7. Concepts Take Shape

If thinking takes place in the realm of images, many of these images must be highly abstract since the mind operates often at high levels of abstraction. But to get at these images is not easy. I mentioned that a good deal of imagery may occur below the level of consciousness and that even if conscious, such imagery may not be noticed readily by persons unaccustomed to the awkward business of self-observation. At best, mental images are hard to describe and easily disturbed. Therefore, drawings that can be expected to relate to such images are welcome material.

Drawings have been used frequently in memory experiments. They cannot be faithful replicas of mental images but are likely to share some of their properties. Therefore, the few examples I shall offer in this chapter are not intended to prove what the images generating them are like, but to suggest what structural characteristics they may have. I will show that such pictorial representations are suitable instruments of abstract reasoning and point to some of the dimensions of thought they can represent.

The prototype of the drawings I have in mind are those diagrammatic scribbles drawn on the blackboard by teachers and lecturers in order to describe constellations of one kind or another—physical or social, psychological or purely logical. Since such drawings are often non-mimetic, that is, do not contain likenesses of objects or events, what exactly do they represent? How are they related to the subject matter for which they stand? What are the means of representation at their disposal? How do they aid thinking? What factors determine how well such a drawing serves its purpose?

Abstract gestures

The difference between mimetic and non-mimetic shapes, so plausible at first glance, is only one of degree. This is evident, for example, in descriptive gestures, those forerunners of line drawing. There, too, one is tempted to distinguish between gestures that are pictographic and others that are not. Actually, the portrayal of an object by gesture rarely involves more than some one isolated quality or dimension, the large or small size of the thing, the hourglass shape of a woman, the sharpness or indefiniteness of an outline. By the very nature of the medium of gesture, the representation is highly abstract. What matters for our purpose is how common, how satisfying and useful this sort of visual description is nevertheless. In fact, it is useful not in spite of its spareness but because of it. Often a gesture is so striking because it singles out one feature relevant to the discourse. It leaves to the context the task of identifying the referent: the bigness portrayed by the gesture can be that of a huge Christmas parcel received from a wealthy uncle or that of a fish caught last Sunday. The gesture limits itself intelligently to emphasizing what matters.

The abstractness of gestures is even more evident when they portray action. One describes a head-on crash of cars by presenting the disembodied clash as such, without any representation of what is crashing. One shows the straight or devious path of a movement, its smooth rapidity or heavy trudging. Gestures enact pushing and pulling, penetration and obstacle, stickiness and harshness, but do not indicate the objects thus treated and described.

The properties of physical objects and actions are applied without hesitation to non-physical ones by people all over the earth, although not always in exactly the same fashion. The bigness of a surprise is described with the same gesture as the bigness of the fish, and a clash of opinions is depicted in the same way as a crash of cars. David Efron, investigating the gestures of two minority groups in New York City, has shown how the character of the movement patterns varies with the style of reasoning of the persons. The gestures of ghetto Jews, whose minds are formed by the traditional sophistry of Talmudic thinking, "appear to exhibit an angular change in direction, resulting in a series of zig-zag motions, which, when reproduced on paper, present the appearance of an intricate embroidery." On the contrary, the gestures of Italian immigrants, deriving typically from an agricultural background of low literacy,
reflect a much simpler style of thinking by maintaining "the same direction until the gestural pattern has been completed."

Gestures will act out the pursuit of an argument as though it were a prize fight, showing the weighing of alternatives, the tug of war, the subtle attack, the crushing impact of the victorious retort. This spontaneous use of metaphor demonstrates not only that human beings are naturally aware of the structural resemblance uniting physical and non-physical objects and events; one must go further and assert that the perceptual qualities of shape and motion are present in the very acts of thinking depicted by the gestures and are in fact the medium in which the thinking itself takes place. These perceptual qualities are not necessarily visual or only visual. In gestures, the kinesthetic experiences of pushing, pulling, advancing, obstructing, are likely to play an important part.

