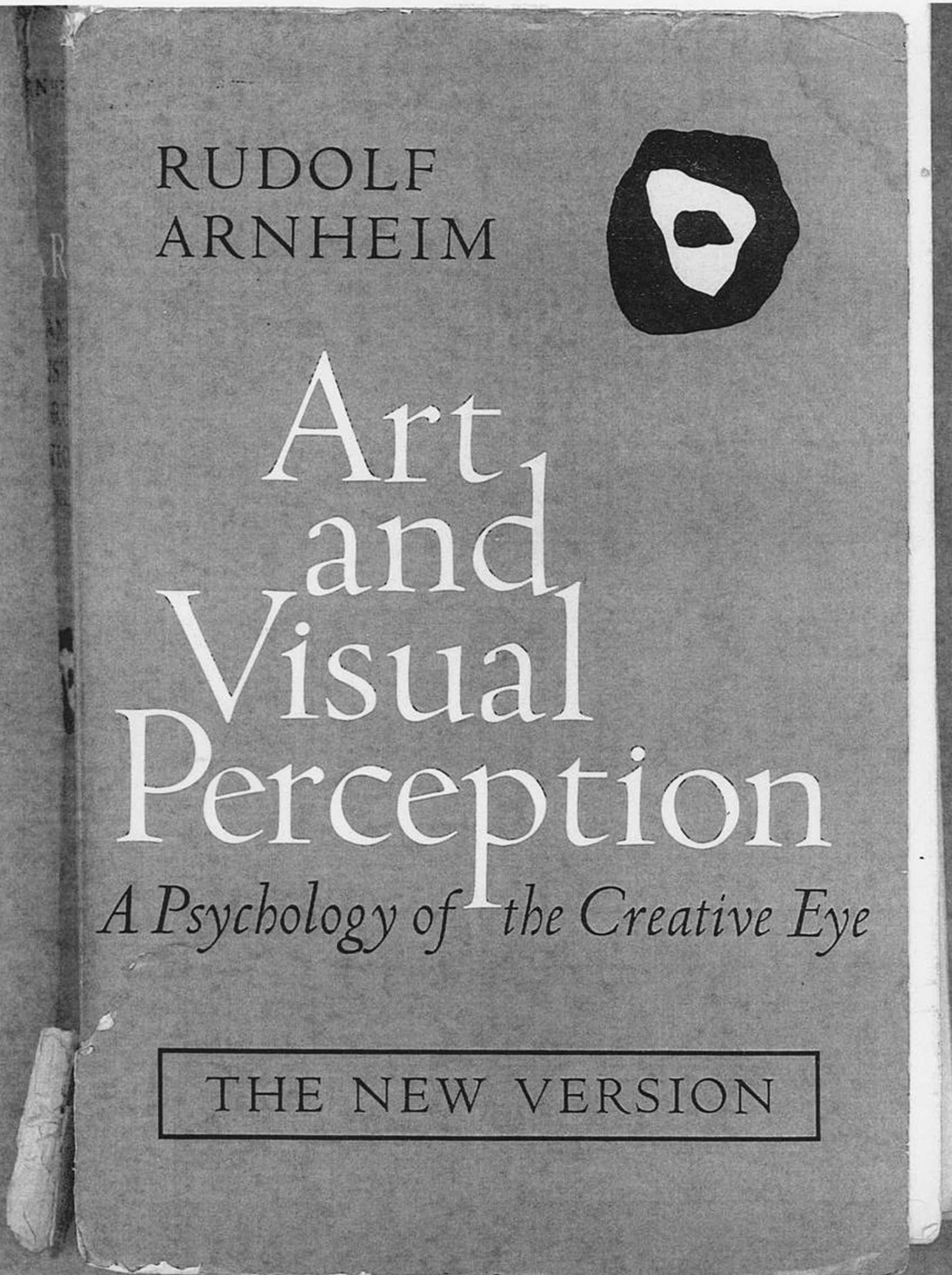
RUDOLF
ARNHEIM
Art and Visual Perception
A Psychology of the Creative Eye
THE NEW VERSION

IV GROWTH

Much of what is said about visual perception and representation in this book applies to human behavior quite in general. The tendency toward simplest shape, for example, governs the activities of the organism at so basic a physiological and psychological level that the country or historical period from which we take our human examples makes little difference. However, even a survey of such generality cannot ignore certain characteristic differences in the handling of visual patterns, differences that reflect the successive stages of mental development.

These stages of development are displayed in their purest, most complete form in the artwork of children. But we find striking analogies to children's art in the early phases of so-called primitive art all over the world, and indeed in what happens when a beginner of whatever age or place first tries his hand at an artistic medium. Obviously, there are important differences between the attitudes and products of Western children and those of Eskimo children, of clever children and dull ones, well-cared-for and neglected ones, educated town dwellers and wild hunters, but here again it will be useful for our purpose to emphasize the similarities rather than the differences.

Early forms of visual representation invite our attention not only because they are of obvious educational interest, but also because all the fundamental features that operate in refined, complicated, and modified ways in mature art show up with elementary clarity in the pictures of a child or a bushman. This is true for the relations between observed and invented form, for space perception in relation to the two-dimensional and three-dimensional media, for the interaction of motor behavior and visual control, for the close connection between perception and knowledge, and so forth. There is, therefore, no more enlightening introduction to the art of the adult than a look at the early

manifestations of the principles and tendencies that forever govern visual creation.

Why Do Children Draw That Way?

From the outset I have insisted that we cannot hope to understand the nature of visual representation if we try to derive it directly from optical projections of the physical objects that constitute our world. Pictures and sculptures of any style possess properties that cannot be explained as mere modifications of the perceptual raw material received through the senses.

This is true also for the sequence of stages in which representational form typically develops. If we assumed that the point of departure for visual experience was the optical projections supplied by the lenses of the eyes, we would expect that the earliest attempts at imagery would cleave most closely to these projections. To be sure, they would resemble their models no more faithfully than a limited power of observation and limited technical dexterity would permit, but the intended image, transpiring through those clumsy endeavors, should surely be that of the optical projection. Any deviation from that model, we would expect, would be a later development, reserved for the freedom of mature sophistication. But instead, the opposite is true.

The early drawings of children show neither the predicted conformity to realistic appearance nor the expected spatial projections. What is the explanation? Since it was assumed that for normal human beings, visual percepts could only be faithful projections, a reason for the deviation had to be found. It was suggested, for example, that children are technically unable to reproduce what they perceive. Just as they cannot hit the bull's-eye with a gun because they lack the concentrated glance and steady hand of an adult marksman, so their eyes and hands lack the skill to hit the right lines with a pencil or brush. Now it is quite true that the drawings of young children show incomplete motor control. Their lines sometimes steer an erratic zigzag course and do not meet exactly where they should. Much of the time, however, the lines are accurate enough to indicate what the drawing is supposed to be like, particularly to the observer who compares many drawings of the same kind. Moreover, at an early age the former imprecision of the stroke gives way to an exactness that is more than sufficient to show what the child is trying to do. Compare these early forms with the drawings of an unskilled amateur who tries to copy photographs or realistic pictures, and you will notice the fundamental difference. The reader is invited to put a pencil in his mouth or between his toes and copy a realistic picture of a human ear. The lines may turn out to be so crooked as to be totally unrecognizable; but if the drawing is at all successful, it will still differ fundamentally from the usual child's drawing of an ear as two concentric circles, one for the outer border and one for the hole inside. No lack of motor skill can explain this difference in principle.

Other theorists have maintained that children aim at making straight lines, circles, and ovals because these simple shapes are relatively easy to draw. This is perfectly true, but does not indicate what mental process induces children to identify complex objects with geometric patterns that we cannot interpret as simplified projective images.

Nor can lack of interest or carelessness of observation be adduced. Children observe with an acuteness that puts many adults to shame; and no one who has seen the expression of breathless fascination in their eyes or the intense concentration with which they draw or paint will accept an explanation based on negligence or indifference. It is true that up to a certain age if the child is asked to draw a picture of his father, he will make little use of the particular man standing before him as a model. This behavior, however, does not prove that the child is unwilling or unable to observe his environment; the child ignores the model simply because fresh information is neither needed nor usable for what he regards as a proper drawing of a man.

Then there are explanations that are little more than wordplay, such as the assertion that children's pictures look the way they do because they are not copies but "symbols" of real things. The term "symbol" is used so indiscriminately nowadays that it can be applied whenever one thing stands for another. For this reason it has no explanatory value and should be avoided. There is no way of telling whether such a statement is right, wrong, or no theory at all.

The Intellectualistic Theory

The oldest—and even now most widespread—explanation of children's drawings is that since children do not depict what one assumes they see, some mental activity other than perception must intervene. It is evident that children limit themselves to representing the overall qualities of objects, such as the straightness of legs, the roundness of the head, the symmetry of the human body. These are facts of generalized knowledge; hence the famous theory which holds that "the child draws what he knows rather than what he sees."

Now knowledge has more than one meaning. Much picture-making does not in fact rely on what the eyes happen to see at the moment the picture is produced. Instead the draftsman relies on a synthesis of his many previous observations of a certain kind of thing, whether horses, trees, or human figures.

This process can indeed be described as drawing from knowledge; but it is a knowledge that cannot be taken to be an alternative to seeing.

The intellectualistic theory asserts that the drawings of children as well as other art at early stages are derived from a non-visual source, namely from "abstract" concepts. The term *abstract* is meant to describe non-perceptual knowledge. But, we must ask, in what other realm of mental activity can a concept dwell if it is banned from the realm of images? Is the child relying on purely verbal concepts? Such concepts exist—for example the fiveness in the statement "a hand has five fingers." The child does in fact possess this knowledge verbally; and when he draws the picture of a hand, he counts the fingers to make sure he gets the right number.

This is what happens, that is, when a child has been alerted to the proper number of fingers. His usual procedure is precisely the opposite. Normally in his work the child indeed relies on concepts, but on visual concepts. The visual concept of a hand consists of a round base, i.e. the palm, from which fingers sprout as straight spikes in sunbeam fashion, their number being determined, as we shall see, by purely visual considerations.

The mental life of children is intimately bound up with their sensory experience. To the young mind, things are what they look like, sound like, move like, or smell like. If the child's mind contains any nonperceptual concepts at all, they must be very few, and their influence on pictorial representation can only be negligible. But even if the child had nonperceptual concepts of roundness, straightness, or symmetry—and who is willing to tell us the stuff such concepts might be made of?—how would they be translated into visual shape?

We must also ask: where would such concepts come from in the first place? If they are derived from visual experiences, are we expected to believe that the primarily visual raw material is processed into a nonvisual "abstraction," only to be translated back into visual shape for the purpose of picture-making? Or, if these concepts are transmitted to children by their elders, and to primitives by cultural convention, how can this be done nonvisually?

Psychological speculation has put a good deal of stock in the sense of touch. On the assumption that visual perception is based on optical projection, the sense of sight was deemed incapable of conveying a truthful image of what three-dimensional things really look like. Such knowledge therefore had to come from the sense of touch. One reasoned: Touch is not dependent on projections transmitted by light across empty space; touch relies on direct contact with the object; it applies from all sides. Touch can be trusted to provide objective information.

The hypothesis sounded good; and in fact there is no doubting the effective interaction of touch and sight at all stages of human development. But the priority of touch or "motor behavior" is another matter. It seems to be a mere assumption, unsupported by evidence. The child psychologist Arnold Gesell asserted years ago that "ocular prehension precedes manual." He wrote: "Nature has given top priority to the sense of sight. Six months before birth the eyes of the fetus move sketchily and independently beneath their sealed lids. In time the eyes move in unison, so the child is born with two eyes partly yoked in a single organ. . . . The infant takes hold of the world with his eyes long before he does so with his hands—an extremely significant fact. During the first eight weeks of life the hands remain predominantly fisted, while the eyes and brain are busy with looking, staring, seeking and, in a rudimentary manner, apprehending." Recently, T. G. R. Bower has suggested by ingenious experiments that infants come to know physical objects as solid and tangible through visual experience, and not through a primary reliance on touch.

This is not surprising once we realize that to apprehend the shape of an object by touch is in no way simpler or more direct than apprehension by vision. To be sure, there is a physical distance between the eyes and a box they see, whereas hands are in immediate contact with the box. But the mind does not partake in the directness of the contact out there. It depends entirely on the sensations aroused in the sense organs. As the hands explore the box, the so-called "touch spots," independent of one another, are stimulated in the skin. The touch image of a surface, a shape, or an angle must be composed by the brain, just as it must create the visual image from a multitude of retinal stimulations. Neither physical size nor distance are given directly to the sense of touch. All the brain receives are messages about the muscular extensions and contractions that occur when a hand reaches out or around a corner. As a person moves through space, his brain is notified of a series of successive leg motions. These sensations do not in themselves include space. To experience space kinesthetically, the brain must create that experience from sensory messages that are not spatial. That is, kinesthesia involves the same kind of task as vision, except that the way it is accomplished seems immensely more difficult to understand in the case of kinesthesia—so much so that, to my knowledge, no psychologist has attempted to describe the process. It cannot be doubted that the sensations deriving from the organs of touch, from muscles, joints, and tendons, contribute enormously to our awareness of shape and space. But anyone who tries to avoid the problems in visual perception by referring to kinesthesia is leaping from the frying pan into the fire.

