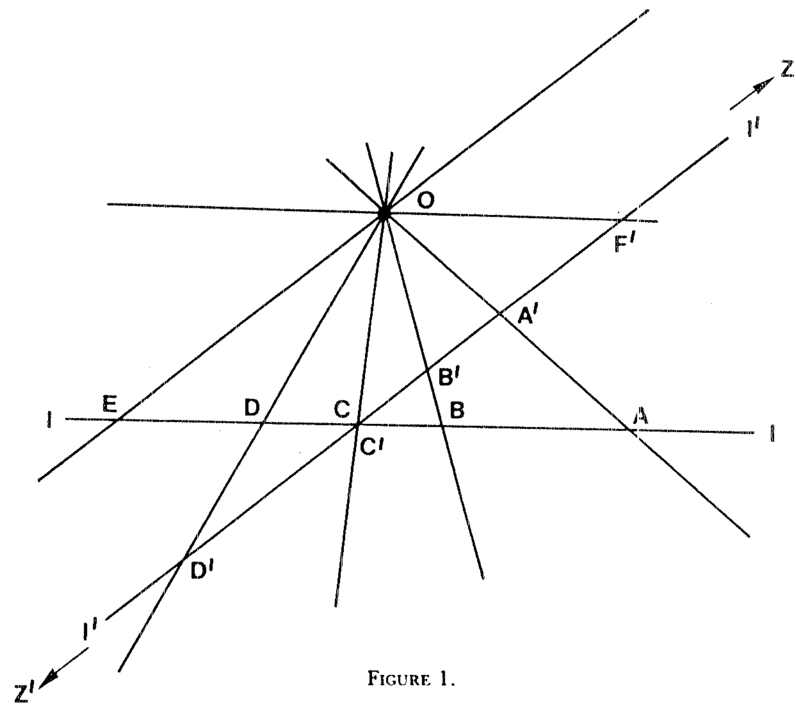

FIGURE 1.

proach to geometry developed especially during the 19th century as projective geometry is, I think, wonderfully suited to our purpose. The great English mathematician Cayley would declare, "Projective geometry is all geometry and reciprocally." Hankel called it the "royal road to all mathematics." Let us then begin our journey on this road which, perhaps not surprisingly, has grown recently rather narrow with disuse.

At the very heart of projective geometry is the concept of transformation. Indeed the modifier "projective" refers to the transformation which acts as the generative principle in projective geometry, transforming one spacial form into another. The simplest projective transformation is the mapping of all points on one line to points of a second line by a "perspectivity." Consider Figure 1. Allow line l to be our original line on which we may identify certain points, for example, A, B, C, D and E. Let us suppose that we wish to place the points of line l into one-to-one correspondence with the points of a second line l'. We may do this by choosing a "center of perspectivity" O and then drawing lines through OA, OB, OC and so on. The points of intersection A′, B′, C′, D′, E′ are the points corresponding to their unprimed counterparts. In this way we may transform the points of one line to the points of another line in a unique way. Clearly, the transformation depends on the exact relationship between l, l', and O. Notice that we encounter a special case in the transformation of E to E′. If we take OE to be strictly parallel to l', then we expect from Euclidean geometry that these two lines will never intersect. In projective geometry, on the other hand, we say that OE and l' meet in the "point of infinity." That is, we add so-called "ideal elements" to the primitives of geometry. It is thus clear that we may transform any point on our original line to infinity by a suitable choice of O and l'. Reciprocally, the point at infinity on l may be mapped to a point on l' (say F′). We may gain a further insight into the continuous and unbroken nature of the line in projective geometry if we imagine the several lines through our center of perspectivity, O, to be merely the various positions of a single line through O as it rotates about O. As this line swings clockwise it passes through A′, B′ . . . until it reaches the ideal point E′ of the line l'. If we continue, we notice the point of intersection seems now to approach from above, as if the line l' has only one ideal point (Z′) which can be reached by moving in either direction along the line. To each line of the plane we may associate an ideal point. All parallel lines share the same ideal point. The locus of all such points becomes the "ideal line" of the plane. Inclusion of ideal elements in geometry allows theorems to be stated simply without exceptional cases and provides for wonderfully mobile transformations, as we shall shortly see. We have seen already how the infinite can appear in the finite and reciprocally.

Ironically, although the metamorphic powers of projective transformation are enormous, the primary objective of the geometer, as enunciated for example by Felix Klein in his Erlangen program,[10] is to seek out the *invariant* properties of geometry. Thus, we must, for example, ask after those properties which are unchanged by a perspectivity. As a concrete instance consider the transformation of a triangle ABC by the center of perspectivity, O, as shown in Figure 2. We draw lines connecting OA, OB, OC. Any triangle whose three vertices lie on these three lines can be seen to be in perspective correspondence with triangle ABC. Notice that distances are not preserved. That is, the line segment $\overline{AB}$ is not the same length as $\overline{A'B'}$. Neither are the angles at corresponding vertices equal ($\triangle ABC \neq \triangle A'B'C'$). If we had started with a parallelogram instead of a triangle we would also have discovered that two parallel lines are in general transformed into nonparallel lines. It should be stressed that this is in great contrast to the more familiar Euclidean transformations, which are circumscribed by rotations

