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Chapter 2: Greek color theory

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II.

GREEK COLOR THEORY

PROLOGUE: WHAT IS GREEK COLOR THEORY?

In General

The term color theory no doubt brings to mind for many people only Newton's theory that colors are created by the refraction of (white) light. So pervasive is this doctrine in contemporary life that the existence of other explanations of color—if one has heard of them at all—is considered at best a matter for historians of science.

However, historical research cannot be objective if it proceeds on the basis of Newtonian paradigms and vocabulary as a standard of legitimacy. For one imposes thereby criteria which are, or may be, alien to the thinking that produced different paradigms and vocabulary. Obvious as this proposition may seem in the abstract, the history of scholarship on Greek ideas of color, recently reviewed by Heinke Schulz in *Die Farbe Purpur im frühen Griechentum*, makes it clear that taking that proposition seriously has proceeded only in slow stages.

It is equally clear that an attempt to understand the way Greek thinkers dealt with color on their own terms has the best chance of resulting in some enlightenment if undertaken by someone who has a personal standpoint out of which a question has arisen, giving rise to more questions. This is likely to require a certain inventive capacity, for what one researcher sees as a vital sign may figure hardly at all in the thought structure of another. This is obvious enough in the differing approaches likely to be used by the philologist, historian of science and historian of art; but on this complex subject, it might not be less operative in the work of any two practitioners in the same field. Yet all may add a few tesserae to the mosaic of ancient reality that can never be fully restored.

In Particular: at the Documentary Source

In the case of the book mentioned above the motivating question was the role played by literary references to a color which is usually translated into modern languages as purple. The author begins with a concise discussion of passages in ancient authors referring to the nature of color. This offers a good starting point for me as well: prior to presenting my own review of the ancient testimonia from the point of view of the particular question that motivates me, I shall retrace Stulz' path¹ briefly to bring readers directly into what is a sphere of reasoning and observation that needs much thought. For what is at once evident is that in that sphere the tools of thought are the four elements: fire, air, water and earth. These broad terms need to be defined with the utmost precision—and will be in my own study. However, for the present, I shall introduce them by reviewing the discussion of Stulz.

It is not accidental that Alkmaion of Cretona, one of the earliest sources for a theory of perception, was a Pythagorean physician. His work is known from references in Theophrastus which plunge into a profound physiological problem: how does the eye see? It sees through the water that surrounds it (*dia tou perix hudatos*). But that statement raises a host of other questions, hardly answered by further references to fire “which the eye (also) has” and to that which gleams, and to translucence.² In effect, one is confronted by a philological maze from which exit is possible only by rather arbitrary interpretations. Stulz' conclusion: the ray which transmits the color of an object to the eye is a kind of fire.

However obscure to us, the ideas of Alkmaion provided the frame of reference in which the later Presocratics: Empedokles and Demokritos, moved. The teaching of the former is summed up in his famous simile comparing the eye to a lamp. As the lamp radiates rays of light, so does the eye, which contains eternal fire shut up within it—though able to emerge through channels in the surrounding water. Earth and air can easily be factored into this process (as described in a fragment). Empedokles relates this to perception of white and black by the eyes for the purpose of explaining blindness by day and by night. Stulz found no other discussion of color perception by him and denies that a famous passage in which the philosopher mentions color practice of artists (see Chapter II, *The Ancient Sources*, Empedokles, E) proves that he entertained a theory that four colors were a basis for creating further colors by mixture. Yet it must be granted that he had developed a theory of perception which—combined with his principle of “like gravitates to like”—would indeed offer the framework for a four color theory.

Furthermore, even though there is no record of an Empedoklean perceptual theory for senses other than sight, his basic principle of emanation would obviously be applicable to them: there are emanations of all things that ever came into existence (*panton eisin aporroai, hosa egenonto*). Moreover, the emanations from the eye are corporeal (even light is). But while we might conceive of these as particles, they are not material in the sense of something dead; rather they are compounded of the active principles of the four elements—ultimately, divine forces. A famous passage describes how these forces, quasi nature forces, operate in the world with each one controlling

certain basic emotional responses in the human psyche (see Chapter II, *The Ancient Sources*, Empedokles, A).

If Empedokles did not produce a recognizable color theory, Demokritos did insofar as he attempted to explain the characteristics of particular colors by reference to the characteristics of the atoms constituting them. Thus the color called white has perfectly smooth atoms which cast no shadows; the nearest analogy being mother of pearl, which suggests not only light but also lustre. Translucence is also to be connected in some way with white. The fact that canals are postulated somewhere in the complex of atoms impresses on us how difficult it is really to understand the technicalities of fifth century thought. Black also has such canals but in combination with rough-surfaced atoms, whereas red is allowed to consist directly of fire (light) atoms. Thus in the required mixture for purple: white, red and black, it is white that provides the lustrous quality. Warmth is associated with red, not merely because fire was the only source of energy known to the ancient world, but also because it denoted for Demokritos the interchangeability of the atoms associated with warmth, soul, *nous* and movement. Thus the element fire is not defined as a specific force in nature but as an unstable constellation of atoms (at least as implied by Aristotle—but other statements of that author cast some doubt on this).

In any case Demokritos conceived of colors as so many quantities of energy (light), ranging from a pure form of it to a total lack of it (black). Such reasoning comes from a quite different sphere from the idea of colors laid on an artist's palette: colors are not something laid on objects but energy equations of the objects themselves. In fact, Demokritos would deny the existence of artists' colors as such. To complicate matters for us, Anaxagoras—without being an atomist—had the same opinion about the nature of color.

Like Demokritos, Plato also reckoned with self-radiating objects; but Plato thought that their rays meet and mingle with the pure fire (rays) placed in all human eyes by the gods. Thus seeing (or not seeing) depends on the size, strength and speed of the rays emanating from the objects, while perception of the various colors depends also on that process. The most dynamic confrontation with the eye results in the effect called *lambron* (see Chapter III, *The Evolutionary Aspect of Colors*, paragraph 6), while the least dynamic reaction results in white. A reaction weaker than that of white fails to reach the eye at all, which produces black. Thus a scale is established running through *lambron*, *erython* (red), *leukon* (white) and *melan* (black). In effect, for the colorless neutral atoms of Demokritos, Plato substituted a system of fire (light) reactions as color products. The most potent of these, *lambron*, actually overwhelms the fire of the eye like a lightning flash—and expels it. This leads Stulz to say that color intensity seems more important than hue. The spiritual nature of the color experience is underlined by the words of the dying Sokrates that, in the ideal world, hues are the same but more *lambron* than in our world [But if physical eyes are required for the experience of color, how is this possible?] The dynamic quality of Plato's particles depends partly on their being tiny, with sharp corners, and swift. These qualities allow them to activate the blood, split up and digest food, generate movement and in effect constitute the life processes of all creatures. Colors are a (graduated) effect of this principle.

Aristotle rejected the notion that a fiery ray emanated from the eye and reflected back from the objects to create sight—on the grounds that if this were so, night vision would be normal. By the same token he objected to the theory of emanations from objects, since the eye does not perceive them when the objects are pressed against the closed eye. Still, he did not attempt to eliminate the idea of physical context altogether, for he postulated the necessity of a medium between the eye and its percept, and reached back to the Presocratic translucence (*diaphanes*), which exists in water, air and translucent objects. Light is the agent (*energeia*) that reveals translucence as an incorporeal state ranging from bright to dark. Insofar as this flows into objects it ceases being mere light and reveals color as well as their substantiality. The color of the object in turn puts the medium itself in motion and this is transmitted to the eye. Thus color, like light itself, is immaterial and a state or form of energy. However simultaneous this process may seem to be, conceptually it involves several distinct stages: object activates medium, medium become translucent, medium activates eye. Obviously, the role of light is to make this process possible, but Aristotle attributes no movement to it, whereas the resulting color is an activator (*kinetikon*) of the medium.

Aristotle also deals with the way colors arise. Objects consist of a mixture of elements with colors that reproduce said mixture. Colors are a mixture of black and white (light and darkness). These two colors strike the eye with such velocity as not to be perceptible as such. Color probably arises from superimposition (in accordance with the distribution of elements) taking place on the basis of arithmetical principles. Among the five colors (besides black and white) recognized by Aristotle is purple—comparable to a chord in music. Since this is the point of departure for Stulz, I append her comment (her pp. 61–63):

Since yellow is apparently bracketed with white, the first degree of diminished white is purple. Its origin from black and white is demonstrated in various cosmic phenomena. For example, the sun appears purple behind smoke or mist. In the sky the impact of white and black should often provide the occasion to observe the play of bright colors, but by day the light of the sun prevents this and by night all shades of blue and green are swallowed up by the darkness with only purple being light enough to be seen.

Purple does not eclipse blue and green through its lightness (*value*)—in which case we would be weighing colors—but through its glow (*saturation*), that is, its color intensity. This is quite alien to our way of thinking. Since for Greek eyes color intensity replaces value as the most important color characteristic, purple can appear in that context as the weakened but still second most important color of light. Also, Aristotle proposed purple as the strongest color-energy after light itself.

The author of the post-Aristotelian *De Coloribus* assumes the reflection of the sun from objects as colored light to be the origin of color but resorts to the definition of light as a stream of small particles rebounding off objects—in contrast to Aristotle and also Plato. Pure colors are never seen because of the consistent modification of (visible) objects

through light and darkness. The colors themselves are dependent on the mixture of elements in the objects and—in the case of organisms—additionally by the influence of heat and moisture.

Stulz concludes:

Even within this final document, the two characteristics of Greek color sensibility appear:

Color is rays of light or fire.

Color reflects the state of the object to which it belongs.

At this point the reader may well ask what I have gained from preparing the preceding summary of another scholar's work. This has, in fact, brought clearly and forcibly to mind exactly that side of Greek color experience which the modern mind will most readily grasp, namely, the intellectual continuum from the Greeks to ourselves in the concept of light—with which (to say the least) color is involved—as consisting of rays; for rays were taken up by Arabic science and converted into essentially a mathematical abstraction, as it were, which lay to hand for Newton, whence it has come to form an integral part of modern optics. And, despite the up-front ubiquity of chromatic colors in human vision, their specific existence had an ancillary position to light (and, as we have seen, could even be denied) from the beginning investigations of the Greeks onward. Their speculations were, then, also the beginning of the science we know as physics. I mean this in the following way. Greek ideas on light and color played out against the larger scientific concept of a four elements world. Because there is no ancient treatise specifically analyzing that conception—a little reflection will suggest that there could hardly have been such—even historians of science glide over it. My contribution is to have “thought out to the end” the implications of the interaction of the elements both in general and specifically in relation to color. This is presented in pictorial form in Chapter II.