The intellectualistic theory has been applied not only to children's drawings but to all kinds of highly formalized, "geometric" art, particularly that

of primitive peoples. And since it could not very well be asserted that all art was derived from nonvisual concepts, the theory led to the contention that there existed two artistic procedures, different in principle from each other. Children, Neolithic painters, American Indians, and African tribesmen worked from intellectual abstractions; they practiced "conceptual art." Paleolithic cave dwellers, Pompeian muralists, and Europeans during and after the Renaissance represented what they saw with their eyes; they practiced "perceptual art." This absurd dichotomy was one of the main drawbacks of the theory, for it obscured the essential fact that the same kind of well-defined form so prominent in the work of many primitives is indispensable to any "realistic" representation that deserves the name of art. A child's figure is no more a "schema" than one by Rubens. It is only less differentiated. And, as I have pointed out, Albrecht Dürer's highly naturalistic studies of hands, faces, and birds' wings are works of art only because the innumerable strokes and shapes form well-organized, even though complex, patterns that interpret the subject.

On the other hand, the theory neglects the important contribution of perceptual observation even to highly stylized work. When a South Sea Islander paints the sea stirred by the wind as a rectangle striped with oblique parallel lines, essentials of the model's visual structure are rendered in a simplified but entirely un-"symbolic" manner.

They Draw What They See

A theory so palpably in conflict with the facts could never have been widely accepted had an alternative been available. None was, so long as it was believed that percepts can refer only to particular, individual instances: a particular person, a particular dog, a particular tree. Any general notion about persons, dogs, or trees as kinds of things had to derive necessarily from a nonperceptual source.

This artificial distinction between perception and conception has been superseded by evidence that perception does not start from particulars, secondarily processed into abstractions by the intellect, but from generalities. "Triangularity" is a primary percept, not a secondary concept. The distinction between individual triangles comes later, not earlier. Doggishness is perceived earlier than the particular character of any one dog. If this is true we can expect early artistic representations, based on naive observation, to be concerned with generalities—that is, with simple, overall structural features. Which is exactly what we find.

Children and primitives draw generalities and nonprojective shape precisely because they draw what they see. But this is not the whole answer. Unquestionably children see more than they draw. At an age when they easily tell one person from another and notice the smallest change in a familiar object, their pictures are still quite undifferentiated. The reasons must lie in the nature and function of pictorial representation.

Here again we have to get a superannuated but hardy prejudice out of the way. Just as it was assumed that all visual perception apprehended the totality of individual appearance, so pictures and other images were assumed to aim at the faithful replication of everything the draftsmen can see in his model. This is by no means true. What an acceptable image of an object looks like depends on the draftsman's standards and on the purpose of his picture. Even in adult practice, a mere circle or dot may suffice to depict a city, a human figure, a planet; in fact, it may serve a given function much better than a more detailed likeness. Therefore, when a child portrays himself as a simple pattern of circles, ovals, and straight lines, he may do so not because this is all he sees when he looks in a mirror, and not because he is incapable of producing a more faithful picture, but because his simple drawing fulfills all the conditions he expects a picture to meet.

Another fundamental difference between percept and picture must be considered here. If perception consists not in "photographically" faithful recording but in the grasping of global structural features, it seems evident that such visual concepts possess no explicit shape. For example, seeing the shape of a human head may involve seeing its roundness. But obviously this roundness is not a tangible perceptual thing. It is not materialized in any one head or in any number of heads. There are shapes that represent roundness to perfection, such as circles or spheres. However, even these shapes stand for roundness rather than being it, and a head is neither a circle nor a sphere. In other words, if I want to represent the roundness of an object such as the head, I cannot rely on any shape actually given in it but must find or invent a shape that will satisfactorily embody the visual generality "roundness" in the world of tangible things. If the child makes a circle stand for a head, that circle is not given to him in the object. It is a genuine invention, an impressive achievement, at which the child arrives only after laborious experimentation.

Something similar is true for color. The color of most objects is anything but uniform in space or time; nor is it identical in different specimens of the same group of things. The color the child gives to the trees in his pictures is hardly a specific shade of green selected from the hundreds of hues to be found in trees. It is a color that matches the overall impression given by trees. Again we are dealing not with an imitation but with an invention, the discovery of

an equivalent that represents the relevant features of the model with the resources of a particular medium.

Representational Concepts

We can express the same fact more sharply by saying that image-making of any kind requires the use of representational concepts. Representational concepts furnish the equivalent, in a particular medium, of the visual concepts one wishes to depict, and they find their external manifestation in the work of the pencil, the brush, the chisel.

The formation of representational concepts, more than anything else, distinguishes the artist from the nonartist. Does the artist experience world and life differently from the ordinary man? There is no good reason to think so. To be sure, he must be deeply concerned with—and impressed by—his experiences. He also must have the wisdom to find significance in individual occurrences by understanding them as symbols of universal truths. These qualities are indispensable, but they are not limited to artists. The artist's privilege is the capacity to apprehend the nature and meaning of an experience in the terms of a given medium, and thus to make it tangible. The nonartist is left "speechless" by the fruits of his sensitive wisdom. He cannot give them adequate material form. He can express *himself*, more or less articulately, but not his experience. During the moments in which a human being is an artist, he finds shape for the bodiless structure of what he has felt. "For rhyme can beat a measure out of trouble."

Why do some landscapes, anecdotes, or gestures "ring the bell"? Because they suggest, in some particular medium, a significant form for a relevant truth. In search of such telling experiences, the artist will look around with the eyes of the painter, the sculptor, the dancer, or the poet, responding to what fits his form. On a walk through the fields a photographer may look at the world with camera eyes and react only to what will "come" photographically. But the artist is not always an artist. Matisse was once asked whether a tomato looked to him when he ate it as it did when he painted it. "No," he replied, "when I eat it I see it like everybody else." The ability to capture the "sense" of the tomato in pictorial form distinguishes the response of the painter from the frustrating, shapeless gasping by which the nonartist reacts to what may be a very similar experience.

Experiments with children have helped us realize the importance of representational concepts by pointing up the difference between recognizing and imitating. David Olson has done pioneering work on the problem of why, at a certain stage in their development, children can recognize a diagonal and distinguish it from a vertical or horizontal, but cannot imitate a model diagonal either by drawing one or by arranging checkers on a checkerboard. In one of his experiments, children were shown a diagonal array on the model board, except that the bottom right checker was moved over one space to the left. All the children immediately said the arrangement was not a "criss-cross," but none of them was able to say or show how they knew this, or to correct the deviation by moving the checker to the right place.

The only effective way of making the children succeed was by attracting their attention to the formal components involved in making a diagonal: Start at one bottom corner, go straight across, end up at the opposite top corner, do *not* move in the vertical or horizontal direction, etc. In other words, what the children had to learn was not just the visual concept of the diagonal but the formal features of which it is composed. "The difference," I have stated in this connection, "is not primarily between perception and representation, but between perception of effect and perception of form, the latter being needed for representation."

Whether taught or not, children eventually acquire the art of making diagonals. As we shall see, during the development of spontaneous drawing children first master the relation between horizontal and vertical and then proceed from there to oblique directions. That is, they attain the representational concepts needed to handle increasingly complex shapes and shape relations.

The kinds of shapes the novice can control are sometimes described as "schemata." Not much would be wrong with this term if, as I said earlier, it were applied to all art and did not carry negative connotations. Unfortunately, the term often implies that the child is bound by rigid conventions which bind his eyes and hands to primitive templates and which must be broken like eggshells if the fledgling is to acquire his freedom of expression. Such a view can only block understanding and lead to harmful educational practices. When someone climbs a staircase, he must overcome the first step in order to reach the second; however, the first step was not an obstacle to the second, but rather a prerequisite for reaching it. In the same way, early representational concepts are not strait-jackets but the indispensable forms of early conceptions. Their simplicity is appropriate to the level of organization at which the mind of the young draftsman operates. As the mind becomes more refined, the patterns it creates become more complex, and the two growth processes constantly reinforce each other. At levels of high complexity, representational concepts are no longer as easily detected as they are in early work, but, far from being overcome or cast aside by the mature artist, they remain—at a level appropriate to

the richness of his thought—the indispensable forms that alone enable him to express what he has to say.

Credit is due to Gustaf Britsch for having been the first to demonstrate systematically that pictorial form grows organically according to definite rules, from the simplest to progressively more complex patterns, in a process of gradual differentiation. Britsch showed the inadequacy of the "realistic" approach, which found in children's drawings nothing but charming imperfection and which could deal with the phases of their development only in terms of increasing "correctness." An art educator, Britsch did not avail himself of the psychology of perception, but his findings support and are supported by the more recent trends in that field. Like many pioneers, in attacking the realistic approach Britsch seems to have carried his revolutionary ideas to the opposite extreme. As far as can be determined from the writings published under his name, his analysis leaves little room for the influence of the perceived object upon pictorial form. To him the development of form was a self-contained mental process, an unfolding similar to the growth of a plant. But this one-sidedness makes his presentation all the more impressive; and I acknowledge that as I try to describe some phases of formal development as an interplay of perceptual and representational concepts, I am proceeding from the base laid by Britsch.

Drawing as Motion

The eye and the hand are the father and mother of artistic activity. Drawing, painting, and modeling are kinds of human motor behavior, and they may be assumed to have developed from two older and more general kinds of such behavior—expressive and descriptive movement.

The first scribbles of a child are not intended as representation. They are a form of the enjoyable motor activity in which the child exercises his limbs, with the added pleasure of having visible traces produced by the vigorous back-and-forth action of the arms. It is an exciting experience to bring about something visible that was not there before. This interest in the product for its own sake can be observed even in chimpanzees whitewashing their cages with lumps of white clay or wielding a paint brush. It is a simple sensory pleasure, which remains undiminished even in the adult artist.

Children have a need for abundant movement, and thus drawing starts as gamboling on paper. The shape, range, and orientation of the strokes are determined by the mechanical construction of arm and hand as well as by the child's temperament and mood. Here are the beginnings of expressive movement, i.e., the manifestations of the draftsman's momentary state of mind as well as his more permanent personality traits. These mental qualities are constantly reflected in the speed, rhythm, regularity or irregularity, and shape of bodily movements, and thus leave their mark on the strokes of pencil or brush. The expressive characteristics of motor behavior have been studied systematically in handwriting by graphologists, but they also contribute importantly to the style of painters and sculptors, as will be discussed later.

In addition to being expressive, movement is also descriptive. The spontaneity of action is controlled by the intent to imitate properties of actions or objects. Descriptive gestures use the hands and arms, often supported by the entire body, to show how large or small, fast or slow, round or angular, far or close something is or was or could be. Such gestures may refer to concrete objects or events—such as mice or mountains or the encounter between two people—but also figuratively to the bigness of a task, the remoteness of a possibility, or a clash of opinions. Deliberate pictorial representation probably has its motor source in descriptive movement. The hand that traces the shape of an animal in the air during a conversation is not far from fixating this trace in the sand or on a wall.

We used to take it for granted that the motor behavior of the artist is merely a means to the end of producing painting or sculpture and that it counts no more in and by itself than the action of saw and plane in a cabinet-maker's work. In our own time, however, the so-called action painters have stressed the artistic quality of the motion performed while producing a work of art, and there probably has never been an artist for whom some of the expressive properties of stroke and body motion did not count as part of his "statement."

This representational aspect of motor behavior is quite apparent in young children. Jacqueline Goodnow reports that when kindergarten children are asked to match a series of sounds with a series of dots, they draw the dots in a line from left to right but do not leave blank spaces on the paper to match the intervals between groups of sounds. Instead they often use motor pauses: make two dots, pause, make another two dots, etc. For them, this does justice to the sound model even though the intervals do not show up on paper. Figure 119 is a four-year-old girl's drawing of a man mowing the lawn. The mower, on the right, is depicted by a whirl not only because the rotating lines render the characteristic motion of the machine visually, but also because the child's arm re-enacted the motion as a gesture during the drawing.

In the same way the sequence in which different parts of an object are drawn is significant for the child even though nothing of it may show in the completed picture. At early stages the figure is often drawn first and then

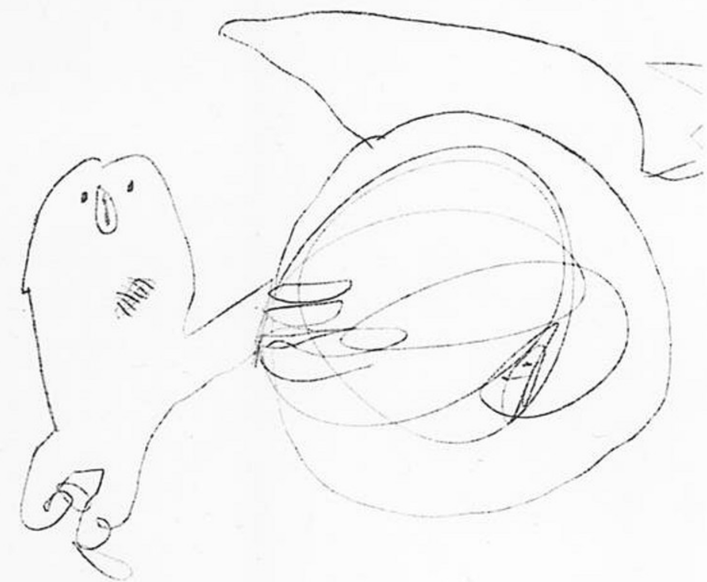

Figure 119

later dressed with suitable coat and pants. Feeble-minded and weak-sig children in particular are sometimes satisfied with the mere time connec in the act of drawing, of items that belong together. They do not both render this connection visually on paper, but spread the eyes, the ears, mouth, and the nose of the face over the paper in almost random disor The order in which children produce the various parts of their drawin most relevant to the psychological meaning of the work and should nc neglected in research.

