

## TWO SPATIAL SYSTEMS

**B**Y VISUAL COMPOSITION we mean the way in which works of art are put together of shapes, colors, or movements. The present book deals almost exclusively with shapes, although the principles I am using can be applied to the composition of colors or movements as well.

### A MASTER KEY TO COMPOSITION

Composition reveals itself when, as we inevitably do, we see a painting or sculpture or building as an arrangement of definable shapes organized in a comprehensive structure. Why do the shapes of such a work need to be composed rather than simply added up in any odd way? The reason usually given is that artists like to put things together in an orderly and balanced fashion because the harmony thus obtained pleases their own eyes and those of the people who look at their work. This explanation, although pertinent, is barely a beginning of what we need to know about composition.

The common practice for showing composition in a treatise on the subject is to reduce the actual image of a work to the simple shapes and directions we see as constituting its skeleton. Circles or squares or triangles underlie pieces of visible matter; arrows indicate directions. Usually the diagrams resulting from this useful procedure illustrate the schema of one particular work or, at most, that of a kind of work created by a single artist or the practitioners of a particular style. Each diagram differs from the next.

My own objective is more ambitious and perhaps foolhardy. It seems to be possible to describe a compositional scheme common to works of visual art of whatever time or place—a condition that needs to be met by all art if it is to fulfill its function. How would such universality come about? Obviously, there is no convention prescribing one particular form of composition to all cultures. Rather, its principle would have to be deeply rooted in

human nature and ultimately in the very makeup of the nervous system we all have in common. Whatever knowledge is available by now on this score will be mentioned in Chapter XI.

Universality also can be expected to come about only if our compositional scheme symbolizes a condition of human experience so fundamental that without it any artistic statement would look irrelevant. I propose that this fundamental theme can be found in the interaction of two tendencies of human motivation, which I will call the centric and the eccentric tendencies, and that this interaction is symbolized in art by the corresponding interaction of a centric and an eccentric compositional system.

#### CENTRICITY AND ECCENTRICITY

Psychologically, the centric tendency stands for the self-centered attitude that characterizes the human outlook and motivation at the beginning of life and remains a powerful impulse throughout. The infant sees himself as the center of the world surrounding him.<sup>1</sup> Things are understood as being directed toward him or away from him, and his actions are controlled by his own needs and wishes, his pleasures and fears. A social group, be it a family, an association of persons, a nation, or even humanity as a whole in its relation to nature, retains centricity as a strong component of its outlook and motivation.

Soon enough, however, the self-centered individual or group is compelled to recognize that its own center is only one center among others and that the powers and needs of other centers cannot be ignored without peril. This more realistic worldview complements the centric tendency with an eccentric one. The eccentric tendency stands for any action of the primary center directed toward an outer goal or several such goals or targets. The primary center attracts or repels these outer centers, and the outer centers, in turn, affect the primary one.

It will be seen that the interaction of the two tendencies represents a fundamental task of life. The proper ratio between the two must be found for existence in general as well as for every particular encounter between the inner and the outer centers. Taken by itself, the activity of either tendency would be one-sided in an unnatural way. It would represent a state of easy freedom desirable to the naive mind but intolerable in the long run and de-

1. I apologize for not adopting the practice of supplementing masculine pronouns with feminine ones. I am all in favor of eradicating the verbal residues of sexism as soon as our language succeeds in offering an acceptable solution. But the law of parsimony, omnipotent in science and art, forbids me to introduce differentiations not required by a proposition. No writer can afford to say, "He bites the left or right hand that feeds him."

prived of the basic challenge of life. The tension between the two antagonistic tendencies trying to achieve equilibrium is the very spice of human experience, and any artistic statement failing to meet the challenge will strike us as insufficient. Neither total self-centeredness nor total surrender to outer powers can make for an acceptable image of human motivation.