A pictorial example

Pictures that are not written in the air but leave a durable trace show more explicitly than gestures what the imagery of thought might be like. Again the resemblance can hardly be literal. For one thing, even in pictorial representation the particular shape of a given thought pattern will depend on whether it is produced on a flat surface or in three dimensions, by line or in broad masses of color, etc., whereas mental imagery is not determined by any of these material conditions. I will begin with an example somewhere in between the average person's ability to give visual shape to concepts and the control, precision, and striking expression characteristic of the work of artists. Figure 18 is the work of an undergraduate student, Miss Rhona Watkins, done shortly before she graduated from college. It represents a promising future temporarily obstructed by present obstacles. The picture is entirely non-mimetic, and yet there is the unmistakable resonance of experiences gathered in the visual world. Just as physical objects or events are often depicted by abstract properties of shape, so can abstract representations of ideas refer more or less openly to things of nature. Here again there is no dichotomy of mimetic versus non-mimetic representation, but only a continuous scale reaching from the most realistic images to the purest elements of shape and color.

The landscape-like distinction between a ground with objects resting on it and a kind of empty sky on top creates the basic dif-
ference between the solid present and the vista of a distant future, the present filled with tangible matter, the ultimate future still vacant. Time is translated into the spatial depth dimension. Nearest in time and space are the dark, clearly articulated obstacles; farther away lies the promise of tomorrow, as yet undifferentiated and dominated by an over-all mood of affective color. The evenness of the distant mass is broken by a laterally penetrating wedge, which opens and menaces the compactness of the prospect, sharing its basic color but creating at the same time a jarring conflict between its own yellowish version of redness and the bluishness of the large mass. Similarly, the shape of the wedge, while breaking the contour of the mass, also acknowledges its limits.

These anticipations of the future are not directly connected with the present. No bridge leads from the front to the back. The immediate presence of the dark obstacles is self-contained and independent, something to be taken care of by itself, not affecting the future and yet blocking the way toward it. While this distinction is made clear, there is also the frightening suggestion that these obstacles do indeed touch the future because the horizontal bar on the left coincides with the horizon, and the bar on the right with the top of the distant mass. Though recognized as an illusion caused by a purely subjective perspective, this threatening interference is, for the moment, visibly real, and the dark bars, metallic and hard, cover the prospect like the bars of a prison window.

At the same time, the impediment is not overpowering. The obstacles, although inorganically hard, are straight only in part. They bend at the bases and on top, indicating some flexibility and weakness, and they are thinnest where they would need their main strength. Neither the parallelism nor the symmetry of the two dark units is rigidly perfect, and this makes the structure of the obstacle somewhat accidental, hence vulnerable and changeable.

The abstractness of this visual statement is evident when compared with the subject matter it represents. Neither the present nor the future are given mimetic portrayal, and yet the essentials of the theme are depicted by thoroughly visual aspects of shape, color, and spatial relations. Although simpler and more obvious than the work of a more accomplished artist is likely to be, all crucial factors are rendered with more precision than we shall find in most of the quick amateur sketches to be presented next. Miss Watkins' print was the final result of considerable searching
and trying, and the search for the "correct" pattern was at the same time a means of working through the situation which she was trying to depict and to cope with. As observations in art therapy have shown, one of the main incentives for such work is the need to think through something important. The completion of the picture is also the solution of a thought problem, although there may be no words to tell about the finding.

Experiments with drawings

Drawings intended to represent specific concepts were obtained in preliminary experiments by my students. They are spontaneous scribbles, with little or no claim to aesthetic value. Miss Abigail Angell asked her subjects, mostly fellow students, to depict the notions of Past, Present, and Future, Democracy, and Good and Bad Marriage in abstract drawings; Miss Brina Caplan worked under similar conditions with the concept Youth. Verbal explanations, spontaneous or solicited, were obtained during or after the drawing.

The nature of the task created little hesitation in this particular population of subjects. Naturally, drawing ability ranged widely from few schematic, timid lines to more elaborate designs, and great differences in imagination were equally evident. Occasionally, conventional signs were used as shortcuts: a plus and a minus sign to depict good and bad marriage; an arrangement of stars and stripes for democracy; or a growing tree indicating youth. But seldom did a subject protest that such concepts simply were not visual things and therefore could not be shown in drawings. Persons of a different educational level and less familiar with the arts might respond less well; this, however, would tell us nothing about the nature or richness of the imagery in their thinking.