This reminds us of one of the most fundamental features of visual namely, that all manual picture-making—as distinguished from photogr —comes about sequentially, whereas the final product is to be seen all at At the most elementary level this shows in the difference between the ex ence of drawing a line, of seeing it wind its way across the paper, like a g ing line in an animation film, and the static final product, from which r of this dynamics has vanished. The circular path of a line is very differe nature from the centric symmetry of the two-dimensional circle, whic mains as the final product.

The artist's task is made harder not only by the fact that he cannot count on the live motion he felt while he drew or sculpted, but also by the difficulty of having to keep in mind a whole, partly present and partly to be completed as the work proceeds, while producing a small part. How is one to draw the left contour of a leg without being able to correlate it to the right contour, which is not yet there?

As a matter of general strategy, the sequence in which an artist produces a work is important and characteristic. For example, if the whole composition is to depend on the basic structural skeleton, this skeleton is preferably laid out first in its overall features and gradually perfected as a whole. Charles Baudelaire writes: "A good painting, faithful and equal to the dream that gave birth to it, must be created like a world. Just as the Creation we see is the result of several creations, of which the earlier ones were always made more complete by the next, so a painting, if handled harmoniously, consists of a series of superposed pictures, where each new layer gives more reality to the dream and makes it rise another step toward perfection. On the contrary, however, I remember having seen in the studios of Paul Delaroche and Horace Vernet huge paintings not sketched in but partly done, that is, absolutely finished in certain areas while others were indicated only by a black or white outline. One could compare this sort of work with a purely manual job that must cover a certain amount of space in a certain time or with a long route divided into many stages. When one section is done it is done, and when the whole route has been run through, the artist is delivered of his picture."

The Primordial Circle

To see organized form emerge in the scribbles of children is to watch one of the miracles of nature. Indeed the observer cannot help being reminded of that other process of creation, the shaping of cosmic whirls and spheres from amorphous matter in the universe. Circular shapes gradually appear in the clouds of zigzag strokes. At first they are rotations, traces of the corresponding arm movement. They show the smoothing or simplification of curves that always comes with motor training. Any manual operation arrives after a while at fluent motions of simple shape. Horses will turn the familiar corner of the barnyard gate in a perfect curve. The rounded paths of rats running angular mazes and the beautiful spirals described by a swarm of pigeons in the air are further examples of such motor skill. The history of writing shows that curves replace angles and continuity replaces discontinuity as the slow production of inscriptions gives way to rapid cursive. The lever construction of the human limbs favors curved motion. The arm pivots around the shoulder joint, and

subtler rotation is provided by the elbow, the wrist, the fingers. Thus th rotations indicate organization of motor behavior according to the pri of simplicity.

The same principle also favors the visual priority of circular shape circle, which with its centric symmetry does not single out any one directi the simplest visual pattern. It is common knowledge that objects too far to reveal their particular outline are perceived as round rather than a other shape. The perfection of circular shape attracts attention. I noted the roundness of the pupil makes the animal's eye one of the most stri visual phenomena in nature. A dummy eye on the wing of a butterfly simu the presence of a strong adversary, and in reptiles, fish, and birds elab camouflage devices hide the revealing disks of the pupils. Experiment Charlotte Rice have shown that young children often pick the circles fr collection of different shapes even though they have been asked to lool diamonds, and Goodnow reports that when children draw human figures begin with the circle of the head. In fact, as we shall see, the human fi develops genetically from the "primordial circle," which originally repre the whole figure.

The circle is the first organized shape to emerge from the more or uncontrolled scribbles. Of course, we must not look for geometrical perfec in these drawings. Not only is the child's motor and eye control insufficier produce exact shape, but more important, from the child's viewpoint the no need for it. As Piaget and Inhelder put it, early shapes are topological ra than geometrical, i.e., they aim at such general, nonmetric properties as rou ness, closedness, straightness, not at specific, ideal embodiments. Much of time these shapes resemble circles or balls sufficiently to make us underst what is intended; and as one studies children's drawings in large numbers learns to distinguish intended circles from aimless scribbles or other sha such as ovals or rectangles. In particular, one notices a clear difference betw the mere motor product of rotation and the intentionally round and clo shape, controlled by the eye of the draftsman. We can also assume that qu soon in the child's experience the linear curve traced by pencil or brush tra forms itself into a two-dimensional visual object, a disk that is perceived a "figure" lying on a ground. More on the perceptual nature of figure a ground will be said in the chapter on "Space." Here it suffices to note that t phenomenon is responsible for the transformation of the one-dimensio pencil line into the perceived contour of a solid object.

This perceptual transformation favors another fundamental event in t genesis of picture-making: the recognition that shapes drawn on paper made of clay can stand for other objects in the world, to which they are related as the signifier to the signified. This discovery of the young mind is so specifically human that the philosopher Hans Jonas has described picture-making as the most decisive and unique attribute of man. We have no way of telling with certainty at which point in a child's development he first takes his shapes to be representational. Probably this occurs before he confirms the fact for the adult observer by pointing to his scribble and saying "Doggie!" Even after the stage has demonstrably been reached, there is no reason to assume that *all* the shapes he makes from then on will be perceived by the child as representational.

It has been maintained that the child receives the inspiration for his earliest shapes from various round objects observed in the environment. The Freudian psychologist derives them from the mother's breasts, the Jungian from the mandala; others point to the sun and the moon. These speculations are based on the conviction that every form quality of pictures must somehow be derived from observations in the physical world. Actually the fundamental tendency toward simplest shape in motor and visual behavior is quite sufficient to explain the priority of circular shapes. The circle is the simplest shape available in the pictorial medium because it is centrically symmetrical in all directions.

However, once the circular shape emerges in pictorial work, it establishes contact with the similar shape of objects perceived in the environment. This similarity rests at first on a very broad, unspecific basis. In order to understand this early use of round shapes we must remember that even adults use circles or balls to represent any shape or all shapes or none in particular. Being the most unspecific, universal shape, spheres, disks, and rings figure prominently in early models of the earth and the universe, not so much on the basis of observation as because unknown shape or unknown spatial relations are represented in the simplest way possible. After a god had separated the heavens, the waters, and the dry land from one another, reports Ovid in the *Metamorphoses*, "his first care was to shape the earth into a great ball, so that it might be the same in all directions."

In the molecular models of the chemists, particles are represented as balls; and ball-shaped were the atoms of which, according to the Greek atomists, the world was made. Just as the adult uses this most general shape when no further specification is needed or available, a young child in his drawings uses circular shapes to represent almost any object at all: a human figure, a house, a car, a book, and even the teeth of a saw, as can be seen in Figure 120, a drawing by a five-year-old. It would be a mistake to say that the child neglects or mis-

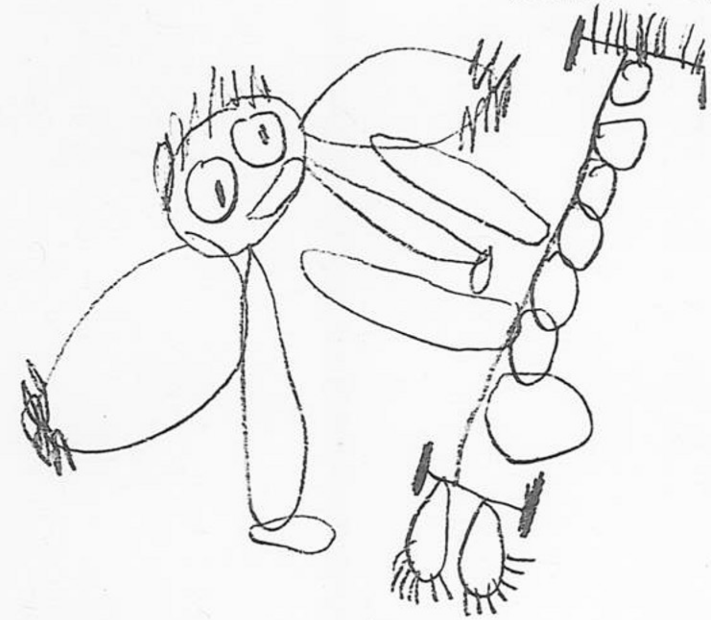

Figure 120

represents the shape of these objects. Only to adult eyes is he picturing them as round. Actually, intended roundness does not exist before other shapes, such as straightness or angularity, are available to the child. At the stage when he begins to draw circles, shape is not yet differentiated. The circle does not stand for roundness but for the more general quality of "thingness"—that is, for the compactness of a solid object as distinguished from the nondescript ground.

In the course of enriching the early shapes, sooner or later the child develops the primordial circle in two directions. One is the combination of several circles in a more complex pattern. Figure 121 is an example of how the child experiments with placing circles concentrically or a number of small ones into a larger one. "Containing" is probably the simplest spatial relation between pictorial units that the child learns to master. At the most elementary level, two concentric circles may be used to represent an ear with its hole or a head with its face. Later elaborations of the container theme serve to show people in a house or train, food on a plate, bodies surrounded by dress.

Figure 121

The other elaboration of the circle makes its radii explicit and leads to sunburst patterns, in which straight lines or oblongs radiate from a central circle or a combination of concentric circles. Whereas mere roundness indicates no spatial direction at all, every radius does; but since the family of radii

covers all directions more or less evenly, the sunburst figure as a whole still operates at a stage prior to that of differentiated direction. The sunburst pattern may be used as a free design (Figure 122*a*); at various levels of differentiation it may recur as a flower (*b*), a tree with leaves (*c*), the headdress of an Indian (*d*), a pond surrounded by plants (*e*), a tree with branches (*f*), a head surrounded by hair (*g*), a hand with its fingers (*h*), the sun with a core of fire or a lamp with its bulb in the center (*i*), a running man (*k*).

Here is a good illustration of how a formal pattern, once it has been added to a child's repertory, will be used—in a more or less identical fashion—to describe different objects of corresponding structure. For example, Figure 122*i*, the inner circle painted red, the outer yellow, was used by one child to depict the sun as well as a lamp. Figures 122*g*, *h*, and *k* show that, to maintain the structurally simple all-around symmetry, considerable violence may be done to the model. Hair, fingers, and legs are made to sprout from all around the central base in order to preserve the centric symmetry of the whole. Such application of an acquired pattern to a great variety of subjects, often at the expense of verisimilitude, may be found even at the highest levels of human thinking—for example, in the shapes characteristic of an artist's style or in the key concepts of a scientific theory.

The Law of Differentiation

In dealing with the primordial circle I have already referred to differentiation. In its most elementary form this principle indicates that organic development always proceeds from the simple to the more complex. In the nineteenth century, which gave rise to the idea of biological evolution, this principle came to mean the splitting up of a unitary organization into more specific functions. Herbert Spencer presents this notion in his *First Principles* of 1862 and reports that he found it in Karl von Baer's treatise on the evolution of animals, published in 1828. In Spencer's view, differentiation involves also a development from the indefinite to the definite, from confusion to order. In our own time, the concept is used by Piaget to describe, for example, how the self and the external world, originally undifferentiated, become separate at a certain stage of mental development. Prior to this differentiation, explains Piaget, "impressions that are experienced and perceived are not attached to a personal consciousness sensed as a 'self' nor to objects conceived as external to the self. They simply exist in a dissociated block or are spread out on the same plane, which is neither internal nor external, but midway between these two poles."