How are the arts to make this theme visible? Fortunately, centricity and eccentricity are spatial relations, as their very names indicate. They are as basic to the physical as to the mental world, and they are easily represented through visual shapes. Furthermore and perhaps even more important, since the psychological relations that art is called upon to depict are motivational strivings, their images, too, must display the action of directed forces. Here we meet a basic problem.

Shapes drawn on paper or painted on canvas as well as those made of various materials in sculpture and buildings are in and by themselves not only physically immobile but also undynamic, in the sense of not being inhabited by animating forces. A ball of clay neither expands nor contracts, and even the drawing of an arrow does not go anywhere. One can see such shapes in what one might call an impoverished or deprived way—a view limited to their purely spatial dimensions. This undynamic view is sufficient and indeed useful for some purposes. Geometry, for example, is concerned only with spatial relations, and therefore a circle is nothing but a figure of certain measurements, and so is a straight line. Even in the arts, as we shall see, such pure shapes serve useful purposes, especially that of supporting visual order.

Artistic expression, however, requires shapes that are thoroughly dynamic. If they are to depict human experience, they must look animated. Here again we are lucky. Although the optical images projected upon the retinas of our eyes share the static hardness of the objects whose surfaces they reflect, their electrochemically generated counterparts in the nervous system do not. These are much more in the nature of processes, and so are their equivalents in consciousness, that is, in visual perception. To the full-fledged vision that is needed for artistic expression, all shapes are configurations of forces.<sup>2</sup> In practice, this way of looking at the world is familiar to anybody open to the experience of art. In fact, it is natural to all people, for example, young children, whose vision has not been degraded by being used for information and identification only. As a matter of theory, however, the traditional notion that the visual world is nothing but an agglomeration of static things is not easily relinquished. It may help to be reminded here of

2. For a more explicit discussion of visual forces see Arnheim (1974, pp. 16ff. and chap. 9).

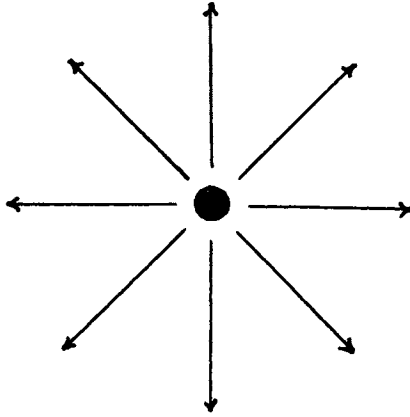


FIGURE 1

the changed picture of the physical world offered to us by the physicists of our century. The old distinction between mass and energy has been superseded by a more unified conception, according to which the universe consists of patterns of energy only. What looks to us like mass, what we call a thing or object, is nothing but a field of energy.

Similarly, things fully perceived appear to us as configurations of forces, and this dynamics of our vision enables us to do justice to the mental and physical strivings portrayed in works of art. Therefore, if we wish to describe compositional structure, the elements to start out from are not things or shapes but vectors.

#### VECTORS AND THEIR TARGETS

For our purpose, a vector is a force sent out like an arrow from a center of energy in a particular direction.<sup>3</sup> When a system is free to spread its energy in space, it sends out its vectors evenly all around, like the rays emanating from a source of light. The resulting symmetrical sunburst pattern is the prototype of *centric composition* (Fig. 1). In nature it is most perfectly embodied in the spherical shapes of planets and stars, but it is also evinced in snowflakes or microscopic radiolarians. Goethe observes in his aphorisms on geology: "Anything that embodies itself with some freedom seeks round shape."

3. Vectors refer to physical as well as to mental situations. In the present book, I am applying the term to either. The first psychologist to speak of vectors was Kurt Lewin (1935, p. 81).