Nevertheless, in contrast to the preceding, what is not of great interest to modern commentators (including Stulz) but cannot be sufficiently stressed, is that Greek color science evolved from direct consideration of human vision as processes of fire and water in the functioning of the eye-structure itself. It rested therefore on an organic-anthropocentric foundation, whereas the problem has since become—and especially since Newton—a matter of quantifiable abstractions; there are only hints of this direction in a few Greek thinkers, particularly Aristotle. Present day physiology has to make the best of these abstractions and obviously has to go in a direction opposite to that of holistic concepts.

In the ongoing development of color theory over the centuries only one creative mind really set itself against the last-mentioned view and thereby rejuvenated the problem, so to speak, in the original Greek sense: J. W. von Goethe. His inspiration to do so, however, did not come from a knowledge of Greek color history but from very contemporary considerations. But in due course he did acquire that knowledge in as much detail as was possible in the late 18th and early 19th centuries and was well aware of his historical position in regard to it. Indeed, his predilection for the “Greek way” was

so marked that the concept “Goethe and the Greeks” has evoked much literature in its own right. What I believe has never been systematically investigated is the degree to which Goethe’s own organic-anthropocentric standpoint created a color theory that appears to incorporate and to expand much for which the basic attitudes of Empedokles, Hippokrates and Plato laid the basis.³ This will be a secondary theme that emerged from my primary motivation.

THE PROBLEM

Although the theory of the four elements is well known, the concept of a theory of four colors is virtually unknown, even among many scholars in the ancient field. What is that concept? It refers first of all to a seemingly insoluble problem in the history of Greek painting, arising from references in Pliny the Elder and Cicero, to the use of *quattuor colores*: black, white, yellow, and red in certain Greek paintings (see note 1). Attempts have been made to understand these references on the basis of philology and art history as well as of the actual remains of ancient painting. Some very valuable and plausible results (to which I shall refer as needed) have indeed been obtained. My interest in this subject, however, is much more comprehensive, that is, to understand what it is that makes these four colors so special (this, of course, involves the other colors!)—insofar as this can be gathered from the natural philosophy of the Greeks themselves and from modern exoteric and esoteric conceptions of the nature of color.

The ancient tradition in regard to a connection between the Four Elements theory and the Four Colors theory—for so it must be called—is not only meager and sketchy but, on the face of it, enigmatic. Yet the parallel positioning of the two concepts, e.g., in Empedokles, Demokritos and Plato, is so noticeable that one cannot really doubt *whether* the Greeks regarded them as being correlative, but only whether they connected each of the four elements to a particular one of the four colors.

It would naturally be ideal if the writings of the ancient philosophers answered this question directly. However, the absence of a single unmistakably attested commitment in this regard, though discouraging, does not have to mean that no such connections were made. It could, for example, have seemed so obvious to the authors concerned that they never thought to mention it, or the point might never have figured in their arguments. Or their theorizing might not have reached a stage that suggested any systematic discussion of the matter. I refer here to the sphere of physics; at least in the sphere of physiology—thus indirectly—we have some information on the problem.

One should also take into account that the Four Elements theory itself apparently did not achieve a systematic form until the poem of Empedokles in the Classical period. Its basic components were certainly recognized in the Archaic period, but not brought together. Moreover, this theory was expressly a concern of the intelligentsia, which at the time of Empedokles was beginning to turn away from the physical science of the Ionians to explore other aspects of philosophy: thus there would have been no urgency about such a tangential aspect of Empedokles’ thought. In fact, we might suppose that

philosophers could have been less interested in pursuing such connections than artists (for purely artistic reasons). On the basis of all this the appropriate question seems to be—not whether there was any conscious equating of the two quaternary series but—whether such an equation can be logically posited. In order to begin work on this problem, we may turn our attention once again to testimonia concerning color.

THE ANCIENT SOURCES

It is essential to have an overview of those ancient passages that throw any light whatsoever on the problem of how the four colors were combined in any way with the concept of four elements. To this end I reproduce and comment on such passages either with original text and translation or with translation alone; in a few cases of longer arguments summaries are used. My concerns, of course, are not purely philological, as in the basic studies of W. Kranz, H. Dürbeck and others. Unless otherwise indicated, translations are my own.

Empedokles

The passage that serves as keystone for this entire study is a fragment of the works of Aëtius, a physician of the late 6th century A.D. Herman Diels 1964, 31, 21 A92 cites Aëtius, I, 15, 3 (D. 313:)

Ἐ. χρῶμα εἶναι ἀπεφαίνεται τὸ τοῖς πόροις τῆς ὄψεως ἐναρμόττον. τέτταρα δὲ τοῖς στοιχείοις ἰσάριθμα, λευκὸν μέλαν ἐρυθρὸν ὠχρὸν.

to Plato, *Meno*, 76D: “SOC. Well, do you speak of certain effluences from things, in agreement with Empedocles?—MENO. Certainly.—SOC. And pores into which and through which the effluences travel?—MENO. Yes, indeed.—SOC. And some of the effluences fit certain of the pores, others are too small or too large?—MENO. Yes.—SOC. And do you say that there is such a thing as sight?—MENO. Yes, I do.—SOC. Well, “take my meaning” from this, to quote Pindar. Colour is an effluence from shapes which is commensurate with sight and perceptible.” (Plato, *Meno* Edited with Translation and Notes by R.W. Sharples, Chicago 1985.) To this Aëtius commented: “(Empedokles) declared that color fits the pores of vision. And the four colors: white, black, red, yellow are equal in number to the four elements.”

It would seem that Plato and Aëtius are independently referring to the same passage in Empedokles’ works. Sharples, 136, notes that the definition of color given by Socrates is not specifically that of Empedokles. The second sentence of Aëtius is generally regarded as a further piece of information from the work quoted (as I have translated it), although in the absence of the complete context its relation to the first sentence is uncertain. However, the fact that Empedokles was here discussing a physiological question, and that Aëtius by his profession could be expected to refer to the same subject makes it doubtful that he was throwing in a proposition from the color physics of Empedokles’

day, particularly since in that sense the statement as worded would make a rather naive proposition. It seems more likely that the mention of the number four has a Pythagorean flavor (see Chapter II, *The Ancient Sources*, Pythagoreans, A, for a similar constellation in the writings of Aëtius). Therefore, I believe that the statement in question *may* have something to do with the (Pythagorean-derived?) Hippokratean *microcosmic* tradition of four colors and four humors. This would be weak evidence indeed to connect Empedokles with a definite system of color-element equations, especially since his own fragments offer no support for such an assumption.

A selection of passages from the *Peri Physeos* in the translation of Kathleen Freeman, *Ancilla to the Pre-Socratic Philosophers* (Cambridge, Mass. 1962) following Diels' compilation is offered to convey a sense of the manner of Empedokles' thinking and feeling as he presents his theory of the elements in a graphic, non-abstract way.

(A) Diels B21; Freeman, 54 "Observe the sun, bright to see and hot everywhere and all the immortal things (heavenly bodies) drenched with its heat and brilliant light; and (observe) the rain, dark and chill over everything; and from earth issue forth things based on the soil and solid. But in (the reign of) Wrath they are all different in form and separate, while in (the reign of) Love they come together and long for one another.....For these (Elements) alone exist, but by running through one another they become different; to such a degree does mixing change them." Empedokles here connects the sun, white and warmth in one all-encompassing conception. Yet λευκόν and even more δυσφοίνια—not very outspokenly a color term—are certainly used in this passage in a poetic sense, so that no technical conclusions can be drawn from them. In this connection note should be taken of a citation from Plutarch in the following:

(B) Diels B. 94; Freeman, 61 "And the black colour in the bottom of a river arises from the shadow, and the same thing is seen in deep caves." Here the shadow on the river bed is called black but not the water itself; this is a common sense observation, not color theory. In the following passage the technical color word μέλαν is more directly connected with materiality:

(C) Diels B.67; Freeman, 59 "For in the warmer part the stomach (i.e. the womb) is productive of the male, and for this reason men are swarthy and more shaggy." Here black is connected with firm substance measured by the density. The following passage summons up the lively intermingling of forms and color:

(D) Diels B.71; Freeman, 59 "But if your belief concerning these matters was at all lacking—how from the mixture of Water, Earth, Aether and Sun (Fire) there came into being the forms and colours of mortal things in such numbers as now exist fitted together by Aphrodite...." This proposition is illustrated by the following:

(E) Diels B.23; Freeman, 55 "As when painters decorate temple-offerings with colors—men who, following their intelligence, are well-skilled in their craft—these, when they make many-colored pigments in their hands, and have mixed them in a harmony, taking more of some, less of another, create from them forms like to all things, making trees and men and women and animals and birds and fish nurtured in water...." For

our (D) above suggests that Empedokles was familiar with a (Pythagorean?) doctrine of numerical proportions (of elements) in the composition of colored organisms; (E) shows that he was familiar to some extent with artists' practices. One can not make out exactly what is meant by ποικίλλωσιν (not translated by Freeman but given as "*bunt*" by Diels) or by πολύχροα φάρμακα (Diels: vielfarbige Gifte.) A final passage rounds out the nature of the system described in (A) above.

(F) Diels B.17; Freeman, 54 "All these (Elements) are equal and of the same age in their creation; but each presides over its own office, and each has its own character, and they prevail in turn in the course of Time. And besides these, nothing else comes into being, nor does anything perish..."

Aristotle on Empedokles:

(G) *Metaphysics* I iv 7 (985a, 30f.) from Loeb edition, 1975 "Empedokles, then, differed from his predecessors in that he introduced the division of the causes, making the source of motion not one but two contrary forces (Love and Strife). Further, he was the first to maintain that the so-called material elements are four—not that he uses them as four, but as two only, treating fire on the one hand by itself, and the elements opposed to it—earth, air and water—on the other, as a single nature..." This virtually implies that Empedokles emphasized the extraterrestrial source of all heat, the sun, as a force polar to the other, more earthbound elements.