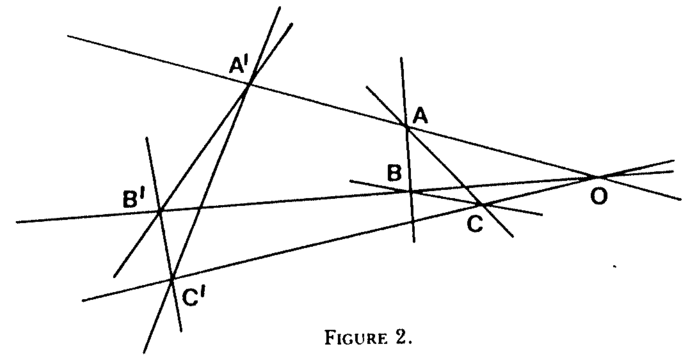

FIGURE 2.

and translations. Under these latter transformations lengths, angles and parallelism are clearly invariants. Under the more general projective transformation such invariants disappear and we must search for other more subtle invariant properties.

The first such invariant we may notice is that a straight line always ends up as a straight line. In fact, projective transformations are the most general transformations for which this is true; they comprise the most general group of "linear transformations." A second invariant is that points of intersection are always mapped into corresponding points of intersection. Thus the point of intersection for the two lines AB and BC (namely B itself) is mapped into B′ which itself is the point of intersection for the lines A′B′ and B′C′. From these two invariants we may already begin to gain our bearings in this otherwise extremely dynamic and mobile arena. The spatial notions common to us from everyday experience dissolve, and if we are not to become totally disoriented we must discern the fixed landmarks of our new geometry.

A somewhat more elusive but very deep invariance in projective geometry is that of the "cross-ratio." When projective geometry is elaborated in the explicitly analytic language of coordinates and equations, the cross-ratio often stands as the starting point and cornerstone of the discussion. For our own purposes we may begin synthetically by merely investigating the properties of the "complete quadrangle." As the name implies, the quadrangle possesses four corners or vertices each connected to the three others for a total of six lines, four of which we usually think of as the sides and two as the diagonals of the quadrangle. (See Figure 3.) We now construct the line through points A and C, designating the points of intersection of the diagonals by B and D. So far we have been very general in the construction, imposing no restrictions on the specific nature of the quadrangle, yet a very peculiar relationship exists be-

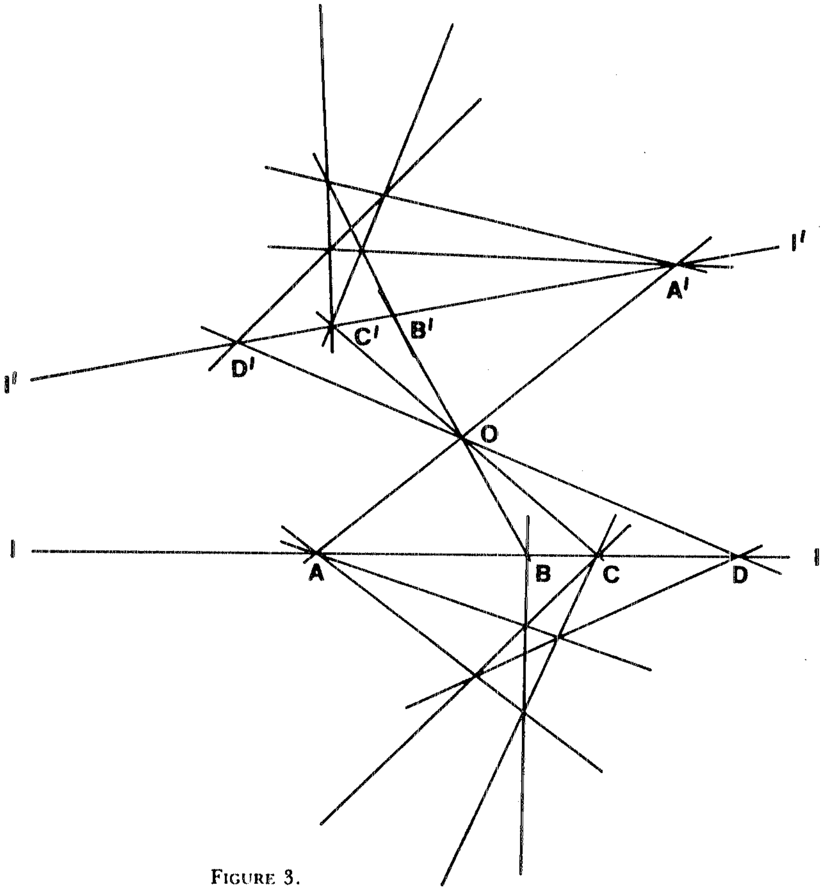

FIGURE 3.