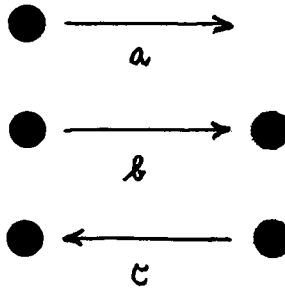


FIGURE 2

The sunburst pattern can be analyzed into a multitude of vectors, each of them issuing from the center and sending its energy into space (Fig. 2a). Depending on its strength, its activity will evaporate at a shorter or farther distance from the center.

So far, we are dealing with purely centrifugal behavior. A different situation comes about when a second object is introduced into the neighborhood of the first. We might say that as the original center responds to the presence of another one, a centric orientation changes into an eccentric one (Fig. 2b). The primary centric system is no longer alone in the world; it acknowledges the existence of other centers by acting upon them and being acted upon by them. Here we have the prototype of our second system, that of *eccentric composition*.

As the primary center focuses upon a second one, the nature of the vector, represented by our arrow, changes. It is no longer a mere passive emanation of energy released into empty space but rather an active goal-directed aiming at a target, a striving to approach that may be friendly, like a longing, or hostile, like an attack. The power of the primary center may also manifest itself as a magnetic attraction, in which case the direction of the vector is reversed (Fig. 2c).

Even if the primary center acknowledges that it is not alone in the world, it may still view the situation in an entirely self-centered fashion: the primary center is conceived as generating all activity and undergoing affliction passively, whereas the secondary center is only a target or afflicted victim. With one step further toward a more realistic appraisal of the situation the secondary center is recognized as a focus of energy in its own right. The primary center comes to realize that it receives an outer power's action when it is attracted or approached.

If we, as the external spectators, choose to switch allegiance and to identify

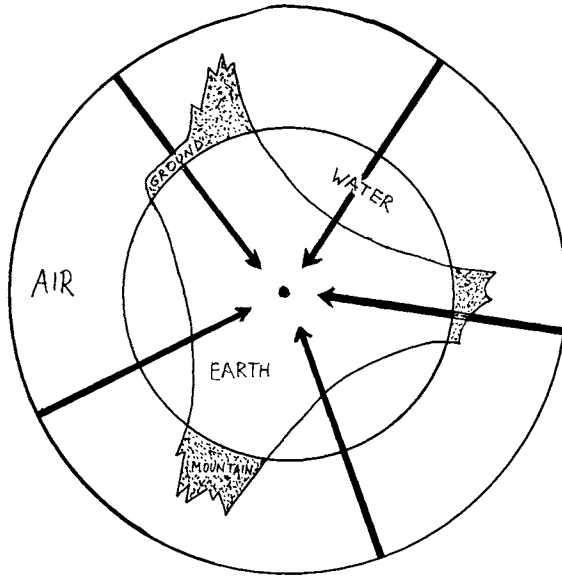


FIGURE 3  
(after Klee)

with the secondary center by making it the primary one, the entire dynamics of the situation is reversed. What was active becomes passive and receptive, and the target becomes the initiator.

We arrived at the notion of the vector by deriving it as a detail or element from the primary sunburst pattern of a focus spreading energy in all directions. Centricity is always first. This is true physically, genetically, and psychologically. Let me mention here the biological fact that in the embryonic development of the nervous system the nerve cells grow first as independent entities and only secondarily send out linear axons to establish communication with their neighbors. Another, very different, example of this priority of the central system may be illustrated with a drawing derived from Paul Klee (Fig. 3). The section through the earth shows a centric system organized around its middle by the focus of the force of gravity. Gravity attracts everything throughout the body of the sphere, including all the living and inorganic things on its surface and in the air. This view of the whole planet, however, is not the one that is natural to us humans as we inhabit the earth. Our attitude is somewhat ambiguous. The attraction to which we are subjected can be perceived as weight, that is, as a property inherent in the mass of our own bodies. This mass presses downward as a vector issuing from the

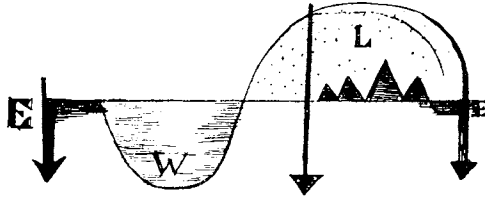


FIGURE 4.