One basic decision the subjects had to make for each task was whether to present the given concept as one entity or as a combination of several. The instruction to draw Past, Present, and Future suggested a triad verbally, and in fact several persons drew three separate items, unrelated in space or perhaps arranged in a loose sequence. This, however, was not true for all. Although nobody drew the whole of life as one undifferentiated unit, a continuous line was not uncommon. Figure 19 indicates a straight and perhaps empty past, large and articulate shapes for the present, and some smaller and vaguer ones for the future. Here, then, the whole of life is represented as an unbroken flow of time—a conception basically different from that of another type of subject, who exists in the present and thinks of it as a state of being rather than a phase of continuing growth (Figure 20).

The mere connection of the three units, of course, does not exhibit by itself much thought about the particular nature of their relation. Figure 21 gives more than a sequence of different entities. It shows gradual expansion, starting with the moment of birth. The break between past and present is maintained, but the largeness of the present is understood in part as a result of the preceding growth. The undirected roundness of the present interrupts the channeling of time, and yet this static situation in the middle of the drawing is "amodally" traversed by a current of movement initiated in the past and carried further into the open future, as a river flows through a lake.

The structural complexity of the present, experienced as a timeless state of affairs and yet perceived by the more thoughtful as a mere phase in the passage of a lifetime, can be represented as the
superposition of two structures. In Figure 22, life is seen as generated by the "solid and complete" past, which projects strong, formative beams. But the present is not entirely determined by the past. It has a core and shape of its own. The resulting complication is presented generically as an agitated texture. The specific effect of the interaction is not worked out. The interacting powers of the past and the present meet in spatial overlap but do not modify each other. The problem is seen but not resolved. The level to which the young draftsman carried her thought—or, at least, the representation of it—can be clearly diagnosed from her drawing.

Language represents the concept of marriage by one word; it does not suggest a pictorial twosome. But the concept itself refers directly to two physical persons. Many subjects, therefore, described marriage in their drawings as a relation between two units. Since both good and bad marriage had to be presented, the two kinds of marriage were shown as merely different from each other, or more intelligently, as different with regard to some common dimension and therefore comparable. Sometimes the relation alone was presented, without any attempt to derive it from the nature of the partners thus related. Two separate circles might depict the one relation, two overlapping ones the other, and the overlap was intended to suggest either desirable closeness or undesirable interference. Or, inversely, the two kinds of marriage were distinguished by the character of the partners, but not by their relation: two smooth circles versus two prickly circles, confronting each other in the same fashion. There is a significant difference between seeing the character of a marriage as derived from the relation as such or from the personality of the partners; and to consider either condition without the other produces necessarily a limited interpretation.

In Figure 23, the bad relation is shown as springing from the difference of the partners. An aggressive saw-tooth outline constitutes one of them, whereas smooth circles describe the other. In addition, the aggressive partner has the more tension-loaded shape of a spiral, the other is represented by more harmonious, concentric curves. The aggressive partner, of course, is not necessarily the male. The drawings, with few exceptions, depict mental, not physical forces. In Figure 24, the crushing boulder on top describes the personality of the subject's mother; the small, dripping dot that of her father, and

Figure 21

Figure 22. "The past is solid and complete, but still influences the present and the future. -- The present is complex and not only a result of the past and leading to future, thus overlapping both, but is an entity in itself (black dot). -- The future is least limited but influenced by both, past and present. -- One line runs through for all have one common element—time."

Figure 23

Figure 24. "Here is a picture of my mother (top) and father (bottom). Although neither shape is particularly revolting in itself, the combination makes for an exaggeration of both forms, so that the top becomes more overpowering when placed next to the bottom form. And the bottom form diminishes in relation to the upper. Ugh!"
the inappropriateness of the relation is intended to reflect back upon the character of the marriage partners, "not particularly revolting" in themselves.