tween the four points A, B, C, and D which are said to form an "harmonic set." Let $\overline{AB}$, $\overline{AD}$ and so on designate the lengths of the line segments between points A and B, A and D . . . as measured, say, by an ordinary ruler. If we form the two ratios $\overline{AB}/\overline{AD}$ and $\overline{CB}/\overline{CD}$, we find that the cross-ratio $\overline{AB}/\overline{AD}:\overline{CB}/\overline{CD} = -1$ or, in terms of multiplication, $\overline{AB}/\overline{AD} \cdot \overline{CD}/\overline{CB} = -1$. (One must pay attention in the above to direction in the segment lengths because $\overline{AB} = -\overline{BA}$.) The cross-ratio so defined will always equal minus one for harmonic sets of points as generated by a quadrangle. Moreover, this cross-ratio is exactly preserved under a projective transformation! That is, if we transform line l to l' by a perspectivity (or series of perspectivities) the cross-ratio $A'B'/A'D':C'D'/C'B'$ will still equal negative one. We need not make measurements to prove this. Again consider Figure 3.

We may merely construct a complete quadrilateral from three points of the harmonic set A'B'C'D'. The last diagonal drawn will always be found to pass through the missing fourth member of the harmonic set. With this we know the cross-ratio has not changed in the slightest!

I have limited our study to the cross-ratio of harmonic sets where the invariance can be clearly seen by our ability to construct a second quadrangle from the set of transformed points. The concept is, however, far more general. (I refer to the extensive literature on projective geometry, for example, to John Wesley Young's *Projective Geometry*[11] or Olive Whicher's book of the same title.[12]) In the cross-ratio we see that although distances themselves are not preserved, ratios of distances are. That is, it is a relationship or pattern which remains constant, not a simple distance or measure. This invariant pattern shows itself in the reappearance of the quadrangle in a metamorphosed form. Thus in projective geometry we cannot hold to distances, which are ever-changing, but must rather train ourselves to perceive invariant patterns of a more subtle and mobile nature. With this I think we begin to sense the real power of mathematics to lift us out of normal, sense-generated concepts to search for deeper unities and invariances in the sense-free domain of pure thought. It can become, as Novalis said, a beautiful sunlit asylum.

Before passing on to Goethe's science of phenomena, I must spend just a short page or two on one further aspect of projective geometry. So far we have been concerned with transformations which transform points to points in a unique way. Such transformations are termed "collineations" and they comprise one group of projective transformations. There exists, however, another class of transformations termed "correlations" which are not point transformations but rather transformations under which there is a change of the space element. The simplest example is the correlation which establishes a correspondence between the points and the lines of a plane. In this case the *entirety* of a line is placed in correspondence with a single point and reciprocally. To be more specific let us consider the pole-polar transformation with respect to a conic section.

For simplicity we start with the special conic section, the circle (although in projective geometry the circle, strictly speaking, is indistinguishable from the ellipse). We would like to establish a one-to-one correspondence between the points of the plane in which our circle lies and the lines of that plane. This may be done in the following way. Choose a point P, say, lying outside of the circle. (See Figure 4.) Through P we construct two lines which intersect the circle in the points A, B and C, D. We now complete the construction of the quadrangle inscribed in the conic by constructing the two

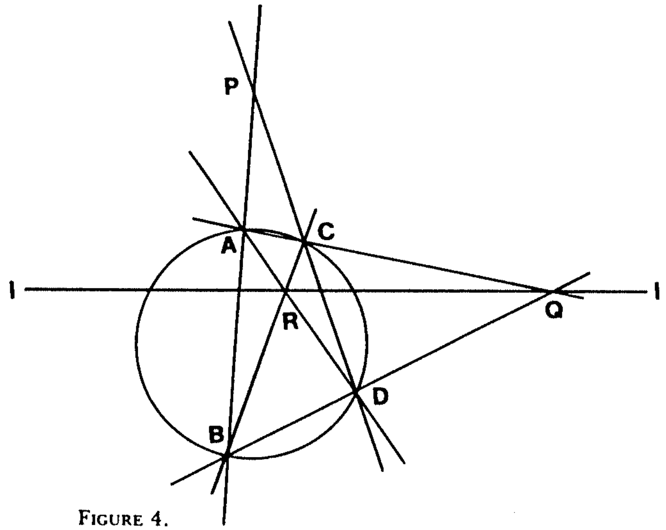

FIGURE 4.

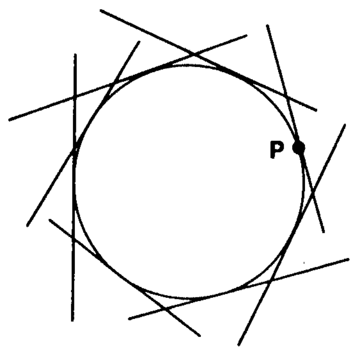

FIGURE 5a.