Paul Klee, drawing from *Unendliche Naturgeschichte*, p. 33.

body as the primary center—a centric conception that ignores the existence of the outer attractive power.

Less narrowly and more modestly, however, we acknowledge the eccentric power of gravity that pulls us down. In response, we struggle to liberate ourselves from the coercion of our earthbound condition and to rise—with height as an eccentric objective, the explicit target of our striving. As we shall see, this tension-laden struggle is a vital component of artistic expression because it dramatizes the pervasive human conflict between powers trying to pull us down and our own striving to overcome them.

The world of our immediate experience, then, is a partial and parochial one. Rather than see ourselves as the outer particles of the terrestrial centric system, each of us has shifted the primary center to his own body—a center tied to an ever-present ground force. The parochial confinement of our environment also modifies the nature of our space fundamentally. Instead of a system of radial vectors oriented toward the center of the earth we perceive a system of parallel verticals, as indicated in another drawing by Paul Klee (Fig. 4). A plumb line establishing the vertical shows us that if we measure their orientation with microscopic precision, the left and the right side walls of a building converge toward the center of the earth; but they run parallel for all practical purposes. It follows that the dominion of the eccentric system is often expressed in whole rows or groups of verticals. This parallelism is found in the choruses of columns or trees or crowds of people.

We should be most grateful for this narrower conception of space because by transforming convergence into parallelism it simplifies our world in a vitally helpful way. It allows us to impose a framework of vertical parallels supplemented by horizontal parallels upon our life space and thereby supplies us with the simplest and most perfect instrument for spatial orientation the mind could seek. Imagine the complications in mathematics and in the pursuit of our daily business if Descartes had had to build his basic analytical geometry on a framework of converging radii; and recall that it took

an Einstein to cope with a universe that does not conform to a Cartesian grid.

Grids of this kind may be constituted of vectors that perform their dynamic action in the vertical or horizontal directions, but they also may be simply the coordinates of a framework of order, in the sense just indicated above. I can refer here to the usefulness of purely geometric shapes, of which I spoke earlier. The grid of analytical geometry is not dynamic, nor is the grid that allows us to define places and spatial relations on geographical maps. Similarly, implicit grids in works of painting and architecture help to create visual order and thereby serve an important compositional purpose.

If such grids are to come alive as elements of artistic expression, however, they must be perceived as vectors. Think of the difference between the streets of Manhattan laid out for the sake of order as a network of empty channels and these same channels populated with streams of people and vehicles moving toward their goals in all four directions. A similar difference holds between mere scaffolds of order in an artistic composition and arteries pervaded by directed visual energy.

#### INTERACTION OF THE SYSTEMS

Consequently, when we go back to our two spatial systems, the centric and the eccentric, we can represent them in two ways. Figure 5 shows them as mere scaffolds of order, both singly and in combination. The concentric circles offer a pattern for the arrangement of things around a common center. The network of parallels meeting at right angles serves to localize items in a homogeneous space, in which no one place is distinguished. The combination of the two in a single pattern presents the facilities of both but also suffers from complications appreciated by anybody who has tried to cope with the street map of Washington, D.C.