The coherence of the marriage can be indicated simply by the amount of contact among the partners: in the good relation, they share an interface, in the bad one they barely touch each other. Subtler are the attempts to show that the combination of the two partners does or does not add up to a whole, either because their characters do not fit or because they are not related in a fitting manner. Figure 25 presents the good marriage as a symmetrical pattern, in which the two partners, alike or undifferentiated in their personalities, fulfill the same function. The drawing indicates that the overall pattern of the marriage should be unified and well structured but that the partners retain integrity by fusing only partially. In the bad marriage, the shapes of the two components do not add up to a unified whole; their contact is accidental and precarious, and they remain essentially independent of each other. In Figure 26, the intended overall shape is less simple although closed and unified. Here, differences in personality are no obstacle to the union, but probably an asset; the roles of the partners are not identical, and the somewhat accidental shape of the whole suggests that differently shaped wholes can work out equally well. In the bad marriage, the two jig-saw pieces cannot be fitted together. A much richer whole is presented by the good marriage in Figure 27, which evokes the image of a plant but uses it freely to show the combination of two units, growing out of each other in an interplay of support and dominance, and fitting into a common, upward-directed striving.

In the last examples there was no clear indication that the conception started with two separate units trying to establish a conjugal relation. The parts and the whole were rather in balance, neither claiming priority. This leads to examples in which the primary vision was clearly that of a whole, subdivided more or less happily into its two components. In extreme cases, nothing but the overall effect is indicated (Figure 28): the smooth harmony of the one, the roughness of the other. The need for interaction is stated simply in Figure 29, more dynamically in the yin-yang design of Figure 30.

The task of drawing Past, Present, and Future suggested a hap-
pening in time, whereas Marriage is more nearly a thing or state. However, the drawings did not necessarily conform to this distinction. While some subjects presented the three stages of life as separate entities, Figure 31 shows life as a static object, in which the present moment as a vertical line separates a dark past from a larger and brighter future. Compare this undynamic apportionment with Figure 32, made up entirely of disembodied movement. The parabola of the past drives forward and is continued into the future. At the moment of the present, however, the convergence of the past is counterbalanced by the beginning of a new expansion—\( f \) we read the third parabola as open toward the right; or otherwise the future, mirroring the past, also converges upon the focus of the present, but in the opposite direction, thereby pointing to an experience that ignores the irreversible progress of time.

While life and its stages can appear as objects, marriage can be depicted as a story. In the good marriage of Figure 33, the partners move along parallel paths like two musical instruments playing the same tune at a constant interval, and when their paths cross they make contact rather than interfere with each other. In the bad marriage, one of the two partners is constantly in the other's way. The caption to Figure 28 indicates that the characteristic outlines of the marriages conceived as things are perceived at the same time is the smooth or rocky road of the travelling pairs.

Figure 33. "A good marriage (top) is two people together but as individuals. They both recognize each other as separate from each other but also involved with each other. A bad marriage (bottom) is one where two people support each other and are absorbed into each other. When a conflict occurs, they cannot help each other."

In the representation of Democracy, some subjects envisage distinct individuals entering a relation, whereas for others the totality of the community is primary. In Figure 34, society is a loose agglomeration of different characters, lined up without interrelation, except for the common base on which they stand. At the other extreme are examples in which the state is seen as a simply shaped object, without any explicit reference to the human elements of which it consists. Figure 35 makes only a perfunctory concession to the overall shape of the community, which is seen as a bagful of individuals, different from, but unrelated to, each other or the whole. This amorphous state of affairs in the drawing corresponds to think-
the subject will often have considered specific examples: their own experiences in the past or present, the character of a particular democracy, the happenings in this or that marriage. In fact, they had to do so, because the abstract forms reflected in the drawings do not offer the evidence needed to define the concepts; they represent only the purest structural shapes emerging from that evidence. The conditions of the experiment prevented the subjects from including any narrative elements. While most helpful in clarifying the theoretical concepts, the non-mimetic patterns must continuously derive their meaning from the live substance of the issues to which they refer.

The principal reason why these disembodied shapes can be so helpful is that thinking is not concerned with the sheer matter or substratum of things but only with their structure. The elementary qualities of a particular red color or a particular sound are supplied by the senses but are neither represented in thinking nor conveyable by it—they can only be pointed to through verbal signs by persons who are not blind or deaf. The perceptual features accessible to thought are purely structural, e.g., the expansiveness of that red, the aggressiveness of that sound, or the centric and compact nature of something round. Thinking treats space and time, which are containers for being, as the structural categories of coexistence and sequence. Both of these categories can be represented in the spatial medium of visual patterns.