Theophrastus on Empedokles:

(H) Diels A.69a: *De Sensu* 59 (D. 516, 9)

Ἐ. δὲ καὶ περὶ τῶν χρωμάτων (näml. λέγει) καὶ ὅτι τὸ μὲν λευκὸν τοῦ πυρός, τὸ δὲ μέλαν τοῦ ὕδατος.

On the subject of colors, E. said that white is that of fire, black that of water.

If this information was culled from such places as (B) above or from the following, it can have little bearing on color theory. Moreover what is suspicious in this sense is that no other colors are mentioned.

(I) Diels A.86: *De Sensu* 1ff. (D.500) 7

τοὺς δὲ πόρους ἐναλλάξ κείσθαι τοῦ τε πυρός καὶ τοῦ ὕδατος, ὧν τοῖς μὲν τοῦ πυρός τὰ λευκά, τοῖς δὲ τοῦ ὕδατος τὰ μέλανα γνωρίζειν· ἐναρμόττειν γὰρ ἑκατέροις ἑκάτερα. φέρεσθαι δὲ τὰ χρώματα πρὸς τὴν ὄψιν διὰ τὴν ἀπορροήν.

E. says the pores of fire and of water respectively are crossed, white things being recognizable by the fire pores, black things by those of the water. For they are adjusted to one another. And he said that colors are brought to the vision by effluence.

Empedokles here is speaking of physiological modalities, which can hardly have anything to do directly with color-element equations, especially since there are no more visual routes to accommodate red and yellow sensations. Yet it is highly interesting that he

proposed a cross-sensory functionality—quite in the mold of contrapposto with its three dimensional contrast of left-right, forward-back, and up-down.

Adding up the available evidence, we are in little doubt that Empedokles was acquainted with a four color physiological system, though the evidence is more indirect than direct. Despite a persistent tendency for water to be associated with dark effects, it does not seem necessary to suppose that he disagreed with the rational equation of black with matter (earth). See especially (G) above. Theophrastus' report on the color of fire and water in (H) may also be meant physiologically. In any case, it is tantalizing because the passage continues: “the other (thinkers with the exception of Empedokles) claim that white and black are the original colors and that the other colors arise from mixtures of these, and also Anaxagoras spoke only of these two.” Also, Aristotle still represented this view (see Chapter II, The Ancient Sources, Aristotle, paragraph 2) and it is not clear actually how Empedokles differed from it (for he too in the available passages speaks of only these). Krantz makes an inference from (E) that Empedokles derived warm and cool colors alike from mixing the four colors (see note 2). This seems to me (as also to Stulz, see above Chapter I, Prologue, *In Particular*, paragraph 3) to be an absurdity which one cannot foist on the words of Empedokles. I prefer to remain with the fact that Empedokles nowhere discussed the four colors in a philosophical way either in the macrocosmic or the microcosmic sense.

Anaxagoras

(A) Diels A97. Sext. Pyrrh. hypot. I 33

νοούμενα δὲ φαινόμενοις [näml. ἀντιτιθεμεν] ὡς ὁ Ἀ. τῷ λευκὴν εἶναι τὴν χιόνα ἀντετίθει ὅτι ἡ χιὼν ὕδωρ ἐστὶ πεπηγός, τὸ δὲ ὕδωρ ἐστὶ μέλαν, καὶ ἡ χιὼν ἄρα μέλαινα ἐστίν.

We are opposing contrived thoughts to appearances, just as Anaxagoras opposed to the fact that snow is white the fact that snow is frozen water, and since water is black, isn't snow also black?

(B) Diels A98 Schol. Hom. (A) zu 161

μέλαν ὕδωρ Ἀ., ἐπεὶ φύσει μέλαν· καὶ γοῦν ὁ καπνὸς μέλας ἐστὶν ἐκ τοῦ ὕδατος τῶν ξύλων ἀνιέμενος.

Since (water) is black by nature, says Anaxagoras, then smoke is also black from the water released from the (burning) wood.

These two passages recall the statement attributed to Empedokles (H). Anaxagoras (A) is, of course, a sophistic play with concepts which nevertheless implies that he routinely associated water with black. The source of all references to black water—not merely that of Anaxagoras(B)—must be the highly poetic and dramatic Homeric allusion to a pack of blood-sated wolves drinking from “the surface of the black water from a dusky spring” (Iliad, XVI, 161). That this became a proverbial trope even in the speech of philosophers is not surprising. What would be surprising would be an attempt on their part to justify the poetic usage in the sense of physical philosophy. That being impossible, I interpret

Anaxagoras (B) in the same sense as (A): a sophistic or ironic statement, for the statement in itself is almost irrational: the smoke from burning wood is normally white (even though enough of it can blacken other objects—from the residue of the chemicals of the wood, not the water in it). I have already suggested the true explanation for the image in the discussion of Empedokles (B). Of course atmospheric effects may also play a part in the effect of darkness of water.

Pythagoreans

(A) Aëtius (plac. I) H. Diels, *Doxographi Graeci* (4.ed. Berlin 1965) 313 Plutarchi Ept. I,15, 1–7)

Χρῶμά ἐστι ποιότης σώματος ὄρατῆ.

Οἱ Πυθαγόρειοι χροιάν ἐχάλουν τὴν ἐπιφάνειαν τοῦ σώματος.

Οἱ ἀπὸ Πυθαγόρου τὰ γένη τῶν χρωμάτων, λευκόν τε καὶ μέλαν ἐρυθρὸν *ὠχρόν*· τὰς δὲ διαφορὰς τῶν χρωμάτων παρὰ τὰς ποιάς μίξεις τῶν στοιχείων·

Color is the visible corporeal quality. The Pythagoreans call the visible surface of the body skin-color...The followers of Pythagoras (regard) white, black, red and yellow as the elementary colors (the families of colors). The differences of the colors (of bodies?) derive from what mixtures of the elements are involved.

This highly important passage was included by Goethe in his history of color theory (see note 3). What is remarkable is the juxtaposition of a purely physiological consideration and a broad generalization that apparently may indirectly refer to macrocosmic colors, perhaps even to the Dark spectrum (see Chapter III, The Two Spectra of Goethe's Color Theory, diagram); for I believe that the word γένη in this particular context might be translatable as root, that is, root-colors, hence the four irreducible spectral colors involved in the creation of the physical earth (see Chapter III, The Evolutionary Aspect of Colors, paragraph 3). Certainly there has to be some deeper knowledge behind such an otherwise mysterious reference to these four colors. The fact that it seems never to have been explained may mean that it could not be explained at that time in publicly comprehensible terms. Yet we know that the concept was used in ancient medical practice in a way sufficiently definite that it survived many centuries. The two passages of Aëtius now cited complement each other and link Empedocles into the circle of the early Pythagoreans.⁴

(B) Aristotle, *Metaphysics* A.5 (986a) *The Works of Aristotle*, VIII, translated by W.D. Ross:

Other members of this same school (Pythagoreans) say there are ten principles, which they arrange by cognates—limit and unlimited, odd and even, one and plurality, right and left, male and female, resting and moving, straight and curved, light and darkness, good and bad, square and oblong. In this way Alcmaeon of Croton seems also to have conceived the matter, and either he got this view from them or they got it from him; for he expressed himself similarly to them. For he says most human affairs go in pairs, meaning not definite contrarities such as the Pythagoreans speak of, but any chance

contrarities, e.g. white and black, sweet and bitter, good and bad, great and small. He threw out indefinite suggestions about the other contrarities, but the Pythagoreans declared both how many and which their contrarities are.

What is significant here for our theme is the fact that an interest in both light and dark *and* black and white as polarities was “in the air” at the time Empedokles must have been working.

Hippocratic Writings

(A) The most important passage occurs in Galen’s *On the doctrines of Hippocrates and Plato (Corpus medicorum Graecorum V 4, 1,2 Berlin 1980 mit Uebersetzung von Phillip de Lacy) Liber VIII 5, 9–12*:

For (Hippocrates) worked out in great detail the generation of the humors, their varieties, their powers, and what humor is dominant in any region, season, time of life or condition of the body. Yet there was no need for Plato to go through all these matters as Hippocrates had done, just as there was no need for Hippocrates to inquire why the humor phlegm is white, blood is red, bitter bile is yellow, sharp bile is black. Hippocrates himself gave a starting-point for the discovery of these causes, as for example when he diagnoses the states of the body from the colors of the tongue, saying that the tongue is blackened by a sooty burning. For just as soot outside (the body) is naturally produced from lamps, pine-torches, and many other oily substances, so also in the bodies of animals something akin to soot is often generated when the humors, especially the oily ones, are overcooked, etc.

The indications given summarily in this passage are also scattered through Hippocrates’ *Peri Physeos Anthropolou* e.g. IV, 1–4 (yellow, black), VII, 14–17 (white), V, 10–12 (colors in general). Also in *Peri Chymon* I, 1–2 (colors in general), XIX, 4–7 (color of skin). The continuous arguments of Hippocrates for the correctness of the Empedoklean synthesis of the four elements is the best proof of the power of conviction it inspires and at the same time a fascinating introduction into the intellectual climate of the later fifth century.

(B) Hippocrates *On Diet (Corpus Medicorum Graecorum I 2,4 Berlin 1984 mit Uebersetzung von Robert Joy) I 2,3–4. 1*:

L’homme et tous les autres animaux se composent de deux (éléments) différents par leur vertus, mais complémentaires dans leur action, le feu et l’eau. Ensemble, ils se suffisent à eux-mêmes et à tout le reste: séparés, ils ne suffisent ni à eux-mêmes ni à rien d’autre... Chacun de ces deux (éléments) a les attributs suivants: le feu a le chaud et le sec: l’eau le froid et l’humide. Chacun tient aussi de l’autre un attribut; le feu, de l’eau, tient l’humide, car il y a de l’humidité dans le feu; et l’eau, du feu, tient le sec; car il y a du sec aussi dans l’eau...

There is an unmistakable note of opposition to Hippocrates-Empedokles in these words. The author of the tract wants to stay with two and resists a quadripartite system. On

what is this dualism based—for it is operating with the same opposites: warm-cold and moist-dry with which Empedokles created his quadripartite scheme?