Figure 5 can be considered the trellis on which the actual composition performs its vectorial play. Similarly structured, Figure 6 shows the dynamic version of our combined systems. The centric system is now an arrangement of vectors radiating from their common center into empty space. In practice, this system need not be complete. There may be no more than one vector relating to its center in this manner, or there may be a few. The second system is represented by a grid of parallel vectors moving toward or away from outer centers of attraction or repulsion. Here again we have a schematization of what happens in practice. Actually such grids are rare, in nature as well as in art, although they are pervasive in architecture. More gen-



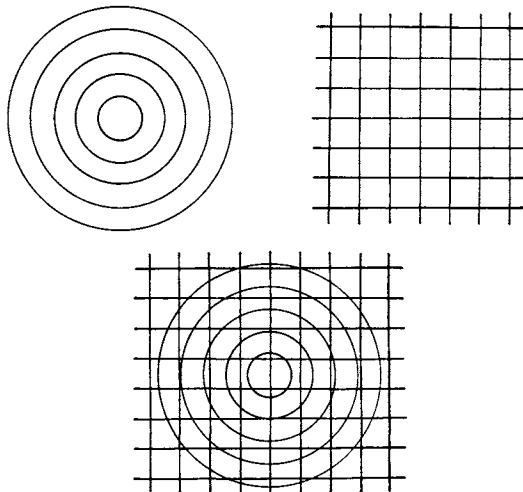


FIGURE 5

erally, eccentric vectors occur in any number and can be oriented toward outer targets in whatever direction. Figure 6 also shows the combination of the two patterns of forces in a single structure.

Thus in Figure 5 we see the spatial order to which the compositional forces conform, whereas Figure 6 schematizes the behavior of these compositional forces themselves within the given framework. In both cases the combination of two rather disparate patterns makes the relationship quite intricate. In the framework of spatial order it allows for the simultaneous presence of focused and homogeneous space but complicates the order by creating a tricky relation between curves and straight lines. In the framework of vectorial dynamics it produces the tension and discord needed by the artist when he represents self-centered behavior as trying for a *modus vivendi* with outward-directed behavior.

We shall see that in almost every practical case both the centric and the eccentric systems are at work. The ratio in which they combine varies greatly. It will be useful to give here two examples in which either the one or the other system clearly predominates. The tracing in Figure 7 is taken from a Japanese mandala of about A.D. 1000. Eight Buddhas and Bodhisattvas surround the supreme deity, Vairocana, from whom creative energy radiates in all directions. The religious hierarchy is expressed by the dominance of the centric system of composition. The only concession to the eccentric system is that all the figures, in deviation from the radial pattern, sit

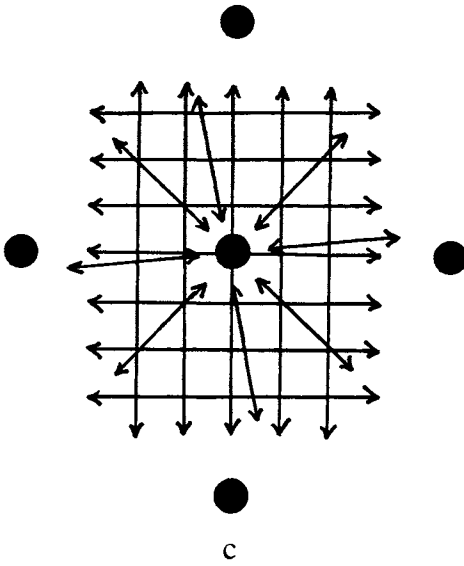
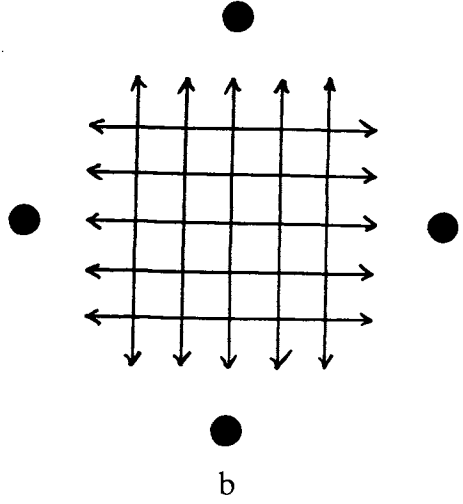
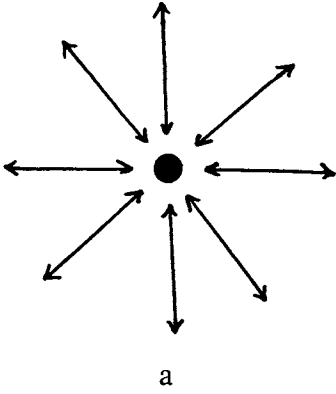


FIGURE 6



FIGURE 7

upright. They thereby acknowledge their dependence on the external attraction of the force of gravity, whose influence is denied otherwise by the centric roundness of the mandala.