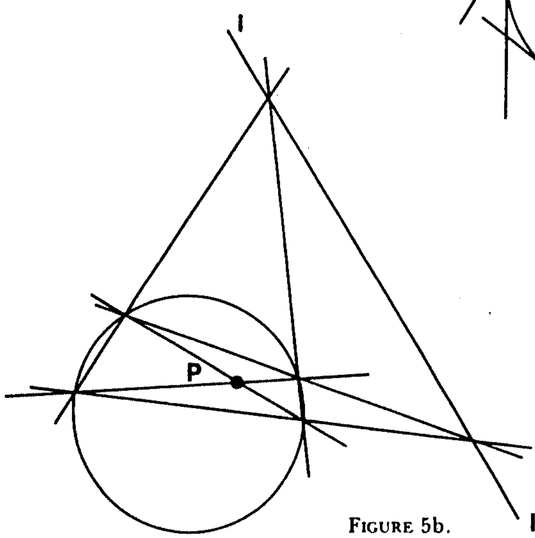

FIGURE 5b.

remaining sides AC, BD and the two diagonals AD, BC. The points of intersection Q and R are the two remaining diagonal points (P was the other). The line *l* through Q and R is the line corresponding to the point P. In this way, using the inscribed quadrangle ABCD, we may always establish a correspondence between a given point and a line of the plane. If on the other hand we wish to find the point corresponding to a given line we must construct a *quadrilateral* which circumscribes the conic and which has the given line as one of its *diagonal lines.* (See Young, pp. 74-79.)

Let us bring the above considerations into movement. Consider the sequence of drawings in Figure 5. For each of four cases, I have established the line corresponding to the point P with respect to a circle. I begin with the "pole," P lying on the circle (Figure 5a). The "polar" line will of necessity be the line tangent to the circle at that point. If we were to move P around the circle, the polar line will follow. Here we may note that an alternative way of considering the circle is made apparent. We are accustomed to considering the circle as that locus of points all a certain distance from a central point. This corresponds to the movement of P around the circle. But clearly we may, with equal justice, consider it as the form embraced, or circumscribed by the family of tangent lines we have drawn. This alternative was first put on a rigorous foundation by the German mathematician and physicist Plucker in the first part of the 19th century. The conics, or indeed any form, may thus be considered not as the locus of an infinity of points, but as the form enveloped by an infinity of tangent lines. If the form is three-dimensional, the lines become bounding planes tangent to all parts of the surface.

Return now to Figure 5 and allow the point P to gradually recede from the circle towards its center (Figures 5b and 5c). The line polar to P gradually moves away from the conic so that we may naturally ask what happens when the point P stands at the precise center of the circle (Figure 5d). In Euclidean terms we would say that the opposite sides of our quadrangle now become parallel, the quadrangle thereby transformed into a parallelogram. When we search after the polar line we find that it has quite disappeared because in Euclidean geometry parallel lines never intersect. From the standpoint of projective geometry, however, the sides still intersect, each pair of parallel lines in a unique point. We may, as before, determine the line which passes through the two points (now at infinity). In this manner we establish the correspondence between the center of our circle and the ideal, line-at-infinity of the plane. Thus with respect to the circle the centermost point is connected with the entirety of the most distant line. If we translate this result into three dimensions, as may easily be done, then with respect to a sphere the

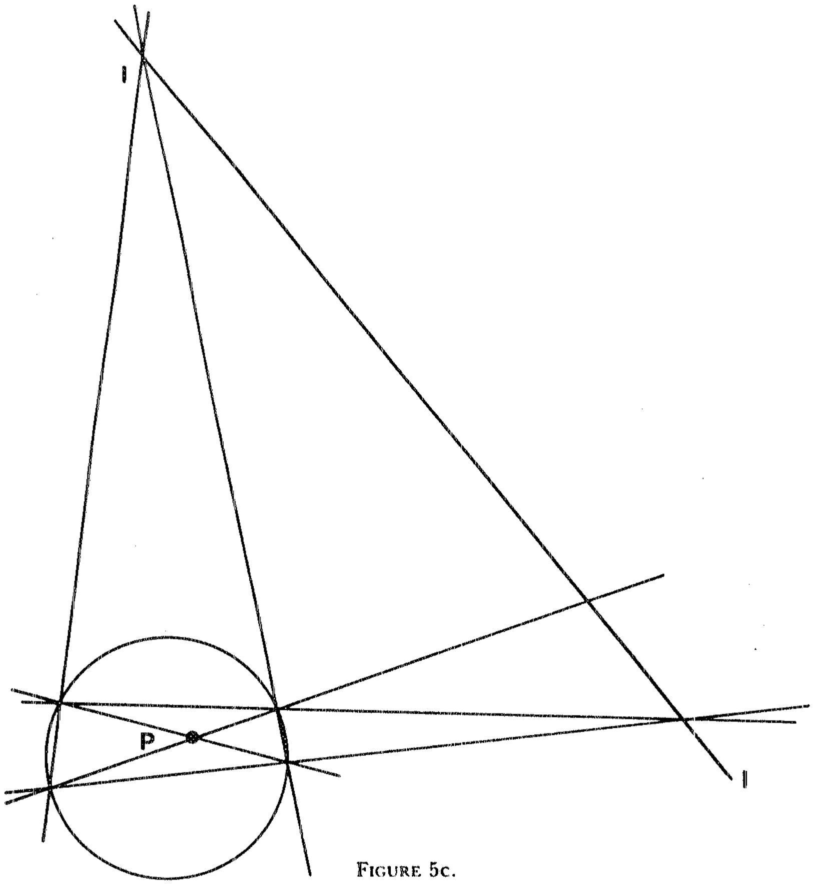

FIGURE 5c.