**Thought in visible action**

I mentioned earlier that drawings, paintings, and other similar devices serve not simply to translate finished thoughts into visible models but are also an aid in the process of working out solutions of problems. Of this, one receives little evidence from studies that yield only one drawing for each task. Therefore, in the experiments
of Miss Caplan, subjects were encouraged to "use as many pieces of paper as you need: a new piece for each new idea; a new piece each time you want to correct an old idea. Continue until you are satisfied with your drawing! Think aloud as you draw and explain what you are doing as you do it!" Eleven subjects produced an average of nine drawings each; one drew as many as thirteen, and nobody settled for fewer than six.

A subject's style of drawing tended to become clearer, more definite, and more individualized as the experiment proceeded. This was evident when the first and the last drawing of a series were compared. As a rule, complexity increased. Sometimes, the experimenter reported, types or shapes of form became more intricate, or contiguity and overlapping were introduced, or a new element such as shading appeared, or some sort of gradient was utilized. Such increase in complexity does not necessarily imply that the first step and the final outcome were recognizable as successive phases of a clearly similar conception. A continuity of one underlying idea was evident in some instances, but not in others, and in no case was the whole series of drawings devoted to the gradual elaboration of only one specific pictorial theme. However, gradual refinement was frequently observable in the progressive changes occurring from one drawing to the next, here and there in a series.

The task consisted in doing a non-mimetic drawing of Youth. One subject started by representing "a kind of upward growth" while thinking of youth at the same time as "turned in on itself, in a process of self-discovery." The first sheet (Figure 39) is covered with spirals, decreasing in size toward the sides and the top and arranged in a vague symmetry. In the second drawing (Figure 40), these elements are combined in a tree-like pattern, which integrates and clarifies the conception. Figures 41 and 42 show the seventh and eighth drawings of a subject who thought of youth as a round or amoebic blob transforming itself gradually into the firm rectangle of adulthood. The seventh drawing (Figure 41) presents three phases: Youth reaching out for age, learning from it by adapting to it, and finally overshadowing it. In the eighth drawing (Figure 42), the three phases have been refined into six. The first of them is essentially unchanged, except that the "reaching out" is explicitly shown by the more dynamic shape of the blob, the beginning of its amoebic response to "age," half advancing, half withholding. Monolithic adulthood also is treated now more subtly: it is open, accessible, and
perhaps actively engaged. During conjugation, "age" is already declining, and the final inversion of power is now carried further to involve not only size but also the change from blob to block, thus completing the new adult.

The gradual enrichment of the concept can be traced in the work of the student who needed thirteen drawings to arrive at a satisfactory statement. A verbal description will suffice to give an idea of the increasing complexity. At first, there is the upward movement of a single shape, which spirals in the first drawing and fills the second sheet as a large pointed wedge. This simple wedge now suffers breaks halfway up—the delays caused by the instability and complexity of adolescence. In the fourth drawing, the wedge is inverted to a cone expanding from its point: mere progression has been re-defined as growth. The cone becomes dark and three-dimensionally solid, the point of origin at the bottom now serving to describe the lack of a stable base. Drawing 7 returns to the original spiral, but now the whole sheet is filled with rising, wildly overlapping spirals. The individual is now multiplied to present the social scene, and this extension of view seems to have thrown the conception back to its initial shape. In Drawing 8, the interaction between growing individuals is more explicitly defined, for which purpose the spiral shapes have been simplified to straight lines, crossing or paralleling each other more clearly. Drawing 9 presents a move back towards individuality: the number of verticals is reduced to three, then to two, showing the "true communication" and "harmony" of two wavy parallels. In Drawing 11, the social context returns with a vengeance in the shape of two sinister solids gripping the two in a vise and causing them to wave rather violently. In the last two drawings, however, they grow beyond the pressure of the environment and rise in ultimate harmony.