The opposite ratio prevails in two Byzantine mosaics of the sixth century in the church of San Vitale in Ravenna, one of which is indicated in Figure 8. On the two walls of the apse the emperor Justinian and his wife are shown, each with an entourage. In both of these mosaics a group of upright figures supports the vault of the chapel like a row of columns. This uprightiness indicates the dominance of the eccentric system, which ties the figures to the ground and has them respond by proudly rising in the opposite direction. This alignment of columnar figures, however, would look like a mere fence if it were not held together by a center, which is located in each case in the imperial figure. Empress Theodora, the first among equals, is distinguished



FIGURE 8

by her crown, jewelry, and halo and roofed by a special cupola. The figure of the emperor on the opposite wall is similarly distinguished.

A comparison of these examples reveals the striking difference between the two compositional systems. The Japanese mandala celebrates the power of the central figure by grouping the entire picture around it. The Byzantine mosaics, limited to a carrying function in the larger architectural context of the apse, refer to the outer powers that hold the human figures down but allow the figures also to rise to the task of holding up the sacred building.

Between these two extremes there ranges the whole wealth of artistic interpretation made possible by the various combinations of the two compositional systems.

## CENTERS AND THEIR RIVALS

THE WORD *CENTER* refers to more than one thing. Two clearly different meanings of the term derive from what was shown in the first chapter. In the dynamic sense, a center is a focus of energy from which vectors radiate into the environment; it is also a place upon which vectors act concentrically. As long as by center we mean merely a center of energy, its location may not matter. As soon as we deal with relations between items, however, an entirely different meaning comes into play: now the word *center* may refer to what has its place in the middle.

## GEOMETRIC AND DYNAMIC

For a simple example from architecture, take four buildings arranged symmetrically as shown in Figure 9. The square created by the four buildings has a center that can be determined geometrically. As such, it serves only spatial order. If workmen were asked to place a statue in the middle of the square, they would determine the center by measuring its distance from each of the buildings. Similarly, the group of concentric circles in Figure 5 has a purely geometric center.

Any such situation, however, can also be viewed dynamically. For artistic purposes indeed it *has* to be seen dynamically. When the situation of Figure 9 is viewed as a field of visual forces, the four buildings become centers of energy emitting their vectors in a wide range of directions. Together, the four groups of vectors constitute a field that is subject to a striving for equilibrium. Any state of equilibrium in which the vectors of a field compensate one another implies the establishment of a center—as, for example, when the weights in the pans of a scale balance around the instrument's center. Thus, a dynamic center reveals itself on the architectural square through the presence of the four buildings. Such a center may or may not coincide with the geometric center of the field, but the two tend to be closely related.