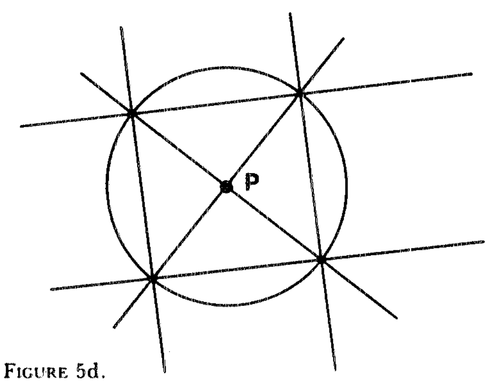

FIGURE 5d.

central point is placed in correspondence with the entirety of the plane-at-infinity.

The symbolic and allegorical richness of such constructions is obvious. We have an extraordinary picture of the macrocosm reflected in the microcosm. More especially, the entirety of the plane may be, as David Bohm might say,[13] "enfolded" in a single point like some Leibnitzian monad. Yet, while the metaphors are many and wonderful, I would have us restrain our fanciful visions and merely experience the splendid artistry of these thoughts. Allow such exercises to remain propedeutics for the mind, purifying, strengthening and vitalizing the fabric of our thinking. Let us not rush to a premature mingling of the perceptual world with the forms and thoughts of pure ideation. No matter how marvelous or mystical, the same dangers exist for us as for Edward Purcell. At this point, we would do well, I think, to follow Goethe's injunction:

> Physics must separate itself from mathematics. Physics must remain resolutely independent and seek with all loving, reverent, pious powers to delve into nature and its holy life with no concern for what mathematics performs and does from its side. Mathematics must on the other hand declare its independence from everything external, follow its own grand spiritual course and develop itself more purely than is possible when, as heretofore, it concerns itself with things at hand and seeks to ascertain something from or assimilate something to them.[14]

The Light of Nature: Goethe's Science of Nature

In the remainder of this article I will attempt to bring before us a picture of Goethe's researches into the phenomena which nature displays before us. I will select a necessarily very narrow cross section of Goethe's investigations and reflections, ones which illustrate the points I have been making. Yet I hope not to distort the intention of Goethe's thought nor to underrate the extraordinary scope of his researches.[15] Nonetheless, I will limit myself to remarks upon his method of research and discovery especially exemplified in his color studies. It was in fact these investigations which he thought would give him a lasting place in the history of human thought.

> As for what I have done as a poet, I take no pride in it whatever. Excellent poets have lived at the same time as myself; poets more excellent have lived before me, and others will come after me. But that in my century I am the only person who knows the truth in the difficult science of colors—of that, I say, I am not a little proud and here I have a consciousness of a superiority to many.[16]

It will prove helpful to know when and why Goethe began his formal study of color. We may safely begin with his journey to Italy in 1786. In contrast to the grey sky and countryside of Germany, Italy appeared as a fairytale land to Goethe: "We remember how harmoniously the sky binds itself with the earth there and its lively shimmer spreads over us . . . ; slowly wandering clouds color themselves in manifold ways and the colors of the heavenly dome distribute themselves to the earth on which we stand in the most pleasing manner."[17] It was in these surroundings that Goethe was often to be found in the company of painters. On such occasions it happened that he was asked his opinion as to how a particular scene should be rendered. Musing on such issues Goethe became unsettled. It seemed clear that there should be an objective aesthetic basis for the use of color in painting, and yet it appeared to depend rather only on the whim of painter or critic. Upon his return to Weimar he attempted to read an orthodox treatise on color and found the theory presented hopelessly difficult and useless. "These difficulties would have discouraged me had I not reflected that pure experience should lie at the root of all physical sciences. . . ." Thus we find Goethe borrowing a case of optical equipment from his friend court counsellor Hofrat Buttner of Jena. Goethe, however, neglected the equipment entirely until the impatient Buttner finally demanded their return. With the messenger in the doorway Goethe resolved to at least see the celebrated phenomenon of colors known to him from childhood play. He took a prism from the case and looked through it at a nearby white wall fully expecting to see the white broken up into colors according to a Newtonian scheme. Instead, all he saw was an unchanged white wall. The importance of this moment for the rest of his research is probably hard to overestimate. Like a shot he was convinced of Newton's error. Turning to a window he noticed that color did not appear in the window panes themselves but only where the dark latticework crossed the bright windows. Here, where light and darkness met, colors leapt into view: yellow, orange and red on the one side, blue and violet on the other. Buttner's messenger was sent away empty-handed, and Goethe's experimental research was begun.

These researches would span twenty years and culminate in the publication of the three volume *Zur Farbenlehre* in 1810. Ideally we should explore the contents of these works, particularly the didactic volume in which Goethe's experiments and reflections concerning color are carefully presented. We should consider not only the result he presents but should follow him in his research, experiencing with him the myriad color phenomena he explores. Yet we do not have the space to do so here. Rather I would have us consider Goethe's

color studies by way of his methodology. For it is here that we may gain a full appreciation for his mode of inquiry and its value as a discipline in positive gnosis. We will find ourselves continually admonished to refrain from theoretical flights and mathematical abstraction. Rather Goethe will invoke the phenomena themselves as the theory, when they are rightly seen.