Demokritos

- (A) Diels 55A 123 Aristot. gen. gener. et. corr. A2 316a 1:

διὸ καὶ χροιάν οὐ φησιν [Demokr.] εἶναι· τροπῆι γὰρ χρωματίζεσθαι.

And so D. thought that there are no colors as such, for color arises from change.

- (B) Diels 55A 124 Aët. I 15, 11 (D.314)

οἱ δὲ τὰ ἄτομα, πάντα συλλήβδην ἄχροα, ἐξ ἀποίων δὲ τῶν λόγῳ θεωρητῶν τὰς αἰσθητὰς ἀποφαίνονται γίνεσθαι ποιότητας.

Some say that the atoms, taken collectively, are quite colorless and that the feeling that (sensuous) qualities exist arises from things which must logically be without any qualities.

- (C) Diels 55A 125 Aët. I 15, 8 (D. 314)

Δ. φύσει μὲν μηδὲν εἶναι χρῶμα· τὰ μὲν γὰρ στοιχεῖα ἄποια, τὰ τε ναστὰ καὶ τὸ κενόν· τὰ δὲ ἐξ αὐτῶν συγκρίματα κεχρῶσθαι διαταγῆι τε καὶ ῥυθμῳι καὶ προτροπῆι, ὧν ἡ μὲν ἐστὶ τάξις ὃ δὲ σχῆμα ἢ δὲ θέσις· παρὰ ταῦτα γὰρ αἱ φαντασίαι. τούτων δὲ τῶν πρὸς τὴν φαντασίαν χρωμάτων τέτταρες αἱ διαφοραὶ, λευκοῦ μέλανος ἐρυθροῦ ὠχροῦ.

D. says that in nature there is no color. For the elements—solids as well as the void—are without qualities. Things compounded from them have acquired color on the basis of arrangement, proportion and movement, of which one resulting factor is their rank, another their shape and position. With these factors (outer) appearances are in accord. In reference to the impression of colors arising from them, there are four varieties: white, black, red, yellow.

- (D) Diels 55A 126 Aristot. *de sens.* 4 442b 11

τὸ γὰρ λευκὸν καὶ τὸ μέλαν τὸ μὲν τραχὺ φησιν [Demokr.] εἶναι τὸ δὲ λείον, εἰς δὲ τὰ σχήματα ἀνάγει τοὺς χυμούς.

Demokritos calls white smooth, black rough; he refers taste to the shape of the atomic figures.

Theophrastus⁵ summarized the color theory of Demokritos at some length and criticized it rather harshly. We learn that Demokritos reckoned with four root-colors (γένη), and offered a long disquisition on the qualities of black and white, especially in the matter of rough and smooth, which were determined by atomic composition. Theophrastus objected specifically (79) that to assume more than black and white as root-colors—the usual procedure—was to invite difficulties. This must be a sign that Demokritos was the first, and apparently the only, thinker to attempt a scientific investigation of the relationship of the four canonical colors. That he did not achieve viable results is

understandable from the fact that he did not undertake this on the basis of spectral conditions—about which he probably had no inkling. Theophrastus, taking the position of the lofty critic, gave the results a proper drumming without himself suggesting any real solution to the difficulties he brought up or attempting an original defense of the two-color theory. If anyone else had made any significant attempt to explain the four colors scientifically, Theophrastus would surely have mentioned it here; in fact this is the best evidence that Empedokles totally avoided the problem, though he might have questioned the two color theory (see Chapter II, *The Ancient Sources*, Empedokles, I).

Can we in any case find the point of departure for the reasoning of Demokritos? First, we may notice that two of the testimonia (B, C) are from the writings of Aëtius, the physician. Secondly, Theophrastus (*de sens.* 78) remarks: “although (D.) holds that the colours, like the savours, are endless in number according to their combinations...” and he uses in this context the word *χυλούς*, which is exactly parallel with *χυμούς*; both can refer to juices or the smell of juices. The inspiration to mention explicitly the parallel cases of colors and juices is easiest to explain in terms of the medical equation of four colors and four humors, while in both cases the innumerableness of instances is owed to the possibility of subtle and subtlest variations in the atomic composition (in other words, through structural *krasis!*).

If this reasoning brings us anywhere near the actual thought patterns of Demokritos, it shows how great was the influence of Empedokles on his contemporaries, even those who rejected his theory. If Demokritos saw a virtue in the concept of four elemental colors and four basic humors, and a type of *krasis* (i.e. mixing atomic combinations), he was bound to land in difficulties without the four elements as well. This circumstance was presumably the basis of Theophrastus’ disenchantment with the explanations of Demokritos. At any rate, probably the most compelling ground for seeing the starting point of the latter’s reasoning in the contemporary medical theory of four humors is his use of *χλωρόν* for yellow, for this equivalent comes directly out of Hippocratic writings⁶ and indeed is the preferred usage in that context. Putting this right silences at once much criticism, beginning with Theophrastus (or translations of same), and eliminates sense-distorting translations of testimonia that give the impression that Demokritos was treating *χλωρόν* as the complementary of red. Demokritos was indeed not that naive. And it is to be noted that Aëtius himself did not employ *χλωρόν* but *ώχρον*—both words referring linguistically to various saturations of yellow.⁷ Demokritos did not substitute green for yellow in the four color canon, nor could he have rationally done so. Moreover, complementation of colors was not a factor in Greek color theory in the fifth century (see Illustration 18).

Given our irremediable uncertainty on external grounds about the chronology of many thinkers of the fifth century, one is obliged to seek the logic of the developing intellectual life. Some version of the Pythagorean microcosmic four color system may well have been generally known in the earlier part of the century, as that would accord with the evidence of painting (see Chapter IV, *Panel Painting*, The Classical Period, paragraph 5). On this basis Empedokles could have formulated his theory of four macrocosmic elements, whereupon a perhaps more *technical* medical theory of four humors and their colors could emerge and stimulate Demokritos. Precisely the

formulation of Aëtius (C above) that Demokritos spoke of four varieties of color (διαφοραί can almost be translated as species here) recalls the formulation of the same author that the Pythagoreans spoke of four γένη: families, roots, elements.⁸ And in the larger sense, it would seem that the basic conception of the four elements had to be *in situ* before the atomists could offer a partial replacement for it.

Plato

A quite perceptible difference in time separates the work of the great thinkers of the fifth century and that of Plato. It is just that difference that clarifies the effect of the earlier work on the creation of what we call Classical culture. We have already had occasion to remark on a certain failure of logicity and consequentiality in the thought-structure of Leukippos-Demokritos, specifically on the unresolved juxtaposition of, on the one hand, a physiologically evolved color system that actually corresponds to real life-processes as understood medically at that time, and, on the other hand, of a hard, mechanical conception of “basic building blocks of the universe” (as we might now phrase it) in terms of atoms that are colorless, devoid of qualities and feeling. Indeed, Theophrastus himself (*de sens.* 68) makes this same criticism of inconsequentiality in no uncertain way, using the terms of his day.

The intellectual bias of the atomists was quite at odds with the spiritual convictions of Empedokles and his temporally removed successor, Plato. The latter could, to be sure, appreciate the idea of atoms to the extent that these may presuppose a mathematical order in things, that is, a kind of order in which Plato had the deepest faith. But for Plato, this order was entirely governed by divine force and intentions, while Demokritos seems to have subscribed to a non-sequitur in this respect. First, he took what is basically an agnostic position:

We know nothing about anything really, but Opinion is for all individuals an inflowing (? of the Atoms). (Diels B-7; Freeman, 93)

Yet one must suppose that he shared the basic conviction of Leukippos:

Nothing happens at random; everything happens out of reason and necessity. (Diels B-2; Freeman, 911)

The Platonist would ask, if we can know nothing for certain, how can we know about atoms, and if atoms are not plan-less, where does the plan come from and, above all, why and how can totally empty things produce sensations of qualities through mere combinations of atoms in their structure? Demokritos must have anticipated some of these objections—in a way that would hardly have satisfied Plato (e.g., Diels B-11 on two kinds of knowledge). But the basic difference in orientation is not bridged.

From this introduction we can turn to Platonic ideas on color. For the purposes of this investigation it is most fortunate that Konrad Gaiser (1965) already assembled and commented on the passages in Plato that bear on this. Having referred to that I will simply extract from his work the points that are pertinent to the problems that have been set out in my investigation.

In the matter of the basic unresolvedness of the atomic theory, Gaiser already surmised that Plato was standing on the same spot where Goethe found himself when confronted by the color theory of Newton: that Goethe who, as the defender of a holistic conception of man and world, was aroused to fierce opposition by the methods of a natural science which, in an almost uncanny parallel to Demokritos, divided up the world into a bloodless, abstract mathematical thought-structure of subsensory, indefinable forces on the one hand and, on the other, a subjective world of qualities lacking basically any locus in reality. With this before us, we must call attention to the fact that the Four Elements school of philosophers ought to have been obliged by the logic of their point of view to investigate the macrocosmic nature of the four colors—as Demokritos, to his credit, tried to do—and their attributability to individual elements. Did Plato attempt to follow this logic (for it was his conviction that the Empedoklean conception of a macrocosmos and microcosmos with one interlocking, inseparable nature was valid)? The answer is indeed no, but to understand that—for it is not necessarily equivalent to a denial of the proposition on his part—we must recall that from the beginning the subject of color had always been a physiological question for the Greek natural philosophers (how does the eye receive color impressions?), not a speculative matter (what is the ultimate nature of color, etc.?). For whatever reasons, and not rising to the challenge of Demokritos on this matter(!), Plato simply accepted the tradition, dealt with the problem in relatively short order and did not go beyond physiological considerations. Thus, his discussion of color in the *Timaeus* (68) remains totally noncommittal about the macrocosmic implications of the fire and water that effectuate color sensations in the vision, and these are the only two elements mentioned at all. This is, of course, not to imply that Plato could not have said more if obliged to do so; but he must not have considered it necessary or appropriate. In regard to the mixtures of the four colors that produce other colors, what Plato says may have a reference to the atomists' views: he deliberately refused even to speculate on the mathematical proportions that are involved in this process, for he believed that human intelligence could not (and should not try to) encompass the supersensory part of this process. Again in this respect he was a forerunner of Goethe who hardly used mathematics⁹ and only hinted at the supersensory explanation of color.