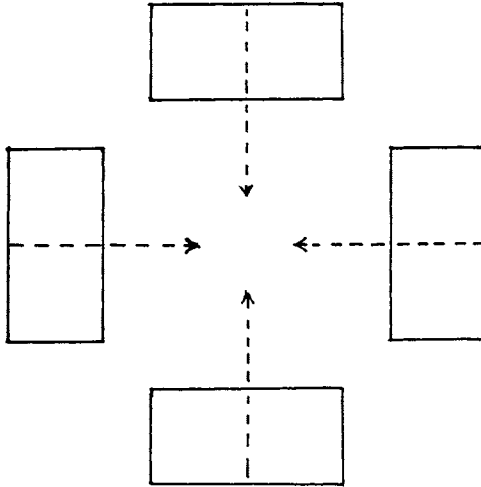


FIGURE 9

A dynamic center is invariably present in any visual field. It may be explicitly marked or created only indirectly by perceptual induction. The sense of vision establishes it intuitively—a process that can be understood by analogy to a corresponding physical process. Suppose one wishes to determine the center of a piece of plywood. If the piece is of simple geometric shape, one can determine the center by measurement. When the shape is irregular, its dynamic center can be found in the manner illustrated in Figure 10. The piece of plywood is suspended first by one and then by another point near its contour. The place where verticals dropped from the points of suspension cross is the object's center of gravity, its dynamic center.

One can obtain the same result by balancing a flat object on the tip of one's finger. In doing so, one searches intuitively for the place where the forces that pull the object down hold one another in equilibrium. This process of testing physical forces by kinesthetic sensation is similar to testing the behavior of visual forces through perceptual exploration and discovering thereby the dynamic center of a shape or configuration.

Throughout this book the various meanings of the term *center* may invite confusion. I shall try to clarify in each case whether I am talking about a focus of energy or a place in the middle. There is also, as I have mentioned, the difference between a place actually marked, for example, by a black dot in the middle of a circle—in which case we would say that the center has “retinal presence”—and a center merely brought about by perceptual induction. An empty circle we look at is organized around a center as a part

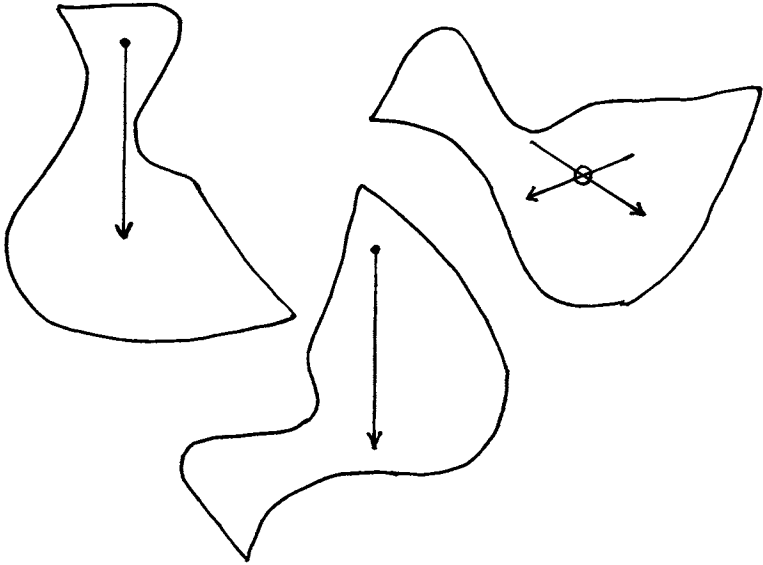


FIGURE 10

of what we “see” even though that center does not actually figure in the circle’s optical projection on the retinas of our eyes. In fact, we cannot even grasp the structure of such a shape without seeing it as organized around its center. Imagine someone drawing, say, a pentagon mechanically by connecting five equally long lines, one after the other, with angles of  $108^\circ$ . He will be in for a sudden structural surprise when the ends meet. The pentagon emerges as a centric figure symmetrically organized around its middle. We shall see that even the most complex patterns, as long as they are spatially limited, are organized around an implicit center and that without reference to that center a pattern’s visual structure cannot be understood.

Add to this complex state of affairs yet another variation: a center as marked by a draftsman or artist may be a simple dot; but it may also assume any other shape, or it may be a cluster of shapes. As a source or target of dynamic action, any visual object whatever is a center. It will be evident that when I undertake to tell the story of the center, I am not dealing with a simple matter.

#### THE PULL OF GRAVITY

The planet on which we live is dominated by the force of gravity. Therefore the geometric center of the earth is its dynamic center as well. Physi-