For our particular purpose it will be useful to combine the principle of

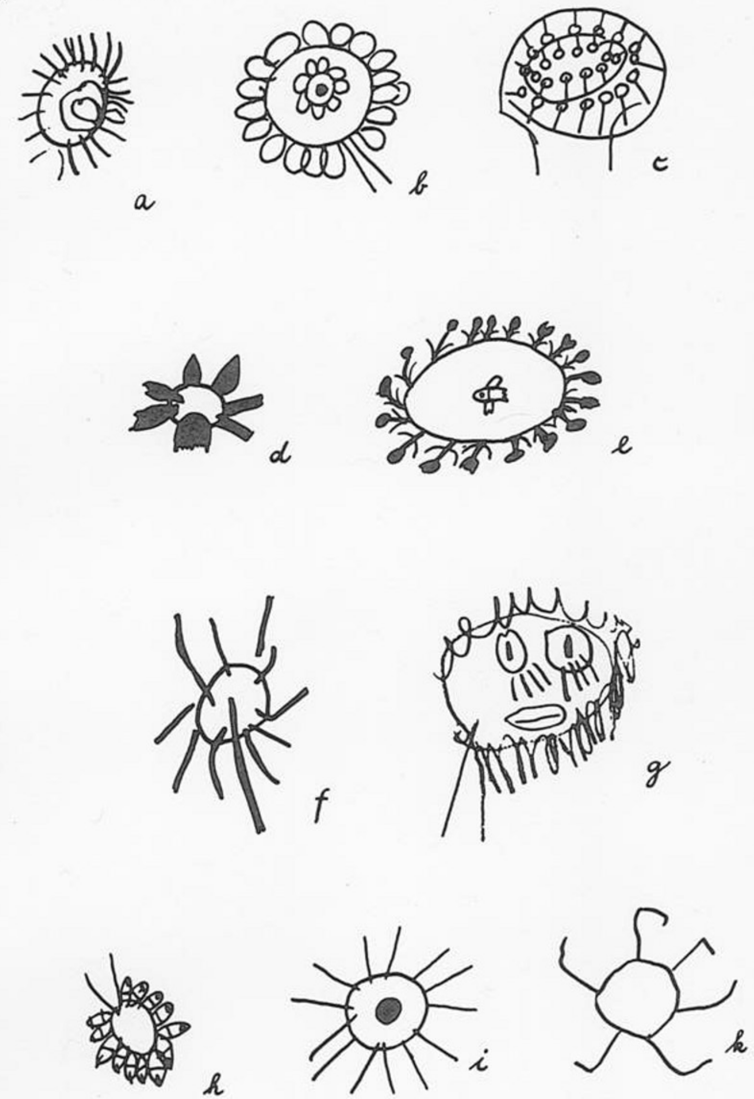

Figure 122

differentiation with the gestalt principle of simplicity. In keeping with our premise that perceiving and conceiving proceed from the general to the specific, we state first of all that *any shape will remain as undifferentiated as the draftsman's conception of his goal object permits.* If, for example, the purpose of a drawing is limited to describing the triangularity of a pyramid as distinguished from the roundness of a cloud, the drawing may show nothing more specific than triangularity vs. roundness.

Second, the law of differentiation states that *until a visual feature becomes differentiated, the total range of its possibilities will be represented by the structurally simplest among them.* For example, I mentioned that the circle, being the simplest of all possible shapes, stands for the totality of all shapes until shape becomes differentiated. It follows that at the stage preceding differentiation, the circle does not yet represent roundness—the saw teeth in Figure 120 are not intended as round—but merely includes roundness in the undifferentiated array of all possible shapes. Only when other shapes, e.g., straight lines or squares, have become articulated, do round shapes begin to stand for roundness: heads, the sun, palms of hands. We can also express this principle by saying, with E. H. Gombrich, that the meaning of a particular visual feature depends on the alternatives considered by the draftsman. A circle is a circle only when triangles are available as an alternative.

In this connection it is useful to refer to a distinction made by linguists between marked and unmarked units. As an example John Lyons uses the words "dog" and "bitch." He says that "dog" is semantically unmarked (or neutral) since it can be applied to either males or females ("that's a lovely dog you've got there: is it a he or a she?") But "bitch" is marked (or positive) since it is restricted to females. It may be used in contrast with the unmarked word to determine the sense of the latter as negative rather than neutral ("Is it a dog or a bitch?"). Lyons concludes that "the unmarked term has a more general sense, neutral with respect to a certain contrast; its more specific negative sense is derivative and secondary, being a consequence of its contextual opposition with the positive (non-neutral) term."

The parallel to the differentiation of visual shapes is very close. The circle is an unmarked or neutral shape, which stands for any shape at all until it is explicitly opposed to other, marked shapes, such as squares or triangles. In response to their opposition, the circle assumes the specific semantic function of designating roundness. Nevertheless, it still should be called "unmarked" because even amidst the other differentiated shapes, the circle retains a generality and simplicity not found in the others.

Only for the purpose of systematic theory can the development of form be presented as a standard sequence of neatly separated steps. It is possible and useful to isolate various phases and to arrange them in order of increasing complexity. However, this ideal sequence corresponds only roughly to what happens in any particular case. Different children will cling to different phases for different periods of time. They may skip some and combine others in individual ways. The personality of the child and the influences of the environment will account for these variations. The development of perceptual structure is only one factor, overlaid and modified by others, in the total process of mental growth. Furthermore, earlier stages remain in use when later ones have already been reached; and when confronted with a difficulty, the child may regress to a more primitive solution. Figure 121 shows experimentation with concentric circles; but at the same time a higher level is indicated by the singling out of the horizontal direction in the oblong figure that contains a row of circles. The simple sunburst patterns of Figure 122 occur in drawings that contain fairly advanced forms of human figures, trees, and houses.

It should also be mentioned that there is no fixed relation between the age of a child and the stage of his drawings. Just as children of the same chronological age vary in their so-called mental age, so their drawings reflect individual variations in their rate of artistic growth. An attempt to correlate intelligence and drawing ability has been initiated by Goodenough on the basis of fairly mechanical criteria of realism and completeness of detail. It would be worthwhile to follow up this lead, using structural criteria for the evaluation of drawings and some more adequate means than I.Q. tests for the determination of general cognitive maturity.

Vertical and Horizontal

The variety of shapes produced by young children in their drawings is of course limitless. An extensive morphology has been worked out by Rhoda Kellogg. I shall confine my description to the few most fundamental features, which are at the same time those found not only in the work of children but wherever shapes are handled at early stages of visual conception.

The visually simplest line is the straight line. If we think of the circle as the boundary of a surface rather than a line, the straight line is the earliest shape of a line conceived by the mind. This is somewhat obscured by the fact that for the arm and the hand, which must execute the lines in practice, the straight line is by no means the simplest. On the contrary, a complex muscular arrangement must be activated to produce straightness, the reason being that upper arms, lower arms, hands, and fingers are levers, which naturally pursue

curved paths. Figure 123 schematically indicates the intricate changes of speed, angle, and direction that are necessary if a jointed lever (pivoting around point C) is to trace a straight line (L) at even speed. To produce a reasonably straight line is difficult, especially for a child. If nevertheless straight lines occur frequently in early art, this proves how highly they are valued.

The straight line is an invention of the human sense of sight under the mandate of the principle of simplicity. It is characteristic of man-made shapes but occurs rarely in nature, because nature is so complex a configuration of forces that straightness, the product of a single, undisturbed force, seldom has a chance to come about. Delacroix notes in his journal that the straight line, the regular serpentine, and parallels, straight or curved, "never occur in nature; they exist only in the brain of man. Where men do employ them, the elements gnaw them away."

Being the simplest, the straight line stands for all elongated shapes before differentiation of this feature takes place. It represents arms, legs, and tree trunks. The so-called stick men, however, seem to be an invention of adults. Kerschensteiner, who examined large numbers of children's drawings, claims never to have found a stick man whose trunk consisted of a mere line. Apparently a drawing must preserve the solidity of "thingness" at least in one two-dimensional unit in order to satisfy the child. Oval oblongs are used early to combine solidity with "directedness"—for example, in representations of the human or animal body.

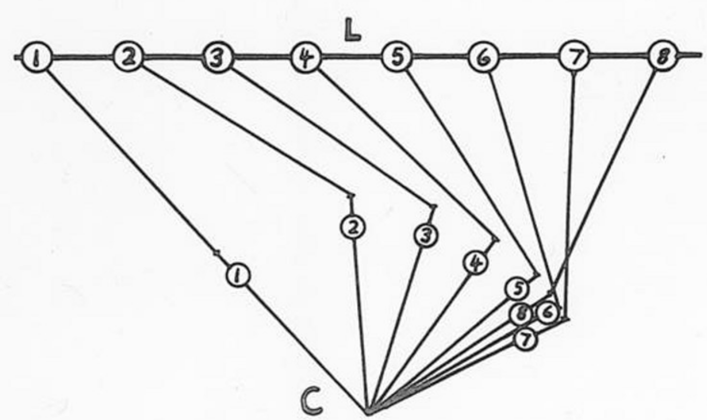

Figure 123

Straight lines look stiff in comparison with curved ones. For this reason adults, who view straightness as one line shape among many, sometimes misread the straight legs, arms, or fingers of early drawings as "rigid" and proceed to use them diagnostically as symptoms of a rigid personality or a means of expressing a momentary sensation of "freezing up," for example, in fear. Such misinterpretations show how indispensable it is to keep the law of differentiation in mind and to avoid taking straightness as a specific shape before it has abandoned its function of representing all elongated shapes. In the history of art, Heinrich Wölfflin has warned that the "rigidity" of archaic representations must not be judged as though later *"Formmöglichkeiten"* (possibilities of form) were already known. "All effects are relative. The same form does not mean the same thing at all times. The meaning of the vertical in Renaissance portraits differs from that in the portraits of the primitives. Here it is the only form of representation; there it is set off from other possibilities and thus acquires its particular expression."

The straight line introduces linear extension in space and thereby the notion of direction. In keeping with the law of differentiation, the first relation between directions to be acquired is the simplest one, that of the right angle. The rightangular crossing stands for all angular relations until obliqueness is explicitly mastered and differentiated from rightangularity. The right angle is the simplest because it creates a symmetrical pattern, and it is the basis for the framework of vertical and horizontal, on which rests our entire conception of space.

In fact, when spatial relations are first practiced they are limited to the rightangular one between horizontal and vertical. I mentioned earlier that a square tilted at 45 degrees completely changes its character. The objectively right angle at the corners is perceived as a roof-shaped, peaked pattern, whose two legs deviate obliquely from a central symmetry axis. Visually, this angle is not identical with the right angle; and because of its more complex relation to the vertical and horizontal framework, it is mastered only later, together with obliqueness of direction quite in general. The Stanford-Binet Intelligence Test indicates that the average five-year-old can copy a square, whereas only the average seven-year-old can successfully cope with the diamond.

The fundamental difference between horizontal and vertical is introduced by gravitational pull. This does not mean, however, that kinesthetic sensations alone account for the dominant role of these spatial directions in vision. It is now known that in the visual cortex of the cat, special teams of cells respond only to vertical stimuli, others only to horizontal ones, and still others again to oblique ones. More cells are concerned with the horizontal and vertical

directions than with the oblique ones. If the same situation prevails in the human brain, it would mean that under the influence of gravity, evolution has built the dominance of the two fundamental directions into the human nervous system.

The perceptual preference for the vertical and the horizontal exists even at a very elementary level. Fred Attneave reports that when four lights are arranged in a square and the diagonal ones are flashed on together, the observer sees lights move back and forth either horizontally or vertically; he does not see switching diagonals.

The introduction of the basic framework goes a long way toward establishing a solid spatial trellis. Figure 124 shows this newly acquired order, imposed on a pattern of circles, oblong, and straight lines in the drawing of a four-year-old. The simple "dog" of Figure 125 is built entirely in this spatial system. Figure 126, *Mother and Daughter*, illustrates the consistency with which an intricate theme is subjected to a given law of form. The overall construction of the two figures clings strictly to the two main directions, and the design of dress, socks, and shoes, as well as the teeth and the dignified wrinkles that distinguish the forehead of the mother from that of the daughter, obey the law with equally strict visual logic. Many an artist might justly envy the incorruptible discipline imposed by the child upon reality and the clarity with which he interprets an involved subject. The drawing can also serve to show how earlier stages survive when higher ones are already attained. To represent the hair the child has fallen back on the disorganized motions of the scribble stage, using half-controlled zigzag and spiral forms. Circles and sunbursts appear in cheeks, eyes, and the mother's right hand, and the right arm seems to indicate the transition from rightangularity to the higher level of bent shapes, which is not yet attained otherwise. Finally, Figure 127, copied from a more complex drawing in colored crayon, demonstrates how a single formal device—the vertical-horizontal T pattern—is used ingeniously to render two very different things: the body and skirt of the girl, and the traffic-light pole. Only a large number of examples could indicate the inexhaustible wealth of formal inventions that children derive from the simple vertical-horizontal relation, every one of them surprisingly new and at the same time faithful to the basic concept of the object.