If Plato averted his attention from macrocosmic color, Aristotle did so even more. An index that seems reliable enough of the direction color studies veered into is the *Peri Chromaton*, a tract in the Aristotelian stream: one gets no clear definition of what the root-colors (*Peri Chromaton*, 1) are, while black is virtually written off as a color in an almost dismaying pre-emption of the Newtonian view of dark as the absence of light. Thus the breadth of Plato's spiritual horizon became contracted; this is a side of Plato's color views that must still be commented on.

The four traditional colors are retained in the *Timaeus*—almost; that is, black, white and red certainly, but yellow? “Bright” (τὸ λαμπρόν), which apparently breaks the sequence, may perhaps not be so much an intruder as a disguised yellow. For yellow itself is defined by Plato as a mixture of red, white and bright—whereby the resulting yellow arrives at exactly the same point where prismatic yellow stands, i.e., darker than white and lighter than red. Bright must therefore logically be described as “light-

enhancing”, as something that assures yellow its place but presses more toward the light side and thus lends shine and lustre. One is reminded of a primaeval yellow like gold itself, which is traditionally associated with moral, even divine, qualities. In terms of my Illustration 16, Plato seems to be adding transcendent white to noetic red and white to achieve an ennobled human color. Granted that Plato’s colors are not pigmentary mixtures but theoretical conceptions,¹⁰ the color bright is a thoroughgoing symbol of Platonic idealism: the lifting of the human being above his unregenerate level, as this would be symbolized by the unadulterated supersensory yellow.

Aristotle

The general orientation in regard to the four colors of this greatest of Greek scientists has already been touched on. In two places he deals with the nature of colors, their origin and selected physiological problems. These passages: *de sensu*, cap. 3, 439f. (Parva Naturalis) and *de anima*, 418f. are too long to cite or summarize, since they deal only tangentially—but then in some cases tantalizingly—with our concerns. An example of this is *de sensu* 442a (translation W.D. Ross):

Savours and colours, it will be observed, contain respectively about the same number of species. For there are seven species of each, if, as is reasonable, we regard Dun [or Grey] as a variety of Black (for the alternative is that Yellow should be Classed with White, as Rich with Sweet): while [the irreducible colors, viz.,] Crimson, Violet, leek-Green, and deep Blue come between White and Black, and from these all others are derived by mixture.

If this list is cropped, as allowed by Aristotle, to the following seven colors: crimson, violet, green, blue, black, white and yellow, then we have the basic colors of Goethe’s Dark spectrum (assuming that blue and yellow have been combined): (on this spectrum see Chapter III, *The Two Spectra of Goethe’s Color Theory*, diagram). However, the order given by Aristotle and his uncertainty about alternatives discourage any thought that he has direct knowledge of that spectrum. It does, however, show that the iron grip of the four colors on earlier Greek thought (through and including probably Plato) has been broken and a freer concern with the whole range of physical colors was possible. See also the comment on the rainbow (see Chapter III, *The Other Colors*, paragraph 3). Again, in groping for a theory to explain the differences in color, Aristotle (*de sensu* 439b) deals with the idea that they are constituted of varying ratios of black and white in such a way that—if one substituted dark and light for black and white and then introduced his concept of a transparent medium (*de anima*, 418b)—one would be within a stone’s throw of important considerations discovered by Goethe. Yet all these advanced ideas never took on a usable, experimental form, for this could only have been given by the prism. It is likely that they were not understood anyway by Aristotle’s contemporaries; by comparison the writer of the tract *Peri Chromaton* must be classed as naive. The sparks given off by Aristotle’s fertile mind did not set fires until far in the future.

Zeno

H. Diehls, *Doxographi Graeci*, 312 Aetii Plac. I. 15. 6; N. Festi, *Frammenti Degli Stoici Antichi* (Bari 1932) 82 no. 9 with further references.

Ζήνων ὁ Στωικὸς τὰ χρώματα πρώτους εἶναι σχηματισμοὺς τῆς ὕλης·

Zeno, the Stoic philosopher, said that colors constitute the first determinant of (the form of) matter.

This extraordinary statement, out of all context and the only fragment of Zeno on the subject, stands furthermore isolated among the statements about color of any later Greek Philosophers. Yet, it has received very little attention. A. Long and D.N. Kelley, *The Hellenistic Philosophers: Translations of the Principal Sources with Philosophical Commentary* (Cambridge 1987) obviously did not find this passage worth recording, even though it gives a glimpse of something potentially more interesting than the repetitious discussion of color as a secondary quality among authors cited. Perhaps the most extensive comment is that of Clemens Baumken, *Das Problem der Materie in der griechischen Philosophie* (1890) 348, who explains it in the following way: “The Stoics, on the other hand, who see the immediate criterion of matter in something visible to the senses, extensible in three dimensions, naturally look for the essential qualities of things in their sensuously tangible make-up. To these they, along with the Epicureans, attribute objective factuality—and no further investigation required—just as Zeno finds in color the most *primaeval* factor in the formation of matter, which otherwise has (at that stage) no qualities.” In using Zeno’s statement to justify a Stoic definition of matter, Baumken may be not only reading into it much from his own 19th century feeling for materialism but actually quite missing the point, for it could be part of a really insightful philosophy of color not pursued or shared by any of Zeno’s followers; it should be borne in mind that the source of the fragment is Aëtius, who was a physician and hence by definition more likely to have been a four elements humanist than addicted to atomic physics. I believe that the real significance of Zeno’s statement has to be left open.

Conclusions

In the Protoclassical period the Pythagoreans probably gave out a theory of four colors adapted either exclusively, or at least principally, for understanding the medical implications of the four-membered human (microcosmic) organism. This must nevertheless have been general enough to have been of great interest and importance to artists, as reflected in the so-called four color system of ceramics (white-ground category) and the tradition concerning Polygnotos. The significance of the white background can virtually be guessed from the qualities associated with white in Illustration 16 (see my extensive discussion Chapter III, *Preliminary Remarks on the Meaning of White in the Classical Period*, paragraph 5). At any rate, the microcosmic color system could hardly have been arrived at (by the Pythagoreans) without a corresponding reference, at least, to the macrocosmic parallel. In fact, ancient sources imply this and there is no obvious effort to conceal it. It is everywhere implicit in the four color system of medicine and art. Paradoxically, however, in dealing with the Four

Elements theory no philosopher seems to have investigated, or even discussed seriously, the question of a specific assignment of the separate colors to the separate elements, even though this was implicit in the microcosmic system. We will put this down to the fact that such an attribution is not feasible purely on the basis of the polarity principle, (see Chapter II, *Basic Considerations*, paragraph 5) and therefore the problem could not be resolved without resort to knowledge of the Dark Spectrum (see Chapter III, *The Two Spectra of Goethe's Color Theory*, diagram) or its equivalent. The Pythagoreans must have had this equivalent but were presumably unwilling or unable to formulate that knowledge in an intellectually understandable way: for example, they may have operated largely out of what would appear to us as intuition. Beyond the practical medical benefits of the system they must have chosen to be reticent. Reticence to an even greater degree would logically characterize the attitude of the more spiritually inclined philosophers.

The ultimate test of this suggestion is the attempt of Demokritos to explain a relationship among the four colors in a scientific way. Yet he could not do so because his theory of atoms automatically short-circuited the only possible approach to the problem, so that his attempt was mercilessly criticized by Theophrastos. But with a better chance at succeeding in this Empedokles passed up the challenge and the whole matter became submerged under other facets of color. The crux of the scientific problem was that the four color system (black, white, red, yellow) was not really in opposition to the two color system (black and white): they complement each other, as we can see from the perspective of Goethe. But it is abundantly evident from the ancient sources that this was not—and could not have been—grasped on a scientific level without specialized knowledge of a kind that lay far in the future. The result was that the two color system more or less prevailed theoretically and that the Four Color theory led a somewhat precarious, if vital, existence alongside it for a while, and then, probably by the middle of the fourth century B.C., slipped into a non-theoretical zone whence it has continued ever since to exercise a powerful though subliminal influence over western art and culture.

BASIC CONSIDERATIONS

Having decided to pursue the problem proposed in this Chapter, I was obliged to look for some way of considering it from the inside, as it were, rather than with the usual purely spectator consciousness. Only then will the bother of scrutinizing the ancient sources have been worthwhile. If we grant that ancient art itself has cognitive value for us, then it may be possible to recover something of the experience of the artists who actuated that value, for example, in the sense that Goethe¹¹ wrote: "One thing is certain. Ancient artists had just as much understanding of nature and just as sure a grasp of what could be represented and how it must be represented as Homer.... These lofty works of art were produced to form at the same time the most sublime works of Nature—though done by men—according to the laws of Truth and Nature. All that is arbitrary and imaginary crumbles away, leaving only Necessity and God." In this spirit let us look back at the best documented part of the Greek artistic record: blackfigure and redfigure vase painting.

Here we do encounter firm principles in the use of color—principles that cannot be satisfactorily explained as merely arbitrary or dictated by technical factors. Let us suppose them to have their foundation in a deeply entrenched world view, such as could be generated through a consciousness of the four elements.

Although the canonical four color grouping of black, white, red, and yellow is not documented in ancient literature before the first half of the 5th century, it can easily be noticed that these same four colors, separately, together, or in mixtures giving the so-called earth colors, predominate not merely in Greece but all through early cultures.¹² The Greeks, specifically the Attic ceramic craftsmen, had a special relationship to this “canon” in that they refined their color choice, presumably out of a passionate attachment to it, to a glossy black and orange-red as an aesthetic norm.¹³ Beings and objects in the pictorial frieze (see Figure 10) are shown in black, suggesting the obvious conclusion that this color represents the corporeality, the density, of earth substance. And the frieze itself, be it noted, is reserved in the black density of the pot, also fired earth-substance. In the first part of this study it was established from quite another point of view and in detail that a main concern of the early Greek sculptors as well was to understand and experience the nature of earth-substance.

The orange frieze used in blackfigure work misses maximum contrast value with the black, so why was it chosen? Perhaps a kind of instinctive insight has always led people to refer to red, or reddish hues, as the color of life. For our purposes that is far too general a statement. In the circumstances we are considering—at least if the artists were not irrational—the reddish hue can really only represent air (atmosphere), in which all beings and things are bathed. For example, if we consider animals or men, they unremittingly draw in life force for the blood through breathing air, whereupon the blood maintains both physical and emotional existence. Red, therefore, represents the air on the macrocosmic plane and in the extended microcosmic sense it represents soul life.