Firstly, let us inquire after how Goethe "explains" the phenomena of color as produced, say, by a prism. This general set of phenomena Goethe classed under the rubric of physical colors. Usually, when we seek the explanation we expect a reply in terms of a normally unseen but actually present mechanism. For example, the generation of color by the prism might be explained by the oscillatory movement of electrons under the action of an electromagnetic wave (light). The formulation may be cast into a mathematical form and the phenomena of refraction and dispersion quantitatively "explained." Notice that in such a case we are engaged in an activity like that of Purcell, wherein the glass prism we hold in our hand is mentally replaced by electrons electrically attracted to a matrix of atoms all driven by an electromagnetic wave (which we naively know as light). This mode of explanation has been the object of a thoroughgoing critique by such philosopher-scientists as Pierre Duhem.[5] It is a mode of explanation which came into conscious dominance after the Renaissance and remains with us to the present. It is essentially a search for what Aristotle termed "efficient causes."

Goethe almost systematically rejected such an approach to nature. He explicitly stated in an essay written for Schiller that "we are not seeking causes but the circumstances under which the phenomenon occurs."[18] In place of the hidden mechanisms underlying nature, Goethe sought the circumstances of appearance, the invariable antecedents or prerequisites for the manifestation of a particular phenomenon. In this sense Goethe sought not mechanical causation, but rather an invariant pattern or relationship among the phenomena he studied. Aristotle also noted this as one of his four causes, terming it the "formal cause" of a phenomenon. The formal cause of the octave is the mathematical ratio in which the lengths of identically stretched strings stand, namely 1:2. This concept must be generalized and freed somewhat from its mathematical form, but once we do so we may recognize in Goethe's "explanations" a search after formal causes or after the patterns and unities which appear amongst nature's multiplicity. These unities are important for Goethe because such outward manifestations are always signs or symbols of an inner agency to which we seem denied access. Unities or invariances are, of course, exceedingly important in orthodox science also: its use of mathematics is an attempt to express just these laws of invariance. At least for Goethe, this language could not capture the full content of color phenomena. By reducing the perceived relationship to a mathematical one, nature is necessarily denuded of just those qualities which Goethe, with Thoreau, would not lose. Most especially, a purely mathematical formulation has little room for what Goethe termed the "*sinnlich-sittliche Wirkung der Farbe*," or roughly, the sensory-moral effect of color. The 18th century view of the cosmos, which saw it as pervaded by a moral order, is foreign to us. To understand it we must take seriously again the idea that the cosmos is a created reality, not an accidental one. We associate moral qualities with the actions of people not with such things as light or color. Yet if, in some way, color is a reflection of the activity of a being or beings, present or past, then the inner quality of that activity will manifest also in the phenomena of color. Goethe hints at this when he in his introduction to the Farbenlehre declares, "Colors are the deeds of light, its deeds and sufferings."[19] At the end of the same work, green and magenta seem to Goethe to be "the earthly and heavenly offspring of the Elohim."[20]

Instead of a mathematical relationship, we must raise, or exalt, the phenomenal world itself, lift it towards the ideal so that through genuine phenomena we may glimpse the principle or unifying agency which expresses itself as law in the natural kingdoms. In botany this will be called by Goethe his "archetypal plant," in color it is the quest for "archetypal phenomena." Whatever the field, the unifying principle is not accessible through the logic of the discursive intellect, but rather we must mount higher and higher by continual study and shifting of phenomena so that the pattern itself is *beheld.* Of course, says Goethe, "the observer never sees pure [or archetypal] phenomena with his eyes . . ,"[21] but, nonetheless, we must come to know the archetype through the phenomena themselves. To replace the experience of color with words, models or equations carries with it the consequential loss of the "sensory-moral aspect" of color. The scientist, rather "should form for himself a method in accordance with observation, but he should take care not to transform observations into concepts, concepts into words and to deal and use these words as if they were things. He should have knowledge of the labors of philosophers in order to lead the phenomena up to a philosophic region."[22]

Color Goethe sought to explain in this sense by leading us through countless color effects until we rise, with the phenomena, to an experience of the two archetypal phenomena at the basis of prismatic and atmospheric colors, the sunset with its vibrant oranges and reds, and the blue vault of the heavens. In these two effects one

beholds the purest expression of those "deeds and sufferings of light" which we call color. From these and similar considerations Goethe goes on to "explain" the colors which first prompted his investigations, those he saw at the boundary of window and latticework.