Like all pictorial devices, the vertical-horizontal relation is at first worked out within isolated units and then applied at a later stage to the total picture space. In early drawings an internally well-organized figure may float in space, totally unrelated to other figures or the picture plane; whereas in Figure 127 the entire picture, including the rectangular boundaries of the sheet of drawing

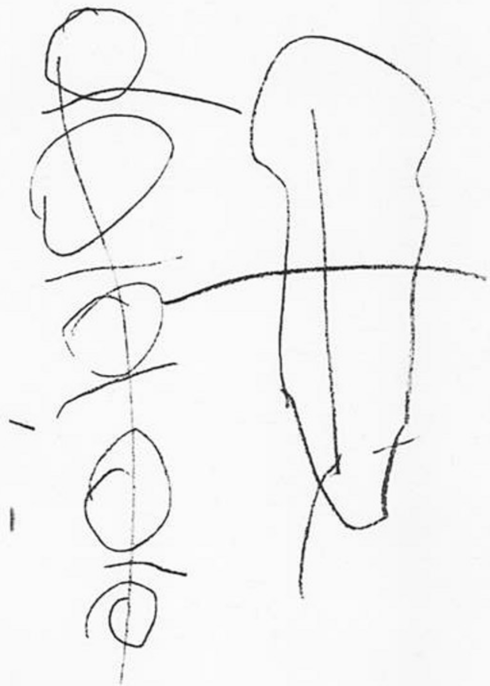

Figure 124

Figure 125

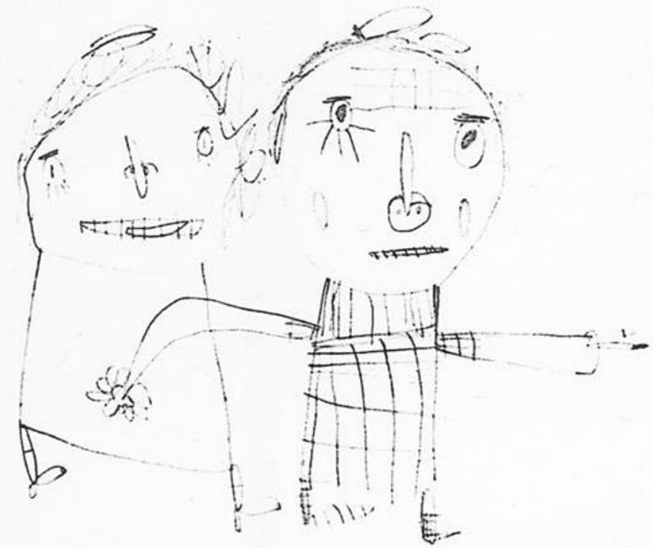

Figure 126

paper, is spatially integrated. The uprights of figures, plants, and poles ar[illegible] seen in relation to the horizontal ground. The picture has become a unifie[illegible] visual entity, in which every detail occupies a clearly defined place in the whole

The vertical-horizontal framework remains inherent in visual composi[illegible] tion, just as the measured beat does in music. Even when no one shape em[illegible] bodies either direction explicitly, all the shapes that are present in a picture ar[illegible] perceived as deviations from them. Piet Mondrian in his late paintings reduce[illegible] his conception of the world to the dynamic relation between the vertical as th[illegible] dimension of aspiration and the horizontal as the stable base.

Obliqueness

The deliberate use of obliqueness must be carefully distinguished from the random distribution of spatial directions in the earliest work. We are now concerned with a controlled enrichment of the vertical-horizontal framework. This framework must have been mastered first, and it remains the base of reference that alone makes obliqueness possible. Obliqueness is always perceived as a deviation, hence its strongly dynamic character. It introduces into the visual medium the vital difference between static and dynamic shapes,

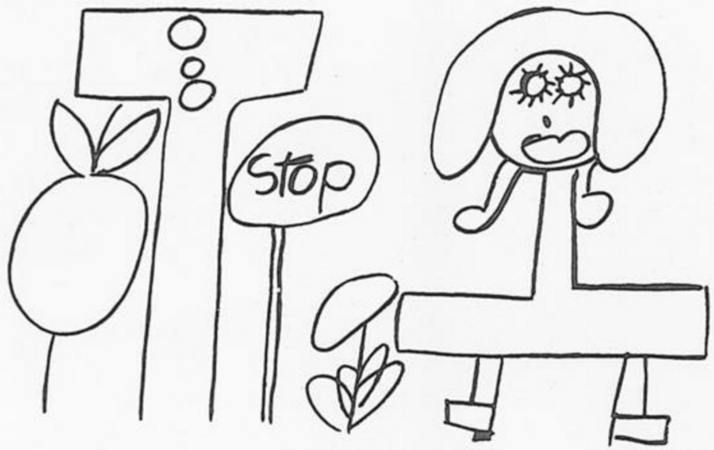

Figure 127

still undifferentiated in the earlier phase. As we look back from this new standpoint at Figure 126, we may be tempted to perceive the outstretched arms of the mother as a gesture of despair, a declaration of bankruptcy. This would be a misinterpretation because at the earlier level the rightangular relation, the maximal directional difference, serves to clarify the functional distinction between body and arms. Only when the divergence of limbs and torso has been understood through its greatest contrast can it be handled in subtler deviations.

In thinking about why artwork proceeds from the simpler to the more complex level, we realize that internal as well as external factors must be considered. Internally, the organism matures, and as it becomes capable of more differentiated functioning, it develops an urge to apply this capacity. This development, however, is not conceivable without the external world, which offers the whole variety of directional relations and which is better understood especially through the distinction between things at rest and things in motion. Motion is of such vital importance to the child that he derives great pleasure from making things visibly move in his pictures.

Oblique relations are applied gradually to everything the child draws. They help to make his representation richer, more alive, more lifelike, and more specific. This can be seen by a comparison of Figures 128 and 129. They are traced from two drawings made by the same child—one about a year earlier

than the other. Figure 128 shows two separate details of the earlier
Figure 129, a part of the later. The earlier tree and flower are done
limited means of vertical-horizontal angularity, clearly and consiste
the later tree is more interesting to the eye; it looks more like a tree
constant application of oblique angles conveys the impression of a li
ing thing. In the earlier giraffe the main relations between head, n
body are rendered by right angles. There is the beginning of obliq
the legs, but it looks as though this refinement is due not so much to
observation of the animal as it is to lack of space. (As often hap
spatial planning had been insufficient, so that by the time she came t
she found that she had to squeeze them in sideways if they were no
the base line of the ground.) A year later the animal walks freely, i
lively, more specifically giraffe-like attitude. Differentiation serves n
distinguish between separate parts but also makes for a more subtle r
of shape. Undulating ground has replaced the straight base line.

In all these respects the later drawing makes the earlier look
schematic; but the later stage could not have been truly mastered if t
had not preceded it. For this reason it is inadvisable to teach the chil

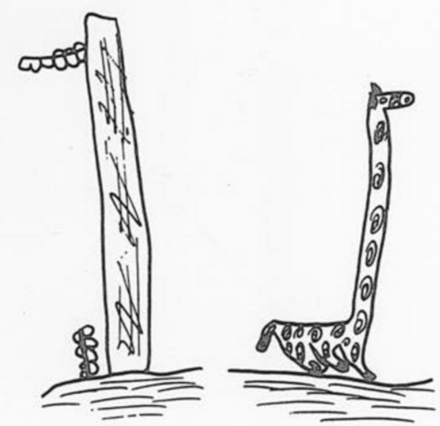

Figure 128

Figure 129

make more complex shapes—which can easily be done and flatters the social ambitions of the child, even though it disturbs his cognitive development. Once the earlier stage has been sufficiently explored, the urge to attain higher complexity leads to progress in its own good time without outside help.

If we adults find it hard to imagine that so simple a matter as the angular relation between shapes could offer so much difficulty, we may be sobered by the perceptual puzzles created by a piece of furniture, a table that has angles of 120° in addition to the usual ones, which we call the right ones (Figure 130). These tables are designed to be more versatile in seating people and relating them to their work and to each other. Combined in clusters, they produce surprising new shapes. To predict how they will look in a certain position or even simply to remember their shape requires considerable visual skill. In practical matters, such as furniture, we tend to cling to the elementary right-angular shapes and relations.

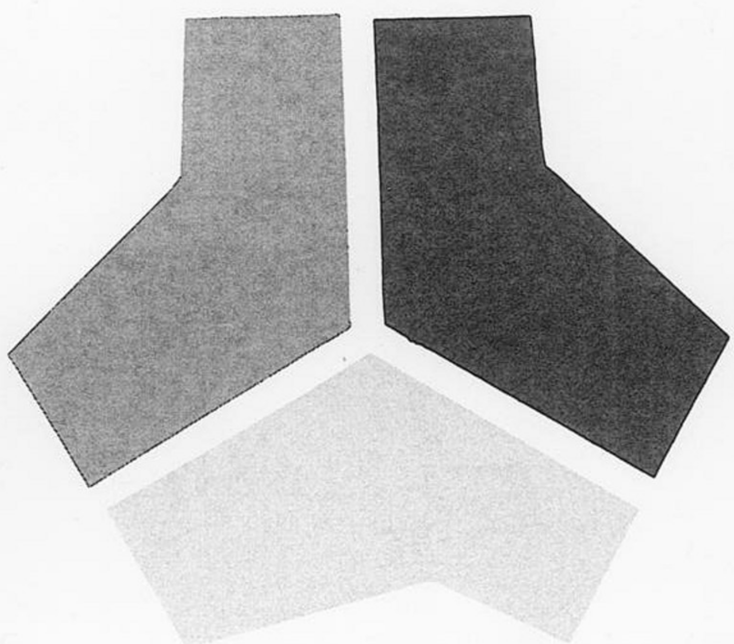

Figure 130

The Fusion of Parts

Throughout the early stages differentiation of shape is accomplished mainly by the adding up of self-contained elements. For example, the child proceeds from the earliest representation of the human figure as a mere circle by adding straight lines, oblongs, or other units. Each of these units is a geometrically simple, well-defined form. They are connected by equally simple directional relations, at first vertical-horizontal, later oblique. The construction of relatively complex whole patterns is made possible by the combination of several simple ones.

This does not mean that, at the earlier stage, the child has no integrated concept of the total object. The symmetry and unity of the whole and the planning of proportions show that—within limits—the child shapes the parts with a view to their final place in the total pattern. But the analytic method makes it possible for him to deal at every particular moment with a simple shape or direction. Some children extend this procedure to highly intricate combinations, building the whole on a hierarchy of detail, which reveals careful observation. The result is anything but poor.

In time, however, the child begins to fuse several units by a common, more differentiated contour. Both the eye and the hand contribute to this development. The eye familiarizes itself with the complex form that results from the combination of elements until it is able to conceive of the compound whole as a unit. When this is achieved, the eye safely guides the continuously moving pencil around the uninterrupted outline of an entire human figure, including arms and legs. The more differentiated the concept, the greater the skill required to work in this fashion. At the highest levels, masters of the "linear style," such as Picasso or Matisse, move with unswerving precision along a contour that captures all the subtleties of muscle and bone. But considering the basis on which the child operates, even the earliest applications of the method require courage, virtuosity, and a differentiated sense of shape.

Contour fusion also accords with the motor act of drawing. At the scribble stage, the child's hand often pendulates rhythmically for some time without lifting the pencil from the paper. As he develops visually controlled form, he begins to make neatly separate units. Visually, the subdivision of the whole into clearly defined parts makes for simplicity; but to the moving hand, any interruption is an obstacle. In the history of writing, there was a change from the detached capital letters of monumental inscriptions to the fluently connected curves of cursive script, in which the hand took precedence over the eye for the sake of speed. Similarly the child, with increasing facility, favors the continuous flow of line. Figure 131, a horse drawn by a five-year-old boy, has the elegance of a businessman's signature. The extent to which the individual draftsman permits the motor factor to influence shape depends considerably on the relation between spontaneously expressed temperament and rational control in his personality. (This can be shown convincingly in graphological analyses of handwriting.)

The two fishes (Figure 132 and 133) are taken from drawings made by one child at different times. In the earlier picture only a first hint of fusion can be observed in the jagged fins. Otherwise the body is constructed from geometrically simple elements in vertical-horizontal relation. Later the entire outline is given in one bold, uninterrupted sweep. It will be seen that this procedure enhances the effect of unified movement, favors oblique direction, and smoothes corners—for example, in the tail of the fish. It also tends to produce shapes more complex than those the eye can truly control and understand at this stage; thus the earlier fish, although relatively less interesting and sprightly, is the more successfully organized.

The snowball fight of Figure 134, drawn even later by the same child, shows how in time the experimentation with more differentiated shape enables him to modify the basic static shape of individual body units. Movement is no longer limited to the relative spatial orientation of different parts, but the trunk itself is bent. At this stage, the child copes more convincingly with figures sitting on chairs, riding horseback, or climbing trees. Beyond bending lies the deformation of shape that is employed in foreshortening. This final differentiation, however, is so sophisticated that it is rarely accomplished spontaneously, except in the simple cases of circles, squares, or rectangles.

The difference between the combination of basic elements and the shaping of more complexly structured units has parallels in other activities of the mind.

Figure 131

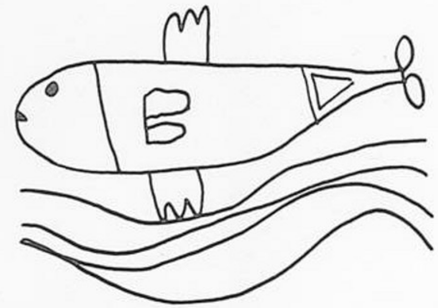

Figure 132

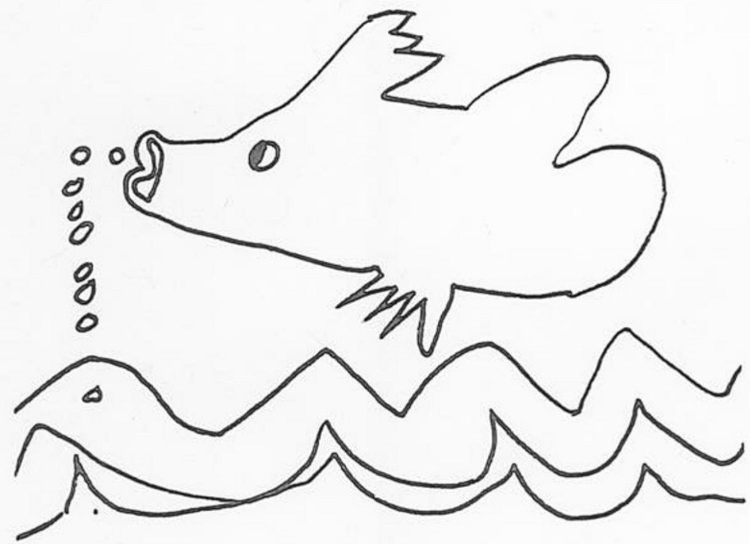

Figure 133

Figure 134

In language, for example, it marks the difference between the English system of declension, which adds prepositions to unchangeable nouns, and the more complex Latin system of inflecting the noun within its own body, even though in language the former does not necessarily precede the latter. Or, to cite an example from the psychology of concept-formation, primitive thinking conceives of soul, passion, or disease as separate entities added to, or subtracted from, the unchangeable unit of the body or mind; whereas more highly differentiated reasoning describes them as fused with or produced by the internal functioning of the body or mind itself. In our own science and philosophy we are witnessing the transition from more primitive "atomistic thinking," which interprets natural phenomena through interrelations between constant elements, to the gestalt conception of integrated field processes. The musician might be reminded of the development from constant tones, which change only in pitch as they move along the melodic line, to integrated chords, which modify their internal structure during harmonic progression.