We can now take stock. The two opposite fix-points, earth-air, provide a contrast that is more spatial than dynamic, for earth and air are fundamentally contiguous, and in an undisturbed state do not act on one another but simply preside over, as it were, the spheres of below and above, respectively. (Fire and water, on the other hand, are by nature hostile to one another, eliminate themselves when, forced together, they must attack each other). Just as in the relationship of earth and air, the colors black and red have a complementary, not an adversarial, relationship, and it cannot be accidental that as prismatic colors of the Dark spectrum (see Chapter III, The Two Spectra of Goethe’s Color Theory, diagram), black and red are precisely contiguous. Nevertheless, the juxtaposition is decisive: black is heavy, immobile, hence can function as support; red as a chromatic color has also a certain density but, as Goethe already noted, it is the least mobile color, so that without forcing a point we could say that it hovers over black. In this way one can *feel* why the Archaic painters remained so long satisfied with this combination: it gave superb expression to their passionate pursuit of physical reality in a way that no other color as background, e.g., white (see Chapter III, *The Emergence of Redfigure Style*, paragraph 12), could have.

During the Archaic and Protoclassical periods the Ionian philosophers consistently pondered the nature of the elements on the basis of the polarity principle. Similarly the colors black and white were certainly seen as polar opposites, (see Chapter II, *The Ancient Sources*, Pythagoreans, B) like cold and warm; but these colors could not be connected with the actual pair of polar opposites in the elements (fire and water) in view of the factors discussed above. Indeed, apart from black-earth, we shall find that a little leeway must be allowed in assigning colors to elements (even red-air). In any case, at this point fire and water are open to apportionment to white and yellow. According to the criterion of density already established, yellow, visually the stronger of the two colors, will go to water, the denser element, leaving white for fire (warmth) as the most rarified substance of all (just as Empedokles—see Chapter II, *The Ancient Sources*, Empedokles, A—took for granted).

Yellow accordingly is the expression of the principle of fluidity, the functional principle (circulatory system) of the earth planet and all its creatures. Yellow therefore can be called the active color *par excellence*. At a later point it will be seen how closely this purely logically derived conclusion approaches the thinking of the ancient physiologists. White, on the other hand, characterizes the element which is the least physical—which in fact can almost not be experienced except as an invisible connective (warmth) of the other elements. And indeed on the visual plane white is passive, lacking specific expressionality. It does not in any sense importune us but kindly provides without preconditions an empty space for inner freedom. This makes it highly suitable to represent, at the macrocosmic level, the sphere of pure thought, the goal of *nous*; the relative loftiness of this sphere may suggest, but does not compel, a connection to the Godhead. I say not compel because the Godhead is logically prior to and beyond all color. Moreover white can be sullied by the admixture of impure elements, as can pure reason.

Some problems that may arise in connection with the foregoing arguments can be touched on in a preliminary way. One difficulty is the report of Theophrastus that Empedokles considered water (rather than earth) to consist of black, and fire to consist of white. I regard it as unlikely that Empedokles was actually intending to equate the two elements with two colors (see Chapter II, *The Ancient Sources*, Empedokles, H). Krantz¹⁴ interprets that passage in a physiological sense, which may remind us not to be too concerned with rigid equations until a comprehensive system of relating the four colors and four elements on both the macrocosmic and microcosmic levels has been worked out (see below). Another report of Theophrastus that the earlier philosophers—*with the one exception of Empedokles*—considered black and white to be the originating colors might mean that Empedokles substituted other colors in this connection, which seems to me highly unlikely, or that he did not concern himself with a *theory* of colors at all (in the macrocosmic sense). This latter supposition, which I favor, of course negates the other report of Theophrastus (above).

My suggestions for equating elements and colors so far have already uncovered one basic reason why the ancient philosophers did not try to think this problem out fully—at least on the macrocosmic level: whereas the four elements can easily be thought of as two pairs of opposites (earth and air as under and above; fire versus water), this is not the case with the canonical four colors (the origins of which will be considered later).

There is only one absolutely unequivocal pair (black and white) and that pair does not correspond in a fully logical way with either of the two pairs of elements. Without modern knowledge of the spectrum (inclusive especially of Goethe's), dialectical thinking cannot take this problem much further. Thus the lack of a systematic assignment of the four colors to the four elements in theoretical philosophy as handed down can hardly be accidental. There is moreover the circumstance that Pseudo-Aristoteles (*De Coloribus*), so close in time to the great theoretical physicists, deals with this matter in a naive-realistic way, devoid of historical polemicizing.¹⁵ Therefore, what these Greek thinkers—and artists—knew or at least instinctively guessed concerning a correlation of elements and colors can only be put in perspective if we ourselves attempt to think it through to the end with all the arsenal both of dialectical reasoning and modern color knowledge.

THE FOUR ELEMENTS AND THE FOUR COLORS IN THEIR MACROCOSMIC AND MICROCOSMIC RELATIONSHIP

*Till God, or kindlier Nature,
Settled all argument, and separated
Heaven from earth, water from land, our air
From the high stratosphere, a liberation
So things evolved, and out of blind confusion
Found each its place, bound in eternal order.
The force of fire, that weightless element,
Leaped up and claimed the highest place in heaven;
Below it, air; and under them the earth
Sank with its grosser portions; and the water,
Lowest of all, held up, held in, the land.*

—Ovid, *Metamorphoses*, I, 1. 21–31 (translated by Rolfe Humphries)

As a point of departure for attempting a coherent presentation of the vast problem set out in the title of this section I offer in tabular form a summary of the results so far obtained (N.B. Although naturalistic considerations of color are not the criterion here, it may be noted that the sun—the ultimate source of warmth—at midday in a clear sky seems to be glaring white. The naive perception that fire is red ignores the fact that actual heat produced by a fire is colorless whereas the burning gasses (air) are red to yellow):

| Element | Processual Designation | Color |
|----------------|-------------------------------|--------------|
| Fire | Calefaction (Combustion) | White |
| Air | Rarefaction | Red |
| Water | Liquefaction | Yellow |
| Earth | Condensation (Compression) | Black |

It will be seen at once from the processual column that the order of listing is not accidental but from least dense to most dense (following Aristotle, as does Ovid in the passage cited); yet this table presents only one possible condition out of many. For it is a fundamental experience in the study of color that every color is subject to movement through the dynamic processes in the earth's atmosphere. Even the pigment colors are subject to this to some degree, with the possible exception of black. To grasp this I found it necessary to ask, how are the remaining elements affected when, for example, combustion is the dominant process—and then when rarefaction is, etc. One could try to use tables like the one above but in fact, if a pictorialization of the processes should be possible, that would be even better. But pictures, even diagrammatic ones, are subject to the laws of picture-making, and these are seldom articulated. Here it is all the more necessary to do this because we are considering the very basis of human existence and human experience. In view of the importance of this matter I have chosen to present a formal investigation of the theme.

Prolegomena to a Study of the Four Elements Theory and its Relation to the Canonical Four Colors

No comprehensive history of the origin, emergence and effectuality of either of these theories, let alone both in combination, in ancient and later times, has ever, to my knowledge, been attempted (but see the recent important work by G. and H. Boehme, citation included in the opening comments to my bibliography of resources not used in the text). The question as to whether specific colors were in antiquity attached to specific elements (*in the macrocosmic sense*) has been variously evaluated. Although a very few authors have proposed or assumed such actual correspondences, no comprehensive reasoning about the fundamental interrelationships of elements and colors has appeared.

Without prejudice to the possibility that such correspondences actually were accepted in antiquity without being recorded or that such actually do exist whether contemplated in antiquity or not, our first step must be to establish a coherent, logical

visual means of conceptualizing the relationship of at least the four elements among themselves. There is no inherited scheme for this from antiquity, even though, again, one could have existed. Indeed, the possibility of some kind of overall geometric scheme may be suggested by the fact that Plato did visualize each individual element as a geometric figure:

Fire: tetrahedon

Earth: hexahedron

Air: octahedron

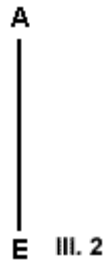
Water: ikosahedron

To these Heaven was added as a fifth—let it be noted—extraterritorial element; its figure was a pentagon dodekahedron.¹⁶ To suggest how to combine all these is beyond my competence. Furthermore, for the purpose of this study, it is essential to invent a “picture” that can also suggest in spatial terms the concept of the miscibility (*krasis*) of the elements, since these were understood by the ancients to be processes¹⁷ whereby a constant metamorphosis of the visual configuration of the world at any moment is actually taking place. The descriptive determination of such momentary states lies within two pairs of opposing conditions: hot-cold and wet-dry. These qualities in effect give the parameters of two of the elements, fire and water, whereby it can be concluded that fire and water have a particular axial quality, a central governing position in the total concept of four.

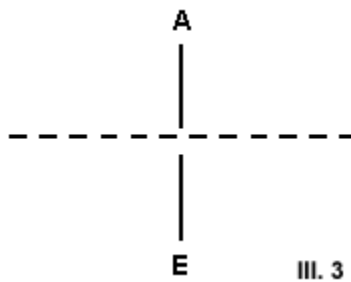
The most obvious and striking aspect of this relationship is, as already suggested, the uncontested polarity of fire and water. The archenemy of fire is water; equally fire opposes water but with much less immediate impact and finality. Fire is quenched by water; water is evaporated (goes into air) by fire. This stronger quality of water may allow it to determine how to pictorialize the relationship. Since the inalienable tendency of water is to seek the horizontal, we may use a horizontal line, whereby the placement of fire and water to left or right is still to be discussed: Liquefaction opposes combustion.

III. 1

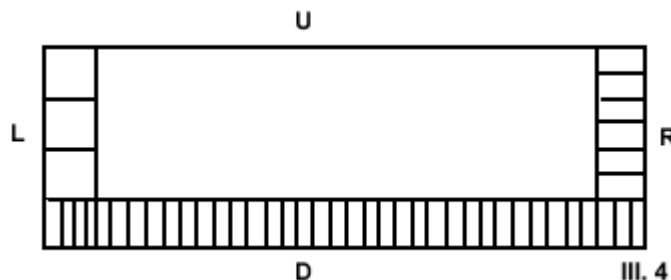
With this given, a second less dramatic but equally inescapable polarity remains: earth and air. Their normal relationship is to be contiguous, with earth below and air above. Their difference in density results in the phenomenon of gravity, which would not be observable without a contrasting medium through which things can fall and, for that matter, rise. If gravity is a force—as science proposes—beyond earth itself, then dialectically an opposing force, levity, must also be postulated.¹⁸ This relationship is logically to be illustrated by a vertical line: condensation opposes rarefaction.