We have encountered this mode of knowing before. Its likeness to seeing, to beholding of natural law in the phenomena themselves, recalls to us the neo-Platonic *episteme.* There remains, however, an essential distinction. Whereas for Plato and his students the sense world could never act as the source of true knowledge, for Goethe it is the sole trustworthy spokesman for the deepest unities of nature. Whereas Plato would admonish his students to turn their eyes away from the stars to know true astronomy, and ridicule the Pythagoreans for torturing the catgut in search of new harmonics, Goethe would show little patience for the "speculative science," *Naturphilosophie*, which contemporaries like Schelling and Hegel propounded. Eckermann reports a conversation between Goethe and Hegel in which Hegel defined for Goethe his dialectic method. Goethe rejoined that it was fine so long as not misapplied to show true as false.

> That is why I prefer the study of nature which does not allow such sickness to arise. For there we have to do with infinite and eternal truth that immediately rejects anyone who does not proceed neatly and honestly in observing and handling his subject. I am also certain that many a person dialectically sick could find a beneficient cure in the study of nature.[23]

Thus we find Goethe advocating a rigorous, positive relationship to natural phenomena. Through such a relationship arises the possibility of profound insight into nature's laws or invariant relationships. Such relationships are to be known not abstractly but through a kind of seeing. Is it any surprise that sight for Goethe was the noblest, almost divine, sense possessed by man?

> Sight is the noblest of senses . . . it stands infinitely higher [than the other four], refines itself beyond matter and approaches the capacities of the spirit.[24]

The special place of *episteme* or of "intuitive judgment" (*anschauende Urteilskraft*) in Goethe's methodology simultaneously brings a new element into Western thought. If the logical tracts of Aristotle acted as the texts on which Western consciousness was weaned, then Goethe's scientific writings struggle to inject a new or at least profoundly neglected dimension into human inquiry. Contemporary science espouses two of the three modes of knowing described by neo-Platonists: *dianoia* or rationalism as exemplified by the rigorous mathematical formulation of physics, and empiricism in which evidence is gathered in support of scientific opinion or hypothesis. The third mode, *episteme*, was always the province of mysticism and revelation—that is, of negative gnosis. Yet Goethe in his science strives to bring the most exalted of Plato's cognitive faculties into the sense world. We may find antecedents of this view in Paracelsus and certain alchemists. But Goethe refrained from anticipating or establishing superficial correspondences so common to his more speculative contemporaries, and rather sought to move through the phenomena themselves, searching for the purest expression of an archetype which could then illumine a broad realm of disparate phenomena. The means which the investigator employs is neither purely rational nor purely empirical, but what Goethe termed "rational empiricism." We should not imagine this as merely a mixture or sequential treatment of phenomena first empirically and then rationally as one has in orthodox science. Rather it is a mode of study through which the investigator may gradually unite with the objects he investigates.

> There is a gentle empiricism that makes itself in the most intimate way identical with its objects and thereby becomes actual theory. This heightening of the spiritual powers belongs, however, to a highly cultivated age.[25]

In place then of hypotheses which are "lullabies that the teacher uses to lull his pupils to sleep,"[26] Goethe advocates a gentle, rational empiricism through which the phenomena themselves, when intimately known, become the theory.

I find it most interesting that certain 20th century philosophers, scientists and psychologists are now drawing our attention to the intuitive or imaginative components of science. I may mention Michael Polanyi, who sees all understanding as "tacit knowings," that is, as a kind of intuitive knowing unlike purely analytic or discursive thought. It is by "indwelling" that tacit knowing arises and so "since all understanding is tacit knowing, all understanding is achieved by indwelling."[27] The kinship between Goethe's knowing-as-seeing and Polanyi's tacit knowing could be elaborated at some length, particularly by a study of Polanyi's "subsidiary and focal awareness" and his many examples given in support of this view. We cannot explore those connections or distinctions here, but let me include just a passage which points to the profound connection Polanyi sees between a perceptual act and the perception of coherence (or I would say the perception of an archetype) in a particular phenomenal realm. He states that scientific discovery is the shifting of our awareness from the particulars of observation to their coherence:

> This has been my basic assumption. I maintained that the capacity of scientists to perceive in nature the presence of lasting shapes differs from ordinary perception only by the fact that it can integrate shapes that ordinary perception cannot readily handle. *Scientific knowing consists in discerning gestalten that indicate a true coherence in nature.*[28]

A few pages later Polanyi writes

> This act of integration, which we can identify both in the visual perception of objects and in the discovery of scientific theories, is the tacit power we have been looking for. I shall call it *tacit knowing.*[29]

Goethe might have called it *anschauende Urteilskraft*, the faculty which allows one to rise above the particulars to a perception of coherence and relationships within the phenomenal world.

Once we have attained this power or capacity in a particular field of inquiry, then the facts carry with them their own explanation.

> The highest thing would be to comprehend that everything factual is already theory. The blue of the heavens reveals to us the fundamental law of chromatics. One should only not seek anything behind the phenomena: they themselves are the theory.[30]

Here we should rest content, not seeking for hidden causes or mechanisms but "let the observer of nature suffer the archetypal phenomena to remain undisturbed in its beauty."