In a broader sense, the development here described must probably be viewed as a phase of an ongoing process in which subdivision and fusion alternate dialectically. An early global shape is differentiated by subdivision, e.g., when an oval figure breaks down into separate head and torso. This new combination of simple units calls for a more thorough integration at a higher level, which, in turn, will be in need of subdivision for further refinement at a later stage; and so on.

Size

The "illusionistic" approach to visual representation leads us to that any picture will represent the sizes of objects the way they look way they are or the way the draftsman chooses them to be. Lack of s carelessness in observation are cited to account for deviations from the size. Reproachful terms such as "incorrect size" or "exaggerated siz typical of such evaluations.

From the developmental point of view, we recognize that as a g rule the sizes of pictorial objects are likely to be equal before they are entiated. We expect that sizes will not be differentiated unless there ar reasons for it. Thus our question should not be, "Why do the size relat some pictures or sculptures not correspond to reality?" but rather, ' makes children and other image-makers give different sizes to the obj their pictures?"

Hierarchy based on importance is certainly a factor. In Egyptian kings and gods are often more than twice as large as their inferiors. psychologists and educators assert that children draw things large whe are important to them. However, this leads to doubtful interpretation when Viktor Löwenfeld asserts that in a drawing of a horse bothered b the fly is given roughly the size of the horse's head because of its impo for the child. Such explanations come easy, but often hide the more c cognitive factors.

Consider Figure 135, an illustration from a Venetian edition of the *of Aesop*, published in 1491. The hungry fox tries to induce the crow t the desirable morsel by flattering him. The visual logic of the story c two coordinated principals, fox and crow, comparable to horse and Löwenfeld's example. Because the two are of equal importance in the there is no reason to give them different sizes in the world of the pict fact, any such difference would make it difficult to read the story as a di between equals. We have reason to admire the appropriateness of th chosen by the draftsman, who is not deflected from his task by a mech visually unjustified imitation of sizes in nature.

Similarity of size ties items together. It is almost impossible to esta direct visual relation between, say, a human figure and a tall building are drawn to scale. Where such great size differences are desirable, artis erally bridge the gap between the large and small units of their compo by others of intermediate size.

In medieval painting, not committed to mechanical naturalism,

Figure 135

may be the size of a building. At the same time, a bishop may carry in his hand the church he built. It is not the "model" of a church but the church itself; just as the small tower always depicted next to St. Barbara *is* not a "symbol" but a tower, even though it has symbolic meaning. These examples show how size differences arise in response to considerations of meaning, e.g., when the relation between creator and creature or saint and emblem is to be expressed. More technically: if a man is to stand in a doorway or look out of a window, his size must be reduced appropriately. If, in a child's drawing, a face is to accommodate explicit eyes, a mouth with teeth, and a nose with nostrils, it must be made large—just as Marc Chagall enlarges a cow's head to make room inside it for another cow and a milkmaid. If, on the other hand, size is not yet differentiated, the various parts of the body—head, trunk, and limbs—are given roughly the same order of magnitude (Figure 136).

What is true for the size of objects holds also for the intervals between

Figure 136

them. The need for clear presentation makes the child leave sufficient space between objects—a sort of standard distance which, from the r point of view, looks sometimes too large and sometimes too small, dep on the subject matter. An overlong arm may be required to connect a figure with an apple on a tree, from which the figure is kept at suita tance. Realistic closeness between items remains visually uncomforta some time.

Realistic size is only marginally relevant to the size of things in p because perceptual identity does not rely much on size. The shape a spatial orientation of an object remain unimpaired by a change in si: as in music a moderate augmentation or diminution of temporal size t a change of speed does not interfere with the recognition of a theme. Th irrelevance of visual size is shown most strikingly by our habitual oblivi to the constant change in size of the objects in our environment brough by changes in distance. As far as images are concerned, nobody protests an inch-high photograph of a human being or against a gigantic sta television screen looks small in the living room, but we need only conc on it for a short time and it becomes an acceptable frame for "real" p and buildings.

The Misnamed Tadpoles

Perhaps the most striking case of misinterpretation due to illusi bias is that of the "tadpole" figures, called *hommes têtards* by the Frenc *Kopffüssler* by the Germans. The popular view is that in these very co drawings the child leaves out the trunk entirely, and that he erroneou taches the arms to the head or the legs. Figures 137 and 138, drawn by year-olds, show some of these mysterious creatures. Various theories hav offered. The child was believed to overlook or forget the body or e

Figure 137

Figure 138

"repress" it for reasons of modesty. If we look at the developmental process, we discover that no such explanation is pertinent, since in these drawings the trunk actually is not left out.

At the earliest stage the circle stands for the total human figure, just as it stands for so many other complete objects. Later, its shape is differentiated through the addition of appendages. For example, in Figure 139, an eight-

Figure 139

year-old boy's drawing of a church, the original circle is still clearly discernibl
In the human figure the original meaning of the circle is gradually limited l
the additions. There are essentially two types. In Figure 137 the circle fur
tions as an undifferentiated representation of head and trunk. Therefore t
child is entirely consistent in attaching legs and arms to it. Only to adults d
the picture look as though something is left out. The circle is often extended
an egg-shaped oblong, which may contain the features of a face in its up
part or indications of clothing in the lower. Figure 138 illustrates the o
type. In the center is a house with two fish in it, at the right a cowboy, an
the left a cow. The cowboy has one stomach in his body, and the cow has
These stomachs are useful for our purpose, because they show that here the
parallel vertical lines are an undifferentiated representation of trunk and
whereas the circle is now limited to being a head. The arms are attached w
they belong—to the verticals. The double function of the line as self-cont
unit and as contour is not yet clearly differentiated; the two verticals are
tours (trunk) and object lines (legs) at the same time. It may be adde
a similar lack of differentiation is often evident in the way other parts
body are represented. The features of the face may be drawn as a single
contained in the larger circle of the head, before they split up into eyes
and mouth; and in Figure 136 the limbs are not yet articulated, so that
adult observer the fingers may seem to be attached to the arms, and t
to the legs.

Translation into Two Dimensions

The law of differentiation leads us to expect that the distinction l
two-dimensional and three-dimensional views in pictures does not ex
the beginning. Instead, the two-dimensional view, as the simpler one
marked" and serves indiscriminately for both. Nothing distinguishe
between depthlessness and depth, or between a flat object and a vol
one. The spatial qualities of a dinner plate are treated no differently fr
of a football, and all things lie at the same distance from the observer

A good way of coming to understand how children represent s
read E. A. Abbott's fantastic novel *Flatland*. Flatland is a two-di
country in which, as compared with our own world, everything is r
one dimension. The walls of houses are mere outlines of plane fi
they serve their purpose, because in a flat world there is no way of p
a closed outline. The inhabitants are planimetric shapes. Their bodi
satisfactorily bounded by a line. A visitor from three-dimensional
makes a nuisance of himself by telling them that their houses ar

can see them inside and outside at the same time. He also proves that he can touch a Flatlander's intestines, producing a shooting pain in the Square's stomach. To the Flatlanders their houses are neither closed nor open at the top since they have no such dimension; and their intestines are kept properly invisible and untouchable by the surrounding contour line.

Those who assert that children draw open houses and X-rayed stomachs resemble the inopportune Spacelander. They are unaware of the admirable logic by which the child adapts his pictures to the conditions of the two-dimensional medium. It is not enough to say that children draw the insides of things because they are interested in them. With all their interest they would be horrified by the picture of a man with an open stomach. An Australian bark painting comes to mind in which the outline of a kangaroo's body is visibly filled with the anatomy of bones, organs, and intestines. The picture does not represent a "section" through the animal's body, as a zoology textbook might. It also shows the figure of a hunter, who shoots his prey with bow and arrow; and obviously one does not hunt a section, but a whole, live animal. This proves that the kangaroo's body is not meant to be open or "transparent." Similarly, a child's drawing of a gorilla that has eaten his dinner (Figure 140) is neither a section nor an X-ray view.

The same point is made in the schematic diagram of Figure 141. The drawing of the house is neither a transparent front view nor a section. It is

Figure 140

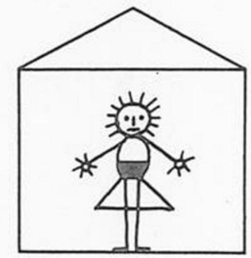

Figure 141

the two-dimensional equivalent of a house. The rectangle stands for cubic space, and its outline for the six boundary surfaces. The figure stands inside, completely surrounded by walls. Only a gap in the contour could provide an opening. The child's invention lingers on through the ages, so that even in the highly realistic art of a Dürer or Altdorfer the Holy Family is housed in a building without front wall, camouflaged unconvincingly as a broken-down ruin. And of course in our modern theater, the stage is accepted without hesitation by the same people who accuse the child of "X-ray pictures."

As indicated in Figure 141, pictures of this kind present hair as a single row of lines, all touching the contour of the head. This is quite correct in that the circular head line stands for the complete surface of the head, which is thus shown as being covered with hair all over. Yet there is in this method an ambiguity deriving from the fact that inevitably the child is using it for two different and incompatible purposes at the same time. Obviously the face is not meant to lie inside the head, but on its outer surface; and the two oblique lines represent arms, and not an open cape hanging down from the shoulders and surrounding the entire body. That is, the two-dimensional units of the drawings are equivalents of solids, of two-dimensional aspects of the outside of solids, or both, depending on what is needed. The relation between flatness and depth is undifferentiated, so that by purely visual means there is no way of telling whether a circular line stands for a ring, a disk, or a ball. It is because of this ambiguity that the method is used mostly at primitive levels and is quickly abandoned by the Western child.

The process was well documented in an experiment by Arthur B. Clark, in which children of different ages were asked to draw an apple with a hatpin stuck horizontally through it and turned at an angle to the observer. Figure 142*d* illustrates the position in which the children saw the model. Figure 142*a*

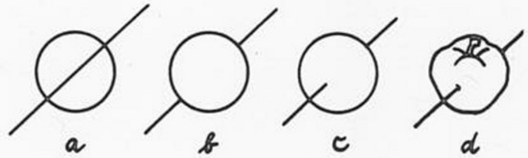

Figure 142

shows the earliest solution of the problem. It is logical in that the pin goes uninterruptedly through the inside of the circle, which stands for the inside of the apple. But it is ambiguous in that the straight line inevitably depicts a one-dimensional object (pin) and not a surface. At the next stage, *b*, the child makes a first concession to projective representation by showing the center part of the pin hidden inside the apple. (To the younger child this would look like a picture of two pins touching the apple at the outside.) But the contour of the circle still stands for the entire surface of the apple, as shown by the way the pin stops at the contour. At *c* the contour has become the horizon line, and the area of the circle represents the front face of the apple. With some refinement of shape, this leads to the realistic solution, *d*. This final picture is spatially consistent, but it sacrifices the striking visual clarity with which the essentials of the three-dimensional conception were rendered in the two-dimensional medium at stage *a*. The differentiation between two-dimensional and three-dimensional form has been achieved, but only through the suspect trick of making the picture plane appear as an image of three-dimensional space.

As long as the two-dimensional view is not differentiated from the projective view, the flat pictorial plane serves to represent them both. This can be done in two ways. The child can use the vertical dimension of his picture plane to distinguish between top and bottom and the horizontal for right and left and thus obtain "vertical space" (elevation). Or he can use his two dimensions to show the directions of the compass in a ground plan, which produces "horizontal space" (Figure 143). Upright objects, such as human beings, trees, walls, table legs, appear clearly and characteristically in vertical space, whereas gardens, streets, table tops, dishes, or carpets ask for horizontal space. To further complicate matters, in vertical space only one among the innumerable vertical planes can be represented directly, so that the picture can take care of the front face of a house but not, at the same time, of the side faces without recourse to some trick of indirect representation. Similarly, horizontal

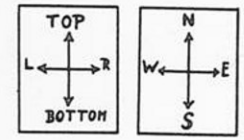

Figure 143

space can show the dishes on the table top but not, in the same pictur
dog lying under the table.