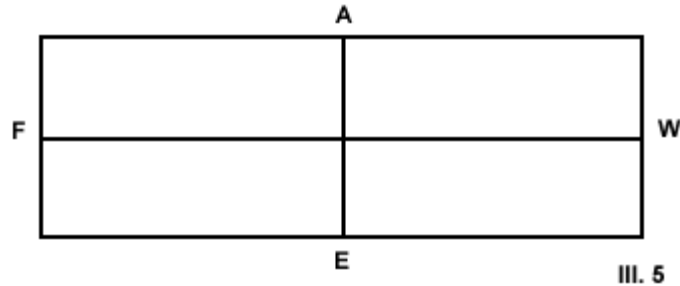
Given the interaction of the four elements observable by the senses, we can now cross the two lines.



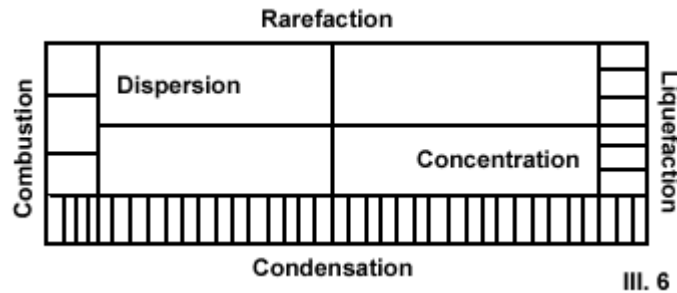
Whereas the positioning of A and E is given by physical characteristics of the two elements, the placement of fire and water involves the relationship of left and right. Therefore the concepts of science and the laws of picture-making, if there be such, must meet and interact. There is no left and right bias in fire and water as such, but there is a fundamental difference between left and right visually. While this is generally recognized as vital by artists and critics alike, it is generally discussed, if at all, using psychological considerations, which plainly are irrelevant here. It was the merit of Vassily Kandinsky,¹⁹ acting on a suggestion of Goethe, to have conceptualized the picture plane as an area—blank or not—that is alive with tensions of weight. Indeed, that plane is an excerpt of each observer’s bodily relationship to the horizontal-vertical conditions of earthly existence. Thus, the horizontal and vertical represent, respectively, earth’s plane from L to R and space from up to down. The visual resistance experienced in a defined rectangular pictorial space is strongest, naturally, below and weakest above. The next strongest resistance (tension) is offered by the right side; this is reduced on the left side but not so much as up and down. Thus, there are four degrees of density (sc. visual density) as represented by the following scheme:



The applicability of Kandinsky's reasoning to the problem at hand, if any, must be axiomatic, as indeed all geometrical reasoning lies inextricably rooted in the human body/mind condition. We may therefore criticize the suggested scheme as it would appear in the following rectangle.

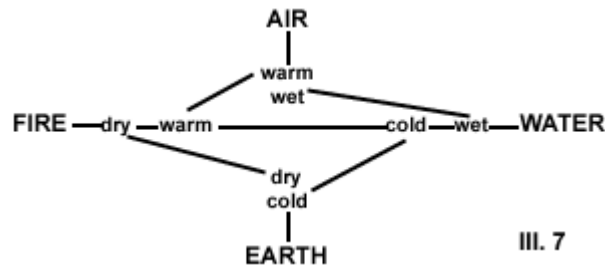


No conflict exists in the vertical plane. The potential conflict is in the horizontal. Although W is correctly placed on the right in relation to A and E, fire can not easily be related to density in the sense of the other three. That is because, in contrast to ancient (and some current esoteric) thought that warmth is a (primeval) substance, present scientific theory sees fire (warmth) as a condition of other substances. In terms of our picture, a resolution of this dilemma may be sought in regarding the elements not as substances but as processes, where there can be no conflict. In this sense we then have the completed diagram as follows:

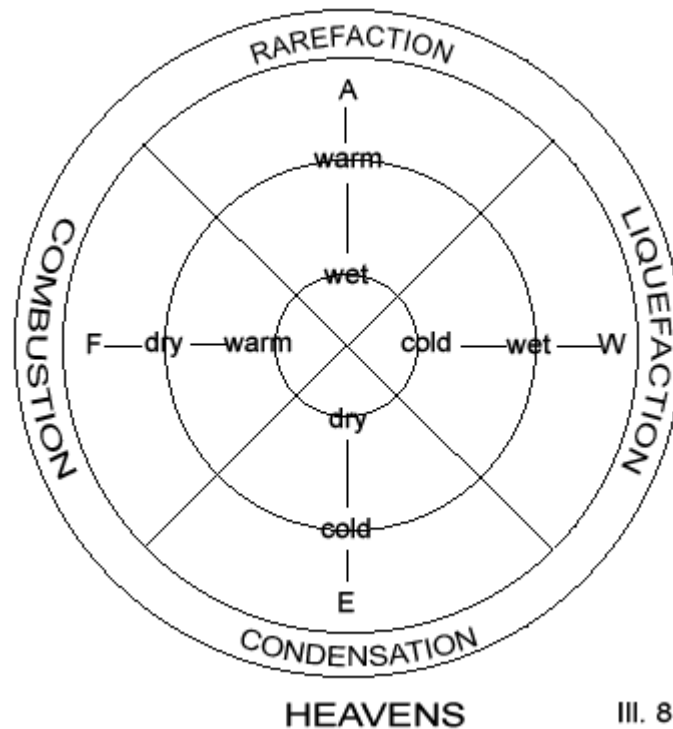


Taking into account again Kandinsky's criteria and visualizing the results of the four processes in terms of changes of density in weighable and measurable materials of earth existence, combustion is clearly in the right position. Combustion can lighten matter, leaving ashes which are lighter than water or earth but still ultimately heavier than air; and on the other hand it may intensify the process of rarefaction and thus contribute to lightness.

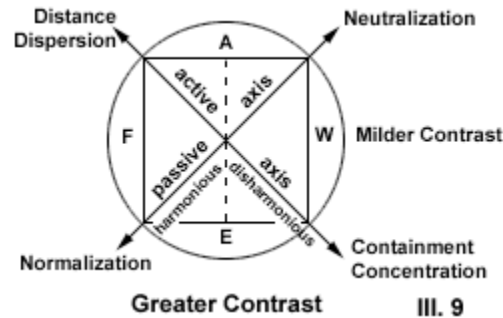
The next problem is to show the opposing pairs of elements in the descriptive sense-analytical terms of early thought. These are described by Empedocles (under A) as hot/cold and wet/dry. The existence of four quadrants allows us to arrange these terms in the sense of equally balancing contrasts;



In this way we have accounted for the nature of the four elements but what of the fifth element? In order to include that in this picture we must find a way of showing that besides the planet earth and its atmosphere, with which we have so far been dealing, there are outside of these the heavens (universe). We can accomplish this by enclosing the above cross in a circle, representing first of all the shape of the planet—if not the arch of the horizon—thus giving an inside and outside, so to speak, and also functioning as a symbol for relationships among equal elements.²⁰ Furthermore, Kandinsky showed how the four arms of the cross function as axes being displaced to the left and right but maintaining the center connection and, in effect, becoming radii of a circular form. Such movement of the arms is particularly meaningful in the circumstances because it literally shows the process of *krasis*, whereby the four elements constantly intermingle as they create and define the quality and quantity of all physicality.

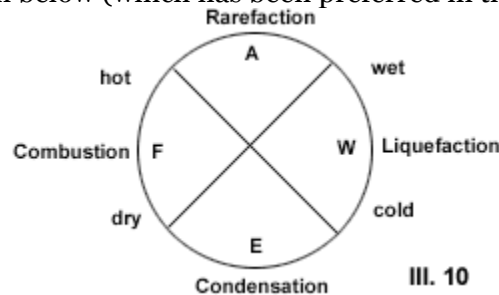


If we now re-instate the picture plane containing (or contained by) the circle, we can see that Kandinsky's characterization of the four quadrants of this plane actually corresponds, to a remarkable degree, to the process of miscibility (cf. e.g., Ills. 9 and 6).



While Kandinsky did not propose that the pictorial framework gives more than symbolical meaning to the qualities of the various quadrants, his considerations nevertheless demonstrate a new degree of sensitivity to the problem of pictorial thinking, without which complicated relationships cannot be prepared for discussion and evaluation in any sphere of knowledge. His apprehension of the pictorial plane as a living entity was deduced exactly from the fact that left and right relationships are not mirrored passively from the observer's point of view. This should be taken into account in all diagrams, for these should correspond to the laws of visual perception. This will become increasingly clear when colors are added to the characterization of the four elements.

N.B. the data about the elements contained in Ill. 8 can also be rendered, and more conveniently, by attaching the information about hot/cold and wet/dry to the vectors, as in the diagram below (which has been preferred in the text).

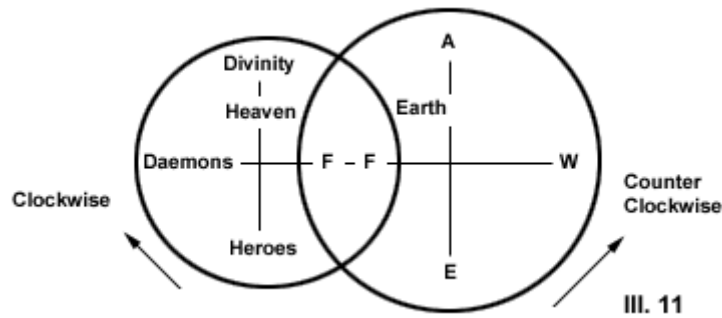


The persistent implication in the method of constructing the picture of the Four Elements theory arrived at in Ills. 8 and 10 above, namely, that this is an irreducible explanation of earthly realities valid for all of humanity, requires a further comment. The elements qua substance require to be thought of as occupying real space: they are in a sense the planet we live on, they are our own body/mind entity. As such they are Being. But they are also synonymous with processes, so that one could just as well speak of the four processes theory—and as such they belong to the realm of time: they are Becoming. There is evidence that the Greeks themselves conceived of this latter idea without, however, living so much in consciousness of the *technical* potentialities of the processes which dominate our minds, but rather in the blessedness of feeling the processes as

earthly projections of realities inherent in higher worlds. Nowhere is this so explicitly put as in a dialogue of Plutarch (*De Defectu Oraculorum*, 10):

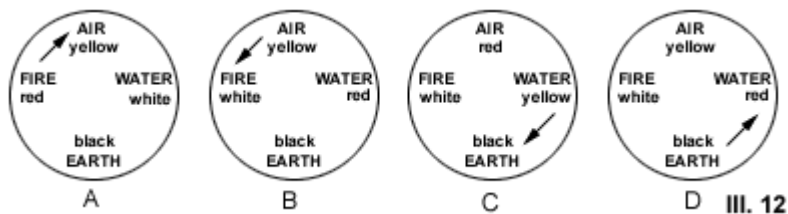
Others (other authors) say, there is a transmutation of bodies as well as of souls; and that, just as we see of [from] the earth is engendered water, of the water air, and of the air fire, the nature of substance still ascending higher, so good spirits always change for the best, being transformed from men into heroes, and from heroes into Daemons; and from Daemons, by degrees and in a long space of time, a few souls being refined and purified come to partake of the nature of the Divinity.²¹

If we consider this passage in microcosmic terms, the reference to men, whose highest earthly member is *nous* (fire), translates into an overlapping of the circle of the four elements by a higher circle of which *nous* is the lowest and, therefore, common member with three stages above it, each of a finer and more (spiritually) rarefied nature: heroes, daemons and the Divine itself. The result of this merger of Heaven as the fifth element and fourfold man is therefore a sevenfold picture in all.



PARADIGMS AND EXPLANATIONS

Having established a structured visual paradigm for the relationship of the four elements among themselves, we can now consider the associated colors when the paradigms are repeated to show the effects of the respective dominant process. Although the impulse to ask how this works arose for me out of the original paradigm itself, the procedure was later found to be quite in the sense of what Empedokles²² himself envisaged: Those elements and forces are to be understood as equally strong and coeval, yet each of them has a different function, each has its own characteristic and *in the rounds of time they take their turn being dominant*.



| (A) | (B) | (C) | (D) |
|---------------------------|-------------------------------------|------------------------------------|------------------------------------|
| Combustion | Rarefaction | Liquefaction | Condensation |
| Fire: flame, searing heat | Air: medium of warmth and dispersal | Water: medium of constant movement | Earth: solid end-product of series |
| Air: warmed up atmosphere | Water: medium of distillation | Earth: dissolves | Fire: by-product of friction |
| Water: steam | Earth: powderized | Fire: extinguished | Air: resists pressure |
| Earth: coal, ash, slack | Fire: invisible energy (warmth) | Air: becomes heavy | Water: becomes immobile |
| Function | | | |
| Illumination | Animation | Movement | Stability |

Fire is the creative principle in (B), (C), (D), hence white; it materializes only in A, hence red (physical).

Air expands in (A), (B), hence yellow and increases its efforts to do so in (D) hence really a deeper yellow; it loses this quality by taking on weight in (C), hence red (immobility).

Water is the least stable in color. In (A) it is white (diminishingly physical). In (B) water signifies (retains) liquidity even in distillation (oxygen) hence red, yet it also becomes gaseous (hydrogen) thus tending toward yellow; in (C) it achieves maximum movement (yellow) and in (D) it tends toward immobility (red).

Earth is always stable to the extent that it remains the darker part in any condition. In principle, yellow is the color of dispersal, black of concentration, red of intensity or arrested movement and white of non-physicality or minimal physicality.

In all cases the colors share the tendency of the elements to mix themselves constantly and must therefore be taken as in constant gradation from one to the other.

It must be emphasized that the foregoing considerations relate to the macrocosmos, that is, more precisely, the universal, external and objective—as it were—basis of physical/physiological processes. Whatever echoes or premonitions of such considerations may be discernible in the ancient literary tradition (probably even including the medical writings) seem to be related to the macrocosmic sphere. However, Goethe's great pioneering work on the psychological and mental/moral aspects of color implicates another dimension to this problem, namely, the microcosmic or individuated realm. Therefore, it would be unconscionable for the modern investigator not to attempt

to understand the implications of elements and colors on the specific level of the human being, whose form and being—physical, physiological, psychological and mental/moral—constantly interact with the macrocosmos.

In structuring the macrocosmic pictures, I employed, as explained above, the hierarchical evolutionary principle of organization: fire, air, water and earth (as solid matter, the finished product of evolution). By contrast, since the psychological and mental/moral effects of interaction can only be realized by an individual consciousness, the microcosmic series is therefore organized according to the biographical principle, wherein the order is exactly reversed: the human being begins with earth (physicality) at birth and rises in the end (ideally) to mental/moral ripeness.



| (E) | (F) | (G) | (H) |
|--|--------------------------------|--------------------------------|---|
| Condensation/compression | Liquefaction | Rarefaction | Combustion |
| Earth: ground of physicality | Water: agent of assimilation | Air: agent of psychic event | Fire: unseen basis of mind/spirit |
| Water: stable (e.g., body temperature) | Air: moisture-laden substratum | Fire: instigator; mood | Earth: carburized by consciousness |
| Air: dispersed actively (breath) | Fire: regulator of movement | Earth: refined physical medium | Water (in the sense of physiological processes): stabilized by pure thought |
| Fire: energy (potential or actual) | Earth: substratum of excretion | Water: dispersed | Air: emotional forces displaced by thought |
| Function | | | |
| Incarnation | Digestion | Animation | Reflection |

Earth is implicit in life processes at all stages providing physicality or its shadow, hence always black.

Water is more subject to movement in (F)-(G), hence yellow but more balanced and stable in (E) and (H), hence red.

Air is more subject to movement in (E) and (H), hence yellow but more stable and dense in (F) and (G), hence red.

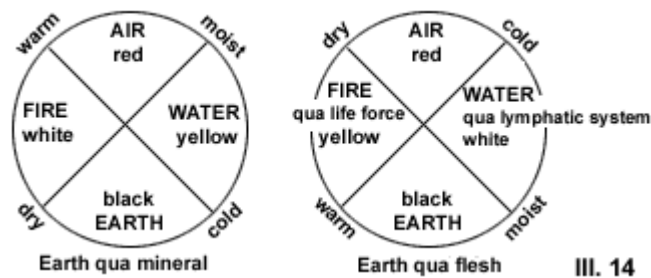
Fire is the invisible presupposition of all processes, hence white throughout.

A comparison of the two sets of figures shows that only the color of earth (matter) remains constant in all cases. Further, only the picture for the dominance of water accords both macrocosmically and microcosmically with the original table that served as the point of departure (see Chapter II, *The Four Elements and the Four Colors*, table) for the study of variations. That original table was obtained from an analysis of the characteristic colors of Archaic ceramics. Yet, quite apart from color altogether, it had appeared from the analysis of sculptural form that Greeks of the Archaic period were at a stage of development that took for its concern the aqueous constitution of man (water-man).

Correspondence of the color series occurs at the earth stage as well as at the water stage of the two systems. Logically this is to be expected, since an individual human being is, as far as physical/ physiological aspects are concerned, identical materially and constitutionally with the surrounding macrocosmic environment. As far as the air stage is concerned, the air-being (soul) corresponds to the color arrangement of the macrocosmic water stage, whereas the individual fire-being (mind) is in accord with the colors of the macrocosmic air stage. This amounts to a chiastic relationship. Tentatively one might argue that individual souls are necessarily limited by a common parameter emotionally, that is, by a certain given range of possible human emotions, whereas individual minds (I-beings) have—theoretically—unlimited freedom to transcend cultural parameters into the sphere of uniquely original creativity. If there is an intelligible pattern in this, it must be stressed that the working out of the tables took place at a comparatively early stage of this study with sole concentration on the separate processual conditions; patterns and implications like those just discussed were not noticed until later.

The various paradigms of Ills. 12–13 show the planet in terms of color, that is, the planet as a four-membered unity with its manifold subordinate, organically living, feeling and even thinking beings, in elemental colors. These tables also go together in the sense of a higher and a lower—though not necessarily oppositional—order. Not as yet taken into account are the functional equalities and oppositions of the separate living beings (microcosms). The very intention to do this brings one to the particular way that philosophy and the rational healing arts of the Greeks were interfaced; for the founders of the latter were, according to the sensitive and sympathetic account of the medical historian, Henry Sigerist,²³ the Pythagoreans, including Empedokles himself—the famous Hippokrates being by this account his successor. In any case, the paucity of the record obscures what contribution these thinkers actually made to the physiological model of the Hippokratean school. On general grounds I am inclined to assume that the

contrapposto-like structure of this scheme as conceived by others from the purely medical standpoint (cf. Illustration 13 with basic macrocosmic figures Illustration 12) makes it indeed a genuine product of the contrapposto principle, and thus an achievement of the High Classical period—that is, a mental model whether visualized as it is here or not.²⁴ Still, the design quality of the resulting inversions (presented in Illustration 14) is so striking and artistic that it could possibly have been symbolized visually in some way. Again, I must stress that the model I justified in Chapter II (see Basic Considerations, paragraphs 2–8) was worked out before I became aware of its virtual existence, together with the same color scheme, in the writings of the Hippokratean corpus and Galen—but there only for a microcosmic purpose and apparently without conscious macrocosmic implication.



III. 14

By the same token, the method of putting the basic macrocosmic model through four variations was anticipated in theory not only by Empedokles (see Chapter II, *The Ancient Sources*, Empedokles, F) but also by Hippokrates in that he reckoned with a rotating ascendancy of each of his basic substances according to the progression of the four seasons, four ages of man, etc., as visualized by H. Schlepperger²⁵ in a scheme exactly like mine (Ill. 15). I must leave it to the medically cognizant to ring the changes on that theme in a fully dynamic macrocosmic/microcosmic way. Although I do not feel qualified to attempt anything so ambitious, I believe that nothing else could give so vivid a conception of the mixture of the elements and the colors going on all the time as Empedokles proclaimed.