Yet how, we may ask, is such a power of knowing to become ours. Goethe's reply would be, I think, through the process of investigation itself. Nature presents itself to us through ordinary "empirical phenomena."[31] We may, however, engage her and shift and vary the conditions of appearance. In this way we may know her through "scientific phenomena." As the result of all our experience and experiments it is now possible that the "pure phenomenon" or archetype may arise to meet us, not circumscribed by a single isolated phenomenon, but rather as a coherence symbolized or most nearly manifest in one or a few primary experiences. The phenomenal world has become our teacher. As we dwell within it, it shapes organs or capacities within us for knowledge of itself. Just as, "the eye owes its existence to the light," so too the subtle faculties by which we "see" coherences or archetypes are shaped within us by the experiences we undergo.

> Out of indifferent animal organs the light produces an organ to correspond to itself; and so the eye is formed by the light so that the inner light may meet the outer. . . . If the eye were not sunlike, how could we perceive the sun.[32]

In the deepest sense Goethe saw the world as formative. What is true of light is also true of perception more generally. Indeed, each act of careful observation and consideration shapes and stimulates capacities within us.

> "Every new object, well contemplated, opens up a new organ within us."[33]

Polanyi in his own language speaks likewise of the transformative power which the act of "indwelling" possesses:

> Such extensions of ourselves develop new faculties in us; our whole education operates in this way.[34]

Through a gentle empiricism we develop faculties which allow us to see more deeply into nature. Under the quiet gaze of this science we may read, as Novalis writes,

> the great Manuscript of Design which we everywhere descry, on wings of birds, on the shells of eggs, in clouds, in snow, in crystal, in rock formations, in frozen water, within and upon mountains, in plants, in beasts, in men, in the light of day. . . .[35]

It is, in Paracelsus' terms, the Light of Nature. But it is not nature known through the intellect alone, but rather also through living Reason which "takes joy in development," which sees in the individual the universal.

WHAT STANDS BEFORE Goethe in imagination, as archetype, can begin to sing as inspiration when the pure-thought organs—exercised, for example, through geometry—wed with the beheld coherences of nature. Perhaps in this way, by a vigorous cultivation of both positive and negative gnosis the loss of Orphism may be redeemed. Through a strict, sense-free thinking and a phenomenology free of mental constructs, the essential, dynamic and ensouled figure of nature can arise first in imagination and then in the sounding of heaven's harmonies, finally to be experienced in selfless, conscious union.

We must be clear that this is not an egotistical quest for self-illumination but rather carries with it a burden of world responsibility. What we have gained through nature must be placed once again at nature's service. Novalis, in a few words, placed with us the greatest task when he wrote, "Man is the Messiah of Nature."

Rudolf Steiner says it more gently in a verse given to his wife, Christmas 1922, yet the meaning is the same. What once was given to man by the gods must now sound anew from our humanity.

> The Stars spake once to Man.
> It is World-destiny
> That they are silent now.
> To be aware of the silence
> Can become pain for earthly Man.
>
> But in the deepening silence,
> There grows and ripens
> What Man speaks to the Stars.
> To be aware of the speaking
> Can become strength for Spirit-Man.[36]

Notes

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35. von Hardenberg, *Novalis Schriften*, Vol. I, p. 79.
36. Rudolf Steiner, *Verses and Meditations*, trans. George Adams (London: Rudolf Steiner Press, 1961), p. 97.

Intently considering once, and reasoning with himself, whether it would be possible to devise a certain instrumental assistance to the hearing, which should be firm and unerring, such as the sight obtains through the compass and the rule, or, by Jupiter, through a dioptric instrument; or such as the touch obtains through the balance, or the contrivance of measures; — thus considering, as he was walking near a brazier's shop, he heard from a certain divine casualty the hammers beating out a piece of iron on an anvil, and producing sounds that accorded with each other, one combination only excepted. But he recognized in those sounds, the diapason, the diapente, the diatessaron, harmony. He saw, however, that the sound which was between the diatessaron and the diapente was itself by itself dissonant, yet, nevertheless, gave completion to that which was the greater sound among them. Being delighted, therefore, to find that the thing which he was anxious to discover had succeeded to his wishes by divine assistance, he went into the brazier's shop, and found by various experiments, that the difference of sound arose from the magnitude of the hammers, but not from the force of the strokes, nor from the figure of the hammers, nor from the transposition of the iron which was beaten. When, therefore, he had accurately examined the weights and the equal counterpoise of the hammers, he returned home, and fixed one stake diagonally to the walls, lest if there were many, a certain difference should arise from this circumstance, or in short, lest the peculiar nature of each of the stakes should cause a suspicion of mutation. Afterwards, from this stake he suspended four chords consisting of the same materials, and of the same magnitude and thickness, and likewise equally twisted. To the extremity of each chord also he tied a weight. And when he had so contrived, that the chords were perfectly equal to each other in length, he afterwards alternately struck two chords at once, and found the beforementioned symphonies, viz. a different symphony in a different combination. For he discovered that the chord which was stretched by the greatest weight, produced, when compared with that which was stretched by the smallest, the symphony diapason. But the former of these weights was twelve pounds, and the latter six. And, therefore, being in a duple ratio, it exhibited the consonance diapason; which the weights themselves rendered apparent. But again, he found that the chord from which the greatest weight was suspended compared with that from which the weight next to the smallest depended, and which weight was eight pounds, produced the symphony diapente. Hence