In dealing with the "Egyptian method" we showed how at an early of spatial representation the artist chooses for each object, or part of an o the aspect presenting it most characteristically. It may be mentioned here the highly sophisticated and realistic technique of the motion picture h captured some of the striking effects of elementary representation. By de posing the visual world into a succession of partial views, the film has able, for example, to return to the principle that the units of a visual state are basically of equal size. If a person is shown watching a butterfly, a clo may make the insect as large as the person. Similarly, a change in ca angle will make the screen picture switch from vertical to horizontal spac that the spectator may see a side view of people sitting at the dinner table a second later, a top view of the food. This procedure is "justified" realisti through the succession of the shots in time, which sanctions a change in tance or angle. In the actual experience of the spectator, however, these cha in observation point are not clearly perceived as such. Essentially, he ac things as being presented at a size and angle that fits them best without w ing whether or not such visual correctness is "true-to-life." In much mo art, of course, all realistic pretense has been frankly dropped: objects clearly given whatever size and angle accords with the visual purpose.

Educational Consequences

In discussing some of the earliest features of visual form, I have trie show, in their pristine clarity, some of the elements on which image-makin forever built. But an understanding of this early development should help the educator evaluate and assist in the work of his students. The princ message is, of course, that the work of children, "primitives," etc., is not t regarded negatively as something below standard, something to be overco the sooner the better, on the road to "competent" art. The preceding secti of this chapter will have suggested that visual form, when permitted to g undisturbed, moves from stage to stage lawfully, and that each stage has its own justification, its own capacities for expression, its own beauty. Since these early stages depend on one another and lay the foundation for any mature achievement, they must be worked through unhurriedly. This is true not only for children but for any developing artist. "An artist does not skip steps," said Jean Cocteau; "if he does, it is a waste of time because he has to climb them later."

In our discussion it will have become evident also that deviations from lifelike representation are not due to deficiencies, but to a remarkable, spontaneous sensitivity for the requirements of the medium. As the teacher watches the manifestation of this enviable native endowment, the sureness of intuitive decision, the logical progression from the simple to the complex, he will ask himself whether the best thing to do is not to leave his pupils alone, entrusted to their own guidance. Is art not one of those skills that one can and should learn by oneself? To some extent this is surely so. Every untoward intervention on the part of the teacher may disorient the student's own visual judgment or cheat him out of a discovery he would more profitably have made himself. In this respect, the old-fashioned teacher who hands out the tricks of central perspective is no more guilty than his progressive colleague who makes the child fill the accidental loops of his scribbles with paint, or the new-styled primitivist who admonishes him: "This is a nice picture, but in second grade we do not make noses yet!" To insist on a child's doing "abstractions" is as harmful as forcing him to draw lifelike representations.

This is true at any level of education. The art student who copies the manner of an impressive teacher is in danger of losing his intuitive sense of right and wrong in the struggle with a form of representation that he can imitate but not master. His work, instead of being convincing and congenial, is puzzling to him. He has lost the honesty of the child, which every successful artist preserves and which gives the simplest possible shape to any statement, complicated as the result may be objectively. Arnold Schönberg, the composer of some of the most intricate music ever written, told his students that their pieces should be as natural to them as their hands and feet. The simpler they seemed to them, the better they would be. "If something you have written looks very complicated to you, you do well to doubt its genuineness right away!"

And yet there is much the art teacher can do. Like his colleagues in other areas, he must steer a course somewhere between the two easy escape routes: to teach everything and to teach nothing. The most helpful suggestion deriving from the study of the developmental stages is that all teaching should be based on an awareness that the student's visual conception is growing in accordance with principles of its own, and that the teacher's interventions should be guided by what the individual process of growth calls for at any given time.

The best example I can find comes from the history of art. The discovery of the geometrical formula for central perspective came in the fifteenth century, after many painters had attempted intuitively to unify pictorial space by making depth lines converge. It is fascinating to observe how in the paintings and woodcuts of the time those perspective lines reach for a common center, attain it approximately, or create separate foci for different sections of the picture. The geometrical formula, which prescribes a common vanishing point, merely codified the solution to a problem that had been thoroughly researched by intuition. The time was ripe for it.

At any earlier historical period, the teaching of the geometrical trick might have been disruptive or useless. Something very similar holds for the development of the individual. The teacher feels tempted to communicate his knowledge in order to satisfy his own aspirations along with those of the student, who begs his instructor to show him how one makes things "go back" into space. However, these are merely social urges, not deriving from the demands of the work itself. Out of ambition the student wishes to equal the standards of some prestigious accomplishment, and would as soon reach that pleasant goal with a minimum of effort. Such social motives must be distinguished from the cognitive motives that arise from the state of the student's visual development. The former must not be gratified at the expense of the latter.

In recent years, art teachers have legitimately striven to go beyond the traditional drawing and modeling and acquaint their students with many materials and techniques. Not only does this accord with the practices of our modern artists, it also keeps the attention of students alive and makes legitimate use of their love of gadgetry. Adolescents in particular grant more prestige to technology than to art. It is essential, however, that materials be selected and employed in such a way that they challenge the student to work on tasks of visual organization at his own level of conception and make it possible for him to do so. Techniques inviting visual confusion or creating excessive difficulty or complexity are destructive; so is the practice of changing tasks so often that the student cannot explore the visual characteristics of a particular medium thoroughly. There is enough unproductive distraction outside the schoolroom.

It is natural for the artist and art educator to think of his field as self-contained, governed by its own rules and dedicated to its own purpose. However, one cannot hope to cultivate the sense of visual form in one area of the curriculum if this sense is neglected or even abused elsewhere. In another book I have made the point as follows: "At a level of development at which the free art work of the child still employs relatively simple geometrical shapes, the art teacher may respect his pupils' early stage of visual conception, but in geography class the same children may be compelled, perhaps by the same teacher, to trace the coastlines of the American continent or the irrational windings of rivers—shapes that can be neither perceived nor understood nor remembered. When a college student is asked to copy what he sees under the microscope, he cannot aim, mechanically, for mere accuracy and neatness. He must decide what matters and what types of relevant shapes are represented in the accidental specimen. Therefore, his drawing cannot possibly be a reproduction; it will be an image of what he sees and understands, more or less actively and intelligently. The discipline of intelligent vision cannot be confined to the art studio; it can succeed only if the visual sense is not blunted and confused in other areas of the curriculum. To try to establish an island of visual literacy in an ocean of blindness is ultimately self-defeating. Visual thinking is indivisible."

Finally, it is necessary to point to a limitation of the present book. It discusses visual organization and invention as deriving from the cognitive functions of the mind: the sensory perception of the outer world, the elaboration of experience in visual and intellectual thinking, the conservation of experience and thought in memory. From this standpoint, pictorial work is a tool for the task of identifying, understanding, and defining things, for investigating relations, and creating order of increasing complexity. We must not forget, however, that the cognitive functions are at the service of the whole personality. They reflect attitudes and fulfill desires, as psychologists have emphasized in using visual experiences for diagnostic or therapeutic purposes. Some art educators have followed suit, interpreting as "emotional" many features that are derived from the conditions of visual perception and representation.

Examples abound in the literature; I will limit myself to one. In his book on art education Herbert Read comments on a drawing done by a girl just under five years old. A tiger is represented very simply by a horizontal stroke for the body and two verticals for the legs. The lines are crossed with short stripes, meant to depict the tiger's skin. Read speaks of the "wholly introvert, inorganic" basis of the picture. The child, he says, has shown no regard for whatever image of a tiger she may have had; she has created "an expressive

symbol which [does not] correspond . . . to her perceptual awa
conceptual knowledge of the tiger." Actually, the picture is a typical
of the horizontal-vertical stage, at which the average child will rep
animal in just this way. Very often no differentiation between org
inorganic shape is possible at this stage; straight lines stand for both. S
tures are meager in content not because the child is unable or unw
observe and to use his observations, but because the elementary stage
sentation does not permit him to use much of what he has seen. Wh
not this particular child is a withdrawn introvert cannot be determ
the basis of her drawing and age alone. Introversion may retard differe
of form, but undifferentiated form in itself does not suggest introversio
same drawing could come from a bubbling extrovert, passionately int
in the way animals look and behave.

Here, then, a one-sided emphasis on personality factors leads to a
terpretation of traits that in fact arise from the stage of the child's co
development and the properties of the pictorial medium. Conversely, ho
an equally one-sided concentration on the cognitive aspects may crea
impression that the young organism is occupied with nothing but perc
and intellectual growth, and that the mind is merely a kind of proc
mechanism tackling the shapes of the outer world at a continuously
complex level. The present book, by trying to fill some of the gaps le
others, means to contribute to a broader conception. The educator of tomo
should be able to view the thinking and perceiving mind in interaction
the aspirations, passions, and fears of the total human being.

The emphasis on personality factors has induced some art educato
regard techniques that favor precision of form with suspicion. They h
replaced the old-fashioned pencil with materials that foster the spontane
stroke, the impulsive flash, the raw effect of amorphous color. Spontane
expression is certainly desirable, but expression becomes chaotic when it in
feres with visual organization. Broad brushes and dripping easel paints co
pel the child to create a one-sided picture of his state of mind, and the po
bility cannot be excluded that the kind of picture he is permitted to make m
in turn, influence the state of mind he is in. Unquestionably, modern metho
have given an outlet to aspects of the child's mind that were hobbled by t
traditional procedure of having him copy models with a sharpened penc
But there is equal danger in preventing the child from using his pictorial wo
for clarifying his observation of reality and for learning to concentrate an
to create order. Shapeless emotion is not the desirable end result of educatio

and therefore cannot be used as its means. The equipment of the art room and the mind of the art teacher should be comprehensive and variable enough to let each child act as a whole person at any time.

The Birth of Form in Sculpture

The principles of visual development described in this chapter are so fundamental that they do not apply only to shapes in drawing and painting. Probably they control the use of color as well. Early art does best with a few simple colors, especially the three fundamental primaries, which serve to separate shapes from one another but do not connect them. Mixed colors introduce the more complex interrelations. Similarly, the homogeneous coloring of objects and areas belongs to an earlier stage than do composites of variously colored parts or deliberate color modulation within a shape. More precise knowledge in this field awaits further research.

More directly, our principles can be applied to the visual arts of the theater, choreography, film, and architecture. In the history of styles as well as in the development of the individual stage director or choreographer, are there early compositional forms, distinguished perhaps by symmetrical arrangements and a preference for frontal and rectangular spatial orientations, or groupings according to simple geometric figures? Can differentiation be shown to proceed step by step from these to more and more complex conceptions? In architecture it would be possible to show the changes from simple circular and rectangular plans to more intricate ones, the gradual breaking up of the unified block and wall, the deviation from the symmetrical façade, the introduction of oblique orientation and curves of an increasingly high order.

Sculpture certainly lends itself to the same kind of description, although three-dimensionality makes for more complex relations. For technical reasons it is difficult to document the early stages of children's sculptural work. The mechanical problems involved in handling clay and similar materials and in keeping constructions from collapsing make it harder for the child to produce the shapes he has in mind; and the rough surfaces of children's work photograph badly. The following analyses are therefore illustrated with the early sculptural work of adults.

It might be supposed that the three-dimensional objects of nature are more easily represented in sculpture than on paper or canvas, because the sculptor works in volumes and therefore is not faced with the problem of rendering three dimensions in a two-dimensional medium. Actually this is true only to a limited degree, because the lump of clay or piece of stone presents the sculptor with three dimensions only materially. He still has to acquire the

conception of three-dimensional organization step by step, and it migh maintained that the task of mastering space is more difficult in sculpt in the pictorial arts for the same reason that playing three-dimensio tacktoe requires a higher level of visual intelligence than the two-dim version.

When the child draws his first circle, he has not mastered two-dim space but merely annexed a bit of territory on paper. We have seen must go through the slow process of differentiating the various angul tions before he can be said to be truly in command of the medium's possibilities. Similarly, modeling a first ball of clay does not mean the c of three-dimensional organization. It merely reflects the most elementa of form concept, which differentiates neither shape nor direction. If v judge by analogy with what happens in drawing, the "primordial ba represent any compact object—a human figure, an animal, a house. I tell whether this stage exists in the work of children, nor have I fou example in the history of art. The examples that come closest seem to small Paleolithic stone figures of fat women, the best-known of which "Venus of Willendorf." These figures, with their round heads, bellies, and thighs, indeed look as though they had been conceived as combinat spheres modified to fit the human shape. One may wonder whethe obesity is to be explained only by the subject matter—symbols of moth and fertility, a preference on the part of prehistoric man for fat wom also as a manifestation of early form conception at the spherical stage.

Sticks and Slabs

The simplest way of representing one direction in sculpture, corre ing to the straight line in drawing, is by means of a stick. A stick is of always a three-dimensional object physically; but just as the breadth of a stroke does not "count" in early drawing and painting, so the stick in scu is the product of one-dimensional conception, counting mainly in its dir and length. Good examples can be found among the terra-cotta figures on Cyprus and at Mycenae during the second millennium B.C. (Figure The bodies of men and animals—legs, arms, snouts, tails, and horns—are of stick-like units of roughly identical diameter. Stick elements are foun in the small bronzes of the Geometric period in Greece, around the e century B.C. Children make sausage-like sticks for their clay and plas figures. Probably this stage exists universally at the beginnings of mod It has also produced very refined constructions of modern sculpture, in w metal rods are combined in spatially intricate arrangements.