The subject has used her sequence of drawings to tell her story of youth chronologically. However, at the same time she assembles the relevant factors step by step and ends up with a picture that contains them all in what she sees as their appropriate character, role, and relation. I will refer briefly to three more examples to illustrate aspects of this search for clarification. The use of the spiral and the wedge in one and the same set of drawings indicated already how a complete change of pictorial pattern may leave the basic theme nevertheless untouched. The same is true for another example in which a subject describes how the young person grows from the carefree pleasures of the early years into the "complex, intricate web" of adolescence. The subject illustrates this change by overlaying the simple waves of childhood with a thicket of whirligigs and criss-cross shapes. In the next drawing, the same state of affairs is depicted as a geometrical maze—apparently a complete break of the pictorial continuity but actually just a more insightful interpretation of complexity, defined a moment earlier as nothing but a confused texture.

Other examples confirm the observation that pictorial breaks occur when the draftsman introduces a new cognitive factor. One subject used an assortment of circles to show completeness and lack of harshness in childhood. In the next drawing, she presented two groups of long lines as the pressures impinging on youth, only to combine the two disparate patterns in her next and final drawing, in which the circles, tightly packed and somewhat deformed, are confined, separated, and crossed by the straight lines depicting responsibility and duty.

Finally, an instance in which two different views of the same concept are first presented separately and later integrated. The subject starts with the notion of youth as jutting sharpness, something sticking out from a base discordantly. Suddenly, in her fifth drawing, youth appears instead as a shapeless blob—a blob, however, which, three drawings later, is plagued by ingrown "pains,"
and these pains, pointing inward along the contour of the blob, assume in the last drawing the same spiky sharpness that represented the concept as a whole in the beginning. Figures 43 and 44 show the first and the last drawings of the series.

Similar features can be found in the work of artists, for example, in the sketches Picasso did for his painting, *Guernica*. In a book on this subject I have shown the continuity and logic underlying the development from the first sketch to the completed work. However, these drawings and paintings, too, may appear, at first sight, as a sequence of erratic leaps from comprehensive views to details and back, a restless play of combining the basic constituents in ever new ways, and many changes of style and subject matter. Yet the final painting is a synthesis of tested acquisitions, a statement whose completeness and necessity defied further modifications.

There are, of course, profound differences between the work of an artist and our amateur scribbles. This would be even more evident if, instead of selecting suitable samples from the experiments, I reproduced a random selection of the drawings or all of them. There were many wildly prolific exercises, showing no disciplined concentration on the task or, at least, no ability to produce drawings that clearly reflected such an attitude. Nevertheless, the intention and the means of realization are basically similar to those of the artist. The amateur drawings contain a pidgin version of the rich and precise vocabulary characteristic of good art.

The drawings were intended to give an accurate visual account of a concept. As such they were purely cognitive, not different in principle from what scientists show in their schematic designs. However, they were apt to go beyond the visual enumeration of the forces constituting the patterns. The draftsmen tried to evoke, more or less successfully, a vivid resonance of these forces and thereby resorted to devices of artistic expression.

The aesthetic element is present in all visual accounts attempted by human beings. In scientific diagrams it makes for such necessary qualities as order, clarity, correspondence of meaning and form, dynamic expression of forces, etc. The value of visual presentation is no longer contested by anybody. What we need to acknowledge is that perceptual and pictorial shapes are not only translations of thought products but the very flesh and blood of thinking itself and that an unbroken range of visual interpretation leads from the humble gestures of daily communication to the statements of great art.

Simple line drawings can give visible shape to patterns of forces or other structural qualities. The drawings in the preceding chapter described the nature of a good or bad marriage or of democracy or of youth as conceived by the person who drew them. Highly abstract social or psychological configurations appeared in visible shape. However, images can also depict the things of our environment themselves, for example, a husband and a wife or a town meeting in a democracy. They commonly do so in a style that is more abstract than the way these persons, objects, or happenings would register on a photographic plate. Images, then, regard the world in two opposite directions. They hover somewhere above the realm of "practical" things and below the disembodied forces animating these things. They can be said to mediate between the two.

**Three functions of images**

In order to clarify and compare various relations of images to their referents I shall distinguish between three functions performed by images. Images can serve as pictures or as symbols; they can also be used as mere signs. This sort of distinction has been made by many writers on the subject. Some have used the same terms or similar ones, but the meanings they have given them overlap complexly with the distinctions I need for our purpose. Instead of analyzing these similarities and differences, I shall try to define the