Figure 144
Mycenaean terra cotta figure of an ox. 1400–1100 B.C. Metropolitan Museum of Art, New York.

To describe further differentiation in a three-dimensional medium we need two terms. The spatial dimensions of an object refer to its own shape (*object dimensions*) and to the pattern it creates in space (*spatial dimensions*). Thus a wire ring is stick-like or one-dimensional as an object, but two-dimensional as a pattern in space.

The simplest combination of sticks leads to patterns of two spatial dimensions—that is, an arrangement within one plane, limited at first to the rightangular relation (Figure 145*a*). Later the third dimension is added in patterns that occupy more than one plane (*b*). Here again the earliest relation is the right angle. Further differentiation of orientation yields oblique connections between units in two or three dimensions (*d*) and bending and twisting (*c*). The length of the units is probably at first undifferentiated, just as we have found it to be in drawing (compare Figure 136). Distinctions of length are worked out only gradually.

In the foregoing examples, the object dimension was kept constant while

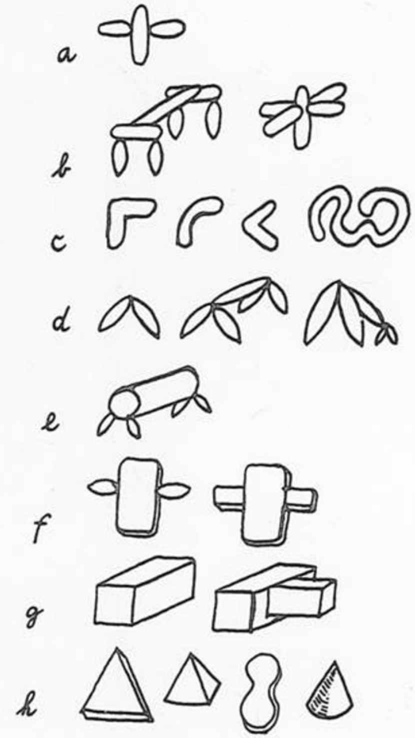

Figure 145

only the spatial dimensions were modified. In Figure 145*e* the shape of th object itself has been changed in the simplest possible way by introducing difference in girth: the trunk is thicker than the legs. Figure 145*f* introduce slabs, a two-dimensional shape, and in the cubic forms of *g* the third objec dimension becomes an active part of the visual conception rather than jus being physically present. Finally, in *h* there is a differentiation of shape withir the two-dimensional or three-dimensional unit. It will be understood that th variations in spatial orientation and size indicated for the undifferentiatec objects in *a–e* can also be applied to these more complex objects, which leads to compositions of considerable intricacy.

Object dimensions offer some difficult, specifically sculptural problems.

A ball looks the same from all sides because it is symmetrical in relation to one central point. A stick, a cylinder, or a cone is symmetrical in relation to a central axis, and therefore does not change aspect when rotated around the axis. But such simple shapes do not satisfy the sculptor's need for long. The human figure in particular soon requires the representation of patterns that are symmetrical in two dimensions and are therefore most simply rendered on a flat surface. Consider the example of the face. If the head is rendered by a sphere, features of the face may be scratched on its surface. This solution, however, can look quite unsatisfactory. In the first place, one aspect is singled out on the surface of the sphere, whose shape makes such a distinction quite arbitrary; also, the two-dimensional symmetry of the face is rendered on a curved surface rather than on the simpler flat one. The same is true for the human body as a whole. What can be done? With regard to the face, the simplest solution is to leave it out altogether. Examples can be found among the Paleolithic "Venus" figures. For example, the Willendorf woman has a head symmetrically surrounded by plaits of hair, but no face. Again we may speculate that this was done, partly or wholly, to avoid interfering with the logic of visual simplicity.

There are other solutions. One can cut a slice off the sphere and place the face on the resulting segmental plane. Flat, mask-like faces of this kind are frequent in early styles of sculpture, in African figures and the Japanese *haniwa* terra-cotta, as well as in the first attempts at sculptural portraiture by Western art students. Picasso has sometimes rendered a head as a combination of two pieces: a spherical volume attached to a flat vertical shield bearing the face. The problem can be solved more radically by reducing the whole head or figure to flatness. Figure 146 illustrates an Indian figurine in which the frontal symmetry of the body is given the simplest, two-dimensional form. The most primitive variety of the small stone idols found in Troy and on the Cycladic Islands were made from rectangular slates of marble and shaped like a violin. Even where the front and the back views have developed some relief, there is not yet a side view that can be considered an active part of a three-dimensional concept. In the same culture are combinations of two- and one-dimensional form; for example, the trunk of the body is a flat, frontal shield, whereas head and legs have the vaselike, undifferentiated roundness of an earlier stage.

Some parts of the body do not fit into the frontal plane: noses, breasts, penises, feet. One radical solution of this problem can be found in the head of the baby, held by the figure to the left in Figure 147. The head is wedged

Figure 146
Indian figurine. Boston Museum of Fine Arts.

like the blade of an ax—nothing but nose, so to speak, with the eyes scratched in laterally.

At the stage of rectangular connections, noses and breasts stick out perpendicularly from the frontal plane. Figure 148*a* shows the section of a flat head with a nose protruding at a right angle. When, in the course of further differentiation, this pattern is smoothed to more organic shape (*b*), we arrive quite logically at the curious bird-like heads of the Cyprian statuettes in Figure 147—a solution found also, perhaps quite independently, in the early sculpture of other cultures.

The strict frontal symmetry of primitive sculpture is abandoned gradually. Even in Egyptian and early Greek art, however, symmetry is still evident to such an extent that Julius Lange described it as the basic law of sculptural composition in these archaic styles.

As in drawing, the differentiation of the figure comes about not only by

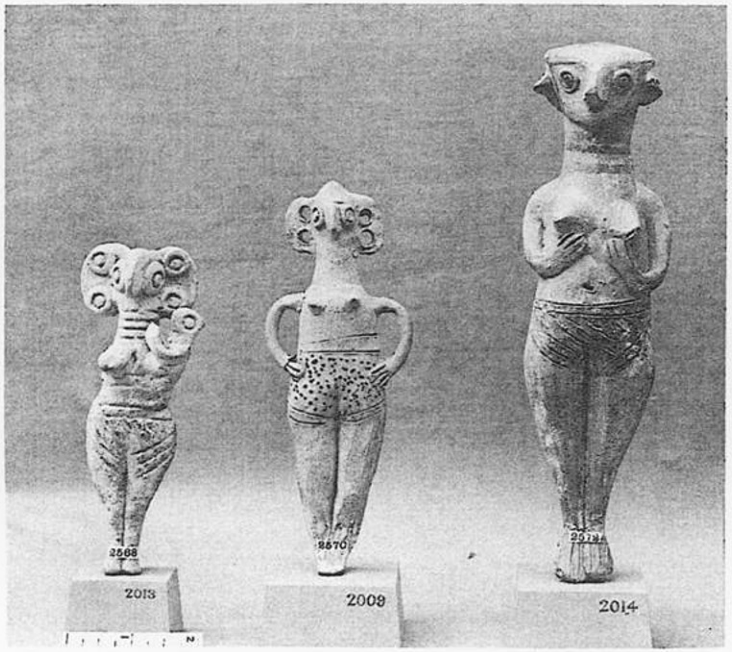

Figure 147
Statuettes from Cyprus. Metropolitan Museum of Art, New York.

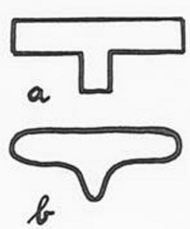

Figure 148

the addition of units to the main base but also through internal subdivision. In Figures 146 and 147 clothing is represented by scratched-in lines. At the same time these early figures show how subdivision develops from scratching to a more sculptural, three-dimensional procedure. The scratched-in lines, remnants of the technique of drawing, are replaced with moldings. Ribbons are applied to the surface to outline the eyes. In the archaic Greek statues of young men (sixth century B.C.), such ribbons are used, for example, to mark the dividing line between the belly and the thigh. Angular steps, rather than mere dividing lines, distinguish the protruding chest from the stomach. These moldings become gradually smoother and fuse with the ground plane; the scratched-in lines develop into cavities representing such things as the mouth or the hollow of the eye. From a combination of separate units a continuous relief gradually evolves. Figure 149 illustrates this development by two schematic sections.

The Cube and the Round

The flat figure, of which the Cycladic marble idols served as examples, conceives the human body in two object dimensions. Further differentiation adds the third object dimension. The simplest realization of this shape is the three-dimensional cube, in which the three directions of space meet at right angles. In addition to the front and back planes, there are now two side views. The visual construction of the figure out of four main views that lie at right angles to one another was first formulated by Emanuel Löwy as a law for archaic Greek sculpture. It can be applied more generally, however, to all sculpture at this particular stage of early development. The continuous roundness of the human body or animal is broken down into independent and relatively self-contained partial views, i.e., front face, profiles, back—the perceptually simplest aspects. This makes it possible for the sculptor to concentrate at any particular moment upon a relatively closed partial composition, which he can survey without changing his point of observation. He may work

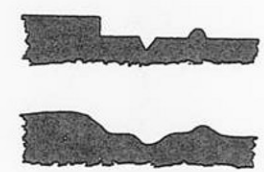

Figure 149

first on the front view, later on the side view, and so forth. The combining of the views is left to a secondary phase of the process.

The independence of the four views is most strikingly illustrated by the winged bulls and the lions serving as gatekeepers of Assyrian palaces (Figure 150). Viewed from the front, such an animal shows two symmetrical front legs standing still. The side view has four legs walking. This means that from an oblique angle of vision we count five legs. But to add up unrelated elements this way is to violate the intended concept. The important thing for the Assyrians was the completeness of each view in itself.

Every beginner in the art of sculpture finds that the simplicity of the cubic concept imposes itself upon his work. When he tries to abandon it in favor of the kind of roundness that was achieved during the Renaissance, he has to overcome the "Egyptian" in himself. Furthermore, he will be tempted constantly to finish one aspect of the work as it appears from a given observation point, only to discover that when he turns his figure the horizon of his previous view is no longer valid as a boundary. In consequence he will find himself with unexpected breaks and ridges and with incomplete planes that shoot into outer space instead of turning around the figure. The ability to think of the total volume as a continuous whole marks a late mastery of three-dimensional space. It would be a mistake to assume that this had been accomplished already in the shaping of the primordial ball. Rather, it took the gradual development from the one-dimensional stick and the step-by-step differentiation by way of flat and cubic bodies to arrive at the genuine roundness of Michelangelo's or Bernini's figures.

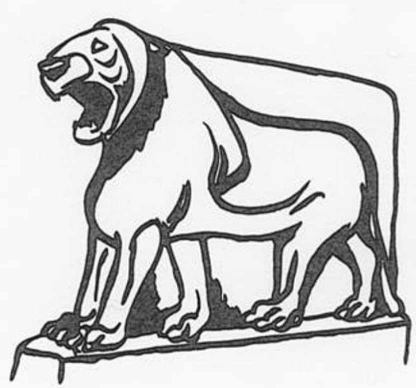

Figure 150

In baroque sculpture the subdivision into well-defined aspects is abandoned, and sometimes it is impossible to find one main view. Every aspect is an inseparable part of constantly changing form. Emphasis on oblique foreshortening prevents the glance from stopping. From any point of observation, planes lead beyond the given view and demand an endless change of position. The screw is the underlying structural pattern, which is applied most simply in the bands of pictorial reliefs spiraling around the Roman columns of Trajan or Marcus Aurelius. A characteristic example is Michelangelo's Christ in the Church of Santa Maria Sopra Minerva in Rome. Every segment of the figure is set obliquely against the next, so that at any given aspect the frontality of one of the segments is counteracted by the obliqueness of others. This adds up to a screw-like rotation of the whole body. According to Lomazzo, Michelangelo advised his students to make their figures "serpent-like."

Needless to say, the style of such figures is not of higher artistic quality than the simpler cubes of the Egyptian or African carver. It is merely more complex; and although the richness of the unending symphonic flow may enchant the educated eye, the artist who strives for it risks losing control and ending up with visually incomprehensible multiformity or amorphous imitations of nature. The danger diminishes when the artist has gradually arrived at complex form through the organic sequence of stages, never going beyond what his eye has learned to organize, and being accustomed to accepting nothing he cannot master. The danger is greatest when a highly differentiated style, whether realism or cubism, is sprung prematurely on the unprepared student. There are no short cuts on the road to the refined manifestations of a late culture.

Of other late stages of complexity, I shall mention only one. Throughout the history of sculpture there is a clear distinction between the solid block and surrounding empty space. The figure is bounded by straight or convex planes, and the holes that detach arms from the body or legs from each other do not impair the compactness of the main volume. In the next chapter I will have occasion to show how the introduction of concave form draws space into the realm of the figure and thereby overcomes the elementary distinction between figure and empty space. The block begins to disintegrate, until in our century we find sculpture that surrounds empty space in addition to being surrounded